



*Pacific Gas and  
Electric Company®*

# ENERGY EFFICIENCY BUSINESS PLAN

2018-2025





## Note for the Reader on the Purpose of the Business Plan

This document is PG&E's Energy Efficiency Business Plan (Business Plan), which outlines PG&E's high-level approach to achieving state energy efficiency policy goals through 2025.<sup>1</sup>

As an energy efficiency program administrator, PG&E submits this Business Plan for California Public Utilities Commission (CPUC or Commission) approval as required by the Commission. The Rolling Portfolio process adopted in Decision (D.) 15-10-028 directs program administrators to submit high-level documents (Business Plans) for Commission approval that describe how they will achieve their energy savings goals. The first Business Plans are to be filed on January 17, 2017. Program administrators may submit updated Business Plans at any time. Program administrators must submit revised Business Plans upon the occurrence of any of the following trigger events:

- The program administrator is unable to meet savings goals, stay within the budget parameters of the most recent and prior Business Plan, or meet Commission established cost-effectiveness metrics (excluding Codes and Standards and spillover adjustments);
- The Commission requires a new application as a result of a policy track decision in the proceeding; or
- The approach of the final year of funding.<sup>2</sup>

D. 15-10-028 described and provided a template for the Business Plans,<sup>3</sup> and also delegated responsibility to Commission staff to provide additional guidance on Business Plan contents. In doing so, the Commission emphasized a desire to balance the need to receive useful information from program administrators with the aim to keep Business Plans "compact and focused, and to reduce administrative costs."<sup>4</sup>

The Commission also requested submittal of Implementation Plans (IPs) that provide detailed descriptions of the interventions program administrators would pursue to achieve the high-level efforts described in the Business Plans.<sup>5</sup> The IPs will describe how PG&E's Business Plan will be carried out in each of the programs in its portfolio.

In this Business Plan, PG&E presents a clear vision for how it expects to meet the state's ambitious energy goals through partnerships with third-party entities and move to the new statewide model under the rolling portfolio structure.

<sup>1</sup> Email communication from Administrative Law Judge Julie Fitch, on November 15, 2016 clarified program administrators' Business Plan timeline. "Because D.14-10-046 only authorizes funding through the end of 2025, it is my expectation that this would be the timeframe for the Business Plans as well, covering calendar years 2018-2025." However, PG&E has built its Business Plan around a ten year vision, and has identified short (1-3 years), medium (4-7 years) and long-term (8-10 years) time periods used to indicate when strategies and tactics will be deployed, and targets will be met. PG&E believes this structure is in line with the intent of the rolling portfolio concept.

<sup>2</sup> See D. 15-10-028, Ordering Paragraph (OP) 2," pp 56-7.

<sup>3</sup> Appendix 3 of D. 15-10-028 provides the draft Business Plan template.

<sup>4</sup> See D. 15-10-028, pg. 57.

<sup>5</sup> D.15-10-028.

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# EXECUTIVE SUMMARY

CHAPTER 00

## Executive Summary

Pacific Gas and Electric Company (PG&E) is one of the largest combined electric and natural gas companies in the United States. The company delivers some of the nation's cleanest energy in the country to nearly 16 million people throughout a 70,000-square-mile service area in Northern and Central California. PG&E serves more than 5 million electric distribution customers and more than 4 million natural gas distribution customers. As an energy provider with a mission rooted in public service, PG&E embraces its role as a pioneer in the transition to a clean energy future and low-carbon economy. In 1976, PG&E became one of the first utilities in the nation to offer energy efficiency programs to our customers.<sup>1</sup> Today, PG&E's commitment to saving energy is stronger than ever.

California has adopted the most ambitious greenhouse gas (GHG) reduction targets in North America. Assembly Bill (AB) 32 requires the state to cut GHG emissions to 40% below 1990 levels by 2030, a more ambitious target than the previous goal of hitting 1990 levels by 2020.<sup>2</sup> Senate Bill 350: Clean Energy and Pollution Reduction Act (SB 350) legislatively mandates a goal of doubling energy efficiency savings in electricity and natural gas end uses by 2030. As California's largest energy utility, PG&E is doing its part now, and will do even more in the future to help California achieve this goal.

In 2015, nearly 30% of the electricity that PG&E delivered to our customers came from Renewable Portfolio Standard (RPS)-eligible resources. More than 58% of the electricity that PG&E delivers

to customers comes from greenhouse gas-free sources—helping achieve a carbon dioxide (CO<sub>2</sub>) emissions rate two-thirds cleaner than the national utility average. Over nearly four decades, PG&E's energy efficiency programs have avoided releasing more than 375 million metric tons of carbon dioxide (CO<sub>2</sub>) emissions based on cumulative lifecycle gross energy savings.

At PG&E, we are proud of what we have accomplished to date to provide clean energy to our customers, and we are committed to increase our deliveries of clean energy and enable a low-carbon future. By following the California loading order,<sup>3</sup> PG&E has proven that energy companies have a unique ability to achieve GHG emissions reductions and accelerate the use of GHG-free resources on a large scale. It is against this backdrop of steadfast commitment to California's clean energy future that we submit our energy efficiency Business Plans for 2018-2025.<sup>4</sup>

<sup>1</sup> <http://www.pge.com/myhome/environment/pge/energyefficiency/>.

<sup>2</sup> Assembly Bill (AB) 32.

<sup>3</sup> The loading order decreases electricity demand through energy efficiency and demand response, and meets new generation with renewable and distributed generation resources first, then with clean fossil-fueled generation second. The California loading order was adopted in the 2003 Energy Action Plan.

<sup>4</sup> Email communication from Administrative Law Judge Julie Fitch, on November 15, 2016 clarified program administrators' Business Plan timeline. "Because D.14-10-046 only authorizes funding through the end of 2025, it is my expectation that this would be the timeframe for the Business Plans as well, covering calendar years 2018-2025."

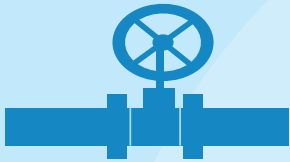


## OPERATIONAL EXCELLENCE



**155+**

miles of gas transmission pipeline replaced\*



**250+**

automated valves added throughout service area

**142**

wildfires spotted in aerial patrols



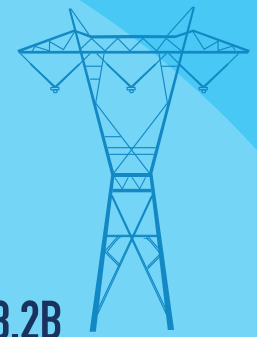
**20.3**

average response time in minutes for gas odor reports\*



**97.1%**

of time personnel were on-site within 60 minutes after receiving a 911 electric-related call\*



**\$3.2B**

of electrical system investments



**\$1.85B**

of gas system investments



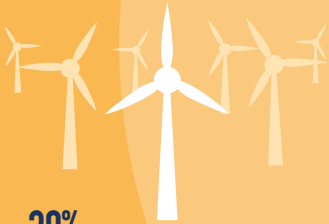
**23,000** employees



**70,000**

square miles in PG&E's service area

## PROVIDER OF CHOICE

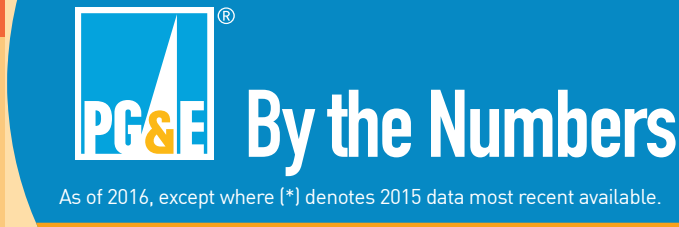


**30%**

renewable energy delivered to customers\*

**55%**

renewable energy PG&E voluntarily committed to deliver in 2031



As of 2016, except where [\*] denotes 2015 data most recent available.



**1 in 5**

EVs in U.S. plug into PG&E's energy grid



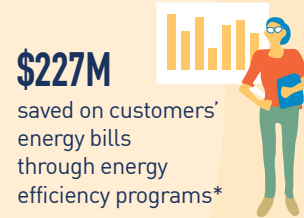
**275,000+**

customers with private solar



**1.4M+**

CARE program (low-income) customers enrolled\*



**\$227M**

saved on customers' energy bills through energy efficiency programs\*



**\$2.5B**

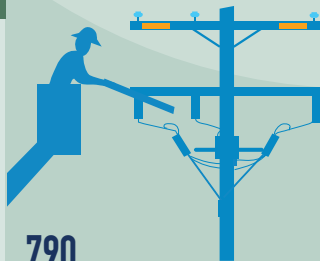
spent with diverse suppliers\*

## POSITIONING FOR THE FUTURE



**\$100M**

pledge to invest in electrifying vehicle fleet over next five years



**790**

smart grid electrical circuits added, reducing or avoiding outage minutes



**50%+**

PG&E's electricity coming from greenhouse gas-free resources

**Top decile**

PG&E's goal for reducing facility energy, water and waste by 2020



**7,500**

EV charging stations proposed by PG&E

**850**

teens received workforce training in PG&E's Better Together Summer Jobs program



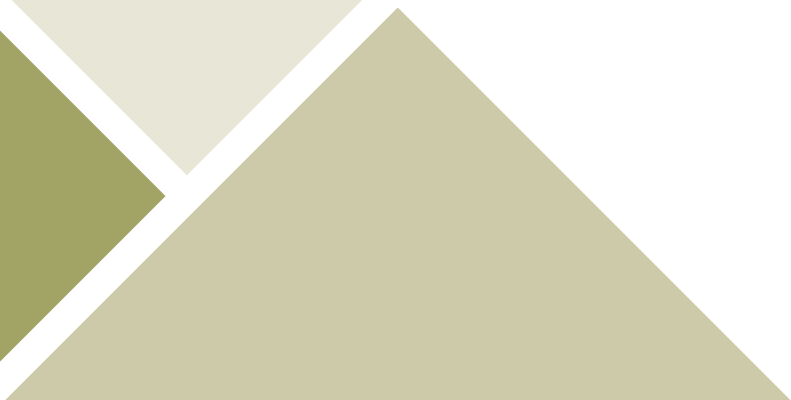
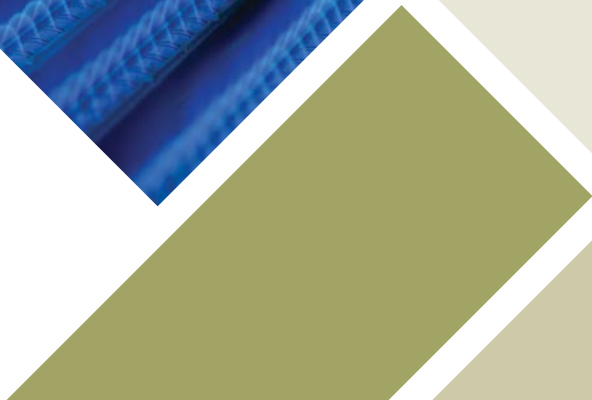
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# PORTFOLIO OVERVIEW

CHAPTER 01



## A. PG&E's Vision

PG&E's Business Plan establishes the strategy for the next generation of PG&E's energy efficiency portfolio. PG&E's Business Plan is driven by state policies, including Senate Bill (SB) 350: The Clean Energy and Pollution Reduction Act (SB 350)<sup>1</sup>, which establishes the goal of doubling cost-effective energy efficiency savings in electricity and natural gas end uses by 2030, and SB 32<sup>2</sup>, which modifies the California Global Warming Solutions Act of 2006 to require the state to cut greenhouse gas (GHG) emissions to 40% below 1990 levels by 2030.

To that end, PG&E will evolve its portfolio to maximize cost-effective energy savings by using our knowledge of our customers, cultivating relationships with new partners and offering programs that drive value and innovation for our customers.

In support of this vision, PG&E's energy efficiency Business Plan is built on three guiding principles:

1. Scale energy efficiency cost effectively by deploying new program models that spur "deep investment and persistence of savings;"<sup>3</sup> targeting customers with high energy savings potential, focusing on selective technology strategies, and making energy efficiency investments more attractive.
2. Make energy efficiency offerings easier to access by streamlining the portfolio.

3. Develop energy efficiency as a cost-effective grid resource that is integrated within PG&E with other distributed energy resources (DERs), enabling deeper savings, greater penetration, and location-specific efficiency.

PG&E's Business Plan outlines a revised portfolio structure, and new and existing strategies and tactics, designed to maximize energy savings across our territory. This revised portfolio structure, and these strategies and tactics are presented for each of our five customer sectors — Residential, Commercial, Public, Industrial, and Agricultural, and our four cross-cutting sectors supporting them — Codes & Standards (C&S), Workforce Education & Training (WE&T), Emerging Technologies (ET), and Financing below<sup>4</sup>:

## B. PG&E's Revised Portfolio Structure

In light of the changing energy landscape, the opportunities presented under the Commission's rolling portfolio structure, and the Business Plan sector approach, PG&E envisions a revised portfolio structure centered on the five customer sectors — Residential, Commercial, Public, Industrial, and Agricultural, with four cross-cutting activities supporting them — C&S, WE&T, ET, and Financing<sup>5</sup>. PG&E's revised portfolio structure departs from its current portfolio approach wherein program design resulted in an assortment of customer-centric (e.g., winery subprogram), technology-specific (e.g., Lighting program), and project-type (e.g., Deemed and Calculated subprograms) programs and subprograms. The current structure has resulted in over one hundred discrete programs, which contributes to dispersed customer transactions and portfolio complexity. PG&E's revised portfolio structure favors simplification to yield scaled energy savings at lower costs, and reduced customer confusion.

In this new structure, PG&E proposes a portfolio of customer-centric programs at the sector and/

<sup>1</sup> Ch. 547, Stats. 2015.

<sup>2</sup> Ch. 249, Stats. 2016.

<sup>3</sup> Mitchell, Cynthia 2014. "A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach," p. 9.

<sup>4</sup> D.15-10-028 set forth the Business Plan sector approach.

<sup>5</sup> Statewide Marketing Education and Outreach (SW ME&O) (A.12-08-007) is a separate proceeding from Energy Efficiency (R.13-11-005). SW ME&O activities and PG&E local marketing activities are designed to complement one another.



## PG&E STATISTICS

**Founded:** 1905

- First energy efficiency programs implemented in 1976

**Service Area:** 70,000 square miles across Northern and Central California

**Customers:** 16 million people

- 1.8 million electric-only customer accounts
- 935,000 natural gas-only customer accounts
- 3.5 million electric and natural gas customer accounts (as of June 2016)

**Employees:** 23,000 employees

### 2015 Energy Efficiency Impacts:

- 1,392 GWh saved
- 23.4 million therms saved
- 295 MW generation capacity avoided
- Avoided the emissions of nearly 1.2 million metric tons of carbon dioxide
- PG&E customers saved \$227 million on their energy bills through energy efficiency programs in 2015

or subsector levels, coupled with cross-cutting programs/subprograms and statewide programs that complement each sector/subsector. Customer sector programs may have elements of cross-cutting activities where and when they are needed<sup>6</sup>

Resource programs<sup>7</sup> would rely and draw on a set of “platforms” to calculate savings, incentivize customers to invest in energy savings opportunities, and/or promote increased and persistent savings. In all cases, PG&E envisions a statewide-consistent set of rules that would govern each platform. PG&E would manage the platforms, allowing us to disseminate policies and procedures regularly and reliably. This structure ensures that all programs fully comply with CPUC policies and regulations, and ensures that PG&E continues to meet its regulatory obligations. As the program design and delivery model shifts more to third parties, portfolio administrators will need to ensure program implementers follow consistent practices. Platforms may evolve over time as PG&E implements the revised portfolio structure, and/or as CPUC policies change.

PG&E envisions these platforms serving as foundational elements of programs — one or all of the platforms could be a feature of a program. This new structure allows programs to deliver every type of project to customers, based on their unique needs. For instance, a third-party implementer may propose a comprehensive program for the Commercial sector that offers prescriptive downstream rebates (e.g., deemed), provides energy savings calculations and incentives based on site-specific information (e.g., custom), measures energy savings and provides incentives based on normalized metered energy use (e.g., meter-based savings and behavior), and uses OBF to overcome funding barriers (e.g., finance).

<sup>6</sup> D.15-10-028, p.50.

<sup>7</sup> Energy efficiency programs that generate energy savings, quantified and tracked by program administrators.

As discussed in greater detail in *Section I Solicitation Strategies and Transition Timeline*, PG&E expects program design to be founded on the intervention strategies and tactics PG&E has identified for each sector.<sup>8</sup>

PG&E will continue to offer a self-service option for trade professionals and customers who would apply for incentives and finance by direct application submissions. **Table 1.1** illustrates PG&E’s revised portfolio structure.<sup>9</sup>

**Table 1.1**  
PG&E’s Rolling Portfolio Structure

Programs	<b>Residential Programs</b> Single Family, Multi-Family	<b>SMB Programs</b> Regional Direct Install	<b>Commercial Programs</b> High Tech, Large Office, Retail, Healthcare, Hospitality	<b>Industrial Programs</b> Petroleum, Manufacturing	<b>Agriculture Programs</b> Food Processing, Dairies, Wineries, Crop Production, Greenhouses	<b>Public Programs</b> Local Partnerships, K-12, etc.	<b>Statewide Programs</b>	<b>Codes &amp; Standards</b>	<b>Workforce Education &amp; Training</b>	<b>Emerging Technologies</b>
Platforms <sup>a</sup>	<b>Deemed</b>									
	<b>Custom</b> (new construction, retrocommissioning, retrofit)									
	<b>Meter-Based Savings</b> (whole building, SEM, operational savings)									
	<b>Behavior</b>									
	<b>Financing</b>									
Enablers	<b>Policy</b> Regulatory changes		<b>Analytics</b> Customer targeting		<b>Sales &amp; Marketing</b> Lead generation		<b>M&amp;V</b> Real-time evaluation			

<sup>a</sup> Platforms are how PG&E measures, pays for and claims energy savings.

<sup>8</sup> Per D.15-10-028, Implementation Plans (IPs) will include detailed program design and delivery approaches. PG&E will work with third parties, and through CAEECC, to develop IPs following approval of Business Plans.

<sup>9</sup> The figure denotes sectors and subsectors. Programs to serve these sectors will be proposed through third party solicitations, and in some specific instances (e.g., Residential Pay-for-Performance (P4P), by PG&E.

PG&E's re-envisioned portfolio structure supports its vision of an evolved portfolio that maximizes cost-effective energy savings by using our knowledge of our customers, cultivating relationships with new partners, and offering programs that drive value and innovation for our customers.

## C. PG&E's Portfolio Plan

The driving forces behind PG&E's portfolio plan are the need to double cost-effective energy efficiency by 2030, and PG&E's portfolio vision and guiding principles (See Section A). PG&E's Business Plan sets forth the following six overarching portfolio goals that will guide our activities over the next eight years:

- Save energy and reduce demand, positioning the state to double energy efficiency of existing buildings by 2030, where cost-effective and feasible.
- Reach a greater proportion of customers without proportional budget increases.
- Focus on increasing cost-effectiveness and achieving operational efficiencies.
- Increase customers' ability to manage energy.
- Assist the state in reaching commercial, public and residential zero net energy (ZNE) goals.
- Transform specific markets that will enable more cost-effective deployment of energy efficiency.
- Streamline program offerings to improve the customer and market actor experience.

Each Business Plan sector has a primary area of focus. The circular diagram in **Figure 1.1** presents the themes for each of the five customer sectors, with the cross-cutting sectors at the center of the figure to depict their support of all sectors. PG&E's areas of focus by sector include:

- **Residential:** Household-level targeting of energy efficiency opportunities using AMI data analytics to drive valuable peak demand savings; new program models, including meter-based pay-for-performance (P4P) to scale cost-effective approaches and facilitate third-party participation; and code readiness and other solutions to facilitate the shift to ZNE for all new residential construction by 2020.
- **Commercial:** Targeted value propositions by business segments to increase energy efficiency actions; new financing structures and program

models, moving the focus away from traditional rebates, to facilitate a doubling of energy efficiency savings cost-effectively, and ease customers' decision-making processes; and a comprehensive suite of assistance and tools to move the market towards greater adoption of ZNE design and construction.

- **Public:** Strategic partnerships to further engage public sector customers, with a focus on rural communities; accessible data platforms that improve public customers' understanding of usage, savings, and potential; and new and modified technical assistance and tools, such as Job-Order Contracting (JOC), to better meet the public sector's diverse and distinct needs.
- **Industrial:** New program models such as strategic energy management (SEM) that are adaptive to all sizes of industrial businesses to build energy efficiency into decision-making; and benchmarking with follow-on technical assistance to identify energy efficiency opportunities.
- **Agricultural:** Strategic partnerships to work within the current market structure and encourage energy efficiency at every level, while also looking for ways to save water; and data access tools that enable agricultural customers to view their energy usage holistically, observe trends, and make smart energy efficiency investments.
- **Cross-cutting: C&S, ET, WE&T, Finance:** Alignment with policy and portfolio goals and objectives.
  - **C&S:** Building codes and appliance standards that position the state to meet ambitious energy savings and GHG emissions reductions goals; compliance improvement efforts; and code-readiness activities to prime the market for "codification."
  - **ET:** Identification of new technologies with verifiable energy savings; and market transformation initiatives.
  - **WE&T:** Education and training for the current energy workforce, targeting high-impact jobs; targeted partnerships with training organizations; and resources for K-12 teachers to promote "green" career awareness.
  - **Finance:** Overcoming customer transaction barriers to investment; and increasing the supply and access to affordable capital.

**Figure 1.1**  
 PG&E's Energy Efficiency Focus Areas



## C.1 PG&E's Portfolio Intervention Strategies

PG&E's Business Plan identifies intervention strategies and cross-cutting efforts designed to achieve our portfolio and sector goals. While the details vary by sector, and not all will be used in each customer sector, these ten intervention strategies represent the core of our activities. These categories of intervention strategies are intended to guide, but not limit, our efforts over the next several years.

PG&E expects that third-party implementers, and in some limited cases PG&E, will be able to design and deliver innovative new options within these strategies and/or under new models. Specifically, these broad categories of intervention strategies are shown in **Table 1.2**.

PG&E is also submitting cross-cutting chapters and strategies (see **Table 1.3**) that focus on supporting California's policy goals, as well as our overall portfolio of programs across the five market sectors.

Each Business Plan chapter describes the proposed intervention strategies and tactics for each sector in greater detail. Statewide programs are founded on the same broad strategies as detailed in each sector chapter.

**Table 1.2**  
Intervention Strategies

Customer Sector (Residential, Commercial, Public, Industrial, Agricultural) Intervention Strategies
<b>Data analytics</b> for strategically targeting high-opportunity projects and providing targeted value propositions
<b>Data access</b> for customers and communities to better understand and manage energy use
<b>Technical assistance and tools</b> for customers to ensure they have access to benchmarking and are aware of energy management technologies provided by the utilities
<b>Financial solutions such as rebates and loans</b> for customers to help overcome first-cost barriers and constraining payback requirements
<b>Outreach and education-related activities</b> to raise awareness and broaden engagement with energy efficiency
<b>Training for mid-stream market actors</b> to increase the skills of the workforce
<b>Upstream and midstream activities to support EE equipment</b> and transform end use areas such as lighting and plug load-related markets
<b>Assistance for the building and design communities</b> to support ZNE goals
<b>Strategic partnerships</b> to leverage existing markets to help scale efficiency and meet SB 350 goals
<b>New models</b> such as pay-for-performance and strategic energy management that will help scale efficiency to meet SB 350 goals and realize savings from stranded potential



**Table 1.3**  
Cross-Cutting Intervention Strategies

Cross-Cutting Sectors	Intervention Strategies
<b>Codes and Standards (C&amp;S)</b>	<ul style="list-style-type: none"> <li>• <b>Building codes and appliance standards advocacy</b> to meet state policy goals<sup>a</sup></li> <li>• <b>Technical assistance for local governments</b> to develop and pass reach codes</li> <li>• <b>Compliance improvement activities</b> to ensure C&amp;S savings are realized and persist over time</li> <li>• <b>Code readiness activities</b> to ensure technologies' readiness for codification</li> </ul>
<b>Emerging Technologies (ET)<sup>b</sup></b>	<ul style="list-style-type: none"> <li>• <b>Technology Priority Maps (TPMS)</b> to ensure resource programs have a comprehensive set of new energy efficiency technologies suitable for inclusion</li> <li>• <b>Market and customer studies</b> on emerging technology measures to inform program design</li> <li>• <b>Technology development partnerships</b> to spur commercialization of new energy efficiency technologies</li> </ul>
<b>Workforce Education and Training (WE&amp;T)</b>	<ul style="list-style-type: none"> <li>• <b>Career Connections</b> to support teachers and organizations training future generations of the energy workforce<sup>c</sup></li> <li>• <b>Career and workforce readiness</b> to support organizations helping members of disadvantaged communities to enter the energy workforce<sup>d</sup></li> <li>• <b>Core (post-secondary) education collaboration</b> to help prepare the incoming energy workforce</li> <li>• <b>Technical upskill</b> to train, support, and advise the current energy workforce</li> <li>• <b>Long-term integrated planning and advocacy</b> to coordinate and align WE&amp;T strategic planning within the energy efficiency portfolio</li> </ul>
<b>Finance</b>	<ul style="list-style-type: none"> <li>• <b>Outreach and tools</b> to build customer and investor interest and confidence in energy efficiency investments</li> <li>• <b>New transaction structures</b> to accelerate the energy efficiency marketplace<sup>e</sup></li> <li>• <b>Access to affordable capital</b> to enable investments energy efficiency</li> </ul>

<sup>a</sup> Per D.16-08-019, C&S Advocacy is a statewide subprogram.

<sup>b</sup> Per D.16-08-019, Emerging Technologies is a statewide program.

<sup>c</sup> Per D.16-08-019, Connections is a statewide subprogram.

<sup>d</sup> Per D.16-08-019, the IOUs are proposing Career and Workforce Readiness as a statewide downstream subprogram.

<sup>e</sup> Per D.16-08-019, New Financing Offerings is a statewide subprogram.

## D. Roles in the Changing Landscape

Consistent with the Commission's adopted rolling portfolio structure, the roles and responsibilities of IOUs and third parties will be different from the status quo.

### D.1 PG&E's Role as Portfolio Administrator

As the portfolio program administrator, PG&E will determine the need for programs and identify the means of fulfilling those needs, while focusing on scaling energy efficiency cost-effectively, operational excellence and meeting customer needs.<sup>10</sup> PG&E sees its role as that of portfolio designer and manager, more so than program designer and implementer, with the exception of select programs and subprograms, as discussed in *Section I - Solicitation Strategy and Transition Timeline*.

In this new paradigm, PG&E's role as portfolio administrator is critical in meeting the state's energy savings targets and ambitious goals. As a utility portfolio administrator, PG&E brings:

- Resources and knowledge to adapt to the rapidly evolving market and regulatory landscape.
- A full breadth of experience and expertise to understand and represent the needs of the customers as their "trusted energy advisor,"<sup>11</sup> and top of mind point-of-contact for energy efficiency.
- Experienced customer-facing employees with the technical expertise to answer complex energy efficiency questions; guide customer actions; provide support to third-party implementers, local government partnerships, and RENs; and the ability to manage intricate integration issues.
- Capacity, expertise, and relationships required to administer statewide programs.
- Structures in place to contract, oversee and coordinate with multiple third party vendors to ensure that at least 60% of the portfolio is designed and implemented by third parties by 2020 as required in D.16-08-019.

- Access to detailed gas and electric data to allow us to target both customers and buildings, and help with matching customers to the savings opportunities.
- Unique ability to integrate IDER to inform energy efficiency programs, and locational-specific targeting efforts to reduce the need for future infrastructure, and support the grid of the future.<sup>12</sup>

PG&E's ultimate responsibility centers on designing an energy efficiency portfolio that achieves energy savings goals cost-effectively, within its approved portfolio budget. PG&E will seek programs through competitive bids from the market that capture available and feasible energy efficiency potential and overcome market barriers by sector/subsector, customer type, and/or geography. While PG&E will manage the set of rules that govern the platforms, discussed in *Section E. PG&E's Revised Portfolio Structure*, PG&E will work collaboratively with other program administrators, Commission staff, and stakeholders to shape and modify these, as required. In some cases, PG&E may look to third parties to develop and maintain platforms statewide.<sup>13</sup> Portfolio optimization, platform management, contract management, and regulatory reporting and engagement are central functions to portfolio administration, and will be led by PG&E utility staff.<sup>14</sup>

The new paradigm of statewide program administration<sup>15</sup> entrusts lead administrators with responsibilities to ensure the pursuit of all cost-effective energy savings throughout the state, while maintaining the utmost in customer satisfaction, and regulatory compliance. PG&E is proposed as statewide program administration for five subprograms. Specifically:

<sup>12</sup> <http://www.pgecurrents.com/2016/11/15/pge-leaders-take-part-in-the-national-distributed-energy-future-conference/>.

<sup>13</sup> As noted in PG&E's application, platforms implemented statewide should count toward the requirement that 25% of program administrators' budget be devoted to statewide activities.

<sup>14</sup> A more detailed discussion of PG&E operations to support its portfolio is found in *Section I - Solicitation Strategy and Transition Timeline*.

<sup>15</sup> The rolling portfolio transforms statewide programs. All upstream and midstream programs, market transformation programs, and select downstream programs move to a model wherein lead program implementer(s) are under contract to a single lead program administrator. D.16-08-019, p.51.

<sup>10</sup> D.16-08-019, p. 71.

<sup>11</sup> D.16-08-019, p. 71.

### Public Sector

- Institutional Government Partnerships - State of California and Department of Corrections

### Agricultural Sector

- Indoor Agriculture Program (downstream pilot)

### Codes and Standards

- Building Codes Advocacy and Appliance Standards Advocacy Programs

### Workforce Education and Training

- K-12 Connections Programs
- Workforce Education and Training: Career & Workforce Readiness (downstream pilot)

PG&E's Statewide Administration Business Plan chapter provides more details on PG&E's role in, and the programs slated for, statewide administration.

## D.2 Third Parties as Program Designers and Implementers

In the rolling portfolio structure, IOUs turn to third-party implementers to propose, design, and deliver the bulk of energy efficiency programs. D. 16-08-019 sets a minimum target of 60% of the utility's total portfolio budget to be devoted to third-party programs by the end of 2020.<sup>16</sup> Third parties will have a greater responsibility to deliver verifiable and persistent energy savings, pursue deeper, more comprehensive savings, and understand and abide by all policies and regulations that govern energy efficiency programs and platforms. PG&E will turn to third parties to ensure continuous improvement of programs based on lessons learned from evaluations and stakeholder feedback.

PG&E provides a detailed third party solicitation strategy and its proposed timeline to transition to the new third party model in *Section I. Solicitation Strategy and Transition Timeline*.

<sup>16</sup> D.16-08-019, p.74.

## E. PG&E's Portfolio Evolution: Comparison to Past Cycles

PG&E's current approach to energy efficiency has evolved significantly as a result of new policies, technology advancements, industry trends, customer needs, lessons learned from past program cycles, and stakeholder feedback through the California Energy Efficiency Coordinating Committee (CAEECC). In each Business Plan chapter, PG&E details the specific changes we anticipate each sector. The most salient developments that place PG&E on the path to realize our portfolio vision and double energy efficiency by 2030 include:

- **A Revised, Streamlined Portfolio Structure:** As discussed in *Section E. PG&E's Revised Portfolio Structure*, PG&E plans to streamline its portfolio structure in light of the changing energy landscape and the opportunities presented under the Commission's rolling portfolio structure. PG&E moves to a customer-centric approach, which allows us to focus on the unique needs of specific customer sectors. For instance, under its revised portfolio structure, PG&E plans to establish a single point of contact (SPOC) to provide coordinated information to multifamily building owners or managers on energy efficiency and upgrade options. The Public sector was created to allow PG&E to focus on the diverse and distinct needs of government agencies, including K-12, local governments, public universities, state agencies, and federal facilities. Additionally, PG&E will move away from programs founded on ways to calculate savings (e.g., Deemed). Instead, programs will rely on a set of "platforms" to calculate savings, influence customers to achieve savings, and promote increased and persistent savings. PG&E's revised portfolio structure favors simplification to yield scaled energy savings at lower costs, and reduce customer confusion.
- **Transition to Third Party Program Design and Delivery Model:** PG&E will transition at least 60% of its program design and delivery to third parties by 2020. This transition allows PG&E to engage third parties to offer a more diverse and innovative portfolio of programs to help customers use energy more efficiently.

- Transforming Markets through the New Statewide Model:** Under the rolling portfolio structure, the Commission has set the stage to transform California’s energy efficiency marketplace. The transition to a single statewide program administrator for market transformation programs extends the reach and increases the purchasing power of ratepayer investments beyond IOU-specific transactions. The new statewide model positions California to effectively prepare the market for more efficient LEDs, new energy efficient HVAC equipment, high quality appliances and electronics, and other high efficient equipment.<sup>17</sup> See the Statewide Administration Business Plan chapter for more on PG&E-led statewide programs.
- New Program Models to Cost-Effectively Scale Energy Efficiency:** SB 350 and AB 802 enable PG&E to unlock energy savings opportunities that were previously not within reach. New program models such as pay-for-performance and strategic energy management (SEM) will help scale efficiency to meet SB 350’s goals. As a result of AB 802, PG&E can offer deeper, more comprehensive whole building solutions, including retrocommissioning and operational savings opportunities. Using normalized metered-based analysis to determine energy savings allows PG&E to capture “stranded” potential and wisely target energy waste in California.
- New Transaction Structures Further the Reach of Ratepayer Dollars:** PG&E plans to scale energy efficiency more cost-effectively by offering new transaction structures, such as Distributed Energy Resources Billing Initiatives (DERBI)<sup>18</sup> or tariffed financing opportunities, to spur greater customer and capital markets investment in energy efficiency and more directly influence customers’ decision-making processes. Over the next decade, PG&E will move away from the traditional incentive model with a focus on expanding the supply of affordable funding by making investments in energy efficiency attractive as a capital-grade resource. PG&E is positioning its customers to reduce building loads substantially over the next 20-30 years by building a more mature energy efficiency marketplace and creating these investment opportunities.<sup>19</sup>
- Customer Targeting via Interval Data Analytics:** AMI data offers PG&E the ability to better understand site-specific customer energy usage and to tailor offerings that benefit customers most in need of specific energy efficiency offerings. While PG&E will provide energy efficiency offerings for its entire customer base, PG&E plans to target customers who are expected to yield the greatest energy savings, energy bill reductions, and/or grid-value location specific resources. Targeted interventions for these customers can drive peak demand savings during the times and at locations that are the most valuable to the entire customer base. PG&E will share AMI data with authorized third parties to facilitate targeted interventions and enhance program effectiveness.
- Minimizing “Stranded Potential” via Code-Readiness, Incentive Structures, and Training:** AB 802 was conceived to allow new ways to estimate energy savings,<sup>20</sup> as stakeholders expressed a concern that Commission baseline policies<sup>21</sup> were giving rise to “stranded potential” and “missed opportunities” in existing buildings due to increasingly stringent Title 24 building codes.<sup>22</sup> While the efficiencies of new buildings, technologies, and codes have steadily increased over time, the efficiency of an existing building tends to decrease over time unless action is taken within the building. Moving forward, PG&E will coordinate its C&S advocacy, energy efficiency resource programs, and WE&T offerings to empower customers and contractors to take action

<sup>17</sup> PG&E supports a bottom-up analysis of the current list of statewide programs delineated in D.16-08-019. Following approval of Business Plans, program administrators may wish to modify the legacy constructs of certain programs/subprograms.

<sup>18</sup> See for instances “MEETS” in Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, “Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings,” 2016, p.11.

<sup>19</sup> Mitchell, Cynthia 2014. “A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach,” p. 8.

<sup>20</sup> As a result of AB 802, the Commission has developed new rules to measure energy savings, and provide financial incentives, based on all estimated energy savings, taking into consideration the overall reduction in normalized metered energy consumption as a measure of energy savings, to include “to and through code,” and behavioral and operations and maintenance activities if they produce multiyear savings. D.16-08-019 established the new baseline rules to be used to measure energy savings for specific programs and measures. These rules are to be clarified further in a Commission resolution by January 1, 2017. [D.16-08-019 OP 4].

<sup>21</sup> Prior to the passage of AB 802, program administrators were required to calculate energy savings and provide incentives based on Title 24 code and/or industry standard practice.

<sup>22</sup> Meija, Alejandra et al., 2016. “Savings To Code: Looking to Whole Systems for Implementing Existing Conditions Baselines” ACEEE 2016 Summer Study on Energy Efficiency in Buildings.

to unlock stranded energy efficiency savings. PG&E will focus on a four-pronged approach to reverse the trend of increasing stranded potential that includes “code-readiness” activities to prime the market for upcoming code cycles, work to simplify codes during development of new code change proposals to reduce code complexity, incentive structures that reward the replacement of antiquated but functional equipment with highly efficient equipment installations, and robust contractor and customer training that facilitates savings persistence.

- **Data Access to Facilitate Customer Understanding of Energy Efficiency:** PG&E developed data platforms such as My Account, My Energy, and Share My Data to encourage increased access to energy data for customers and authorized third parties. PG&E will drive greater customer engagement with data platforms and improve access to aggregated, whole-building data in accordance with AB 802. Further, PG&E will promote data platforms to third parties, who play a critical role in delivering energy savings in the rolling portfolio paradigm.
- **Sharpened Focus on Meeting Zero Net Energy Goals:** The deadline to achieve ZNE in all new homes is fast approaching (2020), with the deadline for existing and new commercial buildings (2030) not far behind. PG&E plans to redouble its efforts to work with ZNE stakeholders to develop code readiness projects and ZNE demonstrations to move the market towards greater adoption of ZNE. PG&E will complement C&S activities by incorporating primary data on equipment and building performance into demonstrations and future offerings in the residential and commercial sectors. In addition, PG&E will develop new financial solutions to mitigate the financial barriers that impede ZNE projects.

To provide context and rationale for our energy efficiency Business Plan, PG&E describes the energy needs within our territory and the evolving energy efficiency landscape that influenced it in sections F and G.

## F. Energy Efficiency and its Role in Helping PG&E Meet its Energy Needs

Several drivers influenced PG&E’s vision, portfolio structure, portfolio plan, and strategies and tactics summarized in sections A-E above. Here, we focus on energy efficiency’s important role in meeting our energy needs, relying on statewide and PG&E-specific data.

Energy efficiency plays an important role at PG&E, and is a key component of our goal to offer our customers safe, reliable, affordable, and clean energy.

Energy efficiency is the cornerstone of California’s energy policy and commitment to a clean energy future<sup>23,24</sup> Each year, the difference between California’s demand for energy versus its existing resources is calculated to determine the state’s net energy need. State law requires IOUs such as PG&E to first meet their “unmet resource needs through all available energy efficiency and demand reduction resources that are cost effective, reliable, and feasible.”<sup>25</sup> This puts energy efficiency as first in the “loading order” of resources potentially available to meet energy needs.

Further, PG&E looks to cost-effective energy efficiency as a preferred resource for achieving GHG emission reductions under California’s cap and trade regulations, reducing demand and alleviating grid reliability issues at a lower cost.

### State Policy Relies on Energy Savings through Energy Efficiency to Meet GHG Goals

The 2015 Clean Energy and Pollution Reduction Act (SB 350) and the 2016 revision of the Global Warming Solutions Act (SB 32) “create a framework

<sup>23</sup> State of California Energy Action Plan II, 2015. “As stated in EAP I and reiterated here, cost effective energy efficiency is the resource of first choice for meeting California’s energy needs. Energy efficiency is the least cost, most reliable, and most environmentally-sensitive resource, and minimizes our contribution to climate change. California’s energy efficiency programs are the most successful in the nation and we want to continue to build upon those successes.” p.3.

<sup>24</sup> The State of California Energy Action Plan 2008 Update reaffirmed energy efficiency as “the most important tool for addressing greenhouse gas emissions in the energy sector...” p. 6.

<sup>25</sup> Public Utilities Code (Pub. Util. Code) § 454.5(b)(9)(C).

to make energy efficiency a way of life in California.”<sup>26</sup> PG&E supports these ambitious goals and offers its Business Plan as a key tool in positioning the state to realize them.

### **Advances in Regulation and Technology May Enable Energy Efficiency to Operate as a Demand-Side Resource**

The Commission intends to develop a unified mechanism to direct the electric and gas IOUs to achieve demand reduction and load shaping using integrated demand-side management resources in the Integrated Distributed Energy Resources (IDER) proceeding.<sup>27</sup> The Commission initiated the Distributed Resources Plan (DRP) rulemaking to evaluate the IOUs’ existing and future electric distribution infrastructure and planning procedures with respect to incorporating DERs into the planning and operation of their electric distribution systems.<sup>28</sup>

Along with the Integrated Resource Plan (IRP) proceeding<sup>29</sup> which has superseded the IOUs’ long-term procurement proceedings, these proceedings may transform the way in which energy efficiency is considered as a resource on the electrical grid.

## **Using Energy Efficiency to Alleviate Distribution Grid Capacity Constraints**

For several years, PG&E has piloted targeted demand-side management (TDSM) solutions, including energy efficiency, to alleviate distribution grid capacity constraints that otherwise would require a traditional wires investment to resolve. By providing higher incentives in these areas, PG&E has been able to motivate the market and drive increased participation in energy efficiency programs.

### **Energy Efficiency’s Role in a Healthy Grid**

By curbing demand for electricity, energy efficiency may also alleviate renewable over-generation issues illustrated by the “duck curve” which is graphed (see **Figure 1.2**) against megawatts (MW) and hours of the day. The duck curve is playing a major role in California’s changing energy landscape. Each day when solar generation subsides, other resources are needed that can bring deliveries online rapidly to “ramp up” capacity. PG&E sees energy efficiency as a resource that can reduce demand and help to manage the need for ramping resources. If fossil-fueled resources are employed in the ramp up, energy efficiency’s reduction in the demand for ramping resources would reduce the emission of GHG in addition to avoiding the cost of generation. Energy efficiency solutions targeted at reducing electrical demand for cooling in homes and businesses can help ease the need for dramatic ramp up capacity.<sup>30</sup> An increased focus on the time-value of energy efficiency will be key in future to ensure its deployed in the most effective way.

<sup>26</sup> California Energy Efficiency Strategic Plan, January 2011 update [http://www.energy.ca.gov/ab758/documents/CAEnergyEfficiencyStrategicPlan\\_Jan2011.pdf](http://www.energy.ca.gov/ab758/documents/CAEnergyEfficiencyStrategicPlan_Jan2011.pdf).

<sup>27</sup> R.14-10-003.

<sup>28</sup> R.14-08-013.

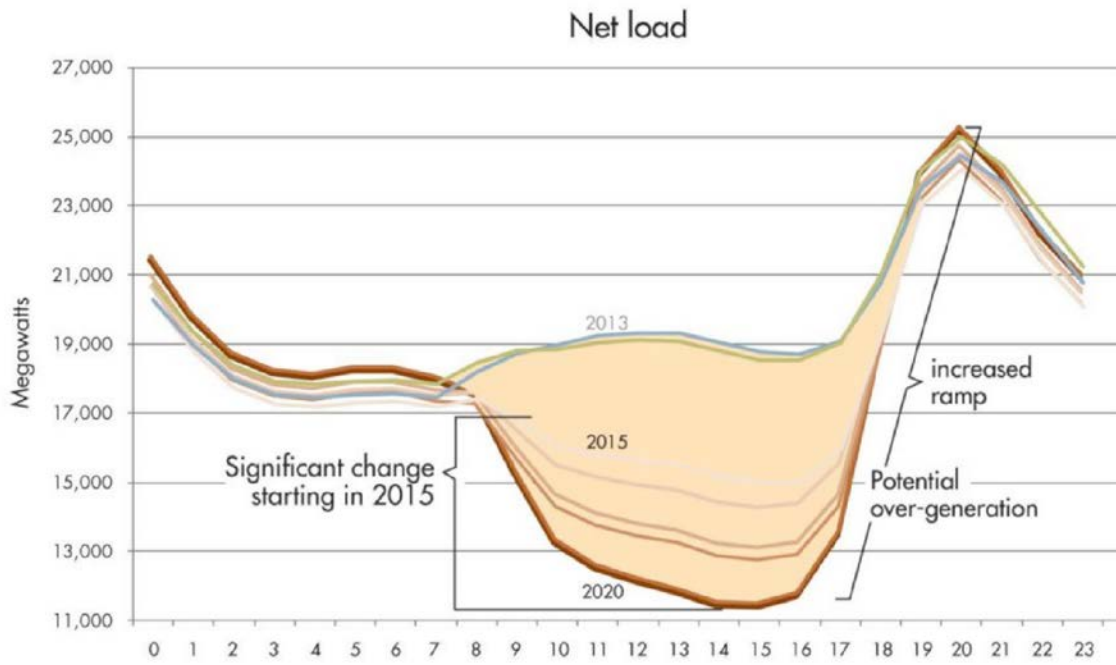
<sup>29</sup> R.16-02-007.

<sup>30</sup> See Mitchell, Cynthia 2014. “A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach,” pp. 6-7.

**Figure 1.2**

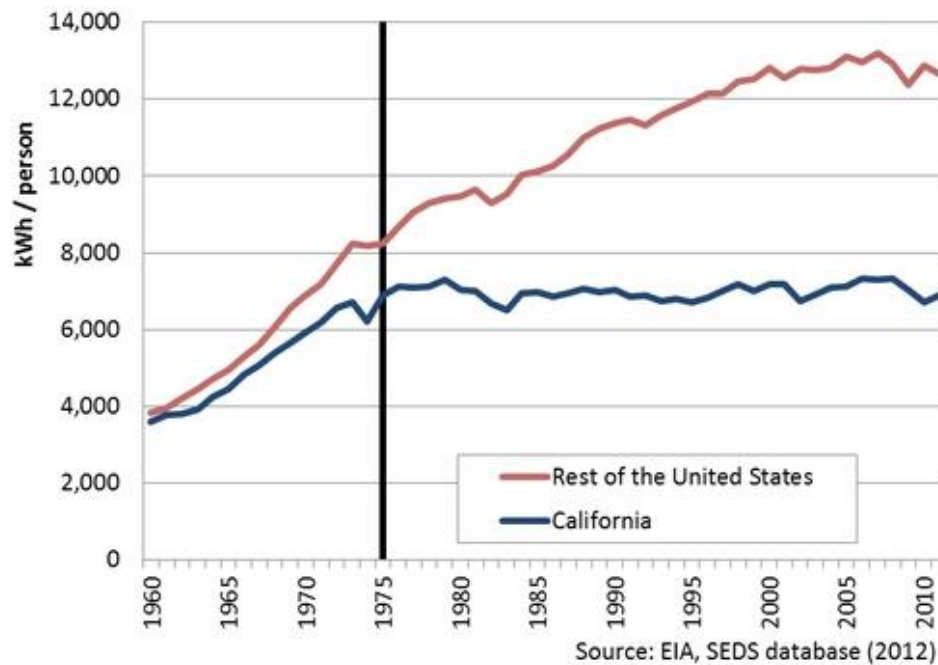
**Projected Hourly Net Load 2013–2020**

Source: CAISO.



**Figure 1.3**

Rosenfeld Curve: Per Capita Electricity Consumption in California and the U.S.



### Energy Efficiency's Track Record Guarantees it a Role in PG&E's Energy Resource Plan

PG&E's energy efficiency portfolio is designed to enable Californians to continue to reduce their energy consumption relative to load growth. California has been effective at managing energy use, as shown (see **Figure 1.3**) by the "Rosenfeld Curve,"<sup>31</sup> a primary measure of how Californians have maintained flat per capita electricity usage since the 1970s despite significant growth in the rest of the United States (US). According to the Natural Resources Defense Council (NRDC), at least one-third of lower usage is partly due to the state's efficiency policies.<sup>32</sup>

<sup>31</sup> See "California Leads the Nation in Energy Efficiency - Part 2: Myth-Busting the Naysayers," <https://www.nrdc.org/experts/sierra-martinez/california-leads-nation-energy-efficiency-part-2-myth-busting-naysayers>.

<sup>32</sup> Ettenson, Lara et al., 2015. "California's Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals," p.12.



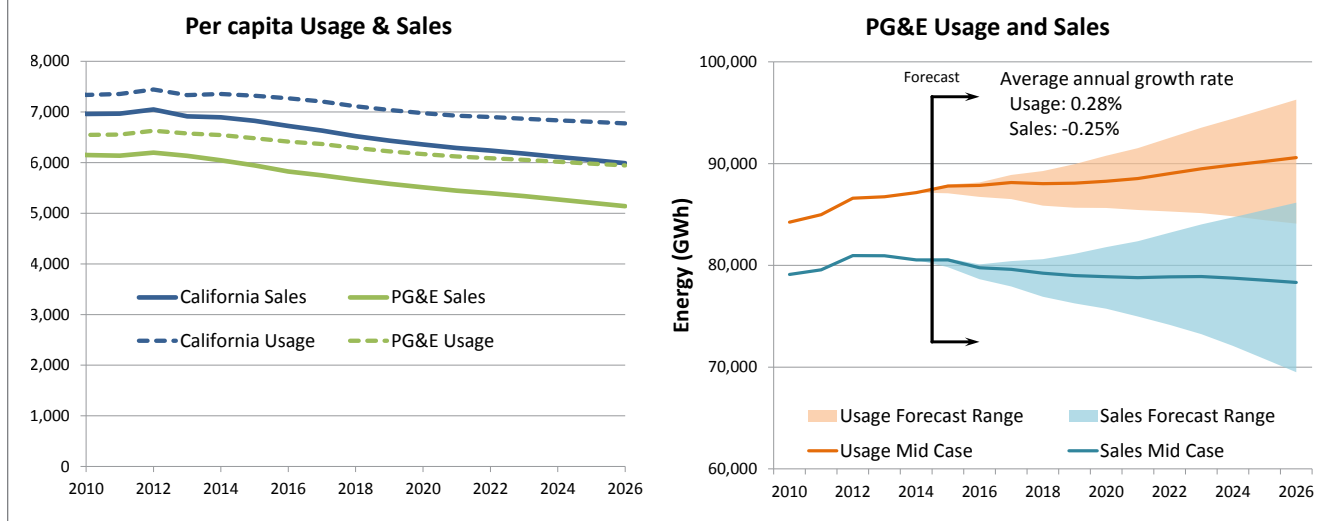
## Energy Efficiency Remains Key in Driving Further Energy Usage Reductions

The California Energy Commission (CEC) Integrated Energy Policy Report (IEPR) Forecast<sup>33</sup> indicates Californians will further distance themselves from the rest of the country. California per capita sales<sup>34</sup> are expected to drop by about 16% over the next 10 years with PG&E will maintain our lower per capita sales compared to the rest of the state (see **Figure 1.4a**). However, even total per capita usage is dropping in California, as households and buildings become more efficient.

The gap between usage and sales is a result of the growth in distributed generation (DG). Increases in DERs, such as rooftop solar, over the next decade will drive the gap between usage and sales even wider. **Figure 1.4b** illustrates this DG growth, and indicates that sales in PG&E’s planning area are expected to further decrease over time, as they have for the past few years. While energy consumption and sales are trending downward, customer bills are increasing. As such, at the individual customer level, energy efficiency investments remain critical to help customers best manage their energy use, reduce energy bills, and ensure homes, facilities, and appliances are as efficient as possible to meet the state’s policy goals.

**Figure 1.4**

CEC IEPR forecast of a) per capita usage and sales in California and PG&E planning area, and b) the growing gap between usage and sales driven by distributed generation



<sup>33</sup> California Energy Commission, 2015, Integrated Energy Policy Report (IEPR), <http://www.energy.ca.gov/energypolicy/>.

<sup>34</sup> In the Rosenfeld Curve, “consumption” refers to sales.

## Using Energy Efficiency to Meet System Needs

PG&E is also pursuing the next generation of energy efficiency programs to meet its own energy needs. One example of this is PG&E's incorporation of energy efficiency in its proposal to retire its 2200 MW Diablo Canyon Power Plant (DCPP). The state's prioritization of renewable energy resources and energy efficiency, coupled with projected lower customer electricity demand in the future, will result in a significant reduction in the need for the electricity produced by the DCPP past 2025. Reflecting this change, PG&E announced a joint proposal with labor and environmental organizations on June 20th 2016, to increase investment in energy efficiency, renewables, and storage beyond current state mandates while phasing out PG&E's production of nuclear power in California by 2025. Energy efficiency will play a prominent role in supporting plant closure. PG&E filed Application 16-08-006 on August 11, 2016, which requests, among other things, the Commission to authorize PG&E to conduct one or more competitive solicitations to achieve 2,000 gross GWh of energy efficiency before 2025. PG&E's Business Plan does not include plans to achieve the energy efficiency contemplated as part of the DCPP settlement, as these details will be determined as part of the Commission's decision on PG&E's Application. PG&E does not anticipate that energy savings enumerated in PG&E's DCPP closure proposal will count towards the energy savings goals in this Business Plan.

## F.1 PG&E's Business Plan is Tailored to the Energy Use, Energy Savings and Participation Patterns of each Customer Class

PG&E provides a snapshot of electric and gas usage, energy and GHG savings, and energy efficiency program participation for 2015. Each Business Plan chapter provides greater detail on sector-level electric and gas usage, energy and GHG savings, and energy efficiency program participation.

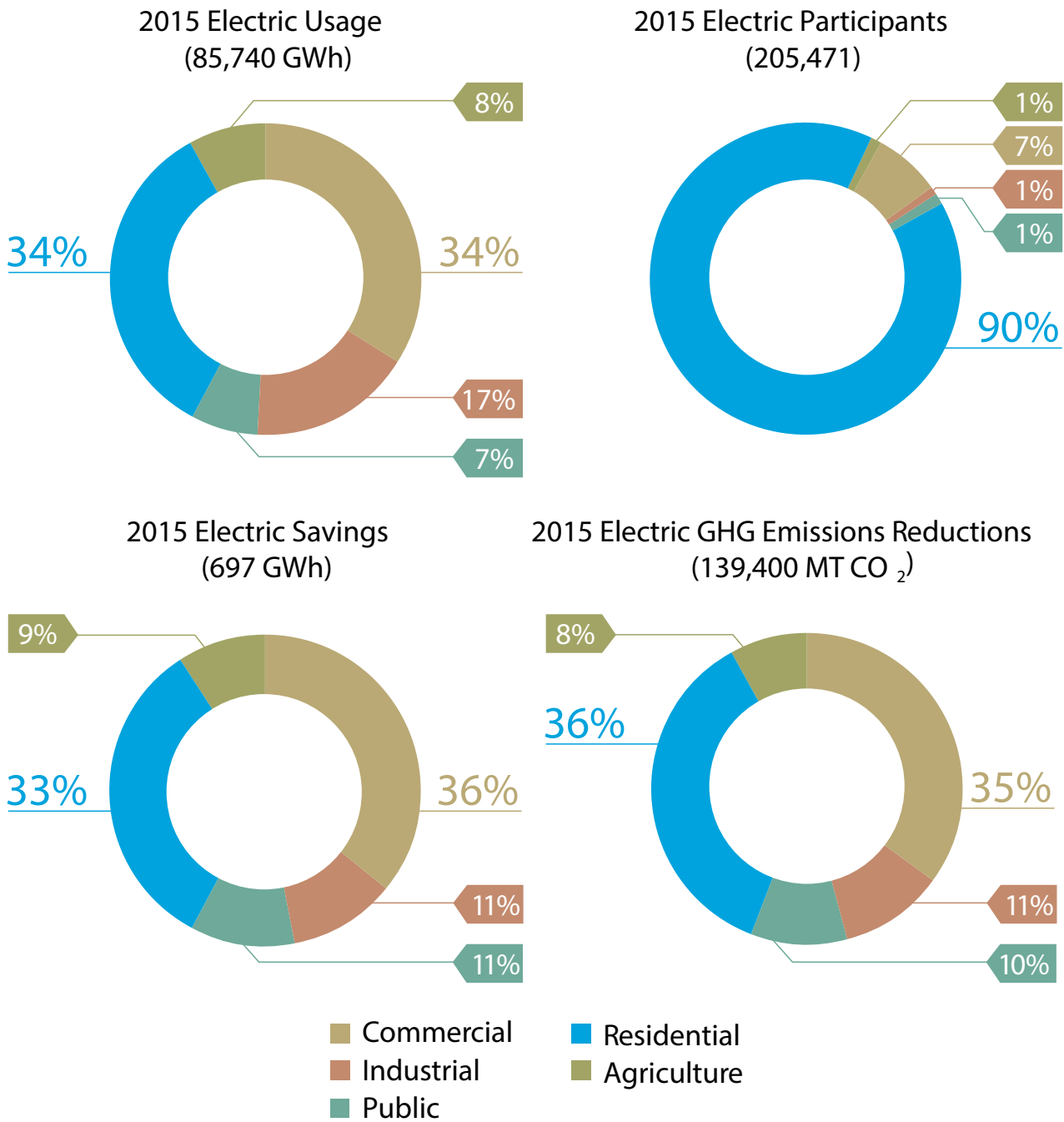
In line with the rolling portfolio decision, PG&E's portfolio structure is based on customer sectors that are further divided into discrete segments. Thanks to these efforts, PG&E is able to target outreach campaigns to customers, tailor its offerings based on segment needs, and better prioritize high potential customers to maximize energy savings.

**Figure 1.5** compares PG&E customers' energy use, energy and GHG savings, and energy efficiency program participation, across all sectors in 2015. The residential and commercial sectors account for over 50% of PG&E's 2015 electric usage and savings. The residential sector also comprises 90% of PG&E's electric participation with over 180,000 participants. In 2015, PG&E avoided 139,000 MT of CO<sub>2</sub> emissions with electric savings from energy efficiency programs, which is the equivalent to taking nearly 30,000 cars off the road for one year.<sup>35</sup>

<sup>35</sup> The typical passenger vehicle emits 4.7 metric tons of CO<sub>2</sub> per year: <https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle-0>.

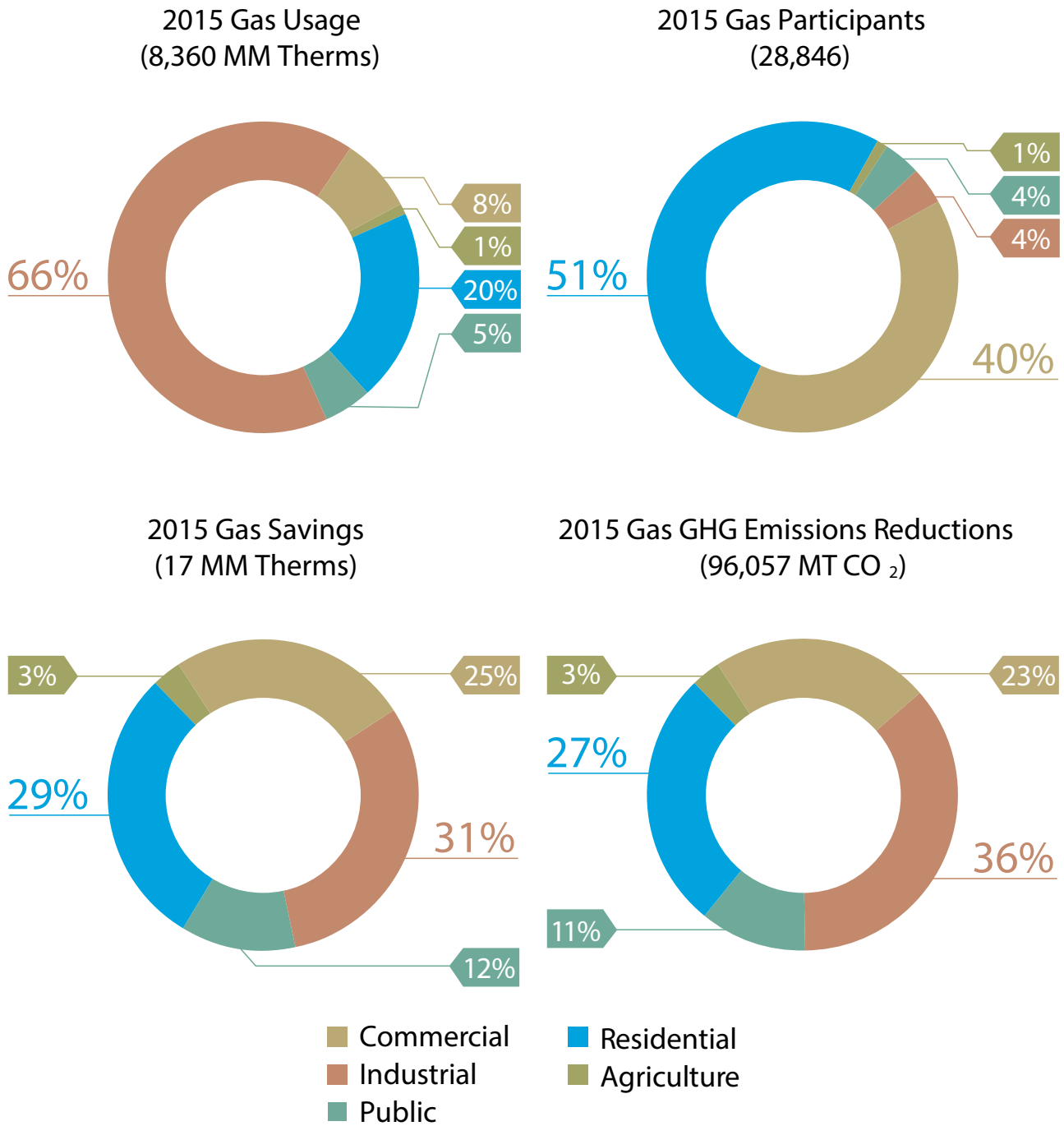
**Figure 1.5**

2015 Electric Usage, Energy Savings, Energy Efficiency Program Participants, and GHG Emissions Reductions by Sector



**Figure 1.6**

2015 Gas Usage, Energy Savings, Energy Efficiency Program Participants, and GHG Emissions Reductions by Sector



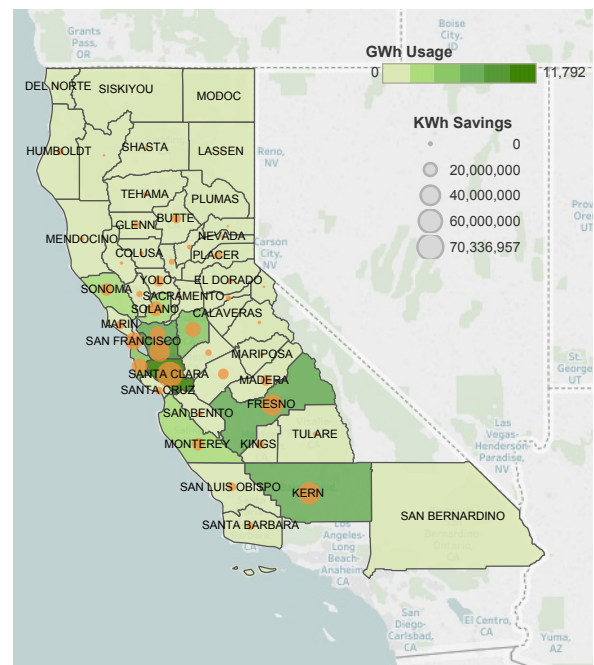
**Figure 1.6** compares PG&E customers' gas usage, gas and GHG emissions reductions, and energy efficiency program participants across all sectors in 2015. Notably, the industrial sector accounts for two-thirds of PG&E's gas usage, but only one-third of total gas savings. PG&E avoided more than 96,000 MT of CO2 emissions with gas savings from energy efficiency programs across the portfolio. This is the equivalent of taking more than 20,000 cars off the road for one year.<sup>36</sup> With electric and gas savings combined, PG&E avoided 235,457 MT of CO2 emissions in 2015, which is equivalent to removing over 50,000 cars from the road for one year.

## F.2 PG&E's Energy Efficiency Portfolio Addresses Energy Usage Across PG&E's Territory

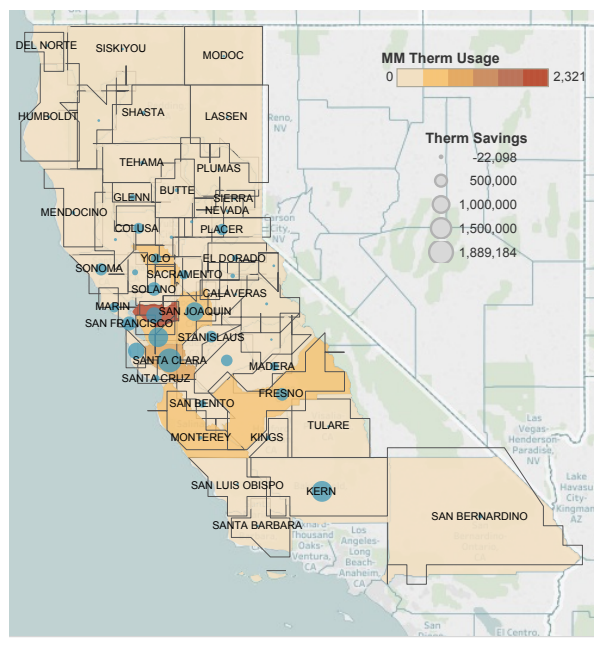
PG&E's customers are spread across a variety of sectors, climate zones, and population densities. PG&E uses data analytics to identify which counties consume and save the most energy. For the most part, energy usage in any particular geographic region is driven by customer density, and the majority of customers are clustered in the heavily urbanized San Francisco Bay Area (Bay Area). However, PG&E also serves more sparsely populated rural regions in the North Coast, Central Valley, and the Sierra Nevada. The maps in **Figure 1.7** and **Figure 1.8** provide an overview of electric and gas usage and savings at the county level.

While PG&E will provide energy efficiency offerings for its entire customer base, PG&E also plans to target customers who are expected to yield the most energy savings, greatest energy bill reductions, and peak load reductions.

**Figure 1.7**  
2015 Portfolio Wide  
Electricity Usage by County



**Figure 1.8**  
2015 Portfolio Wide  
Gas Usage by County



<sup>36</sup> The typical passenger vehicle emits 4.7 metric tons of CO2 per year: <https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle-0>.



## CALIFORNIA ENERGY EFFICIENCY STRATEGIC PLAN “BIG BOLD ENERGY EFFICIENCY STRATEGIES”

- All new residential construction in California will be zero net energy by 2020
- All new commercial construction in California will be zero net energy by 2030
- HVAC will be transformed to ensure that its energy performance is optimal for California’s climate
- All eligible low income customers will be given the opportunity to participate in the low income energy efficiency program by 2020 (*accomplished through the Energy Savings Assistance program*)

- Residential and Commercial usage are concentrated in larger population centers, with emphasis on the Bay Area, Sacramento, Fresno and Kern counties.
- Public agency usage is more broadly distributed than the residential and commercial sectors. Electric usage is concentrated in Fresno, Santa Clara, Kern, and Santa Barbara counties. Gas usage is more concentrated in Bay Area, Placer, Sacramento, and Shasta
- Industrial usage is concentrated in Kern County, Fresno County, and the Bay Area. Gas usage is primarily concentrated in Monterey, Santa Clara, and Yolo counties.
- Agricultural usage is centered around the southern part of PG&E’s service territory. Kern, Fresno, and Monterey all lead in gas usage.

### Targeting Rural and Hard-to-Reach Customers

PG&E also uses data analytics to reach out to customers in rural areas and those that are considered hard-to-reach.<sup>37</sup> PG&E offers its rural and hard-to-reach customers energy usage data, technical tools and assistance, financial solutions, outreach, and partnerships to help them to reduce energy consumption and demand, and build more sustainable communities.

PG&E’s local government partnerships (LGP) play a leading role in developing flexible, tailored approaches to meet local, county, and/or regional needs.

<sup>37</sup> As redefined in Resolution G-3497.

## G. California's Evolving Energy Efficiency Landscape: Business Plan Influences

The role of energy efficiency in meeting our energy needs is just one influence shaping our Business Plan. The Business Plan relies also on a number of guiding frameworks, including the *California Energy Efficiency Strategic Plan*<sup>38</sup> and *Energy Efficiency Existing Buildings Action Plan*, regulatory policies, legislative drivers, industry trends, customer needs, lessons learned from program evaluations, and stakeholder feedback. Each of these elements is discussed in further detail throughout section G.

### G.1 PG&E's Business Plan Guiding Frameworks

The California Energy Efficiency Strategic Plan (CEESP) is intended to serve as a guide to maximize energy savings across all sectors in California, high-opportunity technologies (e.g., lighting and heating ventilation and air conditioning (HVAC)), and cross-cutting activities (e.g., Codes and Standards (C&S), and Workforce Education and Training (WE&T)). PG&E used the CEESP as the foundation for its approach to the Business Plan.<sup>39</sup> The CEESP provides California with a vision to transform the market, setting forth “big, bold” energy efficiency strategies to guide programmatic activities and “galvanize market players.”<sup>40</sup>

In addition, the CEC's Existing Buildings Energy Efficiency Action Plan offers a 10-year roadmap to “activate market forces” and transform California's existing buildings into high performing and energy-efficient buildings.<sup>41</sup> The Existing Buildings Energy Efficiency Action Plan provides actionable steps to align customers' investments in energy efficiency

with building a more mature energy efficiency marketplace for investors and financial institutions. PG&E used the Existing Buildings Energy Efficiency Action Plan to inform its strategies and tactics in the Residential, Commercial and Public sectors.

### G.2 Regulatory Policies: The Rolling Portfolio and other Commission Proceedings Shaping PG&E's Business Plan

#### The Energy Efficiency Rolling Portfolio

To set the stage for a new generation of energy efficiency portfolios, the Commission authorized ten years of energy efficiency funding and adopted a “Rolling Portfolio” process in place of its traditional biennial or triennial energy efficiency portfolio process.<sup>42</sup>

A key component of this new format is the requirement to file Business Plans, which are envisioned as a high-level compendium of long-term strategic initiatives and tactics designed to “effectuate the [California Energy Efficiency] strategic plan.”<sup>43</sup> In addition, the Commission created a new stakeholder engagement process — the California Energy Efficiency Coordinating Committee (CAEECC) — to facilitate ongoing stakeholder input into program administrators' energy efficiency portfolios.<sup>44</sup>

Under the Rolling Portfolio framework, the IOUs focus more on portfolio design and the determination of need<sup>45</sup> as program administrators. The design and delivery of energy efficiency programs shifts to third-party implementers, with a minimum target of 60% of the utility's total portfolio budget to be proposed, designed, and delivered by third parties by the end of 2020.<sup>46</sup>

The Rolling Portfolio structure elaborates on the distinction between local programs and statewide programs, with statewide programs being delivered uniformly throughout the IOU service territories and overseen by a single lead program administrator.<sup>47</sup>

<sup>38</sup> D.15-10-028 required that Business Plans explain at a high-level how program administrators plan to effectuate the California Energy Efficiency Strategic Plan, p. 46.

<sup>39</sup> The CEESP was last updated in 2011. D.15-10-028 envisioned adopting an updated CEESP as part of R.13-11-005 Phase 3 p.46. PG&E has incorporated the direction of the CEESP with knowledge of the marketplace and the customers in PG&E's territory. As new guidance is developed, PG&E will continue to adjust to meet the evolving needs of the state.

<sup>40</sup> CEESP, p. 6.

<sup>41</sup> California Energy Commission, 2015. California's Existing Buildings Energy Efficiency Action Plan.

<sup>42</sup> D.14-10-046 and D.15-10-028.

<sup>43</sup> D.15-10-028, pp.46-48.

<sup>44</sup> See below “Stakeholder Feedback” section for more on the CAEECC.

<sup>45</sup> D.16-08-019, p. 71.

<sup>46</sup> D.16-08-019, p.74.

<sup>47</sup> D.16-08-019, pg. 51.

Statewide efforts are required to comprise at least 25% of each IOU's portfolio budget.<sup>48</sup> All upstream and midstream programs, market transformation efforts, and select downstream programs are subject to statewide administration.

PG&E's Business Plan outlines its proposals to meet the new rolling portfolio structure.

Beyond the rolling portfolio, the Commission is considering a wide-range of policies that complement, and will likely impact, energy efficiency — both in the short-term and long-term.

### Integrated Distributed Energy Resources

The Commission is striving to integrate demand side resources to reduce demand and shape load in the IDER<sup>49</sup> proceeding, and is developing infrastructure and planning procedures to integrate DERs into the operation of electric distribution system. It is also considering the integration of energy efficiency with other resources in the IRP<sup>50</sup> proceeding. These efforts have the potential to transform the way in which energy efficiency can perform as a true grid resource. The Business Plan acknowledges that as the new regulatory frameworks mature, it will be important to consider how the activities promoted through these proceedings complement each other to provide energy, cost, and GHG emission savings to customers.

### Water-Energy Nexus

The Water-Energy Nexus proceeding<sup>51</sup> advances partnerships between IOUs and the water sector to co-fund programs that reduce energy consumption when supplying, conveying, treating, and distributing water. PG&E has been working with the Commission and stakeholders to refine tools that allow IOUs to better quantify the benefits of water-saving programs and embedded energy. For example, through the water-energy nexus proceeding, PG&E has implemented pilots aimed at analyzing behavior-based interventions and their impact on reducing water usage, peak energy usage, and total energy usage. Many synergies exist between energy efficiency and the water-energy nexus, in particular for large industrial and agricultural customers. PG&E's Business Plan outlines ways to better

use tools and technology to capture savings from embedded energy, and improve and prioritize energy efficiency offerings relevant to water conservation and the water-energy nexus.

### Rate Reform and Time of Use (TOU) Rates

The Residential Rate Reform proceeding<sup>52</sup> should enable customers to understand how technology, energy efficiency, and DERs can best be used to manage their energy use in response to price signals. PG&E's Business Plan includes various strategies and tactics to provide customers with the tools they need to understand and manage their energy use, and motivate the adoption of energy efficiency solutions during high energy cost periods. More information on the intersection of Residential rate reform and PG&E's energy efficiency portfolio is discussed in detail in the Residential Business Plan chapter.

### Energy Savings Assistance (ESA)

Energy Savings Assistance (ESA) programs have natural synergies and policies associated with PG&E's energy efficiency portfolio. ESA's new model, as determined in D.16-11-022, requires IOUs to meet meaningful energy-savings targets and requires high-quality, longer-life technologies. ESA will expand to include a new multifamily component. PG&E's Business Plan proposes strategies to coordinate with ESA in an effort to maximize savings potential and customer benefits. For example, one approach combines market-rate and income-qualified measures to ensure energy efficiency is coordinated and leveraged, while remaining accessible to all customers. Ultimately, PG&E's objective is to help income qualified customers reduce their energy consumption while increasing their comfort, health, and safety.

Other Commission policymaking that influenced and shaped PG&E's Business Plan include Energy Efficiency Financing, Statewide Marketing Education and Outreach (SW ME&O), Demand Response, Distributed Generation, and Zero-Emission Vehicles, as detailed throughout the Business Plan chapters.

## 6.3 Legislative Drivers

PG&E's Business Plan integrates California's newer energy efficiency policies into its portfolio design. In 2015 and 2016, California saw unprecedented

<sup>48</sup> D.16-08-019, p. 65.

<sup>49</sup> R.14-10-003.

<sup>50</sup> R.16-02-007.

<sup>51</sup> R.13-12-011.

<sup>52</sup> D.15.07-001.



activity at the legislature in support of energy efficiency and clean energy policies. While the Global Warming Solutions Act of 2006 gave impetus to energy efficiency as a way to address energy needs in place of GHG-producing resources, the 2016 amendment (SB 32), which doubles the reduction in GHG emissions below 1990 levels by the year 2040, compels us to achieve even more GHG emissions reductions. In addition, SB 350 recognized the need for updated policies to allow for a new generation of energy efficiency programs, such as market transformation, pay-for-performance programs, and behavioral and operational savings opportunities.

AB 802 unlocks more energy savings by authorizing program administrators to provide financial incentives based on all estimated energy savings and considering the overall reduction in normalized metered energy consumption as a measure of energy savings. This includes “to and through code” and behavioral and operations and maintenance activities that produce multiyear savings. AB 802 also expands building owner’s data access through whole-building benchmarking, providing customers with the tools they need to better manage their energy use.

AB 793 requires IOUs to develop an outreach program to educate customers about the ability to ascertain real-time energy use data by employing energy management technologies. Additionally, AB 793 requires IOUs to provide incentives to increase the adoption of these technologies. PG&E sees data access and energy management technologies (EMTs) as a key strategy to help customers understand how to best eliminate unnecessary energy use.

The Governor approved SB 1414 in 2016, which requires participants in energy efficiency programs for HVAC installations to provide proof that their equipment has been properly installed. SB 1414 also requires the Energy Commission to approve a plan that promotes the installation of central air conditioning and heat pumps in compliance with the state’s building code and energy efficiency regulations.

While not the sole legislative drivers that influenced PG&E’s Business Plan, these bills are poised to put California on the path to exceed the state’s long term energy efficiency and clean energy goals. Each Business Plan chapter provides a thorough overview of key policies influencing each sector.

## G.4 Industry Trends

A number of overarching trends informed PG&E’s Business Plan. Industry trends specific to each market and/or cross-cutting sector are provided in the respective Business Plan chapters. PG&E presents some of the most notable trends below:

- Concentration of population in urban areas:** Between 2010 and 2040, the population of the nine-county San Francisco Bay Area is anticipated to add 2.1 million people, 1.1 million jobs, and 660,000 new homes.<sup>53</sup> Sacramento is also expected to grow, with population growth projected at 5.9% by 2020.<sup>54</sup> California’s population, therefore, is shifting from larger homes (with higher energy use) in rural areas, to smaller units that use less energy, but put more strain on urban infrastructure.<sup>55</sup>
- Economic growth:** Commercial and industrial job growth in some sectors may indicate a need to focus a greater share of program efforts in these sectors to forestall increasing energy usage. Over the past year, accommodation and food services, health care, and professional services led employment growth, contributing 43 percent of new jobs. The construction industry also continued to rebound in 2015, adding jobs at a rate of 8.1 percent, more than twice the state’s overall job-growth rate. These industries are projected to continue leading growth through 2022. By contrast, manufacturing grew at a comparatively slow 1.7 percent rate.<sup>56</sup>
- Recession in rural areas:** While urban areas, in particular the nine-county Bay Area, are poised for growth, California’s rural communities’ economic position remains in question. California’s interior “farm belt” has seen unemployment rates rise slightly in 2016.<sup>57</sup>

<sup>53</sup> [http://mtc.ca.gov/sites/default/files/2-The\\_Bay\\_Area\\_In\\_2040.pdf](http://mtc.ca.gov/sites/default/files/2-The_Bay_Area_In_2040.pdf).

<sup>54</sup> Sacramento County Economic Forecast, [http://www.dot.ca.gov/hq/tpp/offices/eab/socio\\_economic\\_files/2015/Final%20Forecasts/Sacramento.pdf](http://www.dot.ca.gov/hq/tpp/offices/eab/socio_economic_files/2015/Final%20Forecasts/Sacramento.pdf).

<sup>55</sup> The impact of urban form on residential energy use, <http://www.tandfonline.com/doi/abs/10.1080/10511482.2008.9521624>.

<sup>56</sup> California’s Economy is Growing, but Disparities Persist; [http://www.ppic.org/content/pubs/report/R\\_116SBR.pdf](http://www.ppic.org/content/pubs/report/R_116SBR.pdf).

<sup>57</sup> Walters, Dan. “California’s jobless rolls cut in half, but gains have been uneven.” *Sacramento Bee*. August 14, 2016.

- **Energy prices:** Low natural gas prices can compromise interest in energy efficiency. Based on Energy Information Administration (EIA) data, PG&E expects natural gas prices to remain at relatively low levels in the midterm (rising from over \$2.5/MMBtu to \$4/MMBtu by 2020, and remaining at roughly \$5/MMBtu to 2040)<sup>58</sup>, which may temper some customers' (i.e., industrial customers) motivation to pursue energy efficiency projects.
- **High demand for DERs:** In a push to reduce GHG emissions, reduce energy bills, and/or realize their energy independence, customers are taking generation and storage into their own hands, as technologies become more cost effective. California has an opportunity to integrate energy efficiency with other DER technologies to provide coordinated solutions for individual customers that also deliver benefits to all customers through enhanced avoided costs and grid stability.
- **New energy efficiency financing vehicles are becoming available to spur energy efficiency investments:** New offerings such as on-bill repayment (OBR), Property Assessed Clean Energy (PACE), energy service performance contracting (ESPC), metered energy efficiency, and green bonds can mitigate the upfront costs of energy efficiency projects. According to a 2016 American Council for an Energy Efficient Economy (ACEEE) study, the energy efficiency finance market is estimated to exceed \$100 billion in annual originations within the United States<sup>59</sup>. However, low-income households, multifamily properties, tenanted commercial properties, local governments facing credit-rating declines, and small commercial properties face challenges in accessing capital. Measuring savings at the meter presents a prime opportunity to adopt innovative third party approaches, "performance-based incentives,"<sup>60</sup> new customer financing, and capital market investment models.
- **Technology is reshaping energy efficiency:** The rapid evolution of technology enables IOUs to help customers achieve additional energy savings far beyond the "low hanging fruit." "Intelligent efficiency" made possible through the use of information and communications technologies is ushering in a new era of systems by design.<sup>61</sup> Smart manufacturing and the use of networked devices and anticipatory software systems yield energy savings once considered stranded.<sup>62</sup> AMI data allows IOUs to target the right customers, empowering them to reduce their energy use and track results.<sup>63</sup> Improved cost-effectiveness will enable IOUs to promote additional technologies as high-performance measures, as in the case of LEDs.<sup>64</sup> PG&E expects innovative and cost-effective technologies to continue emerging in support of the next generation of energy efficiency portfolios.
- **Climate change and environmental impacts:** California's prolonged drought will continue to impact the agricultural industry in the next five to ten years. From coastal communities to the mountains, California also braces for more frequent and intense wildfires.<sup>65</sup> Energy efficiency is one of the "six climate change pillars" in Governor Brown's 2015 integrated plan for addressing climate change and ensuring the state's low-carbon future.<sup>66</sup>
- **Community Choice Aggregators (CCA) and Regional Energy Networks (REN):** PG&E shares its territory with a growing number of CCAs and one REN. To date, Marin Clean Energy (MCE), serving Marin County, Napa County, El Cerrito, Benicia, Lafayette, Richmond, San Pablo and Walnut Creek, is the sole CCA offering energy efficiency programs. PG&E anticipates growth in the number and size of CCAs

<sup>58</sup> DOE. 2016. Annual Energy Outlook 2016. DOE/EIA -0383 (2016) August. See, for example, Figure ES-6.

<sup>59</sup> Freehling, Joel et al., 2016. "Energy Efficiency Finance: A Market Reassessment," <http://aceee.org/sites/default/files/market-reassessment-0216.pdf>.

<sup>60</sup> "California's Existing Buildings Energy Efficiency Action Plan," pp. 74-75.

<sup>61</sup> <http://aceee.org/topics/intelligent-efficiency>.

<sup>62</sup> Rogers, Ethan. 2014. "The Energy Savings of Smart Manufacturing." ACEEE. <http://aceee.org/research-report/ie1403>.

<sup>63</sup> <http://aceee.org/topics/advanced-metering-and-behavior>.

<sup>64</sup> <http://www.eia.gov/todayinenergy/detail.php?id=18671>.

<sup>65</sup> Magill, Bobby. "Climate Change Signs Seen in California Wildfires," July 29, 2016.

<sup>66</sup> The pillars include (1) reducing today's petroleum use in cars and trucks by up to 50 percent; (2) increasing from one-third to 50 percent our electricity derived from renewable sources; (3) doubling the energy efficiency savings achieved at existing buildings and making heating fuels cleaner; (4) reducing the release of methane, black carbon, and other short-lived climate pollutants; (5) managing farm and rangelands, forests and wetlands so they can store carbon; and (6) periodically updating the state's climate adaptation strategy: Safeguarding California. <https://www.arb.ca.gov/cc/pillars/pillars.htm>.

over the next several years. Additionally, the Bay Area Regional Energy Network (BayREN) provides energy efficiency programs to customers in the nine-county Bay Area. PG&E collaborates closely with each entity to create a positive customer experience, maximize energy savings, minimize overlap, and make the best use of ratepayer dollars. PG&E discusses specific collaboration opportunities in each of the Business Plan chapters.

## G.5 Customer Needs

PG&E's Business Plan addresses the needs of each customer sector's needs by providing unique solutions that inspire and empower customers to eliminate unnecessary energy use. While PG&E crafts tailored solutions for each customer segment, our Business Plan is founded on seven fundamental principles that we believe drive all customers to increase energy efficiency adoption.

- **Access to information and tools** to understand, manage, and reduce energy consumption
- **Financial solutions** including rebates, loans, and incentives to spur investment in energy efficiency
- **Education and training** to understand the value of energy efficiency
- **Technologies** that match customers' lifestyles, interests, and budgets
- **Flexible options** that meet customers where they are on their energy efficiency journey, from concierge services to self-service options, online tools to detailed, long-term strategic energy management plans, and widget-based rebates to integrated, whole building solutions to drive deeper savings
- **"Trusted energy advisors"<sup>67</sup> and strategic partnerships** to shepherd customers through their energy efficiency journeys, and help them build long term commitments to energy efficiency

- **Compelling "calls to action"** that drive continuous engagement, behavioral change, and persistent energy savings

Each Business Plan chapter provides a thorough overview of customer needs and barriers that must be overcome to incorporate energy efficiency into their lifestyles and business operations.

## G.6 Lessons Learned from Past Evaluations

Lessons learned from the evaluation, measurement and verification (EM&V) of energy efficiency programs spur our continued focus on stewardship of customer dollars. Over the last ten years, the Commission has sponsored EM&V studies that provide valuable feedback and recommendations, as well as validation and attribution of energy savings. Each Business Plan chapter includes key learnings from recent EM&V studies. While EM&V recommendations typically addressed specific sectors and programs, PG&E has synthesized the following high-level recommendations<sup>68</sup> as lessons learned from past evaluations:

- Impact evaluations revealed a need to focus on minimizing free-ridership and improving realization rates.
- Process evaluations provided insights on the value of relationships with key program partners and the need to develop more rigorous standards for data collection.
- Market studies highlighted the importance of overcoming price differentials between the least efficient and the most efficient technologies, as well as ensuring high-quality products and installation to ensure savings persistence. Further, studies found that contractor training opportunities improved program delivery and motivated customer's program participation.

Each Business Plan chapter responds to these themes and incorporates lessons learned and best practices identified in EM&V studies over the last ten years.

<sup>67</sup> Accenture Research, 2015. The New Energy Consumer: "Unleashing Business Value in a Digital World," p. 16.

<sup>68</sup> Summary recommendations taken from the California Public Utilities Commission, 2015. 2010 – 2012 Energy Efficiency Annual Progress Evaluation Report., p.16.

## G.7 Stakeholder Feedback

In 2016, California stakeholders launched the CAEECC,<sup>69</sup> which provides a forum for stakeholders to participate in the development and review of ratepayer funded energy efficiency portfolios and programs. The purpose of CAEECC is five-fold:

1. Facilitate an open and transparent process
2. Review initial design and augmentation of efficiency Business Plans and related items
3. Seek to find efficiencies in various formal and informal processes
4. Improve accessibility and transparency of energy efficiency activities
5. Provide a scheduled forum to discuss ideas or to resolve differences

CAEECC is made up of twenty-two members, representing twenty-two distinct organizations, from program administrators, consumer advocates, environmental organizations, and local governments, to labor unions, industry associations, and third party implementers.<sup>70</sup> PG&E received meaningful feedback through the CAEECC process that improved the strategies presented in our Business Plan. PG&E also incorporated stakeholder feedback in each of the Business Plan chapters wherever feasible.<sup>71</sup>

This dynamic landscape — ranging from new regulatory frameworks and legislative drivers, to vibrant industry trends, diverse customer needs, ten years of lessons learned, and a plethora of stakeholder feedback — calls for a re-envisioned portfolio structure and the conception of the next generation of energy efficiency program offerings. PG&E designed its energy efficiency Business Plan to be responsive to this evolving landscape.

## H. Goals, Budget and Cost-Effectiveness

PG&E's Business Plan provides a vision for how to scale energy efficiency cost-effectively. PG&E anticipates the investment during the implementation of our Business Plan will result in PG&E exceeding the Commission's net energy savings goals in both the near-term and the long-term. PG&E forecasts that our customers will benefit from at least 3,766GWh of total net electric, 515 MW total net demand, and 123 MMT net total gas savings by 2025.<sup>72</sup> With C&S, PG&E forecasts that our customers will benefit from at least 7,428 GWh of total net electric, 1,500 MW total net demand, and 180 MMT net total gas savings by 2025. The total resource cost (TRC) and program administrator cost (PAC) targets for PG&E's portfolio are 1.03 and 1.27, respectively, excluding C&S. With C&S, the TRC and PAC targets for PG&E's portfolio are 1.27 and 3.26, respectively. PG&E expects that energy efficiency still remains the least cost-resource for IOUs to pursue.

As Business Plans were envisioned as “a comprehensive vision outlining long-term strategic initiatives and intervention strategies,”<sup>73</sup> PG&E provides energy and demand savings goals, budgets, and cost-effectiveness forecasts that represent its best estimates to realize its portfolio vision, while retaining flexibility to accommodate potential market or regulatory changes. Each year, PG&E will file a Tier 2 advice letter (AL) that provides detailed goals, budgets and cost-effectiveness for the Commission's review and approval.<sup>74</sup> See **Table 1.4** through **Table 1.10** for goals, budget and cost-effectiveness details.

<sup>69</sup> Approved in D.15-10-028.

<sup>70</sup> <http://www.caeccc.org/members>.

<sup>71</sup> PG&E has responded to all stakeholder feedback received through CAEECC in the “input tracker,” which can be found in [Appendix X](#).

<sup>72</sup> PG&E's projected energy savings are based on the “Energy Efficiency Potential and Goals Study for 2015 and Beyond,” (Potential Study) approved in D.15-10-028. PG&E anticipates exceeding these goals.

<sup>73</sup> D.15-10-028, p.48.

<sup>74</sup> D.15-10-028, OP 4.

## H.1 Energy Saving Goals

PG&E’s primary goal is to enable customers to save energy. PG&E has used the energy and demand savings targets provided in the *Energy Efficiency Potential and Goals Study for 2015 and Beyond*, (*Potential Study*) approved in D.15-10-028, as the foundation for its projected energy savings goals for 2018-2025, and includes 2016 and 2017 for reference. Energy and demand savings targets from the *Potential Study* are shown in **Table 1.4** as net annual targets, per D.16-08-019.

PG&E’s net annual energy and demand savings goals are directional in nature. That is, they are meant to reflect our best estimates of energy and demand savings potential — based on the most recent *Potential Study*. As shown in section H.3 *Cost-Effectiveness*, PG&E projects savings estimates for the near term (2018-2020) that exceed the *Potential Study* goals. Note, the *Potential Study* provided energy savings and demand reduction goals out to 2024. PG&E estimated goals for 2025 based on 2024 values as a proxy.

**Table 1.4**  
Portfolio Annual Net Market Potential

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
<b>Resource Programs</b>										
<b>GWhs</b>	464	475	399	404	413	420	436	452	471	471
<b>MWs</b>	58	60	50	51	53	55	61	66	70	70
<b>MMtherms</b>	11	11	12	13	13	13	14	15	16	16
<b>Codes &amp; Standards</b>										
<b>GWhs</b>	611	506	408	401	381	326	295	254	240	240
<b>MWs</b>	141	105	103	103	101	94	90	84	82	82
<b>MMtherms</b>	6	6	6	6	6	6	6	6	5	5
<b>Portfolio Totals</b>										
<b>GWhs</b>	1075	981	807	805	794	746	731	706	711	711
<b>MWs</b>	199	165	153	154	154	149	151	150	152	152
<b>MMtherms</b>	17	17	18	19	19	19	20	21	21	21

No later than November 1, 2017, the Commission is expected to update the IOUs' energy and demand savings goals to meet the SB 350 energy efficiency targets set by the Energy Commission<sup>75</sup> and the net goals framework adopted in D.16-08-019.<sup>76</sup> PG&E will update its energy savings forecasts after updated targets have been issued.

PG&E intends to update its savings goals annually through a Tier 2 Advice Letter (AL) to accommodate potential market or regulatory changes through detailed revisions to PG&E's portfolio and sector-level energy and demand goals.

## H.2 Portfolio Budget

PG&E's Business Plan budget provides general information on the expected levels of annual spending for 2018-2025, along with 2016 and 2017 approved budgets for reference. The intent of the Business Plan budget showing is to allow program administrators flexibility to adjust spending during the life of the Business Plan.<sup>77</sup> PG&E's Business Plan budget represents its best estimates of spending for the life of the Business Plan.<sup>78</sup> PG&E will file a Tier 2 AL annually, containing a detailed budget for the next calendar year's energy efficiency portfolio that meets the budget requirements in existence at that time.<sup>79</sup> The Tier 2 AL budgets will include detailed budgets for cost recovery, transfer, and contracting purposes.<sup>80</sup> See **Table 1.5** for the portfolio budget summary and **Table 1.6** for the sector budget summary.

**Table 1.5** includes 2016 budgets for San Francisco Bay Area Regional Energy Network (BayREN) and Marin Clean Energy (MCE) budgets as approved in D.15-01-023. They do not reflect the increase of \$3.7M for BayREN, which was approved in Advice Letter 3704-G/4826-E; or the increase of \$366,060 for MCE, which was approved in D.16-05-004. Additionally, BayREN's and MCE's budgets for 2017 and beyond represent the most recent Commission-approved budgets. PG&E will revise this table as necessary to reflect the updated budgets approved by the Commission.

PG&E's budget request for program years 2016 and 2017, as filed in PG&E's 2017 *Energy Efficiency Annual Budget Advice Letter in Compliance With Decision 15-10-028, Ordering Paragraph 4*,<sup>81</sup> met PG&E's authorized budget of \$430.1 million, approved in D.14-10-046.<sup>82</sup> This annual budget is comprised of the following components:

- PG&E Program Budget= \$394.22M
- EM&V Budget = \$17.20M
- BayREN & MCE Budget = \$18.12M

For 2018-2020, PG&E anticipates cumulative reductions of \$35.4 million (approximately 10%) in its total portfolio budget through various operational efficiencies and changes in portfolio strategy. Although PG&E estimates a decrease in overall budget through 2020, PG&E reserves the right to repurpose any cost savings, up to its authorized budget approved in D.14-10-046, if the additional funds are necessary to support future program implementation plans (IP) or other portfolio administration activities. For the 2021-2025 time period, the information is not sufficiently reliable to build a comprehensive budget plan. As a result, PG&E extends its 2020 budget for the 2021-2025 period.

<sup>75</sup> SB 350 requires the Energy Commission to develop and establish statewide targets that lead to a cumulative doubling of energy efficiency savings from all retail electric and natural gas end-users by 2030. <http://www.energy.ca.gov/sb350/timeline.pdf>.

<sup>76</sup> "Commission staff should work with its consultants to prepare a net goals framework in time for the start of 2018, if not sooner." D.16-08-019, p. 20.

<sup>77</sup> D.15-10-028, p. 56.

<sup>78</sup> D.15-10-028, "It [the budget] will establish a "ballpark" figure for spending for the life of the business plan," p. 55.

<sup>79</sup> D.15-10-028, OP 4.

<sup>80</sup> D.15-10-028, p. 56.

<sup>81</sup> Advice 3753-G/4901-E.

<sup>82</sup> D.14-10-046, OP 1.

**Table 1.5**  
PG&E Portfolio Budget Summary

Cost Category	2016	2017	2018	2019	2020-2025 Annual Budget <sup>a</sup>
<b>Admin</b>	\$45,433,984	\$37,927,424	\$33,017,040	\$28,106,655	\$25,086,270
<b>Marketing</b>	\$24,207,811	\$24,164,250	\$16,861,785	\$15,559,320	\$14,256,855
<b>Implementation</b>	\$159,545,211	\$157,425,025	\$156,241,214	\$155,057,403	\$153,873,592
<b>Incentive</b>	\$158,947,134	\$161,206,770	\$161,206,770	\$161,206,770	\$161,206,770
<b>OBF Loan Pool</b>	\$10,000,000	\$13,500,000	\$13,500,000	\$13,500,000	\$5,000,000
<b>Total Program</b>	<b>\$398,134,139</b>	<b>\$394,223,470</b>	<b>\$380,826,809</b>	<b>\$373,430,148</b>	<b>\$359,423,487</b>
<b>BayREN</b>	\$12,837,000 <sup>b</sup>	\$16,537,000	\$16,537,000	\$16,537,000	\$16,537,000
<b>DSM</b>	\$714,617	\$559,206	\$559,206	\$0	\$0
<b>EM&amp;V</b>	\$17,204,418	\$17,204,418	\$17,204,418	\$17,204,418	\$17,204,418
<b>MCE</b>	\$1,220,267 <sup>b</sup>	\$1,586,347	\$1,586,347	\$1,586,347	\$1,586,347
<b>Total Portfolio</b>	<b>\$430,110,441</b>	<b>\$430,110,441</b>	<b>\$416,713,780</b>	<b>\$408,757,913</b>	<b>\$394,751,252</b>

<sup>a</sup> The Annual Budget from 2020 through 2025 will remain the same.

<sup>b</sup> The table includes budgets for Marin Clean Energy (MCE) and San Francisco Bay Regional Energy Network (BayREN) as approved in D.12-11-015. If MCE and BayREN's budgets change with review and approval of their Business Plans (anticipated 2017), PG&E will adjust this budget table accordingly.

**Table 1.6**  
PG&E Sector Budget Summary

Cost Category	2016	2017	2018	2019	2020-2025 Annual Budget <sup>a</sup>
<b>Residential</b>	\$82,835,166	\$83,790,021	\$81,092,165	\$78,694,308	\$77,582,765
<b>Commercial</b>	\$133,331,183	\$105,500,267	\$98,693,364	\$95,486,461	\$93,770,138
<b>Agricultural</b>	\$27,050,099	\$31,900,827	\$32,241,555	\$32,582,282	\$32,163,477
<b>Industrial</b>	\$32,838,398	\$43,352,567	\$42,944,061	\$43,075,556	\$42,502,700
<b>C&amp;S</b>	\$15,335,248	\$17,215,199	\$17,002,831	\$16,790,463	\$16,611,976
<b>ET</b>	\$6,292,077	\$8,025,889	\$7,893,484	\$7,761,080	\$7,654,873
<b>WE&amp;T</b>	\$12,561,342	\$10,894,911	\$10,745,183	\$10,595,456	\$10,473,354
<b>Finance</b>	\$5,568,714	\$4,757,889	\$4,206,226	\$4,014,563	\$3,851,950
<b>OBF - Loan Pool</b>	\$10,000,000	\$13,500,000	\$13,500,000	\$13,500,000	\$5,000,000
<b>Public</b>	\$72,321,914	\$75,285,899	\$72,507,940	\$70,929,980	\$69,812,255
<b>Total Sector Budget</b>	<b>\$398,134,139</b>	<b>\$394,223,470</b>	<b>\$380,826,809</b>	<b>\$373,430,149</b>	<b>\$359,423,488</b>

<sup>a</sup> The Annual Budget from 2020 through 2025 will remain the same.

## Explanation of Accounting Practices

PG&E's accounting practices conform to the rules, cost categories, and cost caps/targets outlined in D.09-09-047 and further explained in the *Energy Efficiency Policy Manual, version 5*. PG&E recently demonstrated its compliance with Commission directives through the Financial, Management and Regulatory Compliance Examination of Energy Efficiency Programs for the PY 2014, evidenced by the Utility, Audit, Finance and Compliance Branch (UAFCB) Final Audit Report dated May 31, 2016. In addition, PG&E will incorporate those UAFCB recommendations into all current and future accounting and reporting.

## H.3 Cost-Effectiveness

This section addresses the projected cost-effectiveness of PG&E's 2018-2025 Business Plan at both the portfolio and sector-level. PG&E's cost-effectiveness calculation represents the near-term years of its Business Plans (2018-2020). The cost-effectiveness and energy savings targets are based on annual projections for the 2018-2020 time period. PG&E's Business Plan is cost-effective under both the Total Resource Cost (TRC) test and the Program Administrator Cost (PAC) test<sup>83</sup> See **Table 1.7** for *Projected Portfolio NET Annual Savings Impacts*, **Table 1.8** and **Table 1.9** for *Portfolio Cost-Effectiveness Results*, and **Table 1.10** for *Projected Portfolio Emission Reductions*.

**Table 1.7**  
Projected Portfolio NET Annual Savings Impacts (2018-2020)

	PGS Goal	PG&E Target	% of Target
<b>Energy Savings (Net GWh/yr)</b>			
<b>IOU Programs</b>	413	534	129%
<b>Codes and Standards Advocacy</b>	381	803	211%
<b>Total</b>	<b>794</b>	<b>1,337</b>	<b>168%</b>
<b>Demand Reduction (Net MW)</b>			
<b>IOU Programs</b>	53	79	149%
<b>Codes and Standards Advocacy</b>	101	180	179%
<b>Total</b>	<b>154</b>	<b>259</b>	<b>168%</b>
<b>Gas Savings (Net MMTh/yr)</b>			
<b>IOU Programs</b>	13	17	130%
<b>Codes and Standards Advocacy</b>	6	16	270%
<b>Total</b>	<b>19</b>	<b>33</b>	<b>174%</b>

Note: Does not include Market Effects.

<sup>83</sup> Per D.15-10-028 footnote #86, p.48, only cost calculator outputs are to be filed with the Business Plan. Full cost calculator submittals will be included in subsequent annual Tier 2 ALs.



**Table 1.8**

Projected Annual Portfolio Cost-Effectiveness Results with C&S (2018-2020)

	Results
<b>TRC</b>	1.27
<b>PAC</b>	3.26

Note: Does not include Market Effects.

**Table 1.9**

Projected Annual Portfolio Cost-Effectiveness Results (2018-2020)

	Results
<b>TRC</b>	1.03
<b>PAC</b>	1.27

Note: Excludes Codes and Standards Program. Does not include Market Effects.

**Table 1.10**

Projected Annual Portfolio Emission Reductions (2018-2020)

	Reductions
<b>Annual tons of CO<sub>2</sub> avoided</b>	257,651
<b>Lifecycle tons of CO<sub>2</sub> avoided</b>	2,437,306
<b>Annual tons of NO<sub>x</sub> avoided</b>	360,760
<b>Lifecycle tons of NO<sub>x</sub> avoided</b>	3,431,054
<b>Annual tons of SO<sub>x</sub> avoided</b>	—
<b>Lifecycle tons of SO<sub>x</sub> avoided</b>	—
<b>Annual tons of PM<sub>10</sub> avoided</b>	56,007
<b>Lifecycle tons of PM<sub>10</sub> avoided</b>	539,235

PG&E's C&S advocacy targets were updated in *California Statewide Codes and Standards Program Impact Evaluation Report: Phase One Appliances*, which resulted in higher C&S savings targets than those identified in the *2015 Potential and Goals* study.

PG&E conducted a cost-effectiveness analysis of its proposed portfolio in compliance with D.15-10-028, and with the California Standard Practice Manual.<sup>84</sup> PG&E used the 2017 updated avoided costs, and cost-effectiveness inputs approved in Resolution E-4801. This cost-effectiveness calculation is directional in nature, which means that PG&E will strive to meet the cost-effectiveness projections set forth for the portfolio and each sector. However, the cost-effectiveness forecasts are subject to updates based on market or regulatory changes. Through the annual Tier 2 ALs, PG&E will provide the Commission updated cost-effectiveness forecasts for each year of Business Plan implementation. See **Table 1.11** for *Projected PG&E Sector Cost-Effectiveness Summary*. Additional details on the portfolio cost-effectiveness calculations are presented in *Appendix B – E-3 Output Table and Savings Goals*.

<sup>84</sup> California Standard Practice Manual: Economic Analysis of Demand Side Management Programs and Projects, 2002. [http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf).

**Table 1.11**

## Projected Annual Cost-Effectiveness Summary by Sector (2018-2020)

Sector	TRC	PAC	GWh/yr	MW/yr	MMTh/yr
Residential	1.01	1.21	184.80	30.25	4.14
Commercial	1.50	1.89	191.06	26.31	3.94
Agricultural	1.03	1.42	40.96	6.77	0.91
Industrial	1.35	2.27	40.88	4.23	7.50
Public	0.84	0.94	76.45	11.19	0.44
<b>Program Total</b>	<b>1.03</b>	<b>1.27</b>	<b>534.15</b>	<b>78.75</b>	<b>16.92</b>
C&S	1.49	46.90	803.12	180.49	16.21
<b>Portfolio Total</b>	<b>1.27</b>	<b>3.26</b>	<b>1337.27</b>	<b>259.24</b>	<b>33.13</b>

**PG&E’s Energy Efficiency Portfolio Vision to Scale Cost-Effectively**

Through implementation of its Business Plan, PG&E seeks to make significant impact in reducing energy waste cost-effectively and maximizing the value of energy efficiency for customers, for the grid, and for the state. To do that, PG&E recognizes the need to take “a more integrated, cost-effective approach”<sup>85</sup> to scale energy savings. PG&E provides an overview of its key strategies to scale energy efficiency and continue to deliver cost-effective energy efficiency portfolios.

In essence, energy efficiency can be viewed as two halves of a whole. The existing construct is one of hundreds of programs, and thousands of discrete and dispersed customer transactions. The emerging construct, envisioned by AB 758, SB530, and AB 802 seeks deeper savings, greater penetration, and location-specific efficiency, integrated with DERs (i.e., demand response and storage). Using AMI data and meter-based performance, opportunities to create large scale, capital market investment grade opportunities in energy efficiency emerge. IOUs, as portfolio administrators, are the pivotal entity to realize this vision, marrying these two halves into a more integrated, cost effective whole.

PG&E’s Business Plan is founded on four key tenets to scale energy efficiency more cost-effectively.

1. Deploy new program models and third-party financial structures that spur “deep investment and persistence of savings.”<sup>86</sup>
2. Target customers with high energy savings potential.
3. Focus on technology strategies that promote deeper, more comprehensive, and energy persistent savings for new and existing buildings.
4. Make energy efficiency investments more attractive and easier.

**Deploy new program models and transaction structures that spur deep investment and persistence of savings:**

The ability to measure energy savings at the meter presents an opportunity to re-think traditional program designs and implementation, and to adopt innovative third-party approaches, using “performance-based incentives,”<sup>87</sup> and new transaction structures to spur further customer and capital market investment. New program models such as pay-for-performance and SEM will help scale efficiency to meet SB 350 goals. As a result of AB 802, PG&E can offer deeper, more comprehensive whole building solutions including retrocommissioning and operational savings opportunities. Using normalized metered-based analysis to determine

<sup>85</sup> Mitchell, Cynthia 2014. “A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach.” p. 1, TURN May 15, 2015 iDSM comments in R.14-10-003, p. 9.

<sup>86</sup> Mitchell, Cynthia 2014. “A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach.” p. 9.

<sup>87</sup> “California’s Existing Buildings Energy Efficiency Action Plan,” pp. 74-75.

energy savings allows PG&E to capture “stranded” potential and target energy waste in California. Results from PG&E’s Residential Pay-for-Performance High Opportunity Project or Program (HOPPs) will inform future program design.<sup>88</sup> Declining costs of sensors and network connectivity are also opening the ability to sub-meter at scale through circuit-and-device level monitoring.

Additionally, PG&E plans to scale energy efficiency more cost-effectively by offering new transaction structures (e.g., DERBI) to spur greater customer and capital markets investment in energy efficiency and more directly influence customers’ decision-making processes. Over the next decade, PG&E will move away from the traditional incentive model with a focus on expanding the supply of affordable funding by making investments in energy efficiency (and bundled or combined with other DERs, such as demand response and energy storage), attractive as a capital-grade resource.

Furthering the vision for new cost-effective transaction structures, PG&E will encourage statewide program administrators to better leverage statewide (and/or regional) buying power, and regional/national partnerships, for energy efficiency equipment and technologies in a centralized, collaborative, coordinated and strategic way. This method will extend the reach and increase the power of California ratepayer investments beyond individual IOU-specific transactions. Statewide administration of upstream and midstream programs encourages and facilitates this type of approach.

Moreover, with the move to normalized meter-based savings, and default existing condition baseline policies, PG&E will modify incentive structures to ensure that energy efficiency programs capture savings that would not otherwise occur, and ensure that energy efficiency portfolio budgets do not exponentially increase. Pay-for-performance incentives and tiered incentive structures to motivate above-code savings prevent “lost opportunities” and ensure high quality “equipment/hardware, installation, operations, and maintenance practices”<sup>89</sup> are tactics that PG&E will explore with program implementers.

<sup>88</sup> Advice 3698-G/4813-E.

<sup>89</sup> Post Workshop Comments of the Utility Reform Network on Energy Efficiency Baseline and To-Code Incentive Eligibility Issues, May 28, 2015, pp.3-4.



## PG&E’S PORTFOLIO-LEVEL GOALS

- Save energy and reduce demand, positioning the state to double energy efficiency of existing buildings by 2030, where cost-effective and feasible
- Reach a greater proportion of customers without proportional budget increases
- Focus on increasing cost-effectiveness and operational efficiencies
- Increase customers’ ability to manage energy
- Assist the state in reaching commercial, public and residential zero net energy (ZNE) goals
- Transform specific markets that will enable more cost-effective deployment of energy efficiency

### Target customers with high energy savings potential:

AMI data offers PG&E the ability to better understand site-specific customer energy usage, and tailor offerings that benefit customers most in need of specific energy efficiency offerings, while at the same time achieve higher energy savings and more valuable peak load reduction. While PG&E will provide energy efficiency offerings for its entire customer base, PG&E plans to target customers who are expected to yield the greatest energy savings, energy bill reductions, and grid-value location specific resources.

### Focus on technology strategies that promote deeper, more comprehensive, and persistent energy savings for new and existing buildings:

As California's peak loads continue to grow<sup>90</sup> and the state seeks to double energy efficiency by 2030, to address these challenges requires a deep understanding of efficiency technology, barriers to realizing their potential, and a comprehensive strategy to maximize the effectiveness of ratepayer investments in energy efficiency. PG&E's portfolio design will focus on whole-building approaches; high quality LEDs; targeted HVAC with demand response (DR) enabled capabilities and quality maintenance;<sup>91</sup> electronics, appliances, and "smart" devices that drive plug load energy consumption;<sup>92</sup> operational and behavioral savings opportunities to optimize building performance; and integrated systems<sup>93</sup> and other optimized building sensors and controls.<sup>94</sup>

Ultimately, PG&E will seek ways to improve "the performance of system components (e.g., improving the efficiency of lighting devices)" and improve "the way they are controlled as a part of integrated building systems (e.g., sensors that adjust light levels to occupancy and daylight)."<sup>95</sup>

<sup>90</sup> California Energy Demand 2016-2026, Revised Electricity Forecast, Volume 1: Statewide Electricity Demand and Energy Efficiency.

<sup>91</sup> See Mitchell, Cynthia 2014. "A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach," pp. 10-11.

<sup>92</sup> Plug-load energy consumption is projected to grow at 94% rate from 2005 to 2030, dwarfing the growth of loads from lighting and HVAC. Department of Energy (DOE) EIA Annual Energy Outlook 2008, [http://www.eia.gov/oiaf/aeo/pdf/0383\(2008\).pdf](http://www.eia.gov/oiaf/aeo/pdf/0383(2008).pdf).

<sup>93</sup> See Mitchell, Cynthia 2014. "A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach," pp. 10-11.

<sup>94</sup> DOE, 2015. Quadrennial Technology Review: An Assessment of Energy Technologies and Research Opportunities. Chapter 5: Increasing Efficiency of Building Systems and Technologies.

<sup>95</sup> Ibid.

Whatever the technology, PG&E will increase its focus on longer life measures to drive more cost-effective, persistent energy savings. Additionally, PG&E will deliver trainings and provide incentives as appropriate to contractors, customers and other market actors to ensure persistency of savings, improve energy savings realization rates, and facilitate improvements in quality installations and code compliance.

### Make energy efficiency investments more attractive and easier:

PG&E is simplifying its portfolio structure based on customer segments, cross-cutting segments, and statewide programs, where programs rely on a set of consistent platforms to measure savings and spur customers' investments in energy efficiency.<sup>96</sup> PG&E's goal is to effectuate easy program access for customers, and ultimately drive more cost-efficiencies.<sup>97</sup> See *Section E* for a more detailed description of PG&E's revised portfolio structure.

PG&E's Business Plan is founded on the need to scale energy efficiency cost-effectively. PG&E will continue to work with the Commission, program administrators, program implementers, and other stakeholders through the CAEECC to identify and implement the most cost-effective energy efficiency solutions to ensure that energy efficiency is truly the first in California's loading order.

## I. Solicitation Strategy and Transition Timeline

In the rolling portfolio, the model of delivering energy efficiency will shift away from one where the utility designs programs, to a future where third-party implementers have a larger role in providing expertise and innovation in program design.

D. 16-08-019 sets a minimum target of 60% of the utility's total portfolio budget, including administrative costs and EM&V, to be proposed, designed, and delivered by third parties by the end of 2020.<sup>98</sup> To that end, PG&E has developed its proposed solicitation strategy and transition plan to effectuate at least this minimum level of third-party

<sup>96</sup> See Chapter X, Section x for a complete description of PG&E's proposed portfolio structure.

<sup>97</sup> D.16-08-019, p. 51.

<sup>98</sup> D.16-08-019, p.74.

programs.<sup>99</sup> PG&E will evolve its energy efficiency portfolio to maximize energy savings in support of California's goal to double energy efficiency by 2030, and achieve cost-effectiveness by offering programs that drive value and innovation for customers, cultivate relationships with new partners, and use its knowledge of customers to more efficiently and effectively deliver energy efficiency programs.

PG&E's solicitation strategy is founded on three primary objectives, and four secondary objectives.

### Primary Objectives

1. Comply with regulatory requirements (e.g., at least 60% of the portfolio budget devoted to third-party programs by 2020).
2. Reduce portfolio administration costs by 10% by 2020.
3. Retain customer relationships.

### Secondary Objectives

1. Provide a consistent, integrated energy efficiency portfolio, from our customers' perspective.
2. Deliver innovative solutions.
3. Integrate successfully with other PG&E initiatives (i.e., DER pilots).
4. Evaluate most effective contract structures (e.g., pay for performance vs. time and materials) to achieve portfolio goals.

PG&E will solicit energy efficiency programs for all sectors — including market and cross-cutting — that align with PG&E's overall portfolio goals. A guiding principle for PG&E's Business Plans is to continue to achieve cost efficiencies across its energy efficiency portfolio. As such, PG&E will also evaluate activities that support portfolio administration including product management, engineering support services, operation and maintenance of IT systems, quality assurance activities, and rebate processing. PG&E will benchmark these activities to identify opportunities to further reduce costs through outsourcing.<sup>100</sup>

<sup>99</sup> In cases where utilities propose to continue staffing program design and/or delivery functions with utility personnel, the utility is required to explain why this continues to be necessary. (D.16-08-019 p. 74).

<sup>100</sup> This solicitation strategy and associated timeline does not include every request for proposal (RFP) that PG&E anticipates issuing in support of its energy efficiency portfolio, but provides the solicitation strategy and timeline associated with programs required to deliver energy efficiency activities required to meet its portfolio and sector-level goals.

PG&E looks to third parties to bring innovation, expertise, and cost efficiencies to its portfolio. PG&E plans to establish a rolling cadence to solicitation opportunities. In 2017, 2018, and 2019, PG&E will run a number of solicitations by sector, bidding out at least 60% of its portfolio budget by the end of 2019. PG&E's proposed solicitation timeline takes into account the transition period the Commission acknowledged in D.16-08-019<sup>101</sup> to minimize market disruption, customer confusion, and avoid funding hiatus for ongoing efforts.

## I.1 Transition and Solicitation Implementation Plan Overview

PG&E's plan aligns with its re-envisioned portfolio structure based on customer segments (Residential, Commercial, Public, Industrial, Agricultural), cross-cutting segments (Codes and Standards, Workforce Education and Training, Finance, Emerging Technologies<sup>102</sup>), and statewide programs, where programs rely on a set of consistent platforms to measure savings and spur customers' investments in energy efficiency.<sup>103</sup> PG&E's ultimate goal is to simply its portfolio effectuating easy program access for customers, and lowering transaction costs for third parties and PG&E.<sup>104</sup>

PG&E's transition timeline is founded on the market and cross-cutting sectors Business Plans' intervention strategies' type (new, modified, existing) and proposed timelines — short-term (2017-2020), mid-term (2021-2023), long-term (2024-2027). Additionally, PG&E's plan considers future energy efficiency potential, customer needs, market trends, and legislative and regulatory direction. Solicitations will be based on bundled intervention strategies/tactics, or in some cases a stand-alone intervention strategy/tactic, informed by the market characterization data PG&E provided

<sup>101</sup> D.16-08-019, OP 14, "Program administrators shall ensure a smooth transition between existing energy efficiency program activities and the changes outlined in this decision, to be proposed in the business plans due January 15, 2017, minimizing program disruptions and avoiding any funding hiatus for ongoing efforts or partnerships.

<sup>102</sup> Emerging Technologies is a statewide program to be led by lead statewide administrators, per D.16-08-019. Southern California Edison and Southern California Gas Company have been identified as lead statewide administrators. As such, PG&E will not solicit for any Emerging Technologies programs.

<sup>103</sup> See Section E for a description of PG&E's proposed portfolio structure.

<sup>104</sup> D.16-08-019, p. 51.

## SHORT-TERM SOLICITATION STRATEGIES

- Programs that address new or short-term intervention strategies/tactics, as well as select existing and/or modified short-term activities
- Statewide programs for those of which PG&E is the designated SW lead administrator to realize the cost-efficiencies as envisioned by the Commission
- Other opportunities to gain efficiencies sooner, streamline activities and/or make access easier for customers
- Opportunities that may benefit from longer ramp-up time

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## MID-TERM, LONG-TERM AND ON-GOING SOLICITATION STRATEGIES

- Following the solicitation of short-term interventions/tactics and statewide programs, PG&E will move on to mid-term interventions/tactics, culminating with long-term interventions/tactics
- Pilots to test smaller scale, innovative concepts
- Opportunities delayed in consideration of a mindful transition timeline
- Opportunities to fill gaps unaddressed in short-term
- Rebid opportunities for contracts that are expiring

in each sector chapter. For example, PG&E would issue a solicitation in the third quarter (Q3) 2017 for Agricultural sector programs, where third-party proposed programs would incorporate intervention strategies and example tactics identified as short-term, founded on customer participation, energy usage data, and/or market potential.

PG&E plans to stagger solicitation opportunities by sector and/or statewide programs, in three phases, as shown in **Figure 1.9**. The timeline is based on the assumption that the Commission approves Business Plans in 2017 Q2, issuing the first round of solicitations very soon thereafter. Additionally, the solicitation timeline depends on the engagement of peer review groups (PRG) and the Independent Evaluator (IE) proposal, as proposed by CAEECC members.<sup>105</sup> However, Business Plans represent a 10-year outlook. As such, PG&E requests flexibility to accommodate potential market or regulatory changes.

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<sup>105</sup> ORA et al. propose an Independent Evaluator (IE) to facilitate the solicitation process <http://www.caeec.org/ee-prg-ie>. Standing up a new process for energy efficiency make take time, and may result in delays in solicitation timelines.

**Figure 1.9**  
Statewide Programs Solicitation Strategy

2017 (target ~20% portfolio budget bid out)			
Q1	Q2	Q3	Q4
		<ul style="list-style-type: none"> <li>• Codes and Standards Advocacy Program (Statewide)</li> <li>• Commercial Sector Programs</li> <li>• Public Sector Programs</li> <li>• Industrial Sector Programs</li> <li>• Agriculture Sector Programs</li> <li>• Indoor Agricultural Program (Statewide)</li> </ul>	<ul style="list-style-type: none"> <li>• WE&amp;T Connections (Statewide)</li> <li>• WE&amp;T Sector Programs (rolling)</li> </ul>
2018 (target ~40% portfolio budget bid out)			
Q1	Q2	Q3	Q4
<ul style="list-style-type: none"> <li>• WE&amp;T Career &amp; Workforce Readiness (Statewide)</li> <li>• Residential Sector Programs</li> <li>• Codes and Standards Programs</li> <li>• WE&amp;T Sector Programs (rolling)</li> </ul>		<ul style="list-style-type: none"> <li>• State of California and Dept. of Corrections Program (Statewide)</li> <li>• Commercial Sector Programs</li> <li>• Industrial Sector Programs</li> <li>• Agriculture Sector Programs</li> </ul>	
2019 (target ~60% portfolio budget bid out)			
Q1	Q2	Q3	Q4
<ul style="list-style-type: none"> <li>• Residential Sector Programs</li> <li>• Codes and Standards Programs</li> <li>• WE&amp;T Sector Programs (rolling)</li> </ul>		<ul style="list-style-type: none"> <li>• Commercial Sector Programs</li> <li>• Industrial Sector Programs</li> </ul>	
2020 (≥60% of portfolio budget bid out)			
<ul style="list-style-type: none"> <li>• Commercial Sector Programs</li> <li>• Industrial Sector Programs</li> <li>• Agriculture Sector Programs</li> <li>• WE&amp;T Sector Programs (rolling)</li> </ul>			
Mid-and Long-term (2021-2028)			
<ul style="list-style-type: none"> <li>• Portfolio gaps and rebids, etc.</li> <li>• Mid/long-term strategies/tactics</li> </ul>			

**Phase 1 (2017 Q3-Q4):** PG&E will solicit for three of its statewide programs, Codes and Standards Advocacy and the Indoor Agricultural downstream pilot solicitations will occur 2017 Q3. The WE&T Connections solicitation will occur in Q4 2017. Additionally, PG&E plans to refresh third party program offerings in its Commercial, Public, Industrial and Agricultural sectors. PG&E anticipates open solicitations starting in 2017. Solicitations will be held in the following years to continue to fill gaps in PG&E's portfolio. PG&E will offer rolling WE&T sector solicitations throughout 2017-2020 to ensure that its curricula reflect portfolio needs. By the end of 2017, PG&E anticipates that these statewide and third party programs will account for approximately 20% of its portfolio budget. Phase 1 is contingent upon approval of Business Plans in 2017 Q2.

**Phase 2 (2018 Q1 and Q3):** In 2018 Q1, PG&E will solicit for the statewide Career Workforce Readiness downstream pilot. Additionally, in Q1 PG&E will solicit for third party programs for the Residential, Commercial, Industrial and Agricultural sectors, as well as C&S programs. In Q3, PG&E will commence another round of solicitations devoted to third party programs for the Residential, Commercial, and Industrial sectors. Q3 solicitations will also include the statewide State of California and Department of Corrections Institutional Partnership program. By the end of 2018, PG&E anticipates that these statewide and third party programs and activities will account for approximately 40% of its portfolio budget.

**Phase 3 (2019 Q1 and Q3):** In 2019 Q1, PG&E will solicit for third party programs for the Residential and Industrial sectors, as well as C&S programs. In Q3, PG&E will solicit for third party programs for the Commercial and Industrial sectors. By the end of 2019, third party programs will account for at least 60% of PG&E's portfolio budget.

In Phases 2 and 3, PG&E has staggered solicitations in Q1 and Q3 in consideration of potential bandwidth issues for third parties, PRG members and PG&E sourcing staff. By staggering the solicitations, PG&E provides third party vendors ample time to design and propose effective programs.

PG&E will devote 2020 and beyond to filling gaps in its portfolio, rebidding contracts, and focusing on solicitations for mid and long-term strategies and tactics.

In its role as portfolio administrator,<sup>106</sup> PG&E will shape solicitations to ensure programs capture market potential by sector / subsector, geography, technology, and/or channel.<sup>107</sup> In all cases, PG&E will seek third parties to propose and design programs that fit its stated needs, and may work collaboratively with winning bidders to ensure the proposed program design meets the portfolio needs, and align with key portfolio metrics (e.g., savings goals, cost-effectiveness targets) to ensure a healthy, compliant energy efficiency portfolio.<sup>108</sup>

Depending upon the identified need, solicitation options may include:

- Market sector/subsector (e.g., commercial or hospitality)
- Customer type (e.g., SMB)
- Statewide programs (e.g., up/midstream, market transformation, downstream pilot)
- Location and/or time-value specific (e.g., TDSM, or opportunities focused on peak period energy reductions)
- Platforms<sup>109</sup>

<sup>106</sup> D.16-08-019, pp. 71 and 74, "By necessity, the program administrator will be determining the needs for which a solicitation is being conducted in the first place."

<sup>107</sup> D.16-08-019, p. 72, "We clarify...that nothing in this decision is intended to remove or diminish the utilities' responsibility for electric and natural gas reliability, particularly in local areas."

<sup>108</sup> D.16-08-019, COL 57, "...utilities may consult and collaborate, using their expertise, on the ultimate program design implemented by the third party." D.16-08-019, p. 74, "...in the contract negotiation and implementation of successful proposals, the expertise of the utility personnel and the third parties should be brought to bear to ensure the best possible results."

<sup>109</sup> See Section E for a discussion of "platforms."



PG&E anticipates that solicitations will vary between sectors and subsectors, for cost-effectiveness and other criteria necessary to meet PG&E's Business Plan objectives. This type of flexibility is important for careful portfolio planning and design, as highlighted in D.16-08-019.<sup>110</sup> PG&E's proposed solicitation schedule provides current thinking around the solicitation approach by sector. For certain sectors, segment differentiation may require targeted solicitations to ensure that the unique needs of the customers are met. Other sectors may be more homogeneous and broader solicitations may provide scaling benefits.

PG&E supports a vibrant energy efficiency ecosystem. PG&E will continue to offer opportunities for large and small providers, with a focus on Diverse Business Enterprises (DBE). PG&E's plan is intended to ensure a smooth transition for customers and minimize market disruption.

## I.2 Solicitation Budget Estimates

PG&E provides estimates of the percent of portfolio budgets to be bid out each year, in the short-term. Portfolio budget percentages also include estimates of all statewide programs that will be proposed, designed and delivered by third parties (see **Table 1.12**). Additionally, 2017 reflects third-party programs that meet the third-party definition as delineated in D.16-08-019, such as PG&E's Residential Energy Advisor subprogram.<sup>111</sup> PG&E will include a list of any legacy third-party programs that meet the new third party definition, and count toward the 60% minimum third party threshold, in its 2018 Annual Budget AL. PG&E includes these estimates to provide stakeholders a sense of scale for outsourcing activities each year. However, Business Plans represent a long-term outlook. As such, PG&E requests flexibility to accommodate market and regulatory changes over time. To provide stakeholders more accurate outsourcing budgets and activities, PG&E will update these estimates as part of its annual Budget AL due September 1 of each year.

<sup>110</sup> D.16-08-019, "Having both programmatic and all-source solicitation options within one sector highlights the importance of careful portfolio planning and solicitation rules. At this time there is no other logical existing entity besides the utility that is able to handle this portfolio design role on behalf of their entire geographic service area," p. 71.

<sup>111</sup> This subprogram was proposed and designed in 2014 and is delivered by a third-party vendor.

**Table 1.12**  
PG&E's Third-Party Program Schedule

(Budget percentages do not include CCA and REN)

2017	2018	2019
20%	40%	60%
\$82,397,419	\$159,436,173	\$234,380,740

## I.3 Sector Sourcing Strategy

PG&E's Business Plan identifies intervention strategies, as well as several cross-cutting efforts, designed to achieve its portfolio and sector goals. These categories of intervention strategies are intended to guide, but not limit, our efforts over the next 10 years. These strategies are directed at five customer sectors - Residential, Commercial, Public, Industrial, and Agricultural. PG&E's portfolio is also made up of cross-cutting segments - Codes and Standards, Workforce Education and Training, Finance, and Emerging Technologies — that support all of the customer segments.

PG&E expects that third-party vendors will propose, design and deliver programs that incorporate these broad intervention strategies. These categories of intervention strategies are intended to guide, but not limit, PG&E's efforts for each market sector over the next 10 years. Further, PG&E expects programs that align with, and position PG&E to achieve each sector's specific goals, and PG&E's overarching portfolio goals.<sup>112</sup>

## I.4 Statewide Programs Solicitation Strategy

In D.16-08-019, the Commission identified a list of programs to be administered statewide,<sup>113</sup> and has requested that program administrators identify at least four downstream programs to pilot statewide. In collaboration with IOUs and other program administrators, PG&E has been chosen as the statewide administrator for the following subprograms, and will lead solicitations for each, as previously shown in **Figure 1.9**.

<sup>112</sup> Sector goals are identified in Section A of each Business Plan chapter.

<sup>113</sup> D.16-08-019, OP 8 and 9.

The list statewide programs reflects the current program and portfolio construct, and may be revisited and revised once Business Plans are approved and implemented.

**Public Sector**

- Institutional Government Partnerships — State of California and Department of Corrections

**Agricultural Sector**

- Indoor Agriculture Program (downstream pilot)

**Codes and Standards**

- Building Codes Advocacy and Appliance Standards Advocacy Programs

**Workforce Education and Training**

- K-12 Connections Programs
- Workforce Education and Training: Career & Workforce Readiness (downstream pilot)

PG&E is also the designated statewide administrator for New Financing Offerings (also known as the Energy Efficiency Financing Pilots).<sup>114</sup> However, per D. 13-09-044, the California Alternative Energy and Advanced Transportation (CAEATFA) has been assigned the responsibility for implementation of the New Financing Offerings. Therefore, PG&E does not intend to solicit for a new third-party implementer.

For other statewide program solicitation strategy and transition timelines, please refer to the *IOU Business Plans* as listed in **Table 1.13**.

**Table 1.13**  
Statewide Program by IOU

IOU	Statewide Program
<b>Southern California Edison Company</b>	<p><b>Emerging Technologies:</b> Electric Emerging Technologies Program</p> <p><b>Lighting:</b> Primary Lighting, Lighting Innovation and Lighting Market Transformation</p> <p><b>Commercial:</b> Savings by Design</p> <p><b>Public:</b> Institutional Government Partnership — University of California and California State University</p> <p><b>Public:</b> Water/Wastewater Pumping Program for non-residential Public sector (<i>downstream pilot</i>)</p>
<b>Southern California Gas Company</b>	<p><b>Residential:</b> New Construction</p> <p><b>Emerging Technologies:</b> Gas Emerging Technologies Program</p>
<b>San Diego Gas and Electric Company</b>	<p><b>Residential and Commercial:</b> Upstream Heating, Ventilation, and Air Conditioning (HVAC)</p> <p><b>Residential:</b> Midstream Plug Load Appliance (PLA)</p> <p><b>Residential:</b> HVAC Quality Installation/Quality Maintenance (QI/QM) (<i>downstream pilot</i>)</p>

<sup>114</sup> See PG&E’s Financing Business Plan Chapter for a description of New Finance Offerings.

## 1.5 Solicitation/Contract Terms

PG&E will determine the appropriate contract model based on sourcing best practices and successful models used in other jurisdictions. PG&E plans to rebid program opportunities one year before the incumbent's contract end date. PG&E will assess the performance of the vendor/implementer via Key Performance Indicator (KPI) indices. Failing to meet KPIs may trigger rebidding. Until such a time as contracts are awarded for new and/or modified third-party programs, PG&E will honor existing third-party contracts.<sup>115</sup>

## 1.6 PG&E-Designed and/or Implemented Activities

PG&E plans to keep “in-house” program design and delivery for programs that are still in pilot phase; and activities that reflect its role as portfolio administrator, those that are integrated with other customer programs or integrated with core utility operations (i.e., rebate processing), and those required to fulfill its regulatory obligations (i.e., quality assurance and quality control (QA/QC)). Once programs transition from pilot phase, PG&E anticipates the program design and delivery to be transferred fully to third parties. In addition, PG&E will evaluate on a continuous basis portfolio administration activities to understand if efficiencies could be found through outsourcing.

### Residential Sector

As part of its Residential portfolio, PG&E is launching the Residential Pay for Performance program, one of PG&E's approved high opportunity project or program (HOPPs).<sup>116</sup> While PG&E has issued solicitations for third-party aggregators, and intends that each intervention is designed and implemented by these third-party aggregators, certain programmatic functions require PG&E management. For example, PG&E staff will maintain the CalTrack system that relies on Advanced Meter Technology to create the energy efficiency baseline and determine savings under the program. Additionally, PG&E's Retail Products Platform (RPP) pilot<sup>117</sup> was proposed, designed and delivered in conjunction with the

U.S. Environmental Protection Agency (EPA), the Northwest Energy Efficiency Alliance (NEEA), Commission staff and other national and California program administrators.

Several third-party vendors support the delivery of this pilot. However, since this is still considered a pilot, PG&E will continue to provide program management and coordination support until it moves out of pilot stage, and is transferred to the lead administrator for the statewide Plug Load and Appliances (PLA) program.

### Public Sector

In many cases, PG&E uses third parties to deliver support services to its Local Government Partnerships. For example, third-parties provide direct install services for public sector facilities. PG&E will continue this practice under the rolling portfolio. However, PG&E does not plan to issue solicitations for the overall design, delivery, and management of Local Government Partnership so that local governments can continue to shape and evolve partnerships to meet their constituents' unique needs. Additionally, PG&E staff will continue to offer certain functions for Local Government Partnerships, such as program and project management support, strategic planning support, and coordination amongst Local Government Partnerships.

### Codes and Standards (C&S)

PG&E contracts out the more than 75% of its budget to support C&S activities, and will continue to do so. PG&E anticipates a portion of the scope of work will be directed by PG&E's C&S team but plans to bid out portions of Building Codes and Appliance Standards Advocacy, Reach Codes, Compliance Improvement and Code Readiness subprograms by the end of 2020. PG&E anticipates providing program design guidance for code compliance, national and international standards, code readiness and reach codes activities. Additionally, PG&E anticipates that certain aspects of each of these programs will be delivered by PG&E staff. For these activities to be successful, coordination with PG&E's resource programs, Commission staff, Energy Commission and other stakeholders is critical, hence the need for utility personnel supporting them. For example, to successfully implement the Building Codes and Appliance Standards Advocacy subprogram, PG&E needs to augment large CASE study development projects to monitor and verify the work.

<sup>115</sup> D.15-10-028 states that any new contract or extension of our existing contract with third parties should terminate no later than 10/28/18.

<sup>116</sup> PG&E Advice Letter 3698-G/4813-E.

<sup>117</sup> PG&E Advice Letter 3668-G/4765-E.

## Workforce Education and Training

PG&E uses a host of third parties to propose, design and deliver education and training to market actors and customers. Additionally, PG&E uses third parties to support certain administrative functions in support of Centergies (e.g., Pacific Energy Center), such as class registration and event management services. However, the overall management of each Education Center will continue to be led by PG&E staff to ensure coordination with overall energy efficiency portfolio needs, as well as with other demand-side management programs such as ESA, DR and DG.

## Financing

PG&E will continue to support On-Bill Financing (OBF) with internal PG&E staff as OBF requires significant utility operational expertise to coordinate PG&E tariff and billing functionality.

### 1.7 PG&E Operations to Support Energy Efficiency Programs

As portfolio administrator, PG&E will provide portfolio and program oversight, and assist third-party providers with other support services to improve program offerings, avoid administrative redundancies, and ensure regulatory compliance. While PG&E will focus more on its role as portfolio designer, and less on its role as program designer and implementer, PG&E retains discretion regarding portfolio make up, with respect to program budget allocations, based on the needs within its service territory.

PG&E plans to retain program/portfolio administration responsibilities that align with PG&E's regulatory and fiduciary responsibilities as stewards of ratepayer funds, as well as those portfolio administration responsibilities critical to the achievement of portfolio goals.

Portfolio oversight roles include regulatory compliance and reporting; engineering reviews; quality assurance and quality control (QA/QC); contract management; data mining and analytics; portfolio optimization; rebate (including financing) and application processing and management; evaluation, measurement and verification (EM&V) support; and integration with other PG&E programs and offerings (e.g., TOU Rates).

Additionally, PG&E plans to maintain some customer-facing workforce to complement program implementation, such as engineers and account

representatives who serve as PG&E's trusted energy advisors. PG&E will continue targeted local marketing outreach to drive customer awareness, interest and participation in energy efficiency programs.

While PG&E anticipates retaining certain responsibilities, PG&E plans to reduce labor and total program portfolio costs by 2020, absorbing additional costs of achieving higher goals.<sup>118</sup> As roles and responsibilities evolve, PG&E will adjust its strategy accordingly.

## J. EM&V Needs and "Preparedness"

PG&E expects that Evaluation, Measurement, and Verification (EM&V) needs will shift over the next ten years. The specific changes that will influence EM&V going forward include:

- The development of new program designs and the need to be responsive to legislative mandates
  - Implementation of new program models such as pay-for-performance (P4P) and programs focused on behavioral interventions are being introduced and may require new study designs
  - Implementation of AB802, HOPPs, and AB793 Energy Management Technology Pilots is introducing new program designs and processes will require evaluations of both design and impacts to inform stakeholders of program administrator progress in these areas
- The expansion of third-party implementation
  - Increased third party program involvement will require research to support third parties and to enable PG&E to understand if the programs are effective
- The shift to net goals (inclusive of free ridership and spillover<sup>119</sup>) means that free ridership and spillover research may be needed to make program adjustments. This would not replace any CPUC impact efforts, but provide information more quickly to enable PG&E's management of portfolio programs.

<sup>118</sup> PG&E anticipates that the 2017 Potential and Goals Study will identify increased energy savings goals to reflect SB 350 and AB 802.

<sup>119</sup> D 12-11-015 (p53-56, OP39)

- The movement towards statewide administration of some programs
  - Statewide administration of some programs is changing implementation processes, and may require research to guide the development and coordination of these efforts across program administrator territories

As such, PG&E expects the nature of some EM&V studies to evolve:

- Market and baseline studies will become more important. PG&E recognizes that there is a greater need for market-level and portfolio-level research to ensure that PG&E can identify gaps and select programs that focus on areas where there is potential. These studies will also enable PG&E to track the business plan strategic direction.
- Process evaluations will be fundamental to ongoing improvement of the portfolio over the rolling cycle. These will continue to be used to inform program designs, reduce uncertainties, and minimize the cost of energy savings to the IOUs and ratepayers. Additionally, portfolio level assessments may look across the suite of offerings to ensure optimal sector level design and/or be required for outside stakeholders.
- Energy impact evaluations are critical, and will remain a cornerstone of validating energy savings and estimating cost effectiveness of programs. A growing number of impact evaluations will be built on embedded data collection and/or will be able to increasingly rely on normalized meter energy consumption (NMEC) based savings. Methodologies to estimate net savings, free ridership and spillover will continue to evolve.

The timing of some studies may also change (as well as plans for funding the studies) because PG&E expects to need relatively quick turn-around evaluations that inform third party effectiveness and ensure that the programs provide the outcomes that they proposed to deliver.

The current changes also require a need for new EM&V frameworks and new methods of measurement to determine how to assess stranded potential as well as to assess the impacts of market transformation programs. The resurgence of market transformation aimed at mid- and upstream partners, as well as the ability to capture stranded potential under AB802, means that new EM&V frameworks and approaches are needed to understand how to best capture impacts (savings and other impacts) from these efforts.

### J.1 Synopsis of Research Needs

Forecasting research needs for the period covered by the business plans is difficult due to the changes described above. However, **Table 1.14**, provides a high-level synopsis of current research needs as of 2017.<sup>120</sup> These needs may change over time and PG&E will continue to follow the current annual CPUC process for documenting EM&V studies (where all studies are proposed within the Energy Division and Program Administrator EM&V Plan and reviewed by stakeholders and then documented annually

<sup>120</sup> This table does not have the full suite of all research needs and further examples are described in individual sector chapters (within the EM&V Needs section).

**Table 1.14**

Select Research Needs as of 2017

Study Type	Select Research Needs	
<p><b>Market and baseline studies to understand program gap, needs, and inform design and metrics</b></p>	<ul style="list-style-type: none"> <li>• Updating Commercial End Use Study (CEUS) and Residential Appliance Saturation Study (RASS), including end use intensity for main energy users</li> <li>• Technologies and strategies to achieve ZNE</li> <li>• Determining where there are untapped energy saving opportunities</li> <li>• Baseline information for the public sector (and related five key public sector segments); Baseline information for new finance or other program offerings</li> </ul>	<p>Commercial/Public/Residential</p> <p>Residential/Commercial</p> <p>Industrial</p> <p>Public; Cross-cutting</p>
<p><b>Process studies to understand whether pilots, new programs, or new strategies are working</b></p>	<ul style="list-style-type: none"> <li>• How to improve customer access and engagement with energy data to enable energy reduction</li> <li>• Use of existing energy management tools, tools available in the market, and opportunities for new tools</li> <li>• Effectiveness of strategic partnerships</li> </ul>	<p>Commercial (especially SMB)</p> <p>Industrial/Agricultural</p> <p>Agricultural</p>
<p><b>Energy impact studies (and studies that look at potential impacts) that are specific to measures, end uses, or sectors</b></p>	<ul style="list-style-type: none"> <li>• Impacts specific to sector</li> <li>• Effect of real-time feedback on plug load energy use</li> <li>• Savings from CEC-specific lamps incentivized through the program vs. other LEDs</li> </ul>	<p>All</p> <p>Commercial</p> <p>Residential</p>
<p><b>EM&amp;V framework and methods-based studies to understand best ways to apply NMEC or options for determining impacts from market transformation efforts</b></p>	<ul style="list-style-type: none"> <li>• How to measure savings from pay-for-performance pilots and other innovative new models (including mid- and upstream models)</li> </ul>	<p>Residential</p>
<p><b>Monitoring of a sector to inform PG&amp;E and stakeholders about accomplishments to date, sector needs, and remaining potential</b></p>	<ul style="list-style-type: none"> <li>• Set up studies to enable tracking of business and implementation plan metrics</li> <li>• Potential &amp; Goals Study to inform PG&amp;E goals and indicate potential savings by end use</li> </ul>	<p>All</p> <p>All, but with special attention to industrial, agricultural, and public sectors</p>

## J.2 EM&V Preparedness

As the EM&V environment changes, PG&E is preparing to address the associated EM&V needs.<sup>121</sup>

For PG&E-led programs, PG&E will identify specific data collection needs and strategies early in program development to support internal performance analysis and external program evaluations. PG&E will embed data collection and evaluation into the program designs whenever possible to reduce evaluation costs and increase feedback to the programs.

PG&E evaluation staff will be involved in the program design and planning stages and will continue to monitor the programs throughout implementation. Through on-going interactions, PG&E's evaluation specialists seek to inform program designs, improve program implementation and documentation, and identify and measure key performance indicators. For example, within the residential sector, PG&E's embedded data collection and evaluation includes early development of a new framework for documenting market changes for the evaluation of the Retail Products Portfolio, building in the experimental designs for the evaluation of Home Energy Reports, and detailing an evaluation method using normalized metered energy consumption within the residential Pay-for-Performance program.

For third-party programs, PG&E will ask program designers to include an EM&V plan demonstrating their program evaluability, documenting what data will be collected through the program, and to propose a method for assessing impacts. PG&E's EM&V team will review the third-party EM&V plan as an integral part of the program proposal. As such, for both PG&E-led and third-party programs, PG&E will collaborate with CPUC staff and their evaluation consultants to ensure that appropriate data collection and reporting capabilities are in place to facilitate accurate and efficient evaluation.

The specifics on data collection and reporting will be provided in as much detail as possible in PG&E's Implementation Plans (IPs). 'EM&V 2.0' methodologies--those which leverage the increased availability of information and communications technologies including Smart Meters and communicating smart thermostats, as well as

<sup>121</sup> PG&E's team of evaluation specialists are assigned to specific customer segments and, among their other duties, serve as internal consultants to program managers to improve program design and implementation activities.

cloud-based software that can facilitate improved data access and advanced analytics--will be used wherever the PG&E and CPUC evaluation teams believe these offer more accurate and cost-effective evaluations. More traditional tracking data (e.g., contact information, project development and technical descriptions, savings calculations) will also be used to support evaluation efforts.

## K. Policy Considerations

PG&E must seek new energy saving opportunities in order to increase the use of energy efficiency to the extent of meeting SB 350 targets - doubling energy savings to the extent doing so is cost effective and feasible - and SB 32 goals - cutting GHG emissions to 40 percent below 1990 levels. The legislature has directed the Commission to update its policies governing energy efficiency programs to achieve its SB 350 targets by authorizing certain programs at a minimum.<sup>122</sup> These include programs based on measured savings, pay for performance programs, and operational, behavioral, and retrocommissioning activities, as well as market transformation programs.<sup>123</sup> While not limiting the variety of programs that can generate savings to meet SB 350 targets, the legislature provided that certain programs are expressly eligible, including appliance and building energy efficiency standards, and savings from retrofitting existing below-code buildings.<sup>124</sup> In recognition of these challenges and opportunities, PG&E asks the Commission to reconsider certain energy efficiency policies that stand in the way of the full recognition of energy savings, and to confirm that PG&E is on the right track.

### K.1 Certain Cost-Effectiveness Assumptions Should be Re-examined in Light of New Energy Goals

PG&E recommends that the Commission modify its current cost-effectiveness protocols to give program administrators' ability to accelerate the adoption of new technologies, support deep retrofits, and offer a broad portfolio of programs. Specifically, the Commission should:

<sup>122</sup> SB 350 Section 16, amending Public Utilities (Pub. Util.) Code section 399.4 (d).

<sup>123</sup> Pub. Util. Code section 399.4(d), subsec.(1)-(4).

<sup>124</sup> Public Resources Code section 25310, subsection (d.). See also Public Utilities Code section 381.2.

- Review participant cost inputs in the Total Resource Cost (TRC) calculations
- Allow effective useful lives (EULs) in excess of the current 20-year limit to encourage long-term measure installations
- Include codes and standards (C&S) advocacy savings in the evaluation of program portfolio cost-effectiveness, as well as total portfolio cost-effectiveness
- Exclude costs from non-resource program areas that most stakeholders agree provide significant benefits, but for which benefits have not been quantified (e.g., workforce education and training (WE&T))

**Recommendation 1:** The Commission should consider revisions to the TRC test to remove participant costs that are not associated with energy savings.

Avoided costs included in the E3 calculator for demand-side management programs declined by 33 percent in terms of average monthly 2017 avoided costs when they were updated by Resolution E-4801. This update makes it very challenging for program administrators to continue offering certain energy efficiency programs.

The TRC analysis for energy efficiency measures includes the full costs of measures, including both energy and non-energy benefits. These project costs reflect customer expenditures to procure energy efficiency measures that include both energy and non-energy benefits. Including project costs attributable to non-energy benefits of a measure, such as comfort or other improvements, unnecessarily reduces the cost-effectiveness results of energy efficiency measures.

The Business Plans applications provide an opportunity to address the extent to which participant costs that are unrelated to incremental energy efficiency benefits are currently included in the TRC such as product features that are distinct from the energy savings, like better light quality of LEDs, or comfort associated with insulation or air sealing. Including the total participant cost of measures such as these makes it challenging for program administrators to include them in their portfolios, even if the policy direction is to support them.

The Commission previously agreed that it would be reasonable to exclude such costs from the

participant costs included in the TRC analysis:

PG&E is seeking only to address a current alleged bias in the cost-effectiveness calculation by removing from the incremental measure cost costs that participants willingly pay to procure the non-energy benefits. PG&E has proposed 25% (sic) cost reduction is, then, a proxy for the cost of product features of an energy efficient product that are not related to efficiency (such as aesthetics).

*We conclude that the concept of removing project-related, non-efficiency related costs (i.e., the costs in the third bullet, above) from the total cost calculation has merit. Including the cost of non-EE “bells and whistles” because they are hard to tease out of a measure’s total costs undoubtedly inflates project costs. This creates a misleading picture of a measure’s and project’s cost-effectiveness.*<sup>125</sup>

The Commission concluded, however, that it needed additional data to determine the amount of project costs to remove.<sup>126</sup> PG&E proposes that the amount of costs unrelated to the incremental energy efficiency benefits of a measure or project be derived based on proxies for non-EE costs for appropriate groupings of EE end uses, programs, or channels. Approaches for doing this expeditiously could make use of available California-specific research, research from other states, or Delphi panels of practitioners that frequently engage with customers. The Commission should resolve this issue in advance of the program administrators’ annual budget advice letter filings in September, 2017.<sup>127</sup> PG&E recommends these changes occur in an open, transparent process.

Maximum EUL should be extended to 30 years for certain measures. Currently, the EULs of all energy efficiency measures are subject to an arbitrary 20-year ceiling, regardless of the true lifetime of measures. This unnecessarily reduces the energy efficiency benefits of long-lived measures, such as furnaces, boilers, building shell measures, and insulation. Eliminating years of savings reduces the measures’ cost-effectiveness, biases the portfolio toward measures whose savings are accumulated

<sup>125</sup> D.14-10-046, p. 100 (emphasis added)

<sup>126</sup> Ibid

<sup>127</sup> D.15-10-028, OP 4, requires each program administrator to provide an updated annual report on its portfolio and budget by September 1 each year during the Rolling Portfolio period



within 20 years, and distorts the perceived ability of energy efficiency as a substitute for supply-side options, which have longer lives.

Given the adverse impact of the 2017 avoided costs updates on the cost-effectiveness of energy efficiency portfolios, PG&E recommends that benefits for codes and standards and spillover effects should be incorporated into all TRC calculations and no longer be treated as a “bonus” or “hedge.” Applying the full benefits of codes and standards savings to the TRC calculation will help to maintain energy efficiency as the first resource in the loading order.

Costs associated with non-resource program areas that most stakeholders agree provide significant benefits, but for which benefits have not been quantified, should be excluded from the evaluation of cost effectiveness to avoid placing such programs at risk under the current cost-effectiveness paradigm. The Commission currently excludes Emerging Technologies from the energy efficiency cost-effectiveness calculations and the On Bill Financing Loan pool. PG&E recommends that costs associated with all non-resource programs, such as Workforce Education and Training, which are clearly aligned with the California Energy Efficiency Strategic Plan and are essential to meeting state policy goals, be removed from cost-effectiveness calculations.

**Recommendation 2:** To align energy efficiency programs and measures peak savings values with peak hours that have shifted to the evening, the Commission should promptly order that savings calculations in the Database for Energy Efficiency Resources (DEER) be updated to reflect current system peak hours. This update is required to more accurately reflect the value of energy efficiency.

These should be used in the 2017 Potential Study and for program savings starting in 2018, when the new avoided costs, which reflect these later peak hours, will begin to be used.

In September of 2016, the Commission adopted Resolution E-4801, which requires use of new avoided costs for demand side resources. These new avoided costs resulted in the modification of hourly capacity factors to reflect the shift of peak hours from afternoon to evening.<sup>128</sup> However, the Commission has not made a corresponding update to the system peak hours in DEER. DEER identifies the amount

of energy saved during the hours that a device is operated (for primary usage-based measures) as a percentage of the device’s capacity. Without such an update, assumed capacity savings (which are based on recorded usage) will be inaccurate. This creates a number of risks. These risks include a mismatch between recorded energy savings used to determine energy efficiency goals and the actual achievement of those goals. In other words, achieving peak savings goals without the update would require the pursuit of technologies that provide peak value in the middle of the day, but achieving a cost-effective portfolio would require pursuing technologies that provide peak value in the evening. Updating the capacity factors to show the peak period used for system planning purposes is also necessary to avoid the risk that grid and energy procurement planning will incorporate inaccurate peak savings into the peak forecasts.

**Recommendation 3:** The Commission should also endorse the IOUs’ efforts to redefine “behavioral programs” to allow broader recognition of these programs and their energy savings pursuant to legislative changes, through the CAEECC, subject to Commission approval.

SB 350 requires the CPUC to update policies to achieve deeper savings through behavioral programs.<sup>129</sup> The Commission currently limits behavior-based programs to comparative energy usage disclosure programs.<sup>130</sup> However, AB 802 specifies that behavioral programs are one of the ways of using a meter-based savings approach.<sup>131</sup> The Commission’s requirement that behavioral programs employ experimental design, i.e., lengthy randomized control trials, to estimate savings is a costly hurdle that cannot be justified in light of these new laws. The Commission should discard the existing definition of behavioral programs and allow for a broader set of *ex ante* and/or *ex post* methodologies for the design and evaluation of behavioral programs.<sup>132</sup> The IOUs have been working to develop a common framework for designing behavior based programs that identifies the key

<sup>129</sup> Pub. Util. Code §399.4 (d) (3).

<sup>130</sup> D. 10-04-028

<sup>131</sup> Assembly Bill (AB) 802, now codified at Pub. Util. Code §381.2 (b)

<sup>132</sup> This should include experimental and quasi-experimental approaches such as but not limited to randomized control trials (RCTs), matched comparison groups, normalized metered energy consumption (NMEC) calculations and other standard EM&V practices

<sup>128</sup> D.16-06-007 and CPUC Resolution E-4801

characteristics that distinguish those programs from traditional energy efficiency or distributed energy resource programs.<sup>133</sup> Although most policy issues can be reviewed in the energy efficiency rulemaking proceeding, R.13-11-005, behavioral program design and rules present unique technical issues that should be subject to review and comment in the CAEECC stakeholder engagement process and then adopted after submission to, and approval by, the Commission.

## K.2 Savings Opportunities Should Not be Lost During the Transition from Existing Portfolio to Business Plan Portfolio

PG&E intends to achieve a smooth transition to programs based on the Rolling Portfolio Decision and the Guidance Decision so that customers, programs and implementers continue to reap energy savings initiated under the existing framework pending implementation of the Business Plan. PG&E requests the Commission to approve PG&E's plans for compliance with the Rolling Portfolio Decision and the Guidance Decision in its decision approving PG&E's Business Plan.

**Statewide Programs List.** PG&E seeks confirmation that the list of statewide programs in the Guidance Decision<sup>134</sup> is not final until implementation plans have been reviewed at CAEECC to avoid pre-judging the bottom-up review of program structure that the program administrators are to undertake to optimize program activities. The Commission clarified that "the program administrators are not required to continue to operate their existing statewide programs and subprograms according to their current organization. ... Program administrators are encouraged to conduct a bottom-up review of the program and subprogram structures in order to rationalize and optimize program activities into the most effective and cost-effective possible configurations."<sup>135</sup> The list of statewide programs should be finalized after program administrators have completed their reviews to confirm that programs are configured correctly and have retired

any unnecessary programs.

**Program Budget, not Portfolio Budget.** The Commission should also confirm that the 25 percent statewide program allocation should be based on program budget. The Guidance Decision requires that at least 25 percent of program administrators' budgets be spent on statewide programs and subprograms.<sup>136</sup> The 25 percent calculation should be based on the program administrator's total program budget, rather than its total portfolio budget. This would thereby exclude the budgets allocated to evaluation, measurement, and verification (EM&V), statewide marketing, education, and outreach (SW ME&O), regional energy networks (RENS) and community choice aggregators (CCAs) from the statewide allocation. This distinction is rational because the Commission has previously earmarked each of those budgets for transfer to other parties. Program administrators have no discretion to allocate those funds, so making those funds subject to the 25 percent allocation would require PG&E to allocate additional increments of funding, over which it has control, to make up for the earmarked funds.

**Counting Statewide Functional Activities.** PG&E may determine that the third party provision of functional services, e.g., "back office" types of work, such as engineering services and application processing, can be performed cost effectively on a statewide basis. PG&E proposes to count the budget spent on functional activities that are administered statewide toward the 25 percent statewide program target. If it can be determined that competitive procurement will lead to reduced operating costs on a statewide basis, then those back office activities should be performed by a statewide third party vendor.

**Local Pilots of "Statewide" Programs.** IOUs should be allowed to continue to pilot "locally" those activities that may meet the definition of Statewide but are not ready for statewide treatment. The Guidance Decision states that all upstream and midstream programs "currently in the portfolio should be considered statewide."<sup>137</sup> However, program administrators may have pilots that

<sup>133</sup> The benefits of the behavioral framework include reducing uncertainty around acceptable EM&V approaches, savings persistency, and savings attribution for behavioral programs.

<sup>134</sup> D.16-08-019, OP 8

<sup>135</sup> Listed at D.16-08-019, pp. 66 and 67

<sup>136</sup> D.16-08-019, OP 6

<sup>137</sup> D.16-08-019, p. 58

involve testing and evaluating the viability of certain upstream, midstream, and/or market transformation intervention strategies. Program administrators should be allowed to exercise their judgement to launch and administer a local version of a pilot that meets the “statewide” definition before devoting more resources to launching it at the statewide level if they believe that a limited pilot could improve the likelihood of program success. For example, PG&E would continue to administer its Retail Products Platform (RPP) pilot<sup>138</sup> until evaluation studies suggest it is appropriate for statewide program treatment, at which time PG&E will transfer program administration to the statewide administrator of the Plug Load and Appliances (PLA) program.

**Extension of Existing Contracts.** Program administrators should be allowed flexibility to extend existing third-party contracts until they are replaced by programs procured through the new Business Plan process. The Guidance Decision states:

*“Program administrators shall ensure a smooth transition between existing energy efficiency program activities and the changes outlined in this decision, to be proposed in the business plans due January 15, 2017, minimizing program disruptions and avoiding any funding hiatus for ongoing efforts or partnerships.”<sup>139</sup>*

In the earlier Rolling Portfolio Decision, the Commission stated, “PAs may execute new contracts, and/or modify existing contracts, that may extend up to three years beyond the date of this decision.”<sup>140</sup> That Decision was issued on October 22, 2015; consequently, all third-party energy efficiency contracts must expire by October 23, 2018. A mandatory termination date of October 23, 2018 requires each program administrator to conduct solicitations to replace the existing third party contracts to maintain the 20 percent third-party procurement targets required by the Guidance Decision.<sup>141</sup> This could result in significant market disruption and significant administrative burdens, particularly for vendors, program review group (PRG) members, and Commission staff. To smooth the transition from PG&E’s current portfolio to PG&E’s new portfolio, PG&E proposes that the above-quoted

mandate of the Guidance Decision be interpreted as authorizing program administrators to extend their existing third-party contracts until those services are replaced with new interventions pursuant to the program administrator’s business plan.

### K.3 Conclusion

Each of the foregoing program adjustments is reasonable and should be ordered in the Commission’s decision approving PG&E’s 2018-2025 Business Plan. Greater potential energy savings should be unlocked by the modification to the TRC, the redefinition of behavioral programs, the extension of maximum EUL, and the counting of C&S savings. The accuracy and cost-effectiveness of energy savings measures will be improved by changes such as revising DEER peak periods to coincide with system peak. Clarification is needed to avoid unnecessary risks to cost-effectiveness, such as the retention of programs without sufficient analysis or the premature offering of a statewide pilot. Finally, contributions toward the 25 percent statewide target should be properly credited to avoid imposing unnecessary costs on customers.

<sup>138</sup> PG&E Advice Letter 3668-G/4765-E

<sup>139</sup> D.16-08-019, OP 14

<sup>140</sup> D.15-10-028, OP 22

<sup>141</sup> D.16-09-018, OP 11

# Appendices

# Portfolio Overview Appendices

## Appendix A: Compliance Checklist

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
<b>Portfolio Summary</b>		
0	<b>Executive Summary</b>	
	<i>Company description</i>	Executive Summary p. A
	<i>Definition of market</i>	Executive Summary p. A
	<i>Mission Statement</i>	Executive Summary p. A
	<i>Purpose of Business Plan</i>	Executive Summary p. A
I.A.1, II.D.2	<b>Overview</b>	
	<i>About EE/DSM</i>	Energy Efficiency and It's Role in Helping PG&E Meet Its Energy Needs, pp. 11-16
	<i>CA Energy Needs</i>	California's Evolving Energy Efficiency Landscape, pp. 21-26
	<i>Regulatory Requirements</i>	California's Evolving Energy Efficiency Landscape, pp. 22-23
	<i>Strategic Plan</i>	California's Evolving Energy Efficiency Landscape, pp. 20-21
	<i>Legislation (e.g., AB 758, SB 350, AB 802, AB 793)</i>	California's Evolving Energy Efficiency Landscape, pp.

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		22-23
	<i>IOUs/PAs/CPUC/etc. overall role</i>	Roles in the Changing Landscape, pp. 8-9
I.A.2	<i>Broad socioeconomic and utility industry trends relevant to PA's EE programs (population, economics and markets, technology, environment/climate)</i>	California's Evolving Energy Efficiency Landscape pp. 23-26
I.B.1	<i>Vision (e.g., How PA thinks about and uses EE over next 10 years)</i>	PG&E's Vision, p. 1
I.5	<i>Compare/contrast to past cycles</i>	PG&E's Portfolio Evolution: Comparison to Past Cycles, pp. 9-11
I.B.2	<b>Goals &amp; Budget</b>	
I.B.2 & I.C.2.a	<i>Energy Saving Goals</i>	Goals, Budget and Cost-Effectiveness, pp. 27-28
I.C.2.a	<i>Portfolio Budget (sector and portfolio level per xls checklist)</i>	Goals, Budget and Cost-Effectiveness, pp. 28-30
I.C.2.a, I.C.2.d	<i>Cost-effectiveness (sector and portfolio level per xls checklist)</i>	Goals, Budget and Cost-Effectiveness, pp. 30-34
I.C.2.b	<i>Explanation of Admin Budgets (e.g., Direct/Indirect Labor, Professional/Admin personnel)</i>	Goals, Budget and Cost-Effectiveness, pp. 28-29
I.C.2.c	<i>Explanation of accounting practices</i>	Goals, Budget and Cost-

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		Effectiveness, p. 30
I.C.3 and I.C.4	<b>Intervention strategies (high level)</b>	
	<i>Overall issues/challenges/barriers</i>	PG&E's Portfolio Plan, pp. 4-7
	<i>High level summary of strategies and tools (e.g., AMI data, AB 802, procurement model, up/mid/downstream, etc.)</i>	PG&E's Portfolio Plan, pp. 4-7
I.C.4; I.D	<b>Solicitation plan</b>	
I.C.4	<i>Solicitation strategies/areas that could be SW</i>	Solicitation Strategy and Transition Timeline, pp. 35-42
I.D; II.F	<i>Proposal for transitioning the majority of portfolios to be outsourced by the end of 2020.</i>	Solicitation Strategy and Transition Timeline, pp. 35-42
<b>Sector Chapter (commercial, residential, public, agricultural, industrial, x-cutting)</b>		
II.A	<b>Summary tables</b>	
II.A	<i>Table with CE, TRC, PAC, emissions, savings, budget</i>	N/A
I.C.7; II.E.1.b	<i>Metrics for sector</i>	N/A
II.D	<b>Market characterization (overview and market/gap and other analysis)</b>	
II.D.1	<i>Electricity/NG</i>	N/A
II.D.2	<i>State goals include acknowledgement of goals set by Strategic Plan, SB 350, AB758, guidance as appropriate)</i>	N/A
II.D.3	<i>EE potential and goals</i>	N/A
II.D.5	<i>Customer landscape (e.g., segments/subsegments, major end uses, participation rates, etc.)</i>	N/A
II.D.6	<i>Major future trends that are key for the PA and its customers</i>	N/A

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
II.D.7	<i>Barriers to EE and other challenges to heightened EE (e.g., regulatory, market, data)</i>	N/A
II.2.a	<b>Description of overarching approach to the sector</b>	
	<i>Goals/strategies/approaches</i>	N/A
I.C.6; I.D	<i>How portfolio meets Commission guidance</i>	N/A
II.C	<i>Description of how this chapter addresses the performance challenges/barriers</i>	N/A
I.C.4 a-c	<b>Intervention strategies (detailed)</b>	
II.D.2.a; II.E.3	<i>What specific strategies are being pursued (e.g., near, mid, long AND existing, modified, new)</i>	N/A
I [cmt with excerpt]	<i>Why specific strategies were chosen (e.g., ID current weaknesses, best practices, or other rationale to support choice)</i>	N/A
II.E.1.a; II.E.4	<i>How approaches advance goals discussed above</i>	N/A
I.C.4; I.E; II.D.4	<i>How strategies use lessons learned from past cycles and EM&amp;V</i>	N/A
I	<i>How will interventions support/augment current approaches or solve challenges</i>	N/A
II.D.2	<i>Explanation for how these strategies address legislative mandates from AB 802, SB350, and AB 793, as well as other Commission directives for this sector, including strategic plan.</i>	N/A
I.C.4	<i>Future expectations for intervention strategies</i>	N/A
I.C.1; II.E.6	<i>Description of pilots</i>	N/A
II.F	<i>Key Partners</i>	N/A
I.C.5; I.D; II.B; II.C	<b>Compare/contrast to past cycles</b>	
	<i>Budget changes as appropriate</i>	N/A
	<i>Modification to sector strategies</i>	N/A
	<b>Cross-cutting (sector chapters and ME&amp;O)</b>	
II.E.2; II.H, II.K	<i>Program Administrator marketing and integration with SW MEO as applicable</i>	N/A
II.E.5; II.H	<i>Workforce, education, and training</i>	N/A
II.H	<i>Emerging Technologies</i>	N/A
II.H	<i>Codes &amp; Standards</i>	N/A
II.G	<b>Cross PA and Offering Coordination</b>	
II.G	<i>How strategies are coordination among regional PAs</i>	N/A
II.G	<i>Proposal of statewide program administrator/approaches for this sector</i>	N/A
II.G	<i>How the sector strategies are coordinated with statewide program activities</i>	N/A
II.G	<i>How are strategies coordinated with other state agencies and initiatives (e.g., AB 758)</i>	N/A



Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
II.I	<b>EM&amp;V Considerations (statement of needs)</b>	
II.I	<i>Data collection needs</i>	N/A
II.I	<i>Anticipated study needs</i>	N/A
II.J	<b>Demand Response</b>	
ED Guidance (p.8)	<i>How EE measures use up-to-date DR enabling technologies to be "DR ready"</i>	N/A
ED Guidance (p.8)	<i>How duplication of costs for ME&amp;O, site visits, etc. is avoided for dual-purpose technologies</i>	N/A
ED Guidance (p.9)	<i>How strategies facilitate customer understanding of peak load, cost, and opportunities to reduce</i>	N/A
II.K	<b>Residential Rate Reform</b>	
ED Guidance (p.9)	<i>How BPs will help reduce load during TOU periods</i>	N/A
ED Guidance (p.9)	<i>How BP will diminish barriers to load reduction during TOU periods</i>	N/A
ED Guidance (p.9)	<i>How strategies will provide info to customers and/or provide a tool to show how program may impact customer energy usage during different TOU periods</i>	N/A
ED Guidance (p.9)	<i>How strategies will analyze whether a customer may experience greater savings by switching to a different, opt-in TOU rate</i>	N/A
ED guidance (p.9)	<i>ME&amp;O re: rate reform</i>	N/A
II.L	<b>Integrated Demand Side Resources</b>	N/A
II.M	<b>Zero-Emission Vehicles (EVs)</b>	N/A
II.N	<b>Energy Savings Assistance (Multi-family Focused)</b>	N/A
	<b>Appendices</b>	N/A
	<i>Additional Customer Data</i>	N/A
	<i>Cited research</i>	N/A
	<i>CAEECC stakeholder input resolution</i>	N/A

## Appendix B: References

Accenture Research. 2015. *The New Energy Consumer: Unleashing Business Value in a Digital World*. [https://www.accenture.com/t20151124T172734\\_\\_w\\_/us-en/\\_acnmedia/Accenture/next-gen/insight-unlocking-value-of-digital-consumer/PDF/Accenture-New-Energy-Consumer-Final.pdf#zoom=50](https://www.accenture.com/t20151124T172734__w_/us-en/_acnmedia/Accenture/next-gen/insight-unlocking-value-of-digital-consumer/PDF/Accenture-New-Energy-Consumer-Final.pdf#zoom=50)

American Council for an Energy-Efficient Economy. *Advanced Metering and Behavior*. <http://aceee.org/topics/advanced-metering-and-behavior>

American Council for an Energy-Efficient Economy. *Intelligent Efficiency*. <http://aceee.org/topics/intelligent-efficiency>

Berkeley Law: Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA. March 2016. *Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings*. <https://www.law.berkeley.edu/wp-content/uploads/2016/03/Powering-the-Savings.pdf>

California Department of Transportation. 2015. *Sacramento County Economic Forecast*. [http://www.dot.ca.gov/hq/tpp/offices/eab/socio\\_economic\\_files/2015/Final%20Forecasts/Sacramento.pdf](http://www.dot.ca.gov/hq/tpp/offices/eab/socio_economic_files/2015/Final%20Forecasts/Sacramento.pdf)

California Energy Commission. September 2015. *California Existing Buildings Energy Efficiency Action Plan*. [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN205919\\_20150828T153953\\_Existing\\_Buildings\\_Energy\\_Efficiency\\_Action\\_Plan.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN205919_20150828T153953_Existing_Buildings_Energy_Efficiency_Action_Plan.pdf)

California Energy Commission. June 29, 2016. *2015 Integrated Energy Policy Report (IEPR)*. Docket # 15-IEPR-01, CEC-100-2015-001-CMF. [http://www.energy.ca.gov/2015\\_energypolicy](http://www.energy.ca.gov/2015_energypolicy)

California Energy Commission. July 6, 2016. *Senate Bill 350 & Assembly Bill 802 – Implementation Timeline & Related Proceedings*. <http://www.energy.ca.gov/sb350/timeline.pdf>

California Energy Commission and California Public Utilities Commission. 2005. *State of California Energy Action Plan II*. [http://www.energy.ca.gov/energy\\_action\\_plan/2005-09-21\\_EAP2\\_FINAL.PDF](http://www.energy.ca.gov/energy_action_plan/2005-09-21_EAP2_FINAL.PDF)

California Energy Commission and California Public Utilities Commission. February 2008. *State of California Energy Action Plan: 2008 Update*. <http://www.energy.ca.gov/2008publications/CEC-100-2008-001/CEC-100-2008-001.PDF>

California Energy Efficiency Coordinating Committee. *Coordinating Committee Members*. <http://www.caeecc.org/members>

California Energy Efficiency Coordinating Committee. *Draft Proposal for Revamped Energy Efficiency Procurement Review Group and Independent Evaluator*. <http://www.caeecc.org/ee-prg-ie>

California Environmental Protection Agency: Air Resources Board. *The Governor's Climate Change Pillars: 2030 Greenhouse Reduction Goals*. <https://www.arb.ca.gov/cc/pillars/pillars.htm>

California Public Utilities Code Section 454.5. *OneCle*. <http://law.onecle.com/california/utilities/454.5.html>

California Public Utilities Commission. *R.13-12-011*.

California Public Utilities Commission. *Integrated Distributed Energy Resources (IDER) proceeding, R.14-10-003*.

<http://www.cpuc.ca.gov/General.aspx?id=10710>

California Public Utilities Commission. *Integrated Distributed Energy Resources (IDER) proceeding, R.16-02-007*. <http://www.cpuc.ca.gov/General.aspx?id=10710>

California Public Utilities Commission. January 2011. *California Energy Efficiency Strategic Plan*.

<http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5303>

California Public Utilities Commission. August 2012. *2010-2012 Energy Efficiency Annual Progress Evaluation Report*.

[http://eestats.cpuc.ca.gov/Img/Uploads/Energy%20Efficiency%20Evaluation%20Report\\_v9\\_Web.pdf](http://eestats.cpuc.ca.gov/Img/Uploads/Energy%20Efficiency%20Evaluation%20Report_v9_Web.pdf)

California Public Utilities Commission. October 16, 2014. *Decision 14-10-046: Decision Establishing Energy Efficiency Savings Goals and Approving 2015 Energy Efficiency Programs and Budgets (Concludes Phase I of R.13-11-005)*.

<http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M129/K228/129228024.pdf>

California Public Utilities Commission. December 18, 2014. *Resolution G-3497: Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric Company (SDG&E), and Southern California Gas Company (SoCalGas) requesting approval of program year 2012 and partial 2013 energy efficiency incentive awards*. <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M143/K573/143573160.PDF>

California Public Utilities Commission. July 3, 2015. *Decision 15-07-001: Decision on Residential Rate Reform for Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company and Transition to Time-of-Use Rates*.

<http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M153/K110/153110321.PDF>

California Public Utilities Commission. October 22, 2015. *Decision 15-10-028: Decision Re Energy Efficiency Goals for 2016 and Beyond and Energy Efficiency Rolling Portfolio Mechanics*.

<http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M155/K511/155511942.pdf>

California Public Utilities Commission. August 18, 2016. *Decision 16-08-019: Decision Providing Guidance for Initial Energy Efficiency Rolling Portfolio Business Plan Filings*.

<http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M166/K232/166232537.PDF>

Doherty, Paul. November 15, 2016. *PG&E Leaders Take Part in National Distributed Energy Future Conference*. Pacific Gas and Electric Company. <http://www.pgecurrents.com/2016/11/15/pge-leaders-take-part-in-the-national-distributed-energy-future-conference/>

Ettenson, Lara and Christa Heavey. August 2015. *California's Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals*. Natural Resources Defense Council.

<https://www.nrdc.org/sites/default/files/ca-energy-efficiency-opportunity-report.pdf>

Ewing, Reid and Fang Rong. March 31, 2010. *The impact of urban form on U.S. residential energy use*.

Housing Policy Debate. <http://www.tandfonline.com/doi/abs/10.1080/10511482.2008.9521624>

Freehling, Joel and Brian Stickles. February 2016. *Energy Efficiency Finance: A Market Reassessment*. American Council for an Energy-Efficient Economy. <http://aceee.org/sites/default/files/market-reassessment-0216.pdf>

Governor's Office of Planning and Research. July 2002. *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects*. [http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf)

Magill, Bobby. July 29, 2016. *Climate Change Signs Seen in California Wildfires*. KQED. <https://ww2.kqed.org/science/2016/07/29/climate-change-signs-seen-in-california-wildfires/>  
Martinez, Sierra. March 2, 2013. *California Leads the Nation in Energy Efficiency – Part 2: Myth-Busting the Naysayers*. Natural Resources Defense Council. <https://www.nrdc.org/experts/sierra-martinez/california-leads-nation-energy-efficiency-part-2-myth-busting-naysayers>.

Meija, Alejandra, Douglas Mahone, Armen Saiyan, Nicholas Dirr, and Christopher Rogers. 2016. *Savings To Code: Looking to Whole Systems for Implementing Existing Conditions Baselines*. ACEEE 2016 Summer Study on Energy Efficiency in Buildings. [http://aceee.org/files/proceedings/2016/data/papers/2\\_105.pdf](http://aceee.org/files/proceedings/2016/data/papers/2_105.pdf)

Metropolitan Transportation Commission. *The Bay Area in 2040*. [http://mtc.ca.gov/sites/default/files/2-The\\_Bay\\_Area\\_In\\_2040.pdf](http://mtc.ca.gov/sites/default/files/2-The_Bay_Area_In_2040.pdf)

Mitchell, Cynthia. May 15, 2015. *A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach*. TURN IDSM Comments in R.14-10-003.

Navigant Consulting, Inc. 2015. *Energy Efficiency Potential and Goals Study for 2015 and Beyond. Prepared for the California Public Utility Commission. Final September 25, 2015*. <http://www.cpuc.ca.gov/General.aspx?id=2013>

Pacific Gas and Electric Company. December 24, 2016. *Advice Letter 3668-G/4765-E: Request for Authority for Retail Products Platform (RPP) Pilot within PG&E's Residential Energy Efficiency Plug-Load and Appliances Sub-Program*. [https://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS\\_3668-G.pdf](https://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS_3668-G.pdf)

Pacific Gas and Electric Company. March 25, 2016. *Advice Letter 3698-G/4813-E: Submission of High Opportunity Projects and Programs (HOPPs) Proposal – Residential Pay-for-Performance Program*. [https://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS\\_3698-G.pdf](https://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS_3698-G.pdf)

Pacific Gas and Electric Company. September 1, 2016. *Advice Letter 3753-G/4901-E: PG&E's 2017 Energy Efficiency Annual Budget Advice Letter in Compliance with Decision 15-10-028, Ordering Paragraph 4*. [https://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS\\_3753-G.pdf](https://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS_3753-G.pdf)

*Post Workshop Comments of the Utility Reform Network on Energy Efficiency Baseline and To-Code Incentive Eligibility Issues*. May 28, 2015.

Rogers, Ethan. 2014. *The Energy Savings of Smart Manufacturing*. American Council for an Energy-Efficient Economy. <http://aceee.org/research-report/ie1403>

*Senate Bill 350: Clean Energy and Pollution Reduction Act of 2015*. October 7, 2015. [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160SB350](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350)

The Public Policy Institute of California. January 2016. *California's economy is growing, but disparities persist*. [http://www.ppic.org/content/pubs/report/R\\_116SBR.pdf](http://www.ppic.org/content/pubs/report/R_116SBR.pdf)

United States Department of Energy. June 2008. *Annual Energy Outlook 2008*.  
[http://www.eia.gov/oiaf/aeo/pdf/0383\(2008\).pdf](http://www.eia.gov/oiaf/aeo/pdf/0383(2008).pdf)

United States Department of Energy. September 2015. *Quadrennial Technology Review: An Assessment of Energy Technologies and Research Opportunities. Chapter 5: Increasing Efficiency of Building Systems and Technologies*. [https://energy.gov/sites/prod/files/2015/09/f26/Quadrennial-Technology-Review-2015\\_0.pdf](https://energy.gov/sites/prod/files/2015/09/f26/Quadrennial-Technology-Review-2015_0.pdf)

United States Department of Energy. September 15, 2016. *Annual Energy Outlook 2016*.  
[http://www.eia.gov/outlooks/archive/aeo16/pdf/0383\(2016\).pdf](http://www.eia.gov/outlooks/archive/aeo16/pdf/0383(2016).pdf)

United States Energy Information Administration. November 4, 2014. *LED light bulbs keep improving in efficiency and quality*. <http://www.eia.gov/todayinenergy/detail.php?id=18671>

United States Environmental Protection Agency. *Greenhouse Gas Emissions from a Typical Passenger Vehicle*. <https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle-0>

Walters, Dan. August 14, 2016. *California's jobless rolls cut in half, but gains have been uneven*. The Sacramento Bee. <http://www.sacbee.com/news/politics-government/politics-columns-blogs/dan-walters/article95532397.html>



# MARKET SECTORS

RESIDENTIAL 02

COMMERCIAL 03

PUBLIC 04

INDUSTRIAL 05

AGRICULTURAL 06



# RESIDENTIAL

## CHAPTER 02

## MARKET CHARACTERIZATION & APPROACH

# RESIDENTIAL

### SETTING THE STAGE



USAGE:

**31% OF ELECTRICITY**  
**44% OF NATURAL GAS**

**Over 5.6 million** single-family and multifamily residences

**23%** of PG&E's residential customers live in multifamily housing

**80%** of multifamily households are renters who pay the utility bill



### KEY APPROACH & STRATEGIES



**Targeting** individual homes with interval data analytics to reach new customers

**Improving data access** to facilitate greater understanding of energy usage



**New program models and financing** to cost-effectively deliver comprehensive energy savings

### TRENDS



While per household energy use is decreasing, overall residential sector energy usage is projected to increase due to CA population growth, increasing plug load usage and growth in the electric vehicle market

Demand for a "connected home" experience, and customers' desire for visibility and control of their energy use, drive opportunities to use mobile devices and social media to stay connected

Solar PV is experiencing rapid uptake in PG&E's territory, resulting in a mid-day dip in demand from traditional generation

Customers are interested in financing options beyond traditional rebates, such as on-bill loan repayments

Opportunities exist for increased integration with IOU energy efficiency programs and low-income programs

Using a Single Point of Contact (SPOC) for multifamily properties builds important relationships with property managers and owners, and drives awareness of, and investment in, energy efficiency

Residential energy efficiency is increasingly important for grid stability



## A. PG&E's Residential Sector Vision

Pacific Gas and Electric's (PG&E) vision for the residential sector is to deliver a portfolio that will achieve deep energy savings and robust grid benefits through focused customer engagement, data-driven programs that leverage market actors, and strong partnerships. We will strive to enable programs that are targeted for greater impact and coupled with financing options to deliver customers savings that show up at the meter. These opportunities are driven by the combination of rapidly advancing technologies and policies that encourage PG&E to bring new strategies to the residential market.

Near real-time advanced metering infrastructure (AMI) data makes possible a new set of tools that empower customers with unprecedented awareness of their energy usage and insight into how to save. When combined with two-way communications from home energy management systems (HEMS), savings and cost-effectiveness can be maximized while also preparing the market for connected technologies.

Over the next ten years, California has an opportunity to integrate energy efficiency with other distributed energy resource (DER) technologies to provide coordinated solutions for individual customers that also deliver benefits to all customers through enhanced avoided costs and grid stability. The trends driving the need for agile deployment of energy efficiency include growing electric vehicle (EV) infrastructure, increasing adoption of rooftop solar, and greater use of appliances and plug load electronics. With these new paradigms, wise investment in energy efficiency can play a critical role in keeping energy prices affordable for all customers.



**Table 2.1**  
Customers by the Numbers<sup>a</sup>

Source: PG&E program and customer data.

	2011-2015		2015
	Average	Trend <sup>b</sup>	Total <sup>c</sup>
<b>Customer Counts (Number of customers)<sup>d</sup></b>			
Electric	5,620,535		5,613,306
Gas	5,037,184		5,012,712
<b>Annual Sales (GWh, MM Therms)</b>			
Electric	30,411		29,255.2
Gas	1,891.60		1,678.0
<b>Gross First Year Ex Ante Energy Savings (GWh, MW, MM Therms)</b>			
Electric	227.9		233.6
Demand	49.6		54.1
Gas	1.8		5.0
<b>Program Participation (% of total)</b>			
Electric	2.5%		3.3%
Demand	2.5%		3.3%
Gas	0.3%		0.3%

<sup>a</sup> Note that a single customer could be represented by both the electric and gas customer count depending on if they have one or both services.

<sup>b</sup> Sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively.

<sup>c</sup> See Section D for more detail on 2015 Usage, Savings, Customers, and Participants.

<sup>d</sup> Customer count by unique combination of Account ID and Premise ID.

## RESIDENTIAL SECTOR AND THE CALIFORNIA ENERGY EFFICIENCY STRATEGIC PLAN (CEESP)

**CEESP Vision:** Residential energy use will be transformed to ultra-high levels of energy efficiency resulting in Zero Net Energy new buildings by 2020. All cost-effective potential for energy efficiency, demand response and clean energy production will be routinely realized for all dwellings on a fully integrated, site-specific basis.

The Strategic Plan identifies six strategies to achieve this vision. These are linked to PG&E's Intervention Strategies:

**Building Innovation:** Technical Assistance and Tools supports builders in integrating new technologies and designs into projects. Assistance for the Design and Building Communities targets ZNE construction.

**Comprehensive Solutions for Individual Customers:** Data analytics, data access, and financing options are key to identifying and enabling comprehensive solutions for both single and multi-family homes. New program models like pay for performance readily scale successful third party approaches.

**Customer Demand:** Outreach and education build customer demand for energy efficiency. Upstream and midstream partnerships ensure energy efficient products are widely available.

**Statewide Solutions:** Statewide programs can achieve economies of scale and are addressed in Section K: Statewide Administration and Transition Timeline.

**Financing:** Innovative new approaches for financing address the upfront cost barrier and are discussed in the loans, rebates, and incentives intervention.

**Codes and Standards:** Section G: Leveraging Cross-Cutting Resources discusses residential codes and standards work to prepare the market for aggressive code advancement.

In addition, California's energy efficiency standards (Title 24) are moving toward increasing building performance through zero net energy (ZNE) initiatives targeted for 2020. ZNE goals have also been supported in the California Energy Action Plan, the AB 32 Scoping Plan, the Governor's Clean Energy Jobs Plan, the Clean Energy Futures Vision, and the Existing Building Energy Efficiency Action Plan. PG&E's residential portfolio will coordinate closely with codes and standards (C&S) initiatives to pave the way toward ZNE goals for both existing and new buildings through code readiness activities that prime the market for successful design and operation of ZNE buildings.

Complementing the technology landscape are policies that accelerate energy efficiency. PG&E's residential portfolio will play a leading role in achieving the goals of Senate Bill (SB) 350, Assembly Bill (AB) 758, AB 793, and AB 802. AB 793 is particularly impactful for the residential sector because it directs IOUs to develop more robust solutions to spur greater adoption of home energy management systems (HEMS) and energy management technologies (EMTs), such as smart thermostats, smart power strips, and other "connected" devices. AB 802 empowers PG&E to address stranded potential and measure savings at the meter. Finally, SB 350 requires doubling energy efficiency in California by 2030. Because the residential sector accounts for 31% of PG&E's electricity and more than 44% of gas consumption, residential intervention strategies and supporting tactics must play a central role in achieving these goals.

Finally, PG&E will deliver energy efficiency to the market through new program models, including pay-for-performance (P4P), in which incentive payments are tied to normalized metered energy consumption. These models will be competitively rewarded to enable third party design, innovation and implementation. In addition, PG&E will support administration of midstream, upstream, and market transformation programs on a statewide basis to provide continuity and drive economies of scale.

## PG&E's Residential Sector Goals

Within the next-10-year period<sup>1</sup>, PG&E's primary goal for the residential sector is to:

- Save 817 GWh, 65 MW, and 11.7 MM therms by 2025 by focusing on high savings opportunities within both single family and multifamily properties

In addition, our efforts within this sector will:

- Increase savings from multifamily (MF) properties by focusing efforts on these properties
- Increase customers' ability to manage energy by increasing the number of customers utilizing EMTs and advancing the capabilities of EMTs over the next 10 years
- Increase operational efficiencies by reducing costs of the residential energy-efficiency programs, (i.e., reducing the ratio of \$/kWh and \$/therm saved) by 10% in the mid-term through the use of cost-effective scalable program models such as P4P, financing and behavioral.
- Assist California in reaching the CEESP goal of ZNE for 100% of all new residential construction by engaging builders and other market actors, and supporting new codes and standards

Greater detail on the intervention strategies supporting these goals can be found in section *F*, *PG&E's Approach to Achieving Goals*. See **Table 2.2** for a summary of how intervention strategies map to goals.

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<sup>1</sup> Email communication from Administrative Law Judge Julie Fitch, on November 15, 2016 clarified program administrators' Business Plan timeline. "Because D.14-10-046 only authorizes funding through the end of 2025, it is my expectation that this would be the timeframe for the Business Plans as well, covering calendar years 2018-2025." However, PG&E has built its Business Plan around a ten-year vision, and has identified short (1-3 years), medium (4-7 years) and long-term (8-10 years) time periods used to indicate when strategies and tactics will be deployed, and targets will be met. PG&E believes this structure is in line with the intent of the rolling portfolio concept.

## B. PG&E's Residential Sector Proposal Compared to Prior Cycles

Spurred by technology advancements and new policies, PG&E's approach to residential energy efficiency in the next ten years will be significantly different than in past cycles.<sup>2</sup> Details are given throughout the nine major intervention strategy discussions in section F. *PG&E's Approach to Achieving Goals*, as well as in the appendices. Here we highlight several of the most important changes associated with each intervention strategy.

- Individual Customer Targeting via Interval Data Analytics:** In prior cycles, PG&E focused certain programs in geographic and climate regions that delivered higher average savings. In the short term, PG&E will begin to deploy customer targeting strategies that are based on interval data analysis at the individual-customer level. Analysis of smart meter data allows identification of inefficient building shells and HVAC equipment and the associated stranded potential. Targeted outreach to these customers can deliver the highest savings for specific interventions. When combined with load shape analysis, customers with peak demand coincident with system load constraints can also be identified. Targeted interventions for these customers can drive peak demand savings during the times and locations most valuable to the entire

**Table 2.2**  
Goal to Intervention Strategy Map

Goal	Individual Customer Targeting	Data Access	Technical Assistance and Tools	Loans, Rebates, and Incentives	New Program Models	Assistance for the Design and Building Communities	Upstream and Midstream Partnerships	Outreach and Education	Midstream Training
Save energy and reduce demand	X	X	X	X	X		X		
Increase savings from MF properties		X	X	X	X		X	X	
Increase customers' ability to manage energy		X							
Increase operational efficiencies	X	X	X	X	X		X	X	
Assist California in reaching the CEESP goal of ZNE for 100% of all new residential construction						X			X

<sup>2</sup> For more information on PG&E's residential program in the 2013-2015 program cycle, see the 2013-2014 program implementation plans (PIPs) at <http://eestats.cpuc.ca.gov/>.

customer base. This tactic reinforces AB 802 and AB 758 by capturing stranded potential in existing buildings, and will be critical as PG&E works towards doubling energy efficiency by 2030.

- **Data Access to Facilitate Customer Understanding of Energy Efficiency:**

PG&E developed data platforms such as My Account, My Energy, and Share My Data to encourage increased access to energy data for residential customers and authorized third parties. In the short-term, PG&E will use its marketing, education, and outreach (ME&O) resources to drive greater customer engagement with data platforms and improve access to aggregated multifamily data in accordance with AB 802. In the mid-term, PG&E will promote data platforms to third parties, who will play a critical role in delivering energy savings through their unique tools and strategies.

- **Technical Assistance and Tools to Facilitate Customer Awareness of their Energy Use:**

In the next decade, PG&E will engage third parties to offer a more diverse suite of technical assistance and tools to help customers use energy more efficiently. Strategic energy planning support, energy audits, direct install options for low and middle income customers, financing options, and incentive support for deep retrofits will remain priorities.

In addition, PG&E will optimize Home Energy Reports (HERs) for greater effectiveness and expanded reach and will engage third parties on options to pursue other behavioral savings potential. PG&E will also continue working with the statewide emerging technologies (ET) team to inform the design of offerings that promote EMTs in accordance with AB 793.

- **Loans, Rebates, and Incentives:** Loans, rebates and incentives have always played a major role in PG&E's residential energy efficiency offerings. In the last several years, a number of financing options have been developed, both by PG&E and by external parties. With the maturing energy efficiency financing market, financing options for both deep retrofits and smaller individual measures, including EMTs, are becoming available and can help customers overcome the up-front cost barrier. PG&E plans to closely couple existing and new financing packages with new and established programs to help limit the need for incentive spending while still making energy efficient choices attractive to customers.

- **New Program Models to Cost-Effectively Deliver Comprehensive Energy Savings:** In prior cycles, PG&E has relied on third parties for program implementation. Going forward, we will be transitioning to a third party solicitation model in which specific program proposal and design elements are also under the purview of the implementer. Within this context, PG&E will look for opportunities to transition to P4P program models. This new approach is enabled by AB 802 and the ability to measure savings at the meter. P4P also provides a powerful venue for more rapid product development and innovative program designs that facilitate market-based solutions. PG&E will learn from the initial rollout of the Residential P4P high opportunity project and program (HOPP)<sup>3</sup> to evaluate the feasibility of applying this model to other areas, including the multifamily sector.

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<sup>3</sup> PG&E Advice Letter 3698-G/4813-E (Submission of High Opportunity Projects and Programs (HOPPs) Proposal - Residential Pay-for-Performance Program)

- Assistance for the Design and Building Communities:** In the past, PG&E worked with the design and building communities to develop code readiness projects and ZNE demonstrations to move the market toward greater adoption of ZNE. Since all new residential construction must be ZNE by 2020, PG&E will continue to complement C&S activities by incorporating primary data on equipment and building performance into demonstrations and future offerings. In addition, PG&E will develop financial solutions to mitigate the cost barriers that impede ZNE construction.
- Upstream and Midstream Partnerships:** PG&E values the partnerships it maintains with retailers, distributors, manufacturers and other market actors in the supply chain to increase the awareness and availability of energy efficient products and equipment, in particular in the plug load, lighting, and HVAC markets. These partnerships will remain a critical component of PG&E's approach to promoting EMTs, light emitting diodes (LEDs), and new energy efficient HVAC equipment. PG&E will support statewide administration of these programs going forward. PG&E will be an active partner for these efforts. PG&E believes that the statewide venue will provide a more consistent platform for the market that can drive economies of scale and leverage California's buying power. As the Retail Products Platform (RPP) continues to mature, PG&E will seek expanded national partnerships with both retailers and program administrators. The expanded reach of the program will help us promote higher efficiency levels across a broader suite of plug load products.<sup>4,5</sup>
- Outreach and Education:** Market outreach and education is a key component of effectively increasing awareness of energy efficiency opportunities and value. Since individuals tend to be biased towards maintaining the status quo, outreach and education will use normative approaches such as community-based social marketing to encourage customers to take action. In the future, PG&E will continue to support statewide and local energy efficiency campaigns

and programs such as Step Up and Power Down<sup>6</sup> that broaden residential communities' engagement outside of traditional programs.

- Midstream Training:** Often contractors and technicians are the only market actors that have face-to-face contact with the customer. While education and training opportunities have historically focused on developing technical skill sets, it will be critical that these market actors also receive sales training that incorporates new program approaches (such as P4P) and the availability of financing opportunities to promote the adoption of optimal energy management solutions. In addition, with increases in connected homes and new interactive technologies, PG&E will look to ensure the appropriate market actors also have training to help customers understand the important details needed to best utilize these new technologies.

In addition to these specific intervention strategies, PG&E will expand coordination between our residential resource acquisition offerings and C&S. With the opportunity for more rapid product deployment offered by new program approaches, residential energy efficiency programs can be a powerful data collection instrument to help C&S advocate more effectively for adoption of more aggressive code earlier in the technology adoption cycle. To push the market to the 2020 ZNE goal for all new residential construction, PG&E will complement C&S activities by incorporating primary data collection on equipment and building performance into ZNE demonstrations and future offerings. In addition, PG&E will look to work with market actors to develop financial solutions to mitigate the cost barriers that impede ZNE construction.

More specific tactics and discussion for each of these strategies are given in section *F. PG&E's Approach to Achieving Goals*. Below is a brief summary of key time horizons:<sup>7</sup>

<sup>4</sup> Advice Letter 3668-G/4765-E ("Request for Authority for Retail Products Platform [RPP] Pilot within PG&E's Residential Energy Efficiency Plug-Load and Appliances Sub-Program).

<sup>5</sup> "Pacific Gas and Electric Company Retail Plug-Load Portfolio (RPP) Trial: Evaluation Report," EMI Consulting, 2015.

<sup>6</sup> <https://stepupandpowerdown.com/>.

<sup>7</sup> Email communication from Administrative Law Judge Julie Fitch, on November 15, 2016 clarified program administrators' Business Plan timeline. "Because D.14-10-046 only authorizes funding through the end of 2025, it is my expectation that this would be the timeframe for the Business Plans as well, covering calendar years 2018-2025." However, PG&E has built its Business Plan around a ten year vision, and has identified short (1-3 years), medium (4-7 years) and long-term (8-10 years) time periods used to indicate when strategies and tactics will be deployed, and targets will be met. PG&E believes this structure is in line with the intent of the rolling portfolio concept.

- **In the short-term (1-3 years):** PG&E will optimize portfolio offerings around new energy savings paradigms such as net savings goals and meter-based savings, while exploring new models to scale promising approaches and facilitate third party participation. Data analytics will play a key role in targeting customers and designing and evaluating new program models, such as P4P. PG&E will further develop code readiness projects, ZNE demonstrations, and ZNE financial solutions to facilitate the shift to ZNE for all new residential construction by 2020.
- **In the mid-term (4-7 years):** PG&E will continue to optimize building performance while promoting integration with other demand side management tools. These efforts will be complemented by PG&E's support for EMTs, which may be promoted through upstream and midstream partnerships, or incorporated into third party downstream programs. PG&E will seek to bundle EMTs with other tools, including financing options. Further, PG&E will support whole home retrofit initiatives through meter-based P4P.
- **In the long-term (8-10 years):** Tactics deployed in support of AB 793 and AB 802 will realize savings potential in existing buildings (AB 758) and will support SB 350's energy efficiency goals. Customers will have greater awareness and control over their energy usage through wide deployment of EMTs, accessibility of accurate benchmarking data, and better integration of distributed resources, including electric vehicles, time-of-use pricing, demand response, and distributed generation. Effective education and training opportunities will help the building and design communities adopt deep retrofit and ZNE design and construction practices. Through coordinated support of the contractor and technician workforce, building shell improvements coupled with optimal design and installation of HVAC systems will become a competitive business model.

## Key Learnings from Recent EM&V Reports of California's Residential EE Programs

Evaluation, Measurement and Verification (EM&V) research results have informed the design of PG&E's intervention strategies. In particular, the following key learnings from recent evaluations influenced the strategies and tactics proposed in this plan:

- In both the PG&E Air Conditioning Quality Control (AC/QC) Program and SCE's Residential Quality Installation Program, customers with low total energy usage before program participation tended to save little or no energy at the meter. In contrast, high energy users in hot climate zones saved a great deal.<sup>8</sup> These results showcase the need for targeted outreach, especially for programs that will be assessed with metered savings.
- Increased customization of energy efficiency measures to participants, such as an energy efficiency project's estimated payback period, would improve uptake of energy efficiency upgrades.<sup>9</sup>
- Targeted demand response is an emerging energy efficiency tool that uses smart meter data to realize previously inaccessible savings. Using smart meter data allows for increased identification of savings opportunities and more tailored energy savings approaches that can result in greater program cost effectiveness.<sup>10</sup>
- Some residential sectors, including plug load, would benefit from a dedicated market transformation approach that more effectively address long term market barriers. The RPP midstream incentive program has been designed with specific market transformation goals and timelines.<sup>11</sup>

<sup>8</sup> AMI Billing Regression Study (Phase I). Evergreen Economics (2016) CALMAC ID: SCE0383.01.

<sup>9</sup> See 2010-2012 CPUC HEES Impact Evaluation, July 2013, at <http://calmac.org/publications/HEES%5FFinal%5FReport%5F20130708%2Epdf>.

<sup>10</sup> See 2013 "PG&E Home Energy Reports Program Review and Validation of Impact Evaluation," CalMAC ID CPU0096.00, "Behavioral Demand Response Study - Load Impact Evaluation Report," CalMAC ID PGE0367.01, and "Focused Impact Evaluation of the 2013-2014 Home Upgrade Program," CALMAC Study ID CPU0118.01.

<sup>11</sup> See Program and Technology Review of Two Residential Programs: Home Energy Efficiency Rebate (HEER)/Business and Consumer Electronics (BCE), September 2012, at <http://calmac.org/publications/HEER%5F%5FBCE%5F083012%5FFINAL%2Epdf>.

- To help address gaps in effective program performance, training for retailers and contractors should be aligned and improved across various residential programs.<sup>12</sup>
- Lighting accounts for a significant percentage of residential energy consumption, 17% according to recent estimates.<sup>13</sup> With more than half of residential sockets in California still containing inefficient incandescent or halogen lamps, residential lighting still represents a major savings opportunity.<sup>14</sup> Planned research<sup>15</sup> will assess customer decision making around residential lighting and offer key insights needed for targeting approaches that can best address the stranded potential in the residential lighting market.
- ZNE homes, while technically feasible, face significant challenges to widespread adoption such as builder and consumer education, consistent tracking and labeling methods, inclusion of real estate agents and lenders in the ZNE marketing process, and community-scale solutions for homes that cannot reach ZNE on an individual basis. Technologies and strategies that can be applied across a significant subset of the building volume will likely show the greatest overall gains in moving the state toward its ZNE goals.<sup>16</sup>

Implementation plans will be strategically deployed in the timeframes listed above to achieve the State of California's energy efficiency goals for the residential sector. PG&E also anticipates meeting the following energy savings goals for the following investment, as shown in section *C. Goals, Budget and Cost-Effectiveness*.

## C. Goals, Budget and Cost-Effectiveness

As Business Plans were envisioned as “a comprehensive vision outlining long-term strategic initiatives and intervention strategies,”<sup>17</sup> PG&E provides energy and demand savings goals, budgets, and cost-effectiveness forecasts that represent its best estimates to realize its portfolio vision, while retaining flexibility to accommodate potential market or regulatory changes. Each year, PG&E will file a Tier 2 advice letter (AL) that provides detailed goals, budgets and cost-effectiveness for the Commission's review and approval.<sup>18</sup>

### Annual Net Market Potential

PG&E's primary goal is to save energy. PG&E has used the energy and demand savings targets provided in the “Energy Efficiency Potential and Goals Study for 2015 and Beyond,” (Potential Study) approved in D.15-10-028, as the foundation for its projected energy savings goals for 2018-2025, and shows 2016 and 2017 for reference. Energy and demand savings goals are shown as net annual goals, per D.16-08-019. See **Table 2.3** for Annual Net Market potential in the residential sector.

<sup>12</sup> See Program/Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER)/Business & Consumer Electronics (BCE), September 2012, at <http://calmac.org/publications/HEER%5F%5FBCE%5F083012%5FFINAL%2Epdf>; See also SCE and PG&E Whole House Process Evaluation, Opinion Dynamics and SBW, May 2012, at <http://www.energydataweb.com/cpuc/search.aspx>.

<sup>13</sup> Goebes, M. TRC Energy Services. 2016. ACEEE. Clearing the Path to Market Transformation in the Rapidly Evolving World of Residential Lighting.

<sup>14</sup> Ibid.

<sup>15</sup> EM&V Lighting Roadmap Update: [http://www.energydataweb.com/cpucFiles/pdaDocs/1641/EMV%20Plan%20V.7\\_LightingChapter\\_OUT.pdf](http://www.energydataweb.com/cpucFiles/pdaDocs/1641/EMV%20Plan%20V.7_LightingChapter_OUT.pdf).

<sup>16</sup> Refer to the report “Residential ZNE Market Characterization” available at [http://www.calmac.org/publications/TRC\\_Res\\_ZNE\\_MC\\_Final\\_Report\\_CALMAC\\_PGE0351.01.pdf](http://www.calmac.org/publications/TRC_Res_ZNE_MC_Final_Report_CALMAC_PGE0351.01.pdf) and the report “The Technical Feasibility of Zero Net Energy Buildings in California” available at [http://www.energydataweb.com/cpucfiles/pdadocs/904/california\\_zne\\_technical\\_feasibility\\_report\\_final.pdf](http://www.energydataweb.com/cpucfiles/pdadocs/904/california_zne_technical_feasibility_report_final.pdf).

<sup>17</sup> D.15-10-028, p.48.

<sup>18</sup> D.15-10-028, OP 4.



**Table 2.3**  
Residential Sector Annual Net Market Potential

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
<b>GWhs</b>	198	200	160	161	165	163	169	175	181	181
<b>MWs</b>	18.2	17.0	11.8	10.9	10.4	8.7	8.7	9.9	10.2	10.2
<b>MM therms</b>	5.1	5.1	5.7	5.7	6.0	6.2	6.7	7.2	7.9	7.9

PG&E's net annual energy and demand savings goals are representative, and directional in nature, and meant to reflect our best estimates of energy and demand savings potential. PG&E requests flexibility to accommodate potential market or regulatory changes. PG&E will file an annual Tier 2 AL that provides detailed sector-level energy and demand goals.

PG&E recognizes energy and demand savings goals will be updated to meet the SB 350 energy efficiency targets set by the Energy Commission no later than November 1, 2017,<sup>19</sup> and the net goals framework adopted in D.16-08-019.<sup>20</sup> PG&E will update its energy savings forecasts once the Commission approves new energy and demand savings targets.

### Sector Budget

PG&E's Business Plan budget provides general information on the expected levels of annual spending for 2018-2025, along with 2016 and 2017 approved budgets for reference. As provided in D.15-10-028, PG&E's Business Plan budget represents its best estimates of spending for the life of the Business Plan.<sup>21</sup> The intent is to allow program administrators flexibility to adjust spending during the life of the Business Plan.<sup>22</sup> PG&E will file Tier 2 AL annually, containing a detailed budget for the next calendar year's energy efficiency portfolio.<sup>23</sup>

The Tier 2 AL budgets will include detailed budgets for cost recovery, transfer, and contracting purposes.<sup>24</sup> See **Table 2.4** for PG&E's Residential sector budget summary.

**Table 2.4**  
PG&E Residential Sector Budget Summary

Cost Category	2016	2017	2018	2019	2020-2025 Annual Budget <sup>a</sup>
<b>Administration</b>	\$7,133,453	\$7,752,304	\$6,748,629	\$5,744,955	\$5,127,593
<b>Marketing</b>	\$6,331,429	\$6,351,320	\$5,708,980	\$5,366,641	\$5,024,302
<b>Implementation</b>	\$22,637,129	\$20,192,263	\$20,040,421	\$19,888,578	\$19,736,735
<b>Incentive</b>	\$46,733,155	\$49,494,134	\$48,594,134	\$47,694,134	\$47,694,134
<b>Total</b>	<b>\$82,835,166</b>	<b>\$83,790,021</b>	<b>\$81,092,165</b>	<b>\$78,694,308</b>	<b>\$77,582,765</b>

<sup>a</sup> The Annual Budget from 2020 through 2025 will remain the same.

<sup>19</sup> SB 350 requires the Energy Commission to develop and establish statewide targets that lead to a cumulative doubling of energy efficiency savings from all retail electric and natural gas end-users by 2030, <http://www.energy.ca.gov/sb350/timeline.pdf>.

<sup>20</sup> "Commission staff should work with its consultants to prepare a net goals framework in time for the start of 2018, if not sooner," D.16-08-019, p.20.

<sup>21</sup> D.15-10-028 "It [the budget] will establish a "ballpark" figure for spending for the life of the business plan." p. 55.

<sup>22</sup> D.15-10-028 "It [the budget] will establish a "ballpark" figure for spending for the life of the business plan." p. 55.

<sup>23</sup> D.15-10-028, OP 4.

<sup>24</sup> D.15-10-028, p.56.

For more discussion on PG&E portfolio and sector-level budgets, please see the *Portfolio Overview* chapter.

### Cost-effectiveness

PG&E presents its sector-level cost-effectiveness for its 2018-2025 Business Plan.

PG&E conducted a cost-effectiveness analysis of its proposed portfolio in compliance with D.15-10-028, and with the California Standard Practice Manual.<sup>25</sup> PG&E used the 2017 updated avoided costs and cost-effectiveness inputs approved in Resolution E-4801.

PG&E's cost effectiveness calculation represents the near term years of its Business Plans (2018-2020), and is directional in nature. Meaning, PG&E will strive to meet the cost-effectiveness projections set forth for the sector. However, PG&E requests flexibility to accommodate potential market or regulatory changes. Through the annual Tier 2 ALs, PG&E will provide the Commission updated cost-effectiveness forecasts for each year of Business Plan implementation.

See **Table 2.5** for residential projected cost-effectiveness results 2018-2020, **Table 2.6** for residential projected net annual savings impact from cost-effectiveness scenario 2018-2020, and **Table 2.7** for residential projected emissions reductions from cost-effectiveness scenario 2018-2020.

**Table 2.5**  
Residential Projected Cost-Effectiveness Results 2018-2020

	Results
<b>TRC</b>	1.01
<b>PAC</b>	1.21

Note: Does not include Market Effects

**Table 2.6**  
Residential Projected Net Annual Savings Impacts from Cost-Effectiveness Scenario 2018-2020

	PG&E Target	PGS Goal
<b>Energy Savings (Net GWh/yr)</b>	184.80	165
<b>Demand Reduction (Net MW)</b>	30.25	10.4
<b>Gas Savings (Net MMT/yr)</b>	4.14	6

Note: Does not include Market Effects

**Table 2.7**  
Residential Projected Emission Reductions from Cost-Effectiveness Scenario 2018-2020

	Reductions
<b>Annual tons of CO<sub>2</sub> avoided</b>	65,232
<b>Lifecycle tons of CO<sub>2</sub> avoided</b>	252,273
<b>Annual tons of NO<sub>x</sub> avoided</b>	88,403
<b>Lifecycle tons of NO<sub>x</sub> avoided</b>	345,488
<b>Annual tons of SO<sub>x</sub> avoided</b>	—
<b>Lifecycle tons of SO<sub>x</sub> avoided</b>	—
<b>Annual tons of PM<sub>10</sub> avoided</b>	16,177
<b>Lifecycle tons of PM<sub>10</sub> avoided</b>	74,935

<sup>25</sup> California Standard Practice Manual: Economic Analysis of Demand Side Management Programs and Projects, 2002, [http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf).

Through implementation of its Business Plan, PG&E seeks to make significant impact in reducing energy waste cost-effectively and maximizing the value of energy efficiency for customers, for the grid, and for the state. To do that, PG&E recognizes the need to take “a more integrated, cost-effective approach”<sup>26</sup> to scale energy savings. For more discussion on PG&E’s key strategies to scale energy efficiency and continue to deliver cost-effective energy efficiency portfolios, please see the Portfolio Overview chapter.

## D. Sector Overview

PG&E serves over 5.6 million residential households, both single family and multifamily, throughout the service territory.<sup>27</sup> The residential sector accounts for 31% of electricity consumption and 44% of natural gas consumption. Although average site energy consumption in California homes is already among the lowest in the nation, California’s economy continues to outpace the overall US economy, which drives continued influx of new residents and housing starts across the state. These dynamics lead to a forecasted increase in overall residential electricity and gas consumption within PG&E’s service territory by approximately 10% and 5%, respectively, in the next decade. In addition to continued population growth, these usage increases are expected from rising plug load energy consumption and expanding electric vehicle ownership. This growth illustrates the need for continued energy efficiency to help customers manage their usage and to meet state greenhouse gas savings goals.

### Target Audience

The ideal residential customer to serve through our portfolio is a high energy user with an evening peaking electric load shape in an area of expensive procurement costs, who has little awareness of energy efficiency or financial means to address energy waste. The PG&E service territory contains a wide variety of climates, geography, and communities. In this section, we break out energy usage, customers, savings, and participants by climate region. Regions are aggregates of Climate Zones (Z01-Z16). There are 16 zones but

not all are in PG&E’s territory. Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma. Central Valley includes Z11-Z13. Coastal includes Z01-Z06, and Z09 (excludes Bay Area counties). Mountain includes Z14-Z16. For a more in depth data and analyses on the residential sector that are enabled by AMI data, see *Appendix C*.

### Segment Overview and Energy Usage

**Figure 2.1** shows how electricity customers, usage, participants and savings are broken out by climate region. As the PG&E service territory contains 13 of the 16 California Climate Zones,<sup>28</sup> for simplicity we have combined similar climate zones into representative climate regions.<sup>29</sup> The majority of PG&E residential customers (56%) reside in the Bay Area. Electric program participation tracks closely to total customer populations. Because many Bay Area customers live in lower square footage housing, including multifamily units, and the climate is moderate compared to the rest of the state, it is not surprising that annual per capita electricity usage is lower in the Bay Area than in the service territory as a whole. The opposite is true for Central Valley customers who account for 39% of the total electricity usage while accounting for only 32% of total households. The higher per capita electricity usage in the Central Valley can be attributed to higher cooling demand during the hot summer months and larger home sizes. Driven by higher savings for building shell and HVAC measures, the Central Valley accounts for more than half of the kWh savings from downstream programs. Note that nearly two-thirds of residential savings originates from programs for which location information, including zip code, is not tracked. The upstream programs, including the Primary Lighting Program and the Upstream HVAC Program, as well as Home Energy Reports contribute to these savings.

<sup>26</sup> Mitchell, Cynthia 2014. “A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach.” p. 1, TURN May 15, 2015 iDSM comments in R.14-10-003, p. 9.

<sup>27</sup> These customer counts correlate with the data analyzed for this business plan and do not include some multifamily buildings that are master-metered and classified as “commercial.”

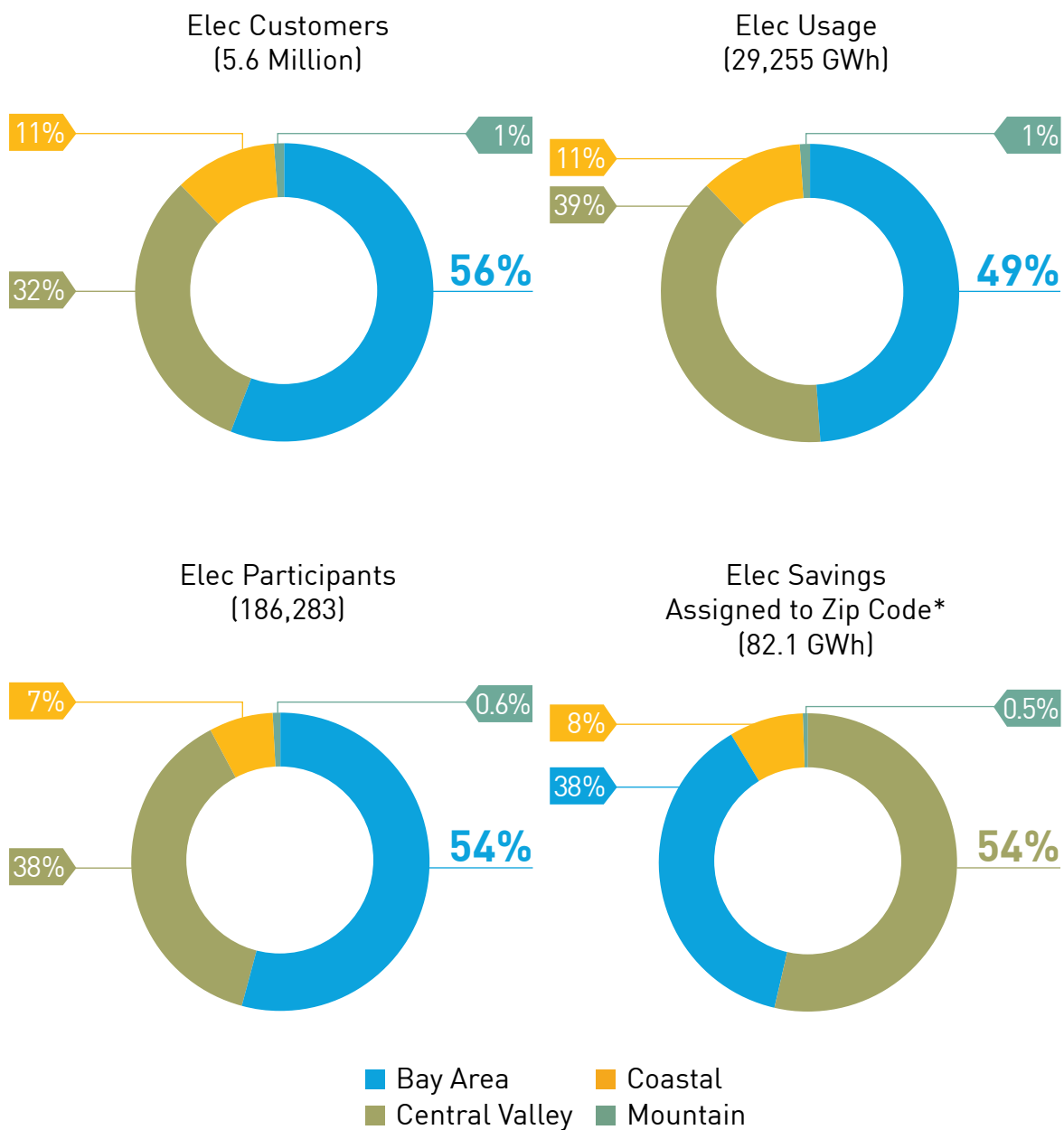
<sup>28</sup> “The Pacific Energy Center’s Guide to: California Climate Zones and Bioclimatic Design,” PG&E’s Pacific Energy Center, 2006, [http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california\\_climate\\_zones\\_01-16.pdf](http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zones_01-16.pdf).

<sup>29</sup> Bay Area includes: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties. Central Valley includes Climate Zones 11 – 13. Coastal includes Climate Zones 1 – 6 and Climate Zone 9 (excluding Bay Area Counties). Mountain includes Climate Zones 14 – 16.

**Figure 2.1**

## 2015 Residential Electric Customers, Usage, Program Participants and Savings by Climate Region<sup>a</sup>

Source: PG&E customer data



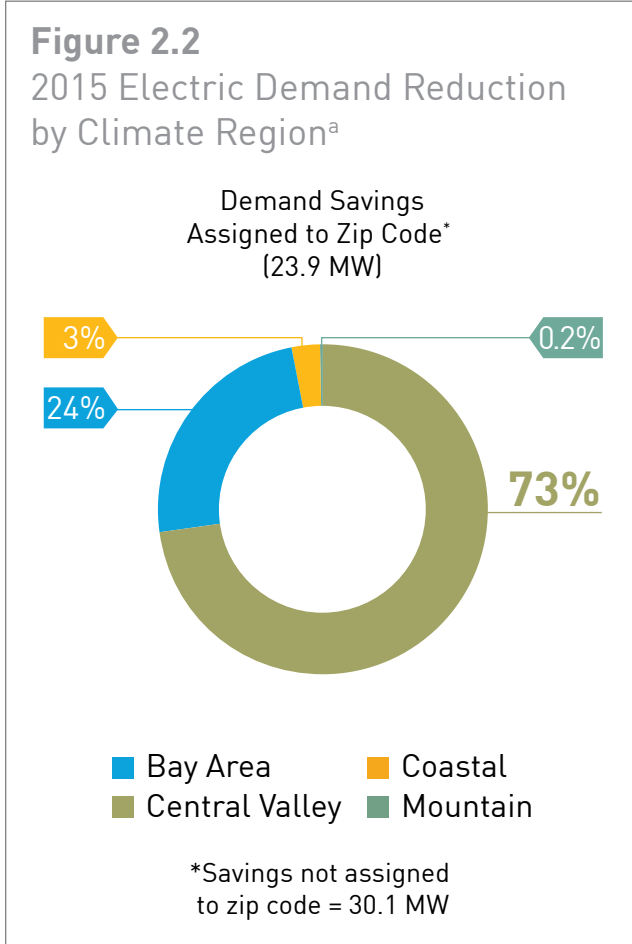
\*Savings not assigned to zip code = 151.5 GWh

<sup>a</sup> Customer counts and usage do not include some multifamily buildings that are master-metered and classified as "commercial." Savings are first year, ex ante, gross and include interactive effects. Electric participants include both single family and multifamily residents. Electric savings and participants represented in the charts include only those with end use customer zip code data. Other residential programs account for an additional 151.5 GWh and include upstream programs such as the Primary Lighting Program and the Upstream HVAC Program as well as Home Energy Reports. Savings from ESA are not included. The Home Energy Checkup and Plug Load and Appliance programs result in the largest contributions to participation. A small fraction of savings and participants (<0.5%) originate from local government partnerships (Moderate Income Direct Install (MIDI) is covered in this chapter).

<sup>b</sup> Savings not assigned to zip code = 151.5 GWh.

**Figure 2.2** gives the 2015 demand reduction by climate region. The distribution shows that the Central Valley accounts for a higher proportion of demand reduction relative to electric savings. This can be understood given the higher degree of HVAC savings achieved in the Central Valley and the HVAC savings load shape, which peaks in the late afternoon and early evening.<sup>30</sup> Again, a significant portion of savings originates from upstream and other programs for which location information is not available.

**Figure 2.3** is analogous to **Figure 2.1** for gas. In contrast to electricity usage, with higher heating needs, the Bay Area accounts for more than half of gas consumption and savings. Much of the locational Therms participation and savings originate from the Plug Load and Appliance Program as well as the Energy Upgrade California Program.



<sup>a</sup> Savings are first year, ex ante, gross and include interactive effects. Demand reduction represented in the chart include only those with zip code data. Other residential programs account for an additional 30.1 MW and include upstream programs such as the Primary Lighting Program and the Upstream HVAC Program as well as Home Energy Reports. Savings from ESA are not included. A small fraction of savings (<0.5%) originate from local government partnerships (MIDI is covered in this chapter).

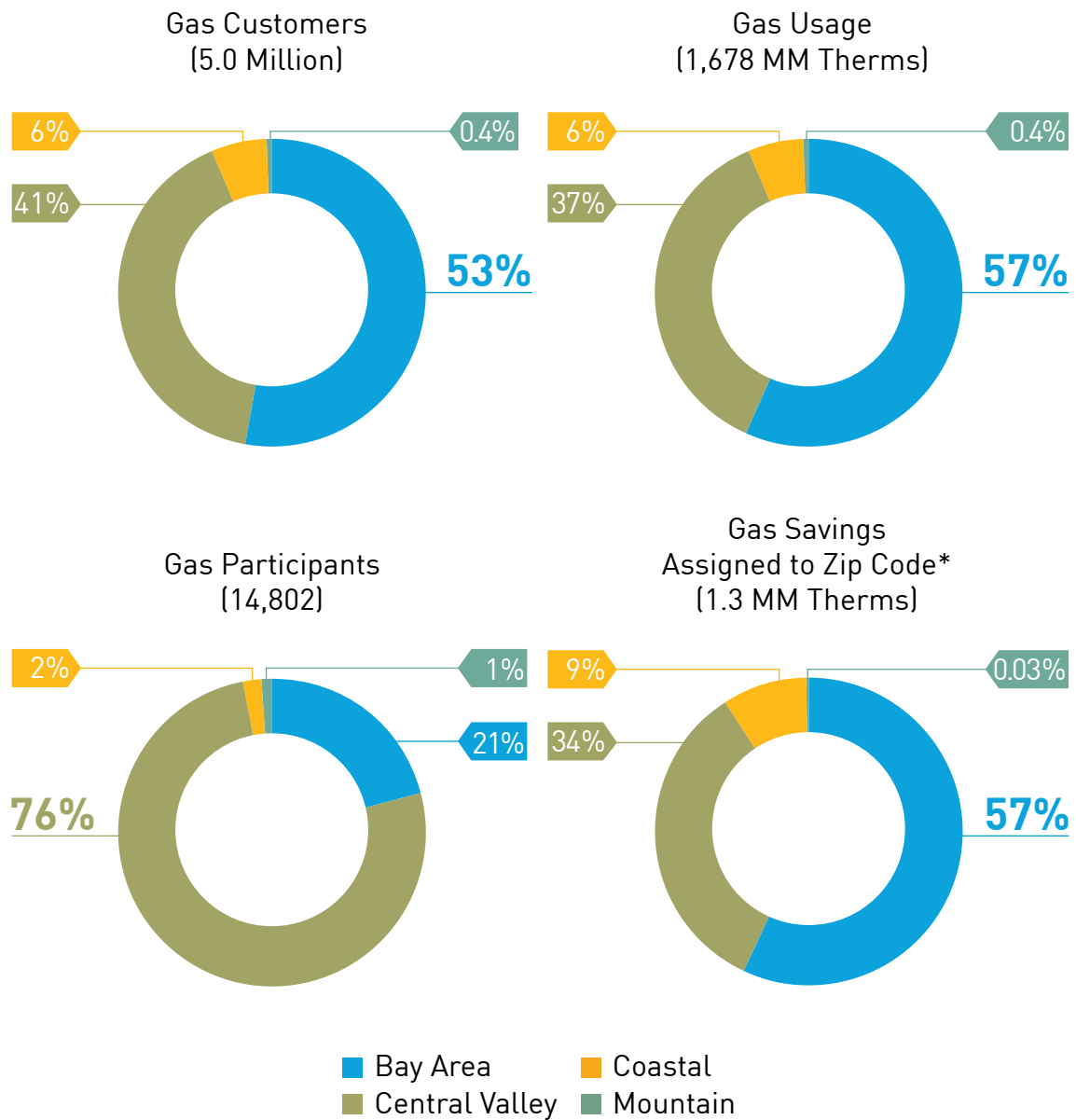
<sup>b</sup> Savings not assigned to zip code = 30.1 MW.

<sup>30</sup> Database for Energy Efficiency Resources, <http://www.deeresources.com/>.

**Figure 2.3**

## 2015 Residential Gas Customers, Usage, Program Participants and Savings by Climate Region<sup>a</sup>

Source: PG&E customer data



<sup>a</sup> Customer counts and usage do not include some multifamily buildings that are master-metered and classified as "commercial." Savings are first year, ex ante, gross and include interactive effects. Electric participants include both single family and multifamily residents. Electric savings and participants represented in the charts include only those with zip code data. Other residential programs account for an additional 3.69 MM Therms and include upstream programs such as the Primary Lighting Program and the Upstream HVAC Program as well as Home Energy Reports. Savings from ESA are not included. A small fraction of savings and participants (<0.5%) originate from local government partnerships (MIDI is covered in this chapter).

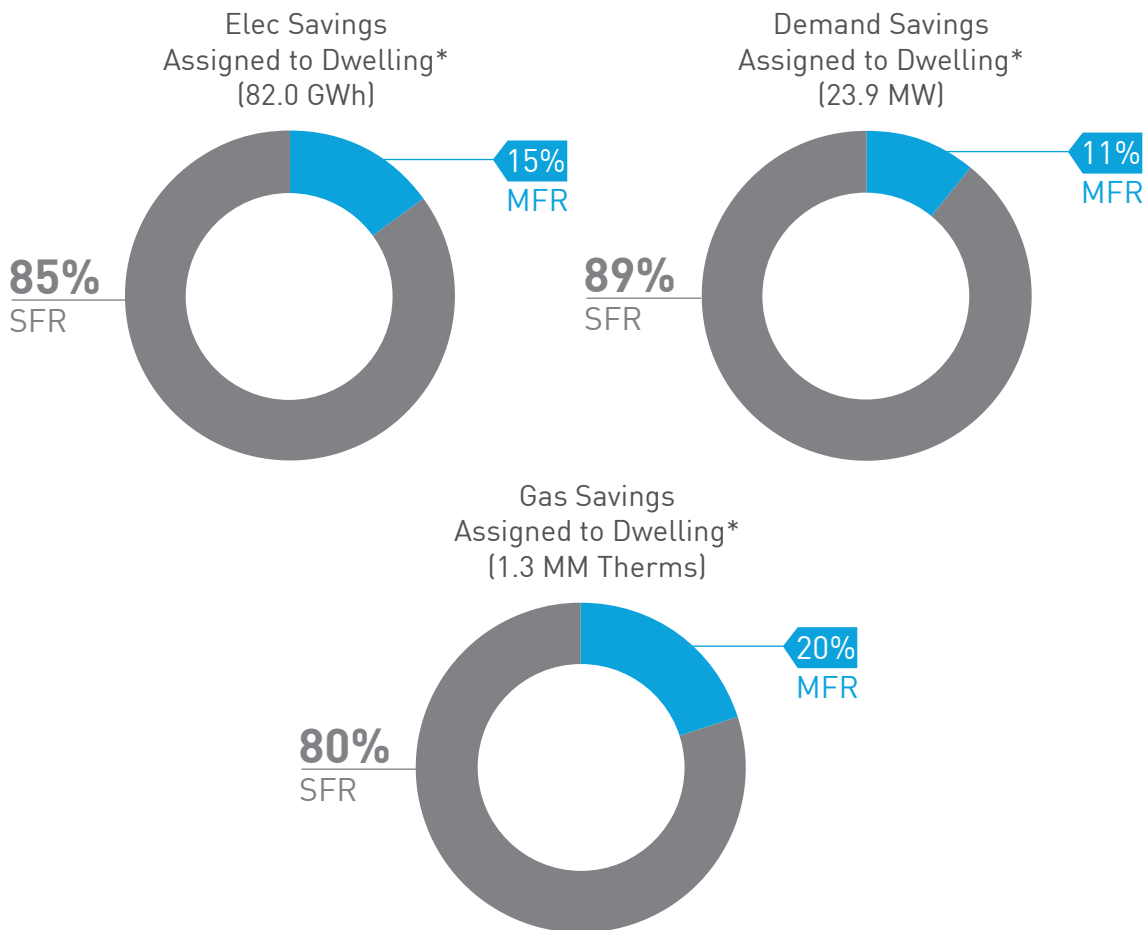
<sup>b</sup> Savings not assigned to zip code = 3.69 Therms.

Savings delivered to single family and multifamily residences are shown in **Figure 2.4**. Values assigned to zip code are almost identical to those also assigned to dwelling type. The data show that the multifamily sector accounts for a higher proportion of gas savings compared to electric or demand savings. This is in line with the higher proportion of multifamily residents in the Bay Area, for which gas usage and savings are higher compared to electric

(**Figure 2.1** and **Figure 2.3**). In partnership with the Energy Savings Assistance Program (ESA), PG&E seeks to serve both market rate multifamily buildings and lower income tenants who reside in multifamily housing. Increasing multifamily savings is one of the goals we have described in section A.

**Figure 2.4**  
2015 Residential Gas and Electric Savings and Demand Reduction by Residence Type<sup>a</sup>

Source: PG&E customer data



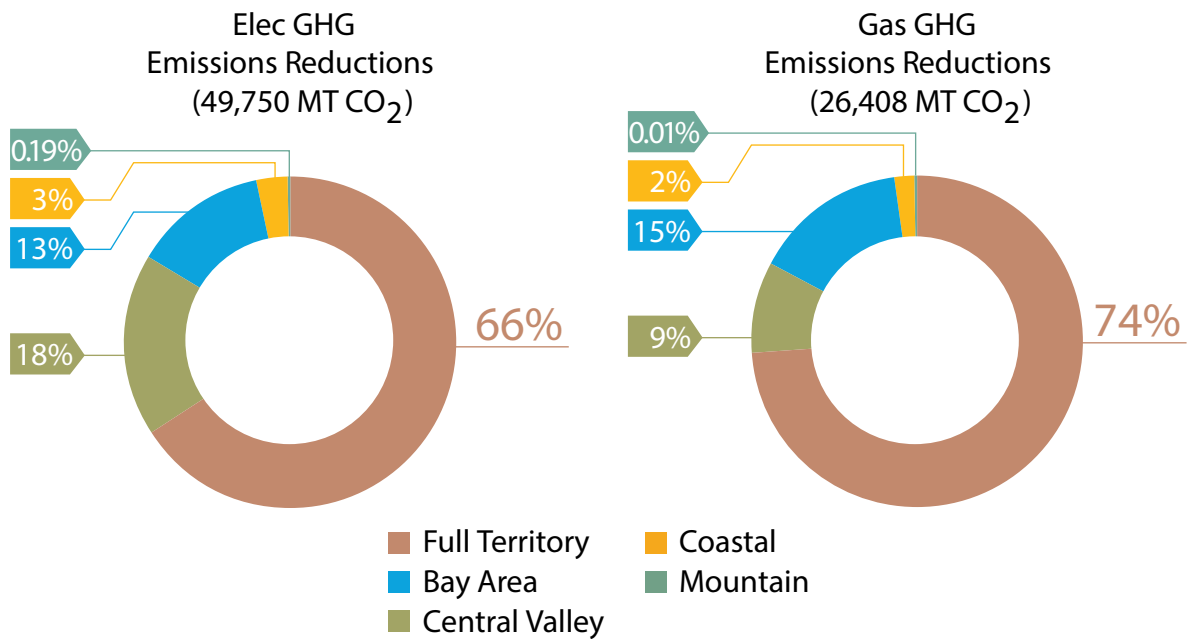
\*Savings not assigned to dwelling type: 151.6 GWh, 30.1 MW, 3.7 MM Therms

<sup>a</sup> Savings are first year, ex ante, gross and include interactive effects. Savings represented in the charts include only those with dwelling type data. Other residential programs account for an additional 151.6 GWh, 30.1 MW and 3.7 MM Therms and include upstream programs such as the Primary Lighting Program and the Upstream HVAC Program as well as Home Energy Reports. Savings from ESA are not included. A small fraction of savings and participants (<0.5%) originate from local government partnerships (MIDI is covered in this chapter).

<sup>b</sup> Savings not assigned to dwelling type = 151.6 GWh, 30.1 MW, 3.7 MM Therms.

One of the most important goals of energy efficiency is to reduce greenhouse gas emissions. **Figure 2.5** gives greenhouse gas savings resulting from PG&E's 2015 residential portfolio. The combined electric and gas CO<sub>2</sub> emissions savings are equivalent to removing about 15,800 cars from the road for a year.<sup>31</sup>

**Figure 2.5**  
2015 Greenhouse Gas Emissions Reductions by Climate Region<sup>a</sup>



<sup>a</sup> Greenhouse gas savings (Metric Tons; MT) for electric and gas measures by climate region. The "Full Territory" savings account for upstream programs such as the Primary Lighting Program and the Upstream HVAC Program as well as Home Energy Reports. Savings from ESA are not included. A small fraction of savings (<0.5%) originates from local government partnerships (MIDI is covered in this chapter). These data include interactive effects.

<sup>31</sup> The typical passenger vehicle emits 4.7 metric tons of CO<sub>2</sub> per year: <https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle-0>.



**Table 2.8** provides a more detailed breakdown of the customer, usage, participation and savings data presented in **Figures 2.3** and **2.5**.

Additional insights into the residential sector are enabled by AMI data analysis. See *Appendices C* and *D* for further detail.

**Table 2.8**  
2015 Customers, Usage, Participants, and Savings by Climate Region

	Customer By Climate Region <sup>a</sup>					Total	Percent of Sector					Total
	Bay Area <sup>b</sup>	Central Valley <sup>c</sup>	Coastal <sup>d</sup>	Mountain <sup>e</sup>	Full Service Territory <sup>f</sup>		Bay Area	Central Valley	Coastal	Mountain	Full Service Territory	
<b>Customers</b>												
Electric	3,142,099	1,774,051	629,313	67,843	-	<b>5,613,306</b>	56%	32%	11%	1%	0%	100%
Gas	2,648,530	2,046,143	295,713	22,326	-	<b>5,012,712</b>	53%	41%	6%	0%	0%	100%
<b>Usage</b>												
Electric (GWh)	14,384	11,437	3,099	335	-	<b>29,255</b>	49%	39%	11%	1%	0%	100%
Gas (MM Therms)	948	619	104	7	-	<b>1,678</b>	57%	37%	6%	0%	0%	100%
<b>Participants</b>												
Electric	100,828	71,124	13,271	1,060	-	<b>186,283</b>	54%	38%	7%	1%	0%	100%
Gas	3,122	11,187	273	220	-	<b>14,802</b>	21%	76%	2%	1%	0%	100%
<b>Savings</b>												
Electric (GWh)	31.1	44.4	6.2	0.4	151.5	<b>233.6</b>	13%	19%	3%	0%	65%	100%
Gas (MM Therms)	0.73	0.44	0.12	0.00	3.69	<b>5.0</b>	15%	9%	2%	0%	74%	100%

Notes: <sup>a</sup> Climate Regions are aggregates of Climate Zones (Z01-Z16). There are 16 zones but not all are in PG&E's territory.

<sup>b</sup>

Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, & Sonoma

<sup>c</sup> Central Valley includes: Z11 - Z13

<sup>d</sup> Coastal includes: Z01 - Z06 & Z09 (excludes Bay Area Counties)

<sup>e</sup> Mountain includes: Z14 - Z16

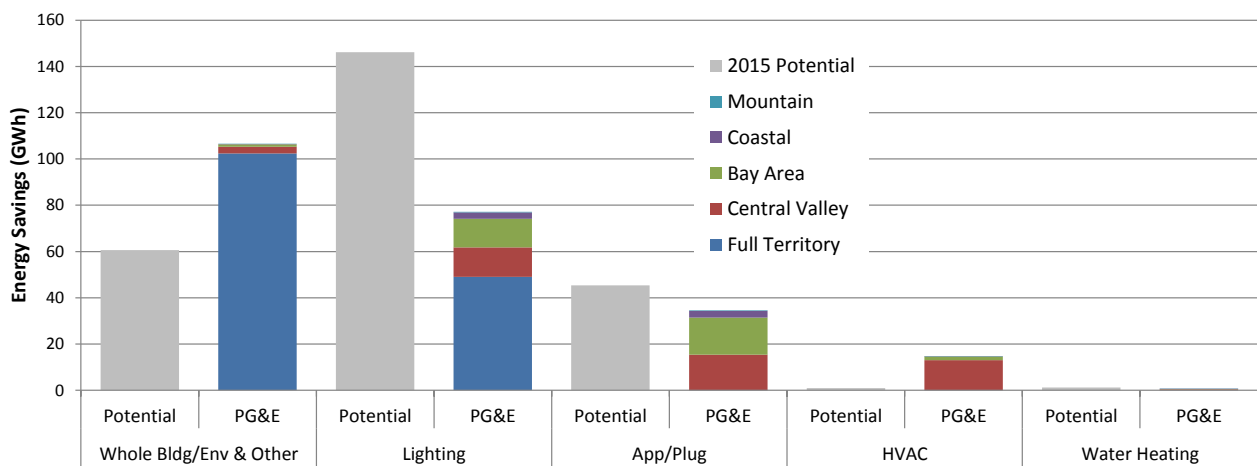
<sup>f</sup> "Full Service Territory" savings result from programs that do not track zip code. For example, the Primary Lighting Program and the Upstream HVAC Program are both upstream programs that do not track customer data. PG&E also does not assign savings by climate zone to Home Energy Reports.

## Energy Efficiency Potential

The 2015 Energy Efficiency Potential and Goals Study provides measure-level forecasts of savings and is used to define utility savings goals. **Figure 2.6** highlights how PG&E program savings compare to the Energy Efficiency Potential and Goals Study.<sup>32</sup> In some cases, PG&E residential programs have delivered fewer savings compared to energy efficiency potential, particularly in lighting. In other cases, such as plug load and HVAC, PG&E programs have yielded greater savings than the potential study indicated.

In addition to lighting, a 2015 report by the Natural Resources Defense Council (NRDC) identifies the need to develop a comprehensive strategy to capture savings from plug-in equipment, which is estimated to account for approximately two-thirds of electricity usage in California homes (see **Figure 2.7**).<sup>33</sup>

**Figure 2.6**  
2015 Savings from Potential Study and Program Savings by End Use and Climate Region<sup>a</sup>



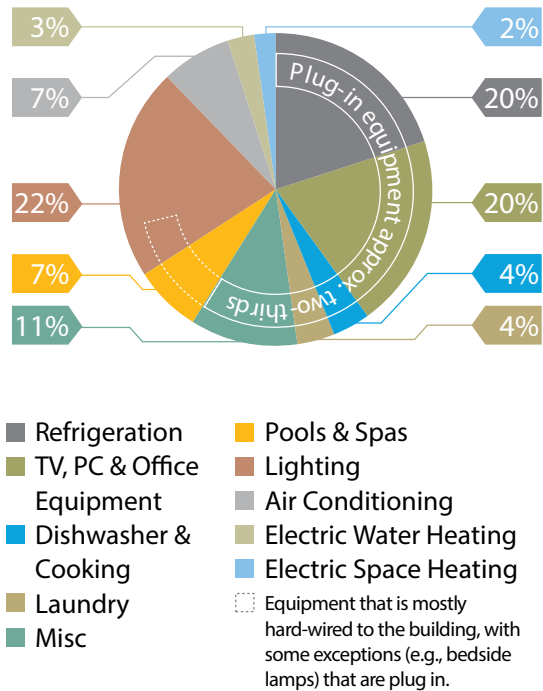
<sup>a</sup> "Whole Bldg/Env & Other" includes Home Energy Reports and Audits

<sup>32</sup> "Energy Efficiency Potential and Goals Study for 2015 and Beyond" Navigant Consulting, 2015, file:///C:/Users/A8S8/Downloads/2015andBeyondPotentialandGoalsStudyStage1FinalReport92515 [1].pdf.

<sup>33</sup> "California's Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals," Natural Resources Defense Council, August 2015, p. 45, <https://www.nrdc.org/sites/default/files/ca-energy-efficiency-opportunity-report.pdf>.

**Figure 2.7**  
2015 Residential Energy Use

Source: Natural Resources Defense Council, 2015



According to the report, curtailing electricity usage from plug-in<sup>34</sup> equipment requires a comprehensive approach that includes working with manufacturers to deploy more efficient technologies, expanding customer rebate programs to accelerate adoption of efficient appliances with high upfront costs, and using data analytics to target deployment of plug-load management solutions.<sup>35</sup> PG&E will continue to develop partnerships with upstream and midstream actors to encourage efficient plug-in equipment, offer financial solutions that enable the greater adoption of these technologies, and use outreach and education campaigns to promote more energy efficient behaviors.

<sup>34</sup> Note that plug-in equipment as classified in the NRDC report meets a broader definition than 'plug-load' described elsewhere in this Business Plan.

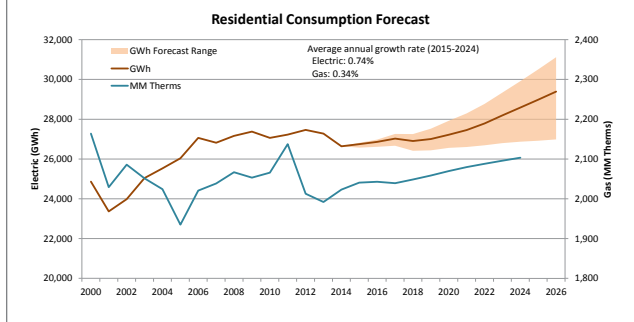
<sup>35</sup> "California's Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals," Natural Resources Defense Council, August 2015, p. 46, <https://www.nrdc.org/sites/default/files/ca-energy-efficiency-opportunity-report.pdf>.

## Residential Energy Usage Forecasts

Overall, residential electricity and gas consumption within the PG&E service territory are projected to increase by approximately 10% and 5% respectively in the next decade. According to the 2015 Integrated Energy Policy Report (IEPR), these increases are driven primarily by continued population growth, rising plug load energy consumption, and the advent of electric vehicle ownership.<sup>36</sup> The projected increase in total PG&E residential energy consumption is displayed in **Figure 2.8**.

In contrast to the forecasted growth in total

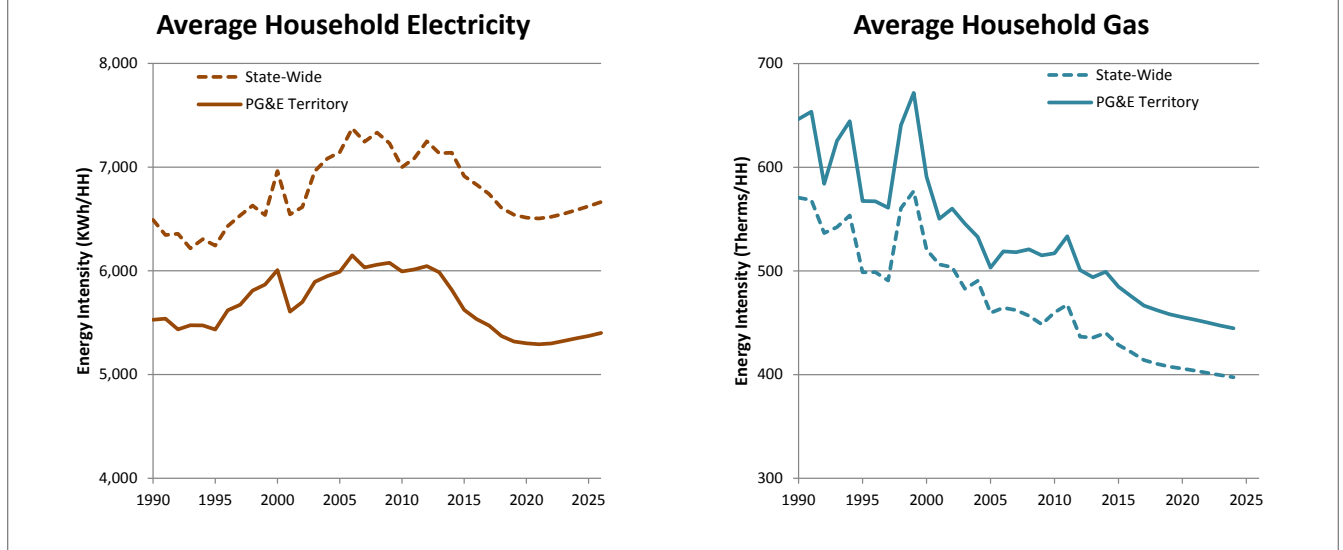
**Figure 2.8**  
Residential Consumption Forecast



residential electricity and gas consumption, forecasts of per household energy usage show an expected decline in the next five years as shown in **Figure 2.9**, where the solid lines indicate PG&E and dashed lines represent statewide data.

<sup>36</sup> "2015 Integrated Energy Policy Report," California Energy Commission, p. 130-145, [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN212017\\_20160629T154354\\_2015\\_Integrated\\_Energy\\_Policy\\_Report\\_Small\\_File\\_Size.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN212017_20160629T154354_2015_Integrated_Energy_Policy_Report_Small_File_Size.pdf).

**Figure 2.9**  
Average Energy Intensity



**Figure 2.9** also shows that average electricity usage per household in California as a whole (dashed line) is higher than in the PG&E service territory by nearly 25% while per household gas usage is higher in PG&E territory by about 10%. The lower average household electricity usage creates a challenge in achieving cost-effective savings as individual customers offer less average savings potential. Falling natural gas prices as fuel supply has increased also inhibits cost effective savings due to the lowered avoided procurement costs.

## E. Residential Sector Trends and Challenges

PG&E's service territory contains a wide variety of climates, terrains, and customer segments. Within the residential sector, PG&E services high density multifamily rental housing in the temperate Bay Area, inland suburbs where summer temperatures routinely reach triple digits, and sparse rural populations, among others. Through data analysis and market research, PG&E has identified the following major market trends and barriers impacting our residential customers, as well as barriers to an optimal energy efficiency portfolio.

• **While per household energy use is decreasing, overall residential sector energy usage is projected to increase due to population growth, increasing plug load usage and growth in the electric vehicle market.**<sup>37</sup>

- Plug load energy usage continues to grow rapidly. Twenty years ago, the average household contained only four or five plug load devices. Today, some homes are now likely to have as many as 65.<sup>38</sup> A typical household's electricity usage shows 15-30% of the load attributable to plug load products,<sup>39,40</sup> and these loads are the fastest growing energy end use category nationwide.<sup>41</sup>
- Computers are a major driver of this increase in plug load, with 8.3 million sold in California each year in both the commercial and residential sectors.<sup>42</sup> As a result, the CEC is exploring new energy efficiency standards for computers, monitors, and displays through its Title 20 authority in a series of workshops scheduled through 2016.<sup>43</sup>

<sup>37</sup> IEPR, [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-03/TN207439\\_20160115T152221\\_California\\_Energy\\_Demand\\_20162026\\_Revised\\_Electricity\\_Forecast.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-03/TN207439_20160115T152221_California_Energy_Demand_20162026_Revised_Electricity_Forecast.pdf).

<sup>38</sup> Natural Resources Defense Council, "Plug Load Efficiency Strategies," presented at IEPR commissioner workshop on Plug Load Efficiency, June 18, 2015.

<sup>39</sup> Estimated U.S. Residential Electricity Consumption by End-use, 2011, Energy Information Administration (2011, Updated 2013).

<sup>40</sup> The 2013 California Energy Efficiency Potential and Goals Study: Final Draft Report, Navigant Consulting prepared for the CPUC (2013).

<sup>41</sup> Miscellaneous Energy Loads in Buildings, S. Kwatra, J. Amann and H. Sachs (2013).

<sup>42</sup> Singh, Harinder, Ken Rider. 2015. Staff Analysis of Computer, Computer Monitors, and Signage Displays. California Energy Commission. CEC-400-2015-009-SD, [http://docketpublic.energy.ca.gov/PublicDocuments/14-AAER-02/TN203854\\_20150312T094326\\_Staff\\_Report\\_FINAL.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/14-AAER-02/TN203854_20150312T094326_Staff_Report_FINAL.pdf).

<sup>43</sup> California Energy Commission. 2015 Appliance Efficiency PreRulemaking – Computers, Computer Monitors, and Signage Displays. <http://www.energy.ca.gov/appliances/2014-AAER-2/prerulemaking/>.

- More customers are installing HVAC systems.<sup>44</sup> Many existing systems have not been installed up to code and many other HVAC systems are operating well beyond their useful lifetimes and represent stranded potential with opportunities for finance programs. For this reason, it will be increasingly important to rely on AMI data analysis to target customers using HVAC energy inefficiently with messages and interventions relevant to their individual needs.

• **Codes and Standards activities spur tremendous energy savings for California,<sup>45</sup> but stranded potential must be addressed to achieve energy savings goals.**

- While codes and standards have contributed significantly to greenhouse gas emission reductions, until passage of AB 802, effectively addressing stranded potential has often been impractical for energy efficiency program administrators. AB 802 presents an opportunity to target customers with stranded potential with stronger value propositions tied to existing conditions baselines, which in turn allows the possibility of measuring savings at the meter. More detail on PG&E's approach to measuring savings at the meter from existing conditions baselines is given in *Appendix D*. More information on how PG&E plans to close the gap on stranded potential is provided in the C&S Cross-cutting chapter.
- A 2011 CEC report found that "more than half of California's 13 million residential units and over 40% of the commercial buildings were built before 1978, when the first energy efficiency standards were implemented."<sup>46</sup> Berkeley Law et. al., found that 75% of existing housing stock was built before Title 24 standards. "This older stock of buildings represents a critical and largely untapped market for energy efficiency improvements to meet state goals."<sup>47</sup>

<sup>44</sup> HVAC6 Top Down Permit Rate Draft11, DNV GL (2016).

<sup>45</sup> NRDC, "California's Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals" <https://www.nrdc.org/sites/default/files/ca-energy-efficiency-opportunity-report.pdf>.

<sup>46</sup> "Achieving Energy Savings in California Buildings: Saving Energy in Existing Buildings and Achieving a Zero-Net-Energy Future," California Energy Commission Staff Report, July 2011.

- **Customers are interested in financing options beyond traditional rebates, such as on-bill loan repayments.**

- High up-front project costs present a significant barrier to the uptake of residential energy efficiency. Over half of homeowners (54%) agreed that high upfront cost is why they might not make an energy-related upgrade, and a third of homeowners stated that a loan could help overcome the costs.<sup>48</sup>
- A recent survey by Parago reports that though 14% of U.S. consumers are currently taking advantage of home energy management programs, 87% indicate they would participate given the right incentives, including financing options.<sup>49</sup>
- The addition of no or low-cost financing has been demonstrated to yield impressive results such as an 80% conversion rate in Arkansas.<sup>50</sup>
- A 2014 report by Accenture finds 76% of consumers are motivated by incentives to recruit those they know to enroll in energy-related products and services.<sup>51</sup>

PG&E has described several potential adjustments to the TRC formalism that could make progress toward these needs in the Portfolio Overview chapter.

- **Customers want visibility and control of their energy use, and they are using mobile devices and social media to stay connected.**

- The world is increasingly connected, as are individual homes. New electronic devices and appliances can now be linked to the Internet to provide real-time data that make it easier to understand and optimize energy use. The trend has impacted customer demands with nearly one-third of consumers (especially the younger generation) expecting functionality on Web and mobile channels from their energy providers.<sup>52</sup>
- Social media can be an influential interface – a 2014 Accenture report<sup>53</sup> shows that three-quarters of consumers can be motivated to recruit their friends and family to sign up for energy-related products and services.
- PG&E has installed more than 9 million smart meters, accounting for more than 84% of all meters in the service territory. These devices have paved the way for improved customer-facing programs, advanced technologies, and improved system understanding. AMI data enables powerful analytics and management tools, facilitating exploration and enhancing understanding of energy usage patterns.

<sup>48</sup> "Existing Buildings Energy Efficiency Action Plan 2016 Plan Update," California Energy Commission, p. 62.

<sup>49</sup> "Turn Up Demand Response: Educate and Incent Consumers," June 17, 2014 <http://www.parago.com/energy-demand-response-survey-press-release/>.

<sup>50</sup> Agard, T. 2016. Financing Building Energy Upgrades with Tariffed On-Bill Investments. Washington, DC: DOE. [betterbuildingssolutioncenter.energy.gov/sites/default/files/Energy\\_Efficiency\\_Financing\\_for\\_Low\\_Income\\_Communities\\_Finance\\_WED.pdf](http://betterbuildingssolutioncenter.energy.gov/sites/default/files/Energy_Efficiency_Financing_for_Low_Income_Communities_Finance_WED.pdf).

<sup>51</sup> "The New Energy Consumer: Architecting for the Future," Accenture, 2014, p. 22, [https://www.accenture.com/\\_acnmedia/Accenture/next-gen/insight-unlocking-value-of-digital-consumer/PDF/Accenture-2014-The-New-Energy-Consumer-Architecting-for-the-Future.pdf](https://www.accenture.com/_acnmedia/Accenture/next-gen/insight-unlocking-value-of-digital-consumer/PDF/Accenture-2014-The-New-Energy-Consumer-Architecting-for-the-Future.pdf).

<sup>52</sup> "The New Energy Consumer: Architecting for the Future," Accenture, p. 22, May 23, 2015 <https://www.accenture.com/us-en/insight-new-energy-consumer-architecting-future>.

<sup>53</sup> Ibid.

- **Single family new construction is on the rise, while multifamily housing is experiencing a dip in the number of new buildings.**

- The number of new single family residential buildings in California rose 14% from 2014-2015 while multifamily construction decreased by 21% for the same period.<sup>54</sup> Due to rising mortgage rates in 2016, single family residential construction is anticipated to slow and end the year at 10% over 2015 numbers while multifamily construction will likely end the year 10% below 2015 performance.<sup>55</sup>
- Per a recent report on residential housing trends, the next peak year for both single family and multifamily new construction is likely to be in 2020, which happens to coincide with the state's progressive ZNE goals.<sup>56</sup>
- The state is continuing leadership in advancing distributed generation and advanced construction practices by setting a goal to achieve ZNE by 2020 for all new residential buildings. California's building energy efficiency standards are among the most progressive in the nation and are moving the market towards increasing levels of high energy performance in new buildings. To date, California has more buildings that are closer to ZNE, than any other state in the nation.<sup>57</sup>

<sup>54</sup> "The Rising Trend In California Construction Starts," First Tuesday Journal, September 30, 2016 <http://journal.firsttuesday.us/the-rising-trend-in-california-construction-starts/17939/>.

<sup>55</sup> <http://hugginshomes.com/2016/11/27/the-rising-trend-in-california-construction-starts/>.

<sup>56</sup> "The Rising Trend In California Construction Starts," First Tuesday Journal, September 30, 2016 <http://journal.firsttuesday.us/the-rising-trend-in-california-construction-starts/17939/>.

<sup>57</sup> <http://www.californiaznehomes.com/faq>.

- **Solar PV is experiencing rapid uptake in PG&E service territory. Along with utility scale solar and other distributed generation, the need for traditional load is becoming more variable.**

- PG&E has supported adoption of solar PV throughout our service territory with a variety of incentives and customer education initiatives. Spurred by this support and by California policy, more than 260,000 residential solar PV systems have been installed in PG&E service territory, accounting for more than 2.2 GW of capacity.<sup>58</sup> These projects account for more than 25% of all residential solar installations nationwide.<sup>59</sup>
- In combination with utility scale solar projects, the net load that must be serviced through traditional generation sources has become highly variable throughout the course of a single day. This phenomenon is often referred to as the challenge of the "Duck Curve." An example of the duck curve is given in **Figure 2.10** as illustrated in forecasts from the California Independent Systems Operator (CalISO).<sup>60</sup> Increasing solar adoption results in a mid-day dip in the demand from traditional generation. Solar electricity production diminishes in coincidence with customers returning home from work in the early evening. The subsequent evening demand peak, occurring near 8 pm in **Figure 2.10**, is exacerbated in part by increased plug load consumption. Recent research indicates that net loads in the mid-day trough are even lower than forecast.<sup>61</sup>

<sup>58</sup> <http://www.californiadgstats.ca.gov/>.

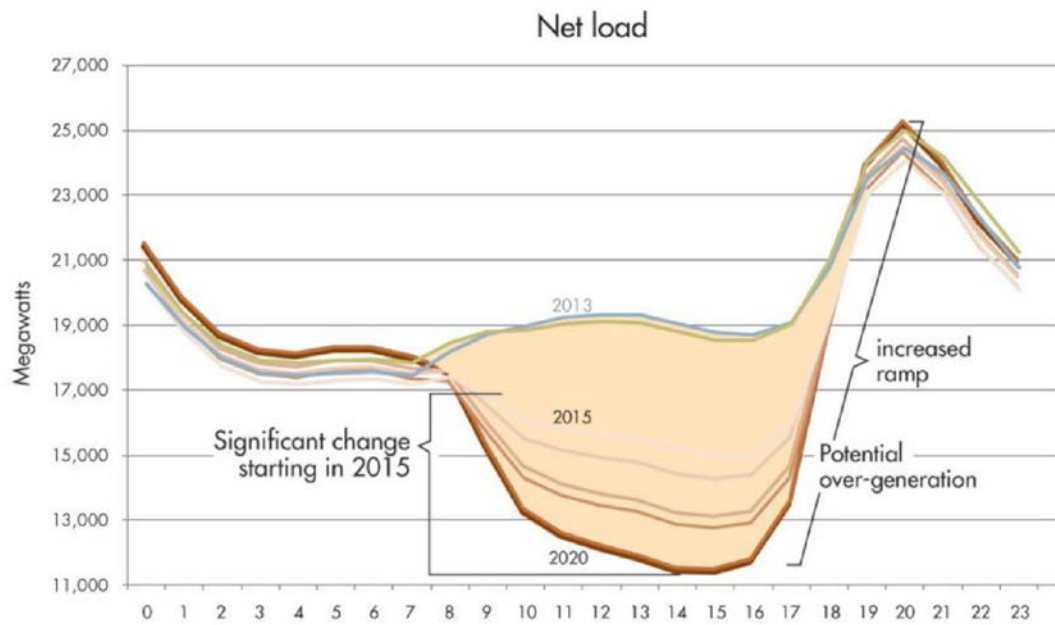
<sup>59</sup> <https://openpv.nrel.gov/rankings>.

<sup>60</sup> Fast Facts; What the duck curve tells us about managing a green grid, California ISO, (2016); 2bThe California Independent System Operator manages electricity transmission for about 80% of California and a small area of Nevada; 2cOvergeneration from Solar Energy in California: A Field Guide to the Duck Chart, P. Denholm, M. O'Connell, G. Brinkman and J. Jorgenson, National Renewable Energy Laboratory (2015).

<sup>61</sup> Revisiting the California Duck Curve, Scott Madden Management Consultants (2016).

**Figure 2.10****Actual and Forecasted California Net Load from 2013-2020**

Source: California Independent System Operator



- Because the residential sector accounts for a high fraction of peak evening demand, energy efficiency can serve an important role in alleviating stress on the grid and reducing usage during the times of highest procurement costs. Further, with the onset of time-of-use electricity rates, energy efficiency and demand response programs that curtail load demands during peak hours will save customers more on their bill than conventional programs.<sup>62</sup>

- **Electric vehicle adoption is accelerating and California customers are leading the way**

- California leads the nation in market growth of electric vehicles.<sup>63</sup> Registration for zero emission vehicles in California has grown steadily since 2008. Electric vehicle registrations rose 115% from 2012-2014 and plug-in hybrid vehicle registrations grew 550% in that same period.<sup>64</sup> According to the Center for Sustainable Energy, electric vehicle sales in California have surpassed 225,000 since January of 2011. These sales account for nearly half of all EVs sold nationwide.<sup>65</sup> Because liquid transportation fuels are not easily displaced with carbon free sources, electrification of the transportation fleet, paired with renewable energy represents a significant opportunity for greenhouse gas savings. As electric vehicle adoption continues, it will be important to ensure customers are educated on the usage of timers,

<sup>62</sup> This general point is demonstrated in recent research from E2e [Do Energy Efficiency Investments Deliver at the Right Time? J. Boomhower and L.W. Davis (2016)] in which the avoided procurement costs for several energy efficiency programs were investigated. Pre/post billing analysis was performed using 1-hour interval data for approximately 10,000 participants in SCE's Residential Quality HVAC Installation (RQI) program between 2010 - 2015. The RQI savings were found to occur largely in coincidence with periods of high procurement costs. [The Model showed that RQI savings occur almost exclusively during the hot summer months and predominantly from noon - 10 pm, when air conditioning needs are greatest]. The authors quantified this overlap, then compared the resulting avoided costs to those estimated by a simple averaging of annual savings and procurement costs. The RQI program was estimated to deliver more than 1.5 times the avoided costs than would be expected with simple averaging. By more effectively targeting customers for program participation as described in the previous section, avoided costs and impact on the grid can be further enhanced.

<sup>63</sup> <http://next10.org/sites/next10.org/files/2016-california-green-innovation-index-1.pdf>, p. 3.

<sup>64</sup> California Energy Commission. [http://www.energy.ca.gov/renewables/tracking\\_progress/documents/electric\\_vehicle.pdf](http://www.energy.ca.gov/renewables/tracking_progress/documents/electric_vehicle.pdf).

<sup>65</sup> <http://www.zevfacts.com/sales-dash-board.html> (December 2016).



and are motivated to charge the vehicle during off-peak hours. Time dependent rates can be used as a tool to encourage off peak charging.

- Electric vehicles also provide an opportunity to “flatten the duck” by drawing from the grid during times of high solar availability and when charged during periods of low demand at night.

Delivering a cost-effective residential portfolio is paramount to PG&E, as is positioning the state to meet the Governor’s goal of doubling the efficiency of existing buildings by 2030. These objectives are hamstrung by the current construct of the total resource cost (TRC) test, which is used as the primary cost-effectiveness evaluation for energy efficiency programs. In recognition of the challenges with the TRC test, PG&E has provided proposals to improve cost-effectiveness evaluations for all energy programs, to include a thorough review of appropriate participant costs to use, in its Business Plan application.<sup>66</sup>

Driven largely by these trends, the residential sector faces several key barriers to driving energy efficiency uptake. PG&E’s nine major intervention strategies are designed to overcome major residential sector challenges, as shown in **Table 2.9** and explained in greater detail in section *F. PG&E’s Approach to Achieving Goals*.

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<sup>66</sup> See PG&E’s Business Plan Application for the complete discussion on cost-effectiveness proposals.

**Table 2.9**

Residential Market Trends and Market Barriers to Energy Efficiency

Key Residential Sector Barriers	Residential Sector Interventions
<b>Individual Customer Targeting via Interval Data Analysis</b>	Customers lack an understanding of energy efficiency opportunities at key trigger points
<b>Data Access to Facilitate Customer Understanding of Energy Efficiency</b>	Customers lack access to their energy usage <sup>a</sup>
<b>Technical Assistance and Tools to Facilitate Customer Awareness of their Energy Use</b>	Customers do not know how to act on energy usage information <sup>b</sup>
<b>Loans, Rebates, and Incentives</b>	<ul style="list-style-type: none"> <li>• Projects that generate deep savings often have high up-front costs, long payback periods, and are not recognized as valuable by the real estate market.<sup>c</sup> Lower income and multifamily customers often require direct financial support to overcome unique barriers</li> <li>• Customers lack an understanding of energy efficiency opportunities at key trigger points</li> <li>• Customers do not know how to act on energy usage information<sup>d</sup></li> </ul>
<b>New Program Models to Cost-Effectively Deliver Comprehensive Energy Savings</b>	New program models based on performance-driven value are needed to increase the efficiency of existing buildings <sup>e</sup>
<b>Assistance for the Design and Building Communities</b>	The incremental cost for ZNE construction is estimated to be 5-15% greater than to-code homes <sup>f</sup>
<b>Upstream and Midstream Partnerships</b>	Downstream incentives may not always be practical or sufficient to increase customer adoption of energy efficient products or equipment <sup>g</sup>
<b>Outreach and Education</b>	Customers are biased toward maintaining the status quo and discount the future benefits of taking action <sup>h</sup>
<b>Midstream Training</b>	Workforce training must align with overcoming barriers to achieve state policy goals <sup>i</sup>

<sup>a</sup> “California’s Existing Buildings Energy Efficiency Action Plan,” pp. 13, 15.

<sup>b</sup> “Driving Demand for Home Energy Improvements,” p. 29.

<sup>c</sup> “Cluett, Rachel and Jennifer Amann “Scaling Up Participation and Savings in Residential Retrofit Programs,” American Council for an Energy Efficient Economy, October 2016, p. v.

<sup>d</sup> “Driving Demand for Home Energy Improvements,” p. 29.

<sup>e</sup> “California’s Existing Buildings Energy Efficiency Action Plan,” pp. 74-75.

<sup>f</sup> “Residential ZNE Market Characterization,” TRC Energy Services, February 27, 2015, p. 13, [http://www.calmac.org/publications/TRC\\_Res\\_ZNE\\_MC\\_Final\\_Report\\_CALMAC\\_PGE0351.01.pdf](http://www.calmac.org/publications/TRC_Res_ZNE_MC_Final_Report_CALMAC_PGE0351.01.pdf).

<sup>g</sup> “Customer Incentives for Energy Efficiency Through Program Offerings,” U.S. Environmental Protection Agency, p. 6, [https://www.epa.gov/sites/production/files/2015-08/documents/program\\_incentives.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/program_incentives.pdf).

<sup>h</sup> “Driving Demand for Home Energy Improvements,” p. 29.

<sup>i</sup> “California Existing Buildings Energy Efficiency Action Plan: October 2016,” California Public Utilities Commission and California Energy Commission, October 2016, p. 1.

## F. PG&E's Approach to Achieving Goals

### Strategic Interventions: Overview

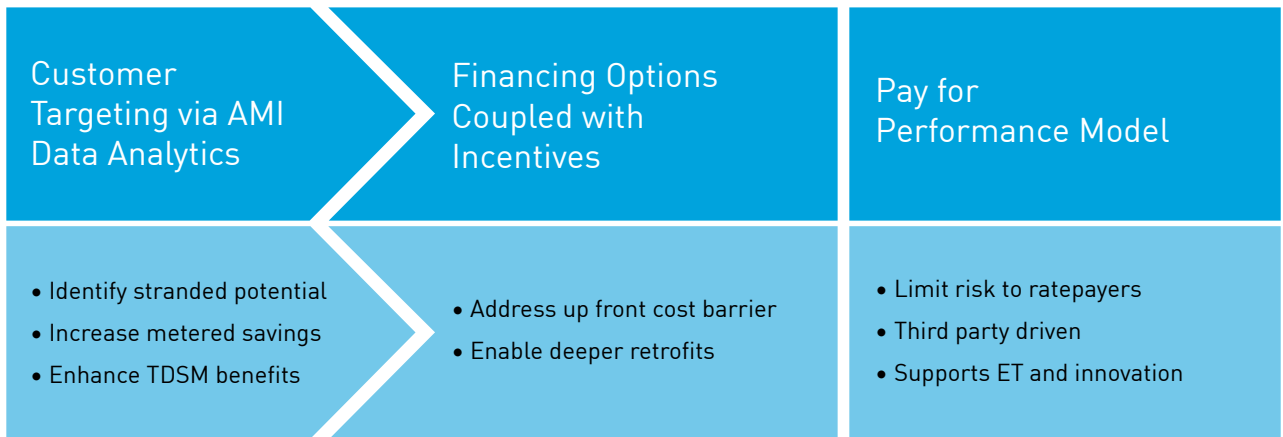
PG&E has a long history of providing a diverse range of energy efficiency offerings to its residential customers. As California's residential energy efficiency technological and policy landscape evolves, PG&E has identified nine major strategic interventions that build on existing strategies where successful and that offer new approaches where new opportunities exist.

**Figure 2.11** illustrates a customer journey based on these strategic interventions.

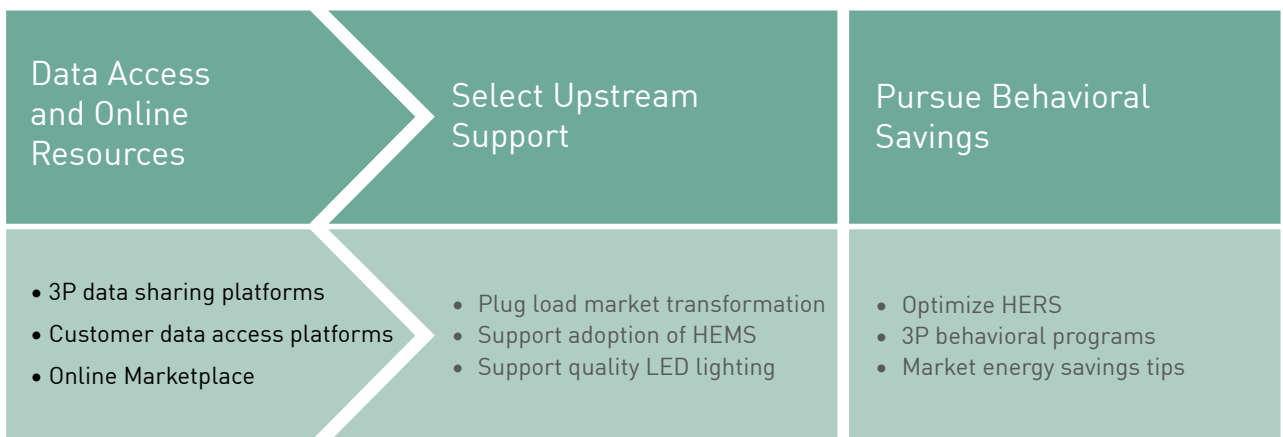
**Figure 2.11**

## Residential Customer Journey

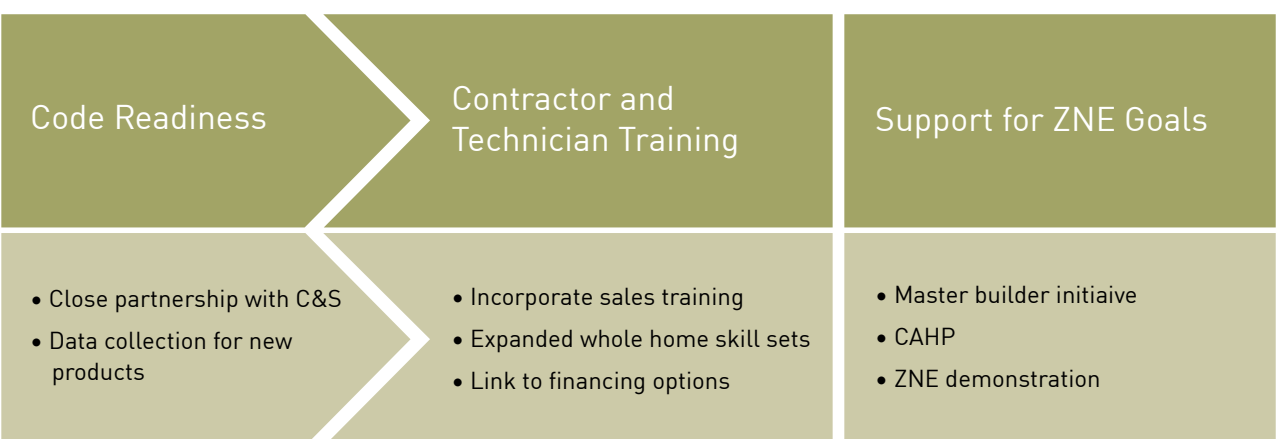
## Strategy 1: Targeted Interventions



## Strategy 2: Reaching More Customers



## Strategy 3: Building for the Future



- **Individual Customer Targeting via Interval Data Analytics** enable PG&E to strategically target high-opportunity projects, address stranded potential, and provide targeted value propositions for residential customers based on their energy usage profiles.
- **Data Access to Facilitate Customer Understanding of Energy Efficiency** empowers customers with enhanced awareness of their energy usage and informs the design of technical assistance and tools through data sharing with authorized third parties.
- **Technical Assistance and Tools to Facilitate Customer Awareness of their Energy Use** address knowledge gaps customers may have when considering how best to act to reduce energy waste. Effectively engaging customers with the appropriate suite of measures helps establish PG&E as a trusted energy advisor, a relationship that can open the door for ongoing engagement with energy efficiency and IDSM opportunities in the future.
- **Loans, Rebates, and Incentives** address up-front cost barriers and provide the impetus to spur energy efficiency investments. These offerings address the unique challenges faced by single family and multifamily communities through bundled loans, rebates, and incentives to encourage customers to take action.
- **New Program Models to Cost-Effectively Deliver Comprehensive Energy Savings** support PG&E's efforts to engage third parties. Pay for performance strategies can facilitate innovative, market driven solutions with verification of savings at the meter.
- **Assistance for the Design and Building Communities** is required to overcome the cost barriers of ZNE construction practices and paves the way to meet the goal of all new residential construction as ZNE by 2020.

- **Upstream and Midstream Partnerships** with retailers, distributors, manufacturers, and other supply chain actors enable PG&E to promote greater access to efficient products and equipment, while driving down the cost of new technologies over time.
- **Outreach and Education** use positive normative social influence strategies such as community-based social marketing to broaden residential communities' engagement with energy efficiency outside of traditional programs.
- **Midstream Training** contributes to the development of a capable, knowledgeable, and highly skilled workforce prepared to succeed within new program designs and able to take energy efficiency practices to the broader market.

The next section provides further detail on the selected intervention strategies and exploratory tactics. Before proceeding with implementation, PG&E will expose each tactic described to a rigorous internal development process to assess its relative viability and cost effectiveness.

## Intervention Strategy 1 – Individual Customer Targeting via Interval Data Analysis

In the last six years, PG&E has deployed more than 9 million smart gas and electric meters (AMI) across the service territory.<sup>67</sup> These meters provide daily gas usage data and 1-hour interval electric usage data. This level of granularity allows load shape analysis and much more sophisticated modeling at an individual-customer level than was previously possible with monthly billing data. The insights gained from AMI data can be game changers for both program design and evaluation. In the short term, PG&E plans to use AMI data to locate inefficient households and stranded potential and to offer customers tailored solutions based on their usage patterns. For detailed examples of customer targeting schemes via AMI data analysis we refer the reader to *Appendix D*. In general, PG&E believes customer targeting has the potential to offer the following benefits:

- Identify stranded potential
- Direct resources to customers who will benefit most from specific program interventions and will offer the highest savings
- Reduce free ridership with proactive outreach
- Increase cost effectiveness

For example, targeting should increase the effectiveness of programs such as the Air Conditioning Quality Control (AC/QC) and Moderate Income Direct Install (MIDI) programs, which currently rely on contractors in the field to recruit customers without having access to information on household savings potential. Recent billing analysis research<sup>68</sup> reveals that total AC/QC program savings originated almost exclusively from the top 25% of customers, as cataloged by baseload energy usage, while negative savings were observed for the aggregate group of customers who ranked in the bottom 40–60% of baseload electricity usage.<sup>69</sup> Targeted customers have also been shown to yield enhanced peak demand reductions in response to

time of use rates.<sup>70</sup> The implications of these results are clear. Data analysis needs to be incorporated into program design in a predictive fashion to best serve customers, to enhance energy savings at the meter, and to maximize avoided costs.

In recognition of the fact that energy efficiency is a valuable grid resource and complements demand response, PG&E will use analytics to identify opportunities for energy efficiency to contribute to targeted demand side management (TDSM) in load constrained regions. The combined approach will defer investments in transmission and distribution capacity, which in turn frees capital to fund other investments yielding enhanced system-wide safety and reliability.<sup>71</sup>

Ultimately, data analytics lays the foundation for PG&E to contribute to the doubling of energy efficiency by 2030 as it enables PG&E to concentrate its resources on specific residential customers that stand to contribute the greatest amount of energy savings.

**Table 2.10** summarizes *Intervention Strategy 1: Individual Customer Targeting via Interval Data Analysis*.

<sup>67</sup> "Putting Energy Efficiency First," Pacific Gas & Electric Company, <http://www.pge.com/myhome/environment/pge/energyefficiency/>.

<sup>68</sup> AMI Billing Regression Study (Phase I). Evergreen Economics [2016] CALMAC ID: SCE0383.01.

<sup>69</sup> Phase II of this research is currently underway and will investigate optimal customer binning schemes.

<sup>70</sup> S. Patel, S. Borgeson, R. Rajagopal et al. "Time Will Tell: Using Smart Meter Time Series Data to Derive Household.

<sup>71</sup> California's Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals," Natural Resources Defense Council, August 2015, p. 39, <https://www.nrdc.org/sites/default/files/ca-energy-efficiency-opportunity-report.pdf>.

**Table 2.10**

## Intervention Strategy 1: Individual Customer Targeting via Interval Data Analysis

GOALS: Save energy and reduce demand, and Increase operational efficiency				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
Individual customer targeting via interval data analysis	Customers lack an understanding of energy efficiency opportunities at key trigger points	Identify customers most in need of building shell and HVAC maintenance/system upgrades using load shape analysis, seasonal usage comparisons, and HVAC disaggregation modeling	N	S
		Identify usage patterns indicative of old or inefficient equipment using innovative tools or third party offerings to reach stranded potential and promote deep retrofits	N	S
		Identify and engage customers who drive evening system load peaks about integrated energy efficiency and demand response offerings to help avoid high procurement costs (TDSM) <sup>a</sup>	N	S

**Partners:** Data analysis experts; evaluators; energy procurement planners

<sup>a</sup> "California's Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals," p. 39.

Beyond AMI data analysis, there are opportunities to focus programs to achieve greater benefit. A 2016 impact evaluation of the 2013-2014 - Home Upgrade Program identifies a need to better target outreach efforts based on particular climate zones. Specifically, the report finds that concentrating on inland climate zones could result in higher electric savings and demand reductions, while gas savings could be maximized by prioritizing climate zones with higher heating loads.<sup>72</sup> This finding demonstrates the value of concentrating program outreach efforts to drive the greatest benefits. Moreover, it highlights the value of incorporating additional factors beyond

energy usage into targeting efforts. Other key inputs that PG&E leverages to identify and reach customers with the largest savings potential may include demographic or customer preference information.

In addition, building vintage can help identify savings opportunities. The 2014-2015 Home Upgrade Process Evaluation finds significant savings opportunities still exist in residential buildings constructed prior to the adoption of California's Building Energy Efficiency Standards in 1978. In particular, the evaluation recommends "program administrators should harness data-mining techniques to target pre-1978 homes in any IOU-led marketing campaigns."<sup>73</sup>

<sup>72</sup> "Focused Impact Evaluation of the 2013-2014 Home Upgrade Program," DNV GL, March 22, 2016, <http://www.energydataweb.com/cpucFiles/pdaDocs/1497/Focused%20Impact%20Evaluation%20of%20the%202013-2014%20Home%20Upgrade%20Program%20draft%20for%20comment%204-1-16.pdf>.

<sup>73</sup> "Energy Upgrade California-Home Upgrade Program Process Evaluation 2014-2015," EMI Consulting, September 12, 2016, p. 12.

Given the energy savings potential from pre-1978 homes, PG&E will explore incorporating this finding into its methodologies to maximize the effectiveness of customer targeting campaigns.

## Intervention Strategy 2 – Data Access to Facilitate Customer Understanding of Energy Efficiency

Residential customers report a key barrier to adopting energy efficiency is a lack of awareness of their energy usage and opportunities to manage their usage more effectively.<sup>74</sup> With the extensive deployment of AMI in its service territory, PG&E has laid the foundation to provide customers with access to their detailed energy data. Through this intervention strategy, PG&E will strive to ensure that all customers have access to their energy usage information and can easily share this data with an authorized third party that is positioned to offer energy savings strategies.

Tactics to support improved data access will focus on delivering relevant messaging to residential customers at key decision points. A 2014 briefing by the American Council for Energy Efficient Economy (ACEEE) points out that data access is a necessary first step toward enabling customers to analyze their usage patterns and identify the need for energy efficiency.<sup>75</sup> In this way, empowering customers with resources that facilitate greater understanding of their usage provides a key entry point to begin the conversation about energy efficiency.

This approach is further supported by the 2015 IEPR, which states, “Data access is the first step to behavioral and operational efficiency improvements that have great potential to optimize energy use.”<sup>76</sup>

In the short-term, PG&E will use its ME&O resources to promote awareness of data platforms among residential customers, such as My Account,<sup>77</sup> Stream My Data,<sup>78</sup> and Share My Data.<sup>79</sup> Implementation of AB 802, which requires IOUs to maintain usage records for all multifamily residential buildings to which it provides service, aggregate usage across meters for multifamily dwellings, and deliver this data to building owners, their agents, or operators upon request, will complement these efforts.<sup>80</sup>

NRDC finds “increasing the transparency of buildings’ energy usage...can drive more retrofits and help owners better manage how their buildings use energy.”<sup>81</sup>

<sup>74</sup> Merrian C. Fuller, et.al, “Driving Demand for Home Energy Improvements,” Berkeley: LBNL, 2010, p. 28; Lowell Ungar, Rodney Sobin, Neal Humphrey, et al, “Guiding the Invisible Hand: Policies to Address Market Barriers to Energy Efficiency,” paper presented at ACEEE Summer Study on Energy Efficiency in Buildings.

<sup>75</sup> “Best Practices for Working with Utilities to Improve Access to Energy Usage Data,” American Council for an Energy-Efficient Economy, June 2014, p. 1-2, <http://aceee.org/files/pdf/toolkit/utility-data-access.pdf>.

<sup>76</sup> “2015 Integrated Energy Policy Report (IEPR),” California Energy Commission, p. 22, [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN212017\\_20160629T154354\\_2015\\_Integrated\\_Energy\\_Policy\\_Report\\_Small\\_File\\_Size.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN212017_20160629T154354_2015_Integrated_Energy_Policy_Report_Small_File_Size.pdf).

<sup>77</sup> Through a partnership with OPower, the My Account interface is accessed online through PG&E’s website. My Account offers a customer their energy usage information by billing period, by day, or even by 1-hour interval. Monthly usage data is compared to similar homes and energy savings tips are provided.

<sup>78</sup> “Stream My Data” is the PG&E data access platform to release real-time stream data locally from individual SmartMeters. The reads are instantaneous kW and can be accessed minute by minute. The data are in the “raw” form straight from the SmartMeter. Stream My Data requires installation of a wireless device on premise that is provisioned on to the SmartMeter. Generally, a location utilizing this data platform needs to have the device within approximately 300 feet of the SmartMeter. There are currently over two thousand five hundred residential locations with active Stream My Data devices.

<sup>79</sup> “Share My Data” is the PG&E data access platform to release interval data. The data structure follows the OpenADR / Green Button standard specification, and delivers data in adherence with the Green Button Connect (GBC) API standard. The data used in GBC is interval data retrieved from the SmartMeter & MV90 meters using the AMI network. The time granularity of the data is highest with the SmartMeter and MV90 in this case, with business customers getting 15 minutes (SmartMeter and MV90) interval data, while residential (SmartMeter) customers get 60 minute interval data. This dataset is generally available 24 to 36 hours after the read. The data is available to third party service providers who have been granted access through a secure open authentication (“Oauth”) process offered to customers by PG&E through its website.

<sup>80</sup> “Assembly Bill No. 802,” [https://leginfo.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160AB802](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB802).

<sup>81</sup> Stamas, Maria “How California’s Unprecedented Public Benchmarking Law Can Yield Even More Benefits for Customers,” Natural Resources Defense Council, February 3, 2016, <https://www.nrdc.org/experts/maria-stamas/how-californias-unprecedented-public-benchmarking-law-can-yield-even-more>.



In the mid-term, PG&E will begin promoting greater access to data sharing platforms among third parties. A 2016 report by ACEEE finds providing contractors and energy assessors with more consistent access to interval data enables them to “understand what devices and equipment are responsible for energy waste, which can help them determine appropriate solutions for the home.”<sup>82</sup> Moreover, this tactic provides third parties with the insights needed to create innovative, inspiring tools for customers to relate to, manage, and ultimately reduce their energy usage.

Privacy is a top priority for PG&E and we protect customers' energy usage data in accordance with the CPUC issued “Rules Regarding Privacy and Security Protections for Energy Usage Data to ensure the protection of customers' privacy. We treat information about our customers as confidential, consistent with all legal and regulatory requirements established by the CPUC and other regulatory agencies.”<sup>83</sup>

Ultimately, promoting customer awareness of their energy usage in the short-term aligns with the AB 758 Existing Buildings Energy Efficiency Action Plan's goal of “data-driven decision making.” In particular, the Action Plan highlights, “building owners and residents demand energy efficiency services informed by the full range of information relevant to them.”<sup>84</sup> **Table 2.11** summarizes *Intervention Strategy 2: Data Access to Facilitate Customer Understanding of Energy Efficiency*.

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<sup>82</sup> Cluett, Rachel and Jennifer Amann “Scaling Up Participation and Savings in Residential Retrofit Programs,” American Council for an Energy-Efficient Economy, October 2016, p. 11.

<sup>83</sup> [https://www.pge.com/en\\_US/about-pge/company-information/privacy-policy/energy-usage-information/energy-usage-information.page](https://www.pge.com/en_US/about-pge/company-information/privacy-policy/energy-usage-information/energy-usage-information.page).

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<sup>84</sup> Zawadzki, Lin, Dahlquist, Bao, et al. “Personalized energy efficiency program targeting with association rule mining,” Pacific Gas and Electric Company—2016 ACEEE Summer Study on Energy Efficiency in Buildings.

**Table 2.11**

## Intervention Strategy 2: Data Access to Facilitate Customer Understanding of Energy Efficiency

GOALS: Save energy and reduce demand, Increase customer’s ability to manage energy, Increase operational efficiency, and Increase multifamily participation and savings				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
Data access to facilitate customer understanding of energy efficiency	Customers lack access to their energy usage	Promote third-party access to Share My Data/Green Button Connect	M	M
		Promote streamlined access to aggregated whole-building data and consent-based tenant data <sup>a</sup>	M	S
		Increase customer adoption of data platforms (e.g. My Account, My Energy, and Share My Data) where customers can engage with personalized energy usage data and tools	N	S

**Partners:** Third-party vendors

<sup>a</sup> “California’s Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals,” p. 46.

The “Program Year 2015 Evaluation of Customer Web Presentment and Energy Alerts” by Applied Energy Group, Inc. analyzed the effectiveness of the My Energy platform, which allows customers with smart meters to view their electricity usage at daily or hourly intervals. One of the key findings from this study is that customers who are highly engaged with My Energy tend to save energy while those that are less engaged typically do not.<sup>85</sup>

This finding illustrates the dual importance of designing an appealing, user-friendly platform and conducting effective outreach that encourages customers to consistently engage with their data. In other words, creating a data platform is not enough to drive savings; customers must use the platform consistently to drive results.

<sup>85</sup> “Pacific Gas and Electric Company’s SmartMeter Enabled Programs: Program Year 2015 Evaluation of Customer Web Presentment and Energy Alerts,” Applied Energy Group, Inc., April 29, 2016, pp. iii-iv.

### Intervention Strategy 3 – Technical Assistance and Tools to Facilitate Customer Awareness of their Energy Use

California’s Existing Buildings Energy Efficiency Action Plan notes that even when residential customers have complete access to their energy usage, they “do not always make rational decisions to prioritize energy efficiency.”<sup>86</sup> As a result, PG&E plays a key role in connecting customers with the appropriate suite of energy efficiency information and offerings that are best suited to their resources and needs. In the short term, PG&E will continue to promote existing resources such as integrated audits, Home Energy Reports, and the “Marketplace” platform,<sup>87</sup> which was featured in the Action Plan as a strategy to increase plug load efficiency.<sup>88</sup> AB 793 presents an opportunity to develop and deploy innovative energy-saving offerings in the short-term.<sup>89</sup> Successful implementation of this intervention strategy will lead to a higher degree of customer awareness that EMTs are available, and higher rates of uptake.

In the short-term, PG&E will prioritize developing and delivering EMTs to residential customers. This includes promoting existing EMTs such as advanced power strips and the Home Energy Checkup, as well as offering new EMTs such as a smart phone applications that engage customers around time-of-use rates. The use of this tactic aligns with the Action Plan, which states that smart phone applications can “...break down consumption by end use, understand usage patterns, pinpoint opportunities for savings, and provide ongoing regular seasonal advice to customers.”<sup>90</sup>



#### PG&E’S MARKETPLACE

Marketplace is an online platform that helps customers identify and purchase efficient products through a user-friendly interface that includes a product’s energy score, satisfaction rating, price, rebate information, and cost savings. For each product attention is drawn to the energy efficiency score that allows on-the-spot comparisons to competing products. When rebates are available, incentive information is also presented. In the Marketplace Trial, the presence of the Energy Score shifted washer preferences towards models that were roughly 15 to 20% more efficient on average than when the Energy Score was absent (Binley et al).

This platform enables PG&E to serve as a trusted energy adviser by connecting customers with the information they need to increase plug-load efficiency, as described in Strategy 1.6 in the Existing Buildings Energy Efficiency Action Plan.

<sup>86</sup> “California Existing Buildings Energy Efficiency Action Plan,” p. 13.

<sup>87</sup> For more information, see Binley, Niederberger, Champniss et al. “Insights from PG&E’s Marketplace Initiative on Influencing Purchasing Decisions,” Pacific Gas & Electric Company and Enverve—2016 ACEEE Summer Study on Energy Efficiency in Buildings, [http://aceee.org/files/proceedings/2016/data/papers/6\\_361.pdf](http://aceee.org/files/proceedings/2016/data/papers/6_361.pdf).

<sup>88</sup> “California Existing Buildings Energy Efficiency Action Plan 2016 Plan Update,” p. 24.

<sup>89</sup> For more information, see [Appendix F: PG&E Planned AB 793 Offerings](#).

<sup>90</sup> “California’s Existing Buildings Energy Efficiency Action Plan,” p. 67.



## MULTIFAMILY ENERGY EFFICIENCY COLLABORATION

PG&E currently offers multifamily rebates to heighten awareness of energy efficiency among property owners, property managers, and tenants. These offerings are provided in collaboration with BayREN and Marin Clean Energy (MCE) for multifamily event coordination and via a common customer interest form to help determine the best solutions to offer. In an effort to maximize savings potential and customer benefits, these rebate measures are coordinated with Energy Savings Assistance (ESA) and other energy efficiency programs, such as the Multifamily Upgrade Program. This integrated approach combines market-rate and income-qualified measures to ensure energy efficiency is accessible to all customers. A more detailed description of PG&E's approach to the multifamily sector, including establishing a Single Point of Contact, is given in *Appendix I*.

In addition, streamlined third party data access processes will help technology companies design technical assistance platforms and tools that best meet customer needs. In this way, both data analytics and data access provide detailed usage and savings data that will inform the design and delivery of specific technical assistance and tools.<sup>91</sup> **Table 2.12** summarizes *Intervention Strategy 3: Technical Assistance and Tools to Facilitate Customer Awareness of their Energy Usage*.

PG&E will also look to engage customers with tools to reduce their peak load demand. The impact evaluation of PG&E's 2013 Home Energy Reports Program confirms HERs can be used to estimate energy savings coincident with periods of high electricity demand.<sup>92</sup> Furthermore, a 2016 study by Nexant concludes HERs may be effective as behavioral demand response tools to reduce peak usage during periods of particularly high load (i.e. summer days). Both of these findings support PG&E's continued development of HERs to reduce peak load, particularly as part of TDSM opportunities to delay costly investments in energy infrastructure.

## Intervention Strategy 4 – Loans, Rebates, and Incentives

A 2016 ACEEE report catalogues several financial barriers to energy efficiency that residential customers face, including high up-front costs, long payback periods, and the lack of added property value as a result of energy efficiency.<sup>93</sup> The Existing Buildings Action Plan also notes multifamily buildings must overcome the “split incentive” barrier, which describes the diverging incentives between tenants and landlords. On one hand, 80% of multifamily households are renters who pay the utility bill but do not control decisions over the structural or appliance improvements that could lower those bills.<sup>94</sup> Multifamily tenants can be particularly hesitant to make energy efficiency investments with ROI periods longer than the expected duration of their stay. On the other hand, building owners pay the utility bill for common

<sup>91</sup> California's Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals,” p. 46.

<sup>92</sup> “2013 PG&E Home Energy Reports Program: Review and Validation of Impact Evaluation,” DNV GL, January 16, 2015, p. 9.

<sup>93</sup> Cluett, Rachel and Jennifer Amann “Scaling Up Participation and Savings in Residential Retrofit Programs,” American Council for an Energy-Efficient Economy, p. v.

<sup>94</sup> Ibid.

**Table 2.12**

Intervention Strategy 3: Technical Assistance and Tools to Facilitate Customer Awareness of their Energy Use

GOALS: Save energy and reduce demand, Increase operational efficiency, and Increase multifamily participation and savings				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Technical assistance and tools to facilitate customer awareness of their energy use</b>	Customers do not know how to act on energy information	Continue promoting existing EMTs (e.g. advanced power strips, bill forecasts, energy alerts)	E	S
		Continue promoting Marketplace to provide customers with information that motivates the purchase of an energy efficient product	E	S
		Optimize HERs and expand the population of recipients	M	S
		Promote behavioral peak load reduction in capacity constrained areas (TDSM) using HERs	M	S
		Improve tools to support benchmarking, audits and other assessments for multifamily communities	N	M
		Provide customers education and incentives to purchase or adopt bundled EMT solutions tailored to meet their needs and maximize energy savings	N	S

**Partners:** Third-party implementers; contractors; evaluators; retail partners

areas but cannot control tenant behavior to reduce costs.<sup>95</sup> These financial barriers are particularly acute for low-income customers, 43% of whom live in multifamily housing.<sup>96</sup> In light of the significant financial barriers residential customers face, PG&E will provide a suite of financial solutions that will help both single family and multifamily customers take energy efficiency actions and will result in a higher percentage of customers using loans or other scalable models.

In the short-term, PG&E will continue to provide residential customers loans, rebates, and incentives to overcome the up-front cost barriers that impede greater adoption of energy efficiency. This includes continuing to mitigate the split-incentive barrier through its coordinated approach of offering rebates to promote energy efficiency in the multifamily sector. Moving forward, PG&E will complement these offerings with incentives for EMTs. These incentives provide added financial impetus for residential customers to actively manage their energy usage and realize control, operational, and behavioral savings. The CEC's SB 350 Barriers Study points out that the minority of low-income Californians who own homes have limited disposable income, which makes them "more risk-averse and less capable of participating in programs with high up-front payments or co-payments for energy efficiency."<sup>97</sup> PG&E is exploring tactics to improve accessibility to EMTs for low-income residential customers through the help of the ESA program and the California Alternate Rates for Energy (CARE) program.<sup>98</sup>

PG&E will also modify its current approach by engaging residential customers with bundled financial solutions to drive deep savings. For example, bundled solutions may be coupled with

data analytics to target customers with high HVAC usage because these customers often require multiple interventions with significant up-front costs, including replacement of old HVAC equipment<sup>99</sup> along with duct repair/replacement along with building shell enhancements.

Ultimately, this intervention strategy plays a critical role in spurring customers to take action. To recap, data analytics yields targeted customers, data access and awareness help customers identify energy saving opportunities, technical assistance and tools provide the means to realize savings, and financial solutions serve as added motivation to get energy efficiency measures off the ground and encourage deeper retrofits. In this way, PG&E's customer intervention strategies can be thought of sequentially and are mutually reinforcing. Moving forward, all four strategies must be implemented in sync to reach stranded potential, maximize savings in existing buildings, and double energy efficiency by 2030.

**Table 2.13** summarizes *Intervention Strategy 4: Loans, Rebates, and Incentives*.

<sup>95</sup> Ibid.

<sup>96</sup> "A Study of Barriers and Solutions to Energy Efficiency, Renewables, and Contracting Opportunities Among Low-Income Customers and Disadvantaged Communities," California Energy Commission, September 9, 2016, p. 17, [http://docketpublic.energy.ca.gov/PublicDocuments/16-OIR-02/TN214830\\_20161215T184655\\_SB\\_350\\_LowIncome\\_Barriers\\_Study\\_Part\\_A\\_Commission\\_Final\\_Report.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/16-OIR-02/TN214830_20161215T184655_SB_350_LowIncome_Barriers_Study_Part_A_Commission_Final_Report.pdf).

<sup>97</sup> "A Study of Barriers and Solutions to Energy Efficiency, Renewables, and Contracting Opportunities Among Low-Income Customers and Disadvantaged Communities," California Energy Commission, September 9, 2016, p. 17, [http://docketpublic.energy.ca.gov/PublicDocuments/16-OIR-02/TN214830\\_20161215T184655\\_SB\\_350\\_LowIncome\\_Barriers\\_Study\\_Part\\_A\\_Commission\\_Final\\_Report.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/16-OIR-02/TN214830_20161215T184655_SB_350_LowIncome_Barriers_Study_Part_A_Commission_Final_Report.pdf).

<sup>98</sup> For more information, see Advice Letter 3744-G-B/4886-E-B, "Second Supplemental: Request for Approval of PG&E's Assembly Bill 793 Implementation Plan," September 20, 2016.

<sup>99</sup> PG&E will collect proof of permit closure before paying rebates or incentives for all downstream central air conditioning or heat pumps and their related fans, in accordance with SB 1414. For more information, see "Senate Bill No. 1414," California Legislative Information, [https://leginfo.ca.gov/faces/billTextClient.xhtml?bill\\_id=201520160SB1414](https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB1414).

**Table 2.13**

Intervention Strategy 4: Loans, Rebates, and Incentives

GOALS: Save energy and reduce demand, Increase operational efficiency, and Increase number of multifamily participation and savings				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Loans, Rebates, and Incentives</b>	Projects that generate deep savings often have high up-front costs, long payback periods, and are not recognized as valuable by the real estate market. Lower income and multifamily customers often require direct financial support to overcome unique barriers	Continue to offer loans, rebates, and incentives to overcome up-front cost barriers	E	S
		Continue to offer prescriptive incentives that motivate multifamily property owners and property managers to take action	E	S
		Coordinate financing options with rebates and incentives to provide targeted value propositions for customers with high savings potential	M	S
		Transition from standard measure-by-measure incentive models to a comprehensive, targeted approach supported by financing and metered savings to provide “performance-driven value” <sup>a</sup>	N	M
		Incentivize EMTs to encourage customers to actively manage their energy usage <sup>b</sup>	N	S
		Implement a Single Point of Contact to coordinate offerings available to multifamily customers, including those available through the ESA program. See <i>Appendix I</i> for more information	N	S

**Partners:** Government agencies; financial lending institutions

<sup>a</sup> CEC, 2016. “California’s Existing Buildings Energy Efficiency Action Plan – 2016 Update,” p. 46.

<sup>b</sup> “California Existing Buildings Energy Efficiency Action Plan,” p. 67.

A process evaluation of 2014-2015 Energy Upgrade California offerings identifies “53% of near-participants with incomes under \$50,000 reported that the cost of equipment was a barrier to their participation... while only 28% of near-participants with incomes above \$250,000 reported the cost of equipment as a barrier.”<sup>100</sup> These findings support the fact that high upfront costs remain a significant barrier to managing energy efficiency offerings that both realize high savings potential and are accessible to all of PG&E’s customers. PG&E will manage incentive programs that promote greater accessibility to EMTs, HVAC, and other technologies that drive deep, persistent energy savings. Additionally, PG&E will look to bundled financial solutions such as loans and incentives to make energy efficiency a more attractive investment. PG&E will also continue to ensure that low and moderate income homeowners as well as multifamily property managers and tenants are directed to the appropriate programs, including ESA and MIDI.

### Intervention Strategy 5 – New Program Models to Cost-Effectively Deliver Comprehensive Energy Savings

According to the CEC’s Existing Buildings Energy Efficiency Action Plan, new program models based on performance-driven value are needed to increase the efficiency of existing buildings.<sup>101</sup> The ability of energy efficiency programs to address stranded potential, coupled with the prioritization of meter-based savings, compels a fresh look at the residential portfolio. These new dynamics also open the door for innovative third party approaches and emerging technologies. Within the portfolio administrator role, PG&E will design, test, and refine new program models that provide flexibility to third parties.

In the short-term, PG&E will continue to test its P4P model,<sup>102</sup> which enables third-party aggregators to develop, design, and implement energy savings strategies in exchange for payments based on savings achieved at a set rate per kWh and therm.<sup>103</sup> PG&E envisions a dynamic approach to program

planning in which tactics can be modified to prioritize locational savings, develop new measures or products (e.g., HEMS, new approaches to HVAC), and to aid workforce training, education, and market transformation objectives.

New program models using meter-based savings<sup>104</sup> will be facilitated by the development of the CalTRACK platform, which aims to develop “a standardized process for measuring residential energy efficiency savings.”<sup>105</sup> CalTRACK is an open source platform that enables third parties to conduct analysis using a standardized calculation method for consistent EM&V.<sup>106</sup> PG&E will continue to collaborate with the CEC, CPUC, other IOUs, and data analysis experts to drive the development, launch, and refinement of the CalTRACK platform.

In the mid-term, PG&E will explore transitioning multifamily offerings to the P4P model based on key learnings from the initial deployment of P4P as a HOPP. PG&E believes that successful P4P models can help transition a greater share of its portfolio to third parties while keeping administrative costs as low as possible. While the P4P model emerged in response to AB 802 and SB 350, its development also aligns with the CEESP’s goal to “develop partnerships for innovative financing programs, such as performance contracts”<sup>107</sup> and the California Existing Buildings Energy Efficiency Action Plan calls for “performance-based incentives.”<sup>108</sup> Ultimately, continued development of P4P and other innovative, scalable program models will play a key role in doubling energy efficiency by 2030. **Table 2.14** summarizes *Intervention Strategy 5: New Program Models to Cost-Effectively Deliver Comprehensive Energy Savings*.

<sup>100</sup> “Energy Upgrade California Home Upgrade Program Process Evaluation 2014-2015,” EMI Consulting, September 12, 2016, p. 8.

<sup>101</sup> “California’s Existing Buildings Energy Efficiency Action Plan,” pp. 74-75.

<sup>102</sup> Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, 2016. “Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings,” p.2.

<sup>103</sup> “Advice Letter 3698-G-A/4813-E-A,” p. 1.

<sup>104</sup> Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, 2016. “Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings,” p.14.

<sup>105</sup> “Advice Letter 3698-G-A/4813-E-A,” p. 4.

<sup>106</sup> “Advice Letter 3698-G-A/4813-E-A,” p. 4.

<sup>107</sup> “California Energy Efficiency Strategic Plan,” California Energy Commission, January 2011, p. 21.

<sup>108</sup> “California’s Existing Buildings Energy Efficiency Action Plan,” pp. 74-75.



**Table 2.14**

Intervention Strategy 5: New Program Models to Cost-Effectively Deliver Comprehensive Energy Savings

GOALS: Save energy and reduce demand, Increase operational efficiency, and Increase multifamily participation and savings				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
New program models to cost-effectively deliver comprehensive energy savings	New program models based on performance-driven value are needed to increase the efficiency of existing buildings	Test P4P program models that are proposed, developed, and implemented by third parties. Scale effective designs and seek innovative new approaches	E	S
		Develop the CalTRACK platform and use immediate feedback for real time program adjustments	N	S
		Investigate P4P designs and meter-based evaluation strategies for multifamily offerings	N	M

**Partners:** Third-party implementers; Contractors; Evaluators; Retail Partners

A process evaluation of PG&E’s 2010-2012 Whole House Retrofit offerings found that participants struggled to realize energy savings from investments in energy efficiency due to factors such as negative behavior changes and a lack of financial resources to implement all recommendations.<sup>109</sup> This finding reveals the need for new program designs that encourage continued engagement between customers and their contractors so that customers are aware of all opportunities to increase savings.<sup>110</sup>

To this end, the P4P model aims to create an on-going relationship between customers and their contractors by incentivizing third-party aggregators to bundle behavioral, retro-commissioning, and operational activities for persistent savings. Since third-party aggregators are paid based on metered savings, this type of new program design promotes innovative and flexible solutions that produce measurable results. New program models to reach stranded HVAC and building shell potential tie together several of the intervention strategies described thus far. Please see *Appendix F* for more detail.

<sup>109</sup> “2010-2012 PG&E Whole House Retrofit Program Phase II Process Evaluation Study—Methods and Findings,” SBW Consulting, Inc., December 31, 2013, pp. 27, 163.

<sup>110</sup> For more information, see PG&E Advice Letter 3698-G-A/4813-E-A, p. 10.

## Intervention Strategy 6 – Assistance for the Design and Building Communities

The 2015 Residential ZNE Market Characterization study finds the incremental cost of paying for a ZNE home compared to a code-built home ranges between 5-15%, or \$15,000 to \$50,000.<sup>111</sup> To achieve the CEESP’s goal of constructing all new residential buildings as ZNE by 2020,<sup>112</sup> PG&E will provide assistance and incentives for the design community with an emphasis on integrated design opportunities. Successful implementation of this intervention strategy will lead to a larger percentage of the design community and builders consistently building to ZNE specifications.

In the short-term, PG&E will continue to support its “Master Builder” initiative and California Advanced Homes Program (CAHP), which works with builders to adopt progressive energy efficiency measures that are part of future code updates. Current Master Builder and CAHP efforts include incentivizing high performance attics and walls, which are key components of the 2016 approved code. These efforts will be expanded in the short-term to incentivize measures to be included in the 2019 code update. PG&E’s continued use of the Master Builder initiative and CAHP aligns with the California New Residential ZNE Action Plan’s (ZNE Action Plan) goals of “creating a robust and well-trained industry that is able to implement and adapt to the technological innovations and integrated business strategies...to effectively meet the ZNE goals.”<sup>113</sup>

Along these lines, PG&E will also continue to provide technical assistance and energy monitoring for ZNE demonstration pilots to educate and empower builders with the ability to implement ZNE designs. A particular emphasis will be made to include low-rise multifamily dwellings, which are included along with single family homes in the 2020 ZNE goal. In addition, PG&E will test innovative financial solutions within future ZNE demonstrations to identify pathways for increasing the affordability of ZNE. This approach also supports the ZNE Action Plan’s goal of “financing, affordability & value,” which includes informing “the creation of various financing and incentive products that will support the market.”<sup>114</sup>

PG&E, through third party implementers, will work collaboratively with mortgage lenders, investors, and mortgage industry service providers to identify financing tools that can support broader adoption of ZNE measures. Possibilities arising from initial outreach include an initiative pairing ZNE homebuilders with lenders offering interest rate incentives and an initiative educating residential appraisers to better support valuations necessary to qualify ZNE homes for advantageous financing. As outreach continues, offerings will be refined.

Ultimately, continued support of code readiness and ZNE demonstration projects will provide key building performance data while improving the workforce’s capacity to design and build residential ZNE buildings. Beyond the CEESP’s ZNE goals, these progressive efforts serve as a testing ground for innovative energy efficiency practices that will contribute to doubling energy efficiency by 2030.

**Table 2.15** summarizes *Intervention Strategy 6: Assistance for the Design and Building Communities*.

<sup>111</sup> “Residential ZNE Market Characterization,” p. 13.

<sup>112</sup> “California Energy Efficiency Strategic Plan: January 2011 Update,” California Public Utilities Commission and California Energy Commission, January 2011, p. 9.

<sup>113</sup> “New Residential Zero Net Energy Action Plan 2015-2020: Executive Summary,” California Public Utilities Commission and California Energy Commission, p. 3.

<sup>114</sup> Ibid.

**Table 2.15**

Intervention Strategy 6: Assistance for the Design and Building Communities

**GOALS: Assist California in reaching the CEESP goal of ZNE for 100% of all new residential construction<sup>129</sup> by 2020 by engaging builders and other market actors, and supporting new C&S**

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Assistance for the Design and Building Communities</b>	The incremental cost for ZNE construction is estimated to be 5-15% greater than to-code homes <ul style="list-style-type: none"> <li>• Implementation of new code occurs early and often in the technology adoption curve, which makes pushing builders beyond code a challenge while leaving some builders behind</li> <li>• Cost effectiveness metrics used to assess code readiness activities do not take into account market effects and the state’s ability to pursue more stringent code iterations</li> </ul>	Continue the “Master Builder” initiative and CAHP, which helps builders with early adoption of measures that are a part of the next code cycle <sup>a</sup>	E	S
		Continue ZNE demonstrations to equip builders with the assistance and tools to meet 2020 ZNE goals	E	S
		Investigate new financial solutions for builders and buyers as part of future demonstrations	N	S

**Partners:** Builders; Statewide PMs; CEC

<sup>a</sup> For more information, see “PG&E’s California Advice Homes Program,” TRC Energy Services, <http://www.trcsolutions.com/projects/utilities/pg-e-california-advanced-homes-program>.

The 2015 Residential ZNE Market Characterization finds that despite promising activity among innovative ZNE adopters, there are indications that “...the market is not currently poised to achieve a ZNE homes 2020 aspirational goal, including a lack of consumer demand, a lack of qualified building professionals, early adopters’ misperceptions about the ZNE concept, [and] questions regarding the cost effectiveness of ZNE-type homes...”<sup>115</sup>

As a result of these barriers, PG&E is adopting a comprehensive approach that includes continuing to demonstrate new designs and approaches, pursuing code readiness projects, developing new financial solutions, and promoting workforce education and training opportunities for the design and building communities.

<sup>115</sup> “Residential ZNE Market Characterization,” TRC Energy Services, 2015 CALMAC ID PGE0351.01, p. 7.

## Intervention Strategy 7 – Upstream and Midstream Partnerships

The CEESP identifies the need to improve Title 20 compliance by “working directly with manufacturers and distributors to improve appliance and equipment compliance.”<sup>116</sup> The Environmental Protection Agency (EPA) also finds that upstream and midstream incentives “can affect larger markets than direct incentives targeted to individual customers, because upstream and midstream players are able to offer the desired products or service to all the customers they serve, not just those who learn about direct customer rebates.”<sup>117</sup> PG&E has long relied on close partnerships with manufacturers, distributors, retailers, and other market actors in the supply chain to deliver efficiency. These partnerships, taken to statewide administration will enable PG&E to increase the availability and stocking of high quality LED lighting, efficient HVAC systems, EMTs, and higher efficiency plug load devices. PG&E views upstream and midstream incentives as particularly impactful tools for the following scenarios:

1. Instances of replace-on-burnout when a customer must buy a replacement product and is dependent on in-store stocking.
2. Ensuring availability of above-code products that are cost competitive in early retirement situations. This benefits customers motivated by efficiency, improved technology, or return on investment.
3. Market transformation programs for devices that use relatively small amounts of energy individually, making downstream incentives logistically difficult.

With the passage of AB 802, stranded potential can now be targeted and savings measured at the meter for certain programs. With the interpretation that upstream and midstream programs influence replace-on-burnout<sup>118</sup> purchases, a code or industry standard practice baseline is appropriate. With the new baseline policy for downstream programs, reevaluation of upstream and midstream approaches for certain sectors is warranted.

In the short-term, PG&E will continue to partner with supply chain actors to increase awareness of offerings that reduce energy usage across technologies with high savings potential. For instance, recent research

attributes 15-30% of a typical household’s electricity usage to home appliances and consumer electronics (plug load” products).<sup>119, 120</sup> Combined, these plug loads are the fastest growing energy use category nationwide, a trend largely driven by the increasing number of plug load products per residence.<sup>121</sup>

However, due to the relatively small savings offered by each plug load device, it is difficult to keep administrative costs low and achieve market transformation through a downstream rebate program. This approach of targeting plug loads aligns with Strategy 1.6 (Plug-Load Efficiency) of the *Existing Buildings Energy Efficiency Action Plan*<sup>122</sup> and the CEESP’s goal to “develop comprehensive, innovative initiatives to reverse the growth of plug load energy consumption through technological and behavioral solutions.”<sup>123</sup>

As part of AB 793 implementation, upstream and midstream partnerships will also be tapped to increase the availability and ultimately reduce the cost of EMTs. In addition, these partnerships provide an opportunity for PG&E to improve customers’ experience with EMTs by working with product manufacturers and national standard setting organizations to increase demand for nationwide connectivity standards and protocols. PG&E will also conduct a “bottoms-up” review of its current partnerships to promote their continued success and cost-effectiveness.<sup>124</sup>

Ultimately, upstream and midstream partnerships will enable PG&E to ensure supply chain actors are creating, distributing, and stocking the most effective energy solutions for customers. **Table 2.16** summarizes *Intervention Strategy 7: Upstream and Midstream Partnerships*.

<sup>116</sup> “California Energy Efficiency Strategic Plan: January 2011 Update,” p. 66.

<sup>117</sup> “Customer Incentives for Energy Efficiency Through Program Offerings,” p. 6.

<sup>118</sup> D.16\_08\_019.

<sup>119</sup> Estimated U.S. Residential Electricity Consumption by End-use, 2011, Energy Information Administration (2011, Updated 2013).

<sup>120</sup> The 2013 California Energy Efficiency Potential and Goals Study: Final Draft Report, Navigant Consulting prepared for the CPUC (2013).

<sup>121</sup> Kwatra, Sameer, Jennifer Amann, and Harvey Sachs “Miscellaneous Energy Loads in Buildings,” American Council for an Energy-Efficiency Economy, June 2013, p. 1. [http://www.cees.ingersollrand.com/CEES\\_documents/2013.ACEEE.MiscEnergyLoadsInBuildings.pdf](http://www.cees.ingersollrand.com/CEES_documents/2013.ACEEE.MiscEnergyLoadsInBuildings.pdf).

<sup>122</sup> “California’s Existing Buildings Energy Efficiency Action Plan,” p. 54.

<sup>123</sup> “California Energy Efficiency Strategic Plan: January 2011 Update,” p. 21.

<sup>124</sup> For more information, see Fogel, Cathy “Overarching Comments Program Administrator Business Plans Focus on Market Transformation Strategies,” September 27, 2016, or D.16-08-019, p. 60.

**Table 2.16**

Intervention Strategy 7: Upstream and Midstream Partnerships

GOALS: Save energy and reduce demand, Increase operational efficiency, and Increase multifamily savings				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Promote upstream and midstream activities to curtail the growth of miscellaneous plug load and increase availability of high quality LED products.</b>	Downstream incentives may not always be sufficient to increase customer adoption of energy efficient products or equipment	Encourage manufacturers, distributors, and retailers to create, offer, and promote efficient products to reduce energy use	E	S
		Refine and continue existing upstream and midstream program models such as Retail Product Platform (RPP), Primary Lighting and the Residential Upstream HVAC program. Transition programs to statewide administration	E	S
		Perform a bottom-up review of upstream and midstream activities to rationalize and optimize them into the most cost-effective configurations <sup>a</sup>	N	S
		Drive demand for nationwide connectivity standard and protocols	N	S

**Partners:** Manufacturers; distributors; retailers; regional and national utilities; government agencies such as EPA and local governments; Western Regional Utility Network (WRUN); third party vendors; Northwest Energy Efficiency Alliance (NEEA)

<sup>a</sup> Fogel, Cathy September 27, 2016. "Overarching Comments Program Administrator Business Plans Focus on Market Transformation Strategies."

The 2012 Program & Technology Review of PG&E's Home Energy Efficiency Rebate and Business & Consumer Electronics offerings highlight the need for a holistic and flexible approach whose ultimate goal is market transformation.<sup>125</sup> This reinforces the importance of evaluating the market barriers for specific products and designing incentive approaches specifically to overcome those barriers.<sup>126</sup>

To these points, this intervention strategy includes evaluating PG&E's existing upstream and midstream activities to determine which approaches are best suited to achieve energy savings cost-effectively. As a result of these efforts, future upstream and midstream activities will be paired with products or equipment that stand to benefit the most from these partnerships.

Primary Lighting has been a longstanding upstream program focused on manufacturers and retail partnerships. The focus of that effort has shifted from driving energy savings through large volumes of CFLs to ensuring code readiness and high LED product quality. For more information on challenges and plans for residential lighting, see *Appendix G*.

<sup>125</sup> "Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER)/Business & Consumer Electronics (BCE), Research into Action and Energy Market Innovations, August 30, 2012, p. v, [http://www.calmac.org/publications/HEER\\_\\_BCE\\_083012\\_FINAL.pdf](http://www.calmac.org/publications/HEER__BCE_083012_FINAL.pdf).

<sup>126</sup> Ibid.



## STEP UP AND POWER DOWN RESIDENTIAL (SUPD-R)

SUPD-R is designed to drive increased awareness of PG&E's residential energy efficiency measures, change attitudes toward energy efficiency, and increase customer engagement and uptake in PG&E's programs.

Campaign activities include grassroots organizing, volunteerism, and leveraging local community partnerships to share experiences, resources, and support for taking energy efficient actions at home.

The campaign was launched in Redwood City, San Carlos, and Woodland in 2015 and research to assess results is underway.

Finally, PG&E currently supports a distributor-based upstream HVAC program. We plan to continue this program in the short term and to transition it to statewide implementation. However, if evaluation indicates more savings at lower cost can be achieved through targeted early retirement through a downstream channel, PG&E will look to re-optimize associated budget allocations. The downstream channel also offers the opportunity to encourage right-sizing and high performance installation of above code equipment and therefore can address multiple market barriers to functionally efficient HVAC usage. For more details on PG&E's residential HVAC strategy, see *Appendix F*.

## Intervention Strategy 8 – Outreach and Education

A 2010 report by the Lawrence Berkeley National Laboratory (LBNL) finds people tend to be biased towards maintaining the status quo and discount the future benefits of taking action.<sup>127</sup> To overcome this barrier, PG&E will explore effective outreach and education approaches so that the engagement of residential communities in energy efficiency broadens outside of traditional programs.

In the short-term, PG&E will continue to engage customers through community-based social marketing campaigns, such as Step Up and Power Down. A 2012 study by the American Council for an Energy-Efficient Economy (ACEEE) finds these campaigns are “an accessible way to apply a behavioral perspective in sustainability and energy efficiency programs.”<sup>128</sup> In addition, it concludes, “Strategies that encourage people to make public and durable commitments to behavioral change, or affect a social norm in a community, can have ongoing impacts as entire communities begin to view themselves differently, potentially leading them to complete additional energy-efficient actions.”<sup>129</sup> Ultimately, this market intervention strategy will enable PG&E to engage an entire community, inspiring those that do not typically participate in energy efficiency programs to realize the value of taking action. **Table 2.17** summarizes *Intervention Strategy 8: Outreach and Education*.

<sup>127</sup> “Driving Demand for Home Energy Improvements,” p. 29.

<sup>128</sup> Vigen, Michelle and Susan Mazur-Stommen “Reaching the ‘High-Hanging Fruit’ through Behavior Change: How Community-Based Social Marketing Puts Energy Savings within Reach,” American Council for an Energy-Efficient Economy, October 2012, p. 10.

<sup>129</sup> Ibid.

**Table 2.17**

Intervention Strategy 8: Outreach and Education

GOALS: Increase operational efficiency, and Increase multifamily participation and savings				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Outreach and education</b>	People are biased towards maintaining the status quo and discount the future benefits of taking action	Engage customers through community-based social marketing such as Step Up and Power Down that operate based on the spirit of competition and normative social behavior	E	S

**Partners:** Regional Communities; third party vendors

Research conducted in 2006 on the California Local Energy Efficiency Program, highlights the impact that a champion or change agent can have on influencing the behavior of a larger group. In particular, the study reports “...a few people in a group will typically adopt innovative ideas and behaviors first, and spread them throughout the group.”<sup>130</sup> Encouraging customers with outreach and education campaigns that use normative social behavior to drive behavioral change aligns with PG&E’s continued use of innovative campaign models such as Step Up and Power Down.

Increasing market awareness of energy efficiency will help broaden the reach of residential energy efficiency opportunities beyond those who have already participated in a PG&E offering. This heightened awareness contributes to greater adoption of behaviors that are needed to doubling energy efficiency by 2030.

**Intervention Strategy 9 – Midstream Training**

As the energy efficiency portfolio continues to shift from widget-based incentives to deeper retrofits and P4P models, having a knowledgeable workforce that is prepared to succeed in that demanding environment and deliver for the customers will be even more essential. Contractors and technicians must have the skillset to promote the best options for the customer and the program design must elicit that approach.

Further, studies suggest most residential sale transactions inadequately value efficiency, yet energy-efficient homes sell for 3%-20% more than comparable non-certified homes. In addition, studies find most homebuyers rate energy costs and efficiency as somewhat to very important when purchasing a home.<sup>131</sup> As a result, untapped opportunity exists to “ignite the market for efficient homes and increase demand for residential energy efficiency.”<sup>132</sup> **Table 2.18** summarizes *Intervention Strategy 9: Midstream Training*.

<sup>130</sup> “Evaluation, Measurement, and Verification of the California Local Energy Efficiency Program,” Ridge & Associated, Vanward Consulting, and Brown, Vence & Associates, Inc., October 16, 2006, pp. 3-10, [http://www.calmac.org/publications/CALEEP\\_Final\\_Report.pdf](http://www.calmac.org/publications/CALEEP_Final_Report.pdf).

<sup>131</sup> US DOE, 2015. “Capturing Energy Efficiency in Residential Real Estate Transactions,” p.1.

<sup>132</sup> Ibid.

**Table 2.18**

Intervention Strategy 9: Midstream Training

GOALS: Assist California in reaching the CEESP goal of ZNE for 100% of all new residential construction by 2020 by engaging builders and other market actors, and supporting new C&S.				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
Midstream Training	Workforce training must align with overcoming barriers to achieve state policy goals	Collaborate with industry partners to increase awareness of and create market demand for energy efficiency during real estate transactions <sup>a</sup>	E	S
		Incorporate sales training and awareness of financing opportunities into contractor and technician training programs	M	S

**Partners:** Western Regional Utility Network (WRUN); EPA; WHPA; local governments; third party vendors; real estate organizations; builders; trade professionals; etc.

<sup>a</sup> CEC, 2016. "California's Existing Buildings Energy Efficiency Action Plan – 2016 Update," p. 55.

A recent study by Energy Market Innovations Consulting on the HVAC market finds that technicians rate utility training, apprenticeship, and in-field training as more effective than online or classroom training programs.<sup>133</sup> In the last decade, PG&E has worked with industry experts to develop and enhance training programs and has required their completion as a prerequisite for participation in its HVAC and Home Upgrade offerings. This training may need to be expanded depending on the needs of contractors and technicians who deliver services through PG&E's comprehensive HVAC offerings.

In addition, when major building shell renovations or new HVAC systems are needed, contractors and technicians face the challenge of assessing the need for that work and upselling those deeper retrofits to customers who are often most concerned with up-front cost. In fact, the large majority of HVAC technicians working in the residential sector report being responsible for selling maintenance

contracts and new HVAC equipment to customers.<sup>134</sup> Further, only about half of technicians report having received sales training from their company. Yet three quarters of technicians responded that additional sales training would be helpful.<sup>135</sup> Because these technicians and contractors ultimately have the most personal and direct contact with the customer, PG&E views sales training in conjunction with technical training as an opportunity to encourage deep retrofits going forward.

The "Market Research on Builder's Selling Practices and Strategies for Energy Efficiency Homes" study found increasing home buyer interest in energy efficiency, and that energy efficiency will continue to be a key differential.<sup>136</sup> As a result, the study recommends an increased focus on training for builder and real estate communities so that they can speak confidently on the energy efficient building features.<sup>137</sup> PG&E plans continued support for

<sup>133</sup> "California HVAC Contractor & Technician Behavior Study, Phase II" Energy Market Innovations Consulting, (2015), Pg. 41; For residential technicians who received the following trainings, the fraction who rated the training as "very effective" or "effective" is given in parentheses. On the Job Training (99%), Union Apprenticeship Training (100%), Utility Training (85%) Online HVAC Course Training (69%), Community College Training (64%).

<sup>134</sup> California HVAC Contractor & Technician Behavior Study, Phase II, Energy Market Innovations Consulting, (2015), pp. 66 - 71; of technicians operating in the residential HVAC sector, 93% report being responsible for selling new HVAC equipment directly.

<sup>135</sup> Ibid.

<sup>136</sup> Navigant, 2013. "Market Research on Builder's Selling Practices and Strategies for Energy Efficiency Homes." p. 24.

<sup>137</sup> Ibid., p 13.



training<sup>138</sup> for key stakeholders that can give them the tools to motivate the value of energy efficiency in residential real estate transactions, such as real estate brokers and agents, appraisers, home inspectors, lenders, and contractors.<sup>139</sup>

## G. Leveraging Cross-Cutting Resources

PG&E's cross-cutting sectors will play a pivotal role in advancing energy efficiency in the residential sector. Here, PG&E provides a brief review of how cross-cutting initiatives fit into its residential sector strategy.

**Finance:** Finance offerings including the new finance pilots being implemented in conjunction with the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) will play a critical role in the residential energy efficiency portfolio. *Intervention Strategy 4: Loans, Rebates, and Incentives* describes how financing in conjunction with loans and rebates will enable residential energy efficiency measures. PG&E will continue to offer financing options for multifamily such as On-Bill Financing (OBF) and OBF Alternative Pathway, and facilitate On-Bill Repayment (OBR). PG&E believes that the residential on-bill pilot will provide a unique opportunity to support smart devices that enable energy efficiency. The availability of flexible financing options will play a key role in ensuring all customers can access and use residential energy efficiency offerings, regardless of their income levels.

PG&E is also exploring the opportunities to incorporate energy efficiency into the broader financial market. This approach aims to mitigate the fact that “energy efficiency is not recognized in property listing, appraisals, or valuation processes.”<sup>140</sup>

**Emerging Technologies (ET):** *ET primarily supports Intervention Strategy 3: Technical Assistance and Tools to Facilitate Customer Awareness of their Energy Use* because it plays a leading role in testing and recommending EMTs that will be provided to residential customers to meet AB 793's goals. ET not only tests whether a given EMT promotes smarter energy management, but also identifies which technologies are best suited for integration with other demand side management offerings, such as demand response.

**Workforce Education & Training (WE&T):** PG&E will continue to leverage WE&T resources to improve the skills and knowledge-base of the design and building communities. In this way, WE&T will play a critical role in supporting *Intervention Strategy 7: Assistance for the Design and Building Communities* because it will provide education and training opportunities for these stakeholders to implement ZNE measures. PG&E WE&T currently offers more than 100 courses relevant to the residential sector, ranging from training for Title 24 compliance to ZNE retrofits.

In addition, WE&T will support *Intervention Strategy 9: Midstream Training*. WE&T will provide training and support for contractors to right-size HVAC installations and complete proper permits as required by the recent approval of SB 1414. WE&T will also use existing partnerships with organizations such as the Sheet Metal and Air-Conditioning Contractors National Association (SMACNA) and the California Building Industry Association (CBIA) to develop the appropriate training programs and promote their availability throughout their memberships. WE&T will also support training real estate professionals on the value of energy efficiency in the home buying and selling process.

**Marketing, Education, and Outreach (ME&O):** ME&O will play a central role in *Intervention Strategies 1-4* due to the importance of engaging residential customers at the appropriate time, through the proper communication channel, and with the most effective messaging. For instance, effective ME&O will be essential to encourage participation among customers targeted through data analytics.

In addition, ME&O will be used to lead the design and implementation of engaging outreach and education as part of community-based social marketing campaigns such as Step Up and Power Down (See *Intervention Strategy 8: Outreach and Education*).

<sup>138</sup> CEC, 2016. “California’s Existing Buildings Energy Efficiency Action Plan – 2016 Update,” p.55.

<sup>139</sup> US DOE, 2015. “Capturing Energy Efficiency in Residential Real Estate Transactions,” p.10.

<sup>140</sup> “Existing Buildings Energy Efficiency Action Plan,” p. 13.

PG&E will collaborate with the IOUs, the CPUC, and other state actors (e.g., California Energy Commission and the State Treasurer's Office) to ensure that we are aligned in pursuing our common energy efficiency goals. PG&E will engage through our role as a stakeholder in the statewide marketing, education, and outreach (SW ME&O) program.

SW ME&O seeks to empower Californians to take actions that will lead to lower bills, higher energy efficiency, and the adoption of demand-side solutions, including customer-owned renewable energy technologies. As an active participant in the creation of SW ME&O's Five-year Marketing, Education, and Outreach Strategic Roadmap and Annual Joint Consumer Action Plan in 2017, PG&E will work with other stakeholders to determine the right blend of state and local efforts to ensure that customers are aware of, and encouraged to participate in, California's energy management and efficiency programs and opportunities.

**Codes and Standards (C&S):** C&S will coordinate closely with PG&E's residential program as part of *Intervention Strategy 7: Assistance for the Design and Building Communities* to support the transition to ZNE for all new residential construction by 2020. Specifically, C&S will continue to collect primary data on equipment performance both in situ and in laboratory conditions to determine how equipment impacts overall building performance uniquely in single family and multifamily communities as well as on the grid as a whole. This detailed information will serve as a key input in the design of PG&E's broader offerings of technical assistance, tools, and financial solutions (See *Intervention Strategy 3: Technical Assistance and Tools* and *Intervention Strategy 4: Loans, Rebates, and Incentives*) that contribute to improving the efficiency of existing buildings and doubling efficiency by 2030.

Within section *F. PG&E's Approach to Achieving Goals*, PG&E describes new and innovative strategies and tactics, some of which will lead to pilot efforts at the program level. PG&E will describe any unique and innovative aspects of each program, as well as any pilots contemplated or underway, within its program-level implementation plans.

Additionally, PG&E will consider the appropriate workforce standard requirements, such as any required certifications, minimum performance standards, or pre-qualification process for specific programs in support of its energy efficiency portfolio. As applicable, PG&E will detail workforce standard requirements in each Implementation Plan (IPs).

## H. Integrated Demand Side Management (DSM)

The CPUC has recently issued a discussion draft of its "California's Distributed Energy Resources Action Plan: Aligning Vision and Action." Please also review our portfolio-wide discussion of PG&E's work to support the action plan in our Portfolio chapter.

Energy efficiency is most effective when coordinated with other efforts to influence demand side energy usage. Coordination with locational targeting, distributed energy resources, and rates are discussed more fully below.

### Locational Targeting and Targeted Demand Side Management (TDSM)

Targeted demand side management (TDSM) integrates energy efficiency, distributed generation, storage and demand response with new business applications and distribution planning to support cost effective distribution and transmission system reliability.<sup>141</sup> PG&E will expand this locational effort by using the existing energy efficiency offerings as well as supporting the solicitation framework being discussed within the DRP and IDER proceedings. TDSM leverages the residential portfolio's segments and identifies the dominant segment within the target location (constrained substation).<sup>142</sup>

<sup>141</sup> Russell, Baatz, Cluett, et al. "Recognizing the Value of Energy Efficiency's Multiple Benefits," American Council for an Energy-Efficient Economy, December 2015, pp. 28-29.

<sup>142</sup> Zawadzki, Lin, Dahlquist, Bao, et al. "Personalized energy efficiency program targeting with association rule mining," Pacific Gas and Electric Company—2016 ACEEE Summer Study on Energy Efficiency in Buildings, pp. 8-9.

The recognition that energy efficiency is a valuable grid resource and partners effectively with demand response programs led PG&E to initiate TDSM efforts. Within TDSM, energy efficiency and demand response tools partner to defer investments in transmission and distribution capacity, which in turn frees capital to fund other investments to ensure system-wide safety and reliability, and to keep costs low for customers. To date, the residential energy efficiency programs have contributed to meeting load needs in more than ten regions across the service territory. PG&E met our original energy efficiency goals for demand reduction within three of the four initial targeted substations. With a total goal of 7.8 MW in savings, PG&E achieved 8.9 MW total paid savings. The final substation, Lammers/Banta, met goal in early 2016. In 2016, six additional substations are targeted for approximately 8.2MW reduction by the end of 2017.<sup>143</sup>

## Residential and Distributed Energy Resources (DER)

PG&E's energy efficiency programs coordinate with the following programs:

- Demand Response (DR) programs can take advantage of new controls to better integrate residential customers into DR programs in order to build a more robust response to potential grid events and leveraging control over localized residential activities. Understanding the residential customer mix is important in offering the right DR program for an individual's needs.
  - Distributed Generation (DG) participation has been on the rise in the residential segment, specifically as it relates to solar. PG&E will continue to support the interconnection of solar systems in the residential market and as solar adoption continues.
  - PG&E is preparing for future growth in storage. The DER Action Plan provides a vision that supports appropriate payments to DERs including storage for services provided to the wholesale market and distribution grid.<sup>144</sup> PG&E is engaged in setting the wholesale market rules and interconnection tariffs to support these activities while minimizing cross-subsidies. PG&E anticipates that the residential sector will be active in this emerging technology area.
- The growth of electric vehicle adoption presents another opportunity to engage the customer in a discussion on their energy use. Trade professionals, such as electricians, may be installing and upgrading equipment at customer sites in order to enable a customer to charge an EV at home. Implementers may choose to engage these trade professionals, and provide clear EE products that the electrician can "upsell" to the customers.
  - PG&E customers who may be environmentally focused but are not able to install rooftop solar because they rent or live in an apartment building now have a new way to go solar through the company's Solar Choice program. With the program launched earlier this year, customers can now go solar by purchasing 50 or 100 percent of their electricity from solar-generated energy. PG&E is partnering with solar contractors to build new solar sites across Northern and Central California to provide solar energy for the program. Additionally, these new solar farms will provide green jobs to the local area.

## Residential Time-of-Use (TOU) Rate Changes

PG&E's approach for default Time-of-Use (TOU) is to design an optimal customer experience driving awareness and understanding of rate options, default TOU rate plans, and how to be successful on them, including ways to conserve energy or shift usage away from the peak periods. Today, the predominant rate plan for residential customers has multiple pricing levels (tiers) where the price of energy increases as more energy is used. Moving forward, the number of pricing levels will be reduced, making energy usage and costs easier to understand and manage.

PG&E has recently introduced two new voluntary TOU rate plans with pricing based on the time of day when energy is consumed. The ETOU-A rate plan has higher prices between 3 p.m.–8 p.m. on weekdays and includes a baseline credit for energy used within the baseline allowance. The ETOU-B rate plan has higher prices between 4 p.m.–9 p.m. on weekdays and does not include a baseline credit.

<sup>143</sup> PG&E energy efficiency Annual Report, p. 7.

<sup>144</sup> DER Action Plan, p. 6.

Starting in 2019, all eligible<sup>145</sup> residential customers are expected to be defaulted to a TOU rate plan, but they can opt-out and remain on the two-tiered rate plan if they prefer.

TOU rate plan prices are based on the cost to supply electricity. TOU customers will pay lower prices for electricity used during periods when the cost to supply energy is low, such as late night, early morning, and mid-day. TOU rate plan options can allow customers greater control over managing their costs, by encouraging them to focus on when and how they use energy. Customers can be further encouraged to lower usage through participation in energy efficiency programs as a way for customers to lower their bills by reducing peak or total energy use.

### **How BPs will help reduce load during TOU periods**

Customers can take a free, five-minute online Home Energy Checkup to see personalized information on programs available to help manage energy use and lower their bills.<sup>146</sup> Data analytics and the enabling of meter-based savings present an opportunity for PG&E to target bundled financial solutions for both customers with high savings potential and low-income communities. PG&E plans to develop financial solutions to promote greater adoption of EMT. All of these strategies and tactics have the potential to help reduce load and diminish barriers to load reduction during high TOU rate periods.

### **How BP will diminish barriers to load reduction during TOU periods**

In the short-term, PG&E intends to use ME&O to drive greater customer engagement with data platforms. In the mid-term, PG&E intends to promote data platforms to third parties, who play a critical role in delivering energy savings through implementation of deep retrofits and the design of new tools.

PG&E plans for summer and winter residential rate campaigns to feature content with energy efficiency tips and programs across PG&E's IDSM portfolio to help customers save money and energy.

### **How strategies will provide info to customers and/or provide a tool to show how a program may impact energy usage during different TOU periods?**

Customers can make smarter energy choices and manage their energy costs through PG&E-developed data platforms such as Share My Data (see Intervention Strategy 2: Data Access to Facilitate Customer Understanding of Energy Efficiency) and PG&E's online account. These products reduce the barriers to customer load reduction during TOU periods by increasing access to energy data for residential customers and authorized third parties. Bill alerts allow customers to set notifications for when their bill is forecasted to reach a designated dollar amount through the customers preferred notification channel, such as text, email or phone.

### **How strategies will analyze whether a customer may experience greater savings by switching to a different, opt-in TOU rate**

PG&E is helping customers understand whether they may experience greater savings by switching to a different, opt-in TOU rate plan. Once logged into their online account most customers can obtain an on-line rate comparison where PG&E will analyze their past 12 months of usage and recommend the best rate plan based on the estimated annual cost.<sup>147,148</sup> Within this platform, customers can also learn about other rate program opportunities, including SmartRate and SolarChoice.

<sup>145</sup> D. 16-09-016. Decision on the Requirements of the California Pub. Util. Code 745 for Default TOU Rates for Residential Customers. September 15, 2016. Section 745(c)(1) identifies specific customer groups, such as Medical Baseline customers and customers who cannot be disconnected without an in person visit must be excluded from default TOU, but also allows the CPUC, in its discretion, to designate other customers who shall not be subject to default TOU without their affirmative consent. The findings the CPUC is required to make under Section 745(c)(2), to "ensure that any time-of-use rate schedule does not cause unreasonable hardship for senior citizens or economically vulnerable customers in hot climate zones" may cause the CPUC to consider either making additional segments of customers ineligible for default TOU, changing the structure of the rate to remove any unreasonable hardship and/or changing the communications to affected customers that helps avoid impacts that might be deemed to constitute "unreasonable hardship."

<sup>146</sup> [www.pge.com/homecheckup](http://www.pge.com/homecheckup).

<sup>147</sup> Not all customers are eligible (example, non-SmartMeter™, CCA, Customer Generated Solar, etc.)

<sup>148</sup> [www.pge.com/myrate](http://www.pge.com/myrate).

## ME&O and Rate Reform

PG&E's ME&O plan<sup>149</sup> aligns with the Commission's intent for rate reform, which includes: making rates more understandable to customers and more cost-based; and implementing default TOU rates in a meaningful way that empowers residential electricity customers and encourages them to conserve energy and shift their usage to times of day that support a cleaner more reliable grid.

The overarching marketing strategy for PG&E's ME&O efforts will evolve in three phases through the 2017 to 2019 period. In Phase 1 (2017), the focus will be to lay the foundation for engagement with customers and deploy a test and learn approach with multiple outreach tactics designed to gain insights on the most effective ways to engage with customers. In Phase 2 (2018), PG&E will optimize the outreach based on lessons learned from 2017 and scale to drive deeper engagement with rate options, tools, tips and programs to help customers further manage their energy usage and prepare for default to TOU rates in 2019. Finally, in Phase 3, during 2019, PG&E will continue to drive customers' engagement with energy management, and begin targeted communications to prepare customers for default with messages that are tailored to their level of likely bill impact.

Residential rate reform ME&O efforts will be coordinated and integrated with energy efficiency programs, tools and tips for saving energy as indicated in PG&E's Residential Rate Reform ME&O Plan filed on November 1, 2016.<sup>150</sup>

## I. PG&E and State Policy Goals

**Table 2.19** provides a summary of how PG&E's approach with the Residential Sector will address key state policies.

<sup>149</sup> PG&E's Proposed Residential Rate Reform ME&O plan was filed with the CPUC on November 1, 2016 and is pending approval as of the filing of this business plan.

<sup>150</sup> [http://www.pge.com/notes/rates/tariffs/tm2/pdf/ELEC\\_4949-E.pdf](http://www.pge.com/notes/rates/tariffs/tm2/pdf/ELEC_4949-E.pdf)

**Table 2.19**

## Summary of Relevant Energy Efficiency Policies, Guidance, and PG&amp;E Support

Policy Drivers	Guidance Given	PG&E's Support for Policy
<b>SB 350</b>	<ul style="list-style-type: none"> <li>• Doubling of energy efficiency savings by 2030 where cost-effective and feasible</li> <li>• Address barriers for low-income customers to energy efficiency and weatherization investments, including those in disadvantaged communities, as well as recommendations on how to increase access to energy efficiency and weatherization investments to low-income customers</li> </ul>	<ul style="list-style-type: none"> <li>• Leverage data analytics and customer segmentation to target customers based on high savings potential and market transformation needs</li> <li>• Continue to partner with manufacturers and distributors to make purchasing energy efficiency equipment easy and affordable</li> <li>• Drive qualifying customers to Energy Savings Assistance and CARE programs, continue to serve customers with no-cost Moderate Income Direct Install services, and coordinate with public agencies on targeting opportunities for public housing</li> <li>• Develop community-level initiatives such as Step Up and Power Down to increase awareness of energy efficiency and reduce energy waste</li> </ul>
<b>SB 32</b>	<ul style="list-style-type: none"> <li>• Reduce statewide greenhouse gas emissions to 40% below the 1990 level by 2030</li> </ul>	<ul style="list-style-type: none"> <li>• PG&amp;E will leverage its support for SB 350 to meet the goals of SB 32</li> </ul>
<b>AB 802</b>	<ul style="list-style-type: none"> <li>• Disclosure of aggregated whole building energy data</li> <li>• Benchmarking</li> <li>• Provide financial incentives and assistance for High Opportunity Projects and Programs</li> </ul>	<ul style="list-style-type: none"> <li>• Test pay for performance (P4P) program models that are proposed, developed and implemented by third parties. Scale up the most effective designs and continually seek innovative new approaches</li> </ul>
<b>AB 793</b>	<ul style="list-style-type: none"> <li>• Provide education on energy management technologies</li> <li>• Provide incentives for energy management technology</li> </ul>	<ul style="list-style-type: none"> <li>• PG&amp;E will continue to promote and enhance online energy management tools to provide customers with insights on their energy usage, rate education and comparison and ways to save. PG&amp;E will continue to promote third party vendors access to Stream my Data/Green Button Connect as a way to encourage innovation in customer tools and offerings. Additionally, PG&amp;E will launch a smart thermostat incentive to help customers better manage their energy use</li> </ul>
<b>AB 758</b>	<ul style="list-style-type: none"> <li>• Access to data, partnering to increase awareness</li> <li>• Increase plug load efficiency</li> <li>• Energy efficiency procurement model</li> <li>• Recognized value of energy efficiency upgrades</li> </ul>	<ul style="list-style-type: none"> <li>• PG&amp;E helped create and continues to refine an innovative Retail Product Platform (RPP) strategic market transformation effort designed to create long-lasting, sustainable changes in the functioning of product-specific markets by reducing market barriers to the adoption of energy efficient plug-load appliances</li> <li>• Training real estate professionals on the value of energy efficiency</li> </ul>
<b>SB 1414</b>	<ul style="list-style-type: none"> <li>• Proof of permit closure for all downstream central air conditioning or heat pumps</li> </ul>	<ul style="list-style-type: none"> <li>• Collect proof of permit closure before paying rebates or incentives for all downstream central air conditioning or heat pumps and their related fans</li> </ul>

**Table 2.19** *(continued)*

Summary of Relevant Energy Efficiency Policies, Guidance, and PG&E Support

Policy Drivers	Guidance Given	PG&E's Support for Policy
<b>CEESP</b>	<ul style="list-style-type: none"> <li>• New construction will reach “zero net energy” (ZNE) performance (including clean, onsite distributed generation) for all new single and multi-family homes by 2020</li> <li>• Home buyers, owners and renovators will implement a whole house approach to energy consumption that will guide their purchase and use of existing and new homes, home equipment (e.g., HVAC systems), household appliances, lighting, and “plug load” amenities</li> <li>• Plug loads will be managed by developing consumer electronics and appliances that use less energy and provide tools to enable customers to understand and manage their energy demand</li> <li>• The residential lighting industry will undergo substantial transformation through the deployment of high-efficiency and high-performance lighting technologies, supported by state and national codes and standards</li> </ul>	<ul style="list-style-type: none"> <li>• Continue to build on the Residential New Construction Core Program (CAHP) to drive builders to the ZNE goal for single family new construction through the next Code cycle</li> <li>• PG&amp;E has worked with partners such as the US EPA and NEEA on the innovative Residential Product Platform (RPP) strategic market transformation effort designed to create long-lasting, sustainable changes in the functioning of product-specific markets by reducing market barriers to the adoption of energy efficient plug-load appliances</li> </ul>
<b>AB 1109</b>	<ul style="list-style-type: none"> <li>• California must reduce its lighting energy use between 2007 and 2018 by 50% for residential interior lighting and by 25% for commercial interior and outdoor lighting</li> </ul>	<ul style="list-style-type: none"> <li>• PG&amp;E has strongly supported the intent of AB 1109’s lighting energy use reductions through codes and standards programs and through upstream and downstream energy efficiency incentive programs. PG&amp;E will continue to support AB 1109’s objectives with guidance from the Energy Commission and CPUC. As envisioned by the AB 1109, this effort will continue beyond 2018</li> </ul>

## J. PG&E's Partners and Commitment to Coordination

PG&E's success in the residential sector will rely on a broad range of program administrators, regulators, government agencies, universities and other educational entities, market actors, and stakeholders.

As discussed in section F. *PG&E's Approach to Achieving Goals*, PG&E's emphasis on strategic partnerships is a key component to its vision for the residential sector.

### Program Administrators

PG&E will collaborate with program administrators and publicly-owned utilities (POUs) to share best practices and lessons learned, ensure consistent messaging and program delivery, minimize gaps and program overlap, and coordinate implementation of statewide offerings, and local offerings that cut across multiple service territories. For example, customers in overlapping counties should have access to the same program offerings. In addition, in the new statewide administration model, PG&E will work closely with statewide administrators leading the residential sector statewide programs such as upstream Lighting and HVAC. Please refer to PG&E Statewide Administration Business Plan chapter for more information on statewide programs.

### BayREN and MCE

PG&E works with both BayREN and MCE to deliver energy efficiency programs, creating a unified experience for the customer and maximizing energy savings outcomes. While PG&E provides funding to both BayREN and MCE, PG&E does not have oversight over BayREN or MCE activities or programs. PG&E will work with MCE and BayREN to leverage their energy advisor programs, expertise with local energy efficiency, water efficiency, and financing programs to provide comprehensive solutions to customers. PG&E will continue to actively align strategies and collaborate with MCE and BayREN to achieve state policy goals and reduce energy use in load constrained areas.

### California Public Utilities Commission (CPUC)

PG&E will work with the Commission staff to assess Business Plan performance, and identify opportunities for continuous improvement. Additionally, PG&E will coordinate with Commission staff to identify and perform market research studies and other studies to ensure the business plans metrics are effectively evaluated. As PG&E modifies existing residential programs, and/or develops new programs, PG&E will work in close concert with Commission staff to ensure that these programs are "EM&V-ready," and meet CEESP, and other state policy directives.

### Government Sponsored Entities (Fannie/Freddie Mac)

PG&E will collaborate with mortgage industry leaders to explore new approaches to financing by conducting research to assess impact and trend analysis of financing elements with respect to energy efficiency home improvements affecting loan performance, property value and loan prepay speed.

### Government Agencies

PG&E will maintain and/or develop new partnerships with government agencies to advance collective interests in the agricultural sector. PG&E will work closely with these agencies to develop, refine, and implement, where applicable, key intervention strategies and programmatic activities. Agencies include:

- California Energy Commission (CEC)
- Local Building Code Agencies - PG&E will work with building departments throughout our service territory to streamline permitting process and encourage enforcement of permitting laws.
- EPA – Continued work via the Retail Products Platform

### Third-Party Implementers and Market Actors

In the rolling portfolio structure, IOUs turn to third party implementers to propose, design, and deliver the bulk of energy efficiency programs. D.16-08-019 sets a minimum target of 60% of the utility's total portfolio budget to be devoted to third party programs by the end of 2020.<sup>151</sup> As such, by 2020, PG&E will have transitioned at least 60% of its program design and delivery to third parties. This transitions allows PG&E to engage third parties to offer a more diverse and innovative portfolio of programs to help customers use energy more efficiently. PG&E will evolve its

<sup>151</sup> D.16-08-019, p.74.



energy efficiency portfolio to maximize energy savings in support of California's goal to double energy efficiency by 2030, and achieve cost-effectiveness by offering programs that drive value and innovation for customers, cultivate relationships with new partners, and use its knowledge of customers to more efficiently and effectively deliver programs.

### Stakeholders

PG&E will continue to engage with experts through participation in the California Energy Efficiency Coordinating Committee (CAEECC), and the residential subcommittee. PG&E will solicit stakeholder feedback input through the duration of the Business Plan, and in the development, refinement, and modification of intervention strategies and programmatic activities for Implementation Plans.

### Disadvantaged Communities

PG&E has offered free energy efficiency programs to income qualified customers in its 48 counties since 1983. The Energy Savings Assistance Program's (ESA) objective is to help income qualified customers reduce their energy consumption and costs while increasing their comfort, health and safety. The ESA Program is ratepayer funded and is available to PG&E customers living in all housing types (single family, multifamily, and mobile homes), regardless of whether they are homeowners or renters. ESA uses a prescriptive, direct install approach to provide free home weatherization, energy efficient appliances and energy education services to income-qualified PG&E customers throughout the service area. To qualify for the ESA Program, the total customer household income must be equal to or less than 200 percent of the Federal Poverty Guidelines, with income adjustments for family size. The 2015 ESA Program treated 100,573 homes with a mix of measures and services, including energy education, energy efficient appliances, and home weatherization.<sup>152</sup>

The recent Commission Decision on the ESA program provides 4-year funding through 2020 with a mid-cycle correction process. One of the new changes establishes a multifamily working group to evaluate the effect of the 65% ESA eligible tenant multifamily common area measure rule on ESA common area measure treatment, and to make recommendations for adjustment if this rule contributes to low participation levels and/or significant unspent fund

balances. Additionally, the decision authorizes free funding of multifamily common area measures (not currently included through ESA) using up to \$80M Statewide of unspent funds, split proportionally among IOUs for eligible government/non-profit/or deed restricted low-income multifamily housing (PG&E: \$36MM).<sup>153</sup> PG&E will work over the Business plan period to ensure seamless integration of the ESA and energy efficiency programs.

## K. Statewide Administration and Transition Timeline

D.16-08-019 modifies the program administration structure for all upstream and midstream programs, market transformation efforts, and select downstream programs, such that these programs become "statewide." D.16-08-019 defines statewide programs as being delivered uniformly throughout the IOU service territories and overseen by a single lead program administrator.<sup>154</sup> Statewide efforts are required to comprise at least 25% of each IOU's portfolio budget.<sup>155</sup>

Please refer to the Statewide Administration Chapter for program administrators' proposals for statewide programs and/or subprograms.

## L. Solicitation Strategies and Transition Timeline

D. 16-08-019 sets a minimum target of 60% of the utility's total portfolio budget, including administrative costs and EM&V, to be proposed, designed, and delivered by third parties by the end of 2020.<sup>156</sup> Please refer to the Portfolio Overview Chapter for PG&E's complete solicitation strategy and transition timeline, by sector.

<sup>152</sup> Pacific Gas and Electric Company ESA Program and CARE 2015 Annual Report.

<sup>153</sup> D.16-11-022.

<sup>154</sup> D.16-08-019, pg. 51.

<sup>155</sup> D.16-08-019, p. 65.

<sup>156</sup> D.16-08-019, p.74.

## M. Metrics

PG&E and the other PAs understand the importance of ensuring that all metrics provide value to the CPUC, program administrators, or other stakeholders. We also recognize that listed metrics can have powerful and unintended effects.<sup>157</sup>

These metrics are consistent with the agreed-upon statewide guiding principles for the metrics shared with the Energy Division on August 16, 2016.

### Metrics should...

Be used and useful by PAs to manage portfolio

Be timely

Rely on data used in program implementation

Be simple to understand and clear of any subjectivity

Have longevity

The guiding principles also indicate that metrics are not a replacement for EM&V.

Additionally, not all metrics have a readily interpretable meaning, so context is needed. As such, we provide context on the metrics in the notes section of **Table 2.20**.

<sup>157</sup> Perrin, in an article in the American Journal of Evaluation, discussed certain known limitations of performance metrics. Among these limitations, he described varying interpretation of the “same” term and concepts, goal displacement, use of meaningless and irrelevant measures, and cost-savings vs. cost-shifting. (Perrin, Burt. 1998. Effective Use and Misuse of Performance Measurement. American Journal of Evaluation 1998:19;367.)

**Table 2.20**

Direct PG&E Residential Sector Effects and Metrics

GOAL: Save 817 GWh, 65 MW, and 11.7 MM therms by 2025					
Metric	Baseline	Metric Source	Short Term Target (1-3 years)	Mid Term Target (4-6 years)	Long Term Target (7-8+ years)
Electricity Savings (First Year Net)	Average of 200 Gross GWh/year across 2011-2015	Annual Net Ex Ante savings from program databases	92 Net GWh/yr (118 Gross GWh/yr)	102 Net GWh/yr (120 Gross GWh/yr)	109 Net GWh/yr (127 Gross GWh/yr)
Demand Savings (First Year Net)	Average of 45 Gross MW / year across 2011-2015		9 Net MW/year (14 gross MW/yr)	7 Net MW/year (11 gross MW/yr)	8 Net MW/year (12 gross MW/yr)
MM Therm Savings (First Year Net)	Average of 2.14 Gross MM Therms/year across 2011-2015		1.3 Net MM Therms / year (1.4 gross MM Therms/yr)	1.5 Net MM Therms / year (1.6 gross MM Therms/yr)	1.7 Net MM Therms / year (2.0 gross MM Therms/yr)
<b>Indicators</b>					
<ul style="list-style-type: none"> <li>• Lifetime GWh and MM Therm energy savings</li> <li>• Participation: Annual number of customers participating in energy efficiency programs. Gas and electric will be tracked separately<sup>a</sup></li> <li>• Participation by climate zone</li> <li>• Depth of savings TBD<sup>b</sup></li> </ul>					
<b>Notes</b>					
<ul style="list-style-type: none"> <li>• Goals are set on first year net energy savings, but lifetime savings will also be tracked</li> <li>• Net savings not available for baseline, therefore targets include gross savings to compare to baseline</li> </ul> <p><sup>a</sup> Participation will be tracked as an indicator because it may go up or down based on the type of program designs submitted by third party implementers. Over time, we expect to touch a larger percentage of customers with our programs, but these will not be able to be tracked if most programs move to mid- and upstream program models. Proportion of customers is not possible due to issues around multi-family units and meters. This will not include My Energy users or customers that receive bill alerts. HER will be tracked separately</p> <p><sup>b</sup> PG&amp;E intends to develop an indicator to look at depth of savings per project. This specific indicator will be used to compare to finance offerings, as well as to look at specific programs that seek to increase savings per project (e.g., Whole House programs)</p>					

**Table 2.20** (continued)

Direct PG&E Residential Sector Effects and Metrics

GOAL: Increase savings from MF properties						
Intervention Strategies	Metric	Baseline	Metric Source	Short Term Target (1-3 years)	Mid Term Target (4-6 years)	Long Term Target (7-9 years)
Technical Assistance and Tools Financial Solutions New Models	Electricity savings from MF customers	8.5 Gross GWh/year <sup>a</sup>	Net ex ante savings from program databases	10% increase Determine mid- and long-term goals <sup>b</sup>	TBD <sup>b</sup>	TBD <sup>b</sup>
	Gas savings from MF customers	0.33 Gross MM Therms/year <sup>a</sup>	Net ex ante savings from program databases	10% increase Determine mid- and long-term goals <sup>b</sup>	TBD <sup>b</sup>	TBD <sup>b</sup>
Indicators						
Number of MF participants in energy efficiency programs (Customers for single meters and buildings for master-metered)						
Notes						
<sup>a</sup> PG&E will increase savings specifically allocated to MF customers. Note that MF customers also participate in upstream programs and programs such as HER, however, these savings are not tracked by segment <sup>b</sup> PG&E will revisit mid- and long-term targets. Current and pending policy decisions make it difficult to determine mid- and long-term goals at this point in time						
GOAL: Increase customers' ability to manage energy						
Data Access Technical assistance and Tools	Proportion of customers who access their data through EMTs (or proactively use EMTs)	TBD (number of customers using EMTs) <sup>a</sup>	PG&E Tracking databases	Finalized EMTs through Advice Letter Determine baseline and set targets	TBD	TBD
Indicators						
None						
Notes						
<ul style="list-style-type: none"> <li>EMTs will be defined by the list of EMTs in the Advice Letter for AB 793. Note that short-term, this will include products that are available. In the mid-term, EMTs will evolve from what is currently available, to including technologies or services that allow for management of energy. And in the long-term, these may lay the foundation for IDER efforts.</li> </ul> <sup>a</sup> Baseline will be listed by product, technology or service.						

**Table 2.20 (continued)**

Direct PG&E Residential Sector Effects and Metrics

GOAL: Increase operational efficiency by reducing the ratio of \$/unit energy saved						
Intervention Strategies	Metric	Baseline	Metric Source	Short Term Target (1-3 years)	Mid Term Target (4-6 years)	Long Term Target (7-9 years)
All	Annual levelized cost of energy	\$0.122/kWh <sup>a</sup> \$0.737/Therm <sup>a</sup>	Program data	Same as baseline <sup>b</sup>	10% lower than baseline	TBD <sup>c</sup>
<b>Indicators</b>						
Operational efficiency for third party implementers and other implementers						
<b>Notes</b>						
Levelized costs represent discounted lifecycle net savings using Program Administrator Costs						
<sup>a</sup> PG&E removed the benefits and costs associated with the Primary Lighting program, in anticipation of program changes, and to motivate the pursuit of longer life measures.						
<sup>b</sup> PG&E will strive to keep levelized costs flat from baseline. However, due to new program administration and implementation structures, and other portfolio/program changes, flexibility is required to adapt to the new paradigm.						
<sup>c</sup> PG&E will update its long term targets once more data is gathered on the new administration and implementation structures.						
GOAL: Assist in reaching the CEESP goal of ZNE for 100% of all new residential construction						
Technical Assistance Financial Solutions	Number of top 25 production builders (by company) that build ZNE buildings through PG&E programs	5 of top 25 companies	Program data	10 of top 25 companies	20 of top 25 companies	Goal will be completed by mid-term
<b>Indicators</b>						
<ul style="list-style-type: none"> <li>Total number of builders (by company) that build ZNE buildings through PG&amp;E programs<sup>a</sup></li> <li>Number of ZNE homes (as a percentage of all new home starts once numbers start to rise)<sup>b</sup></li> <li>Number of projects with SF versus MF buildings</li> </ul>						
<b>Notes</b>						
<sup>a</sup> This will include Habitat for Humanity and other low-income partners that are building ZNE homes through PG&E projects						
<sup>b</sup> PG&E will adopt SW metrics currently being developed for ZNE homes within the Residential New Construction Program						
Additional notes: (1) ZNE is also supported through WE&T trainings for all builders. (2) ZNE should also be examined through market based studies; Proportion of all residential new construction that is ZNE						

Note: **Metrics** have baselines and targets, will be tracked, and when updated will compare the current value to the baseline and target. **Indicators** will be tracked but have no targets and may or may not have baselines. Indicators provide useful context for the metric.

Note that in the Business Plans, PG&E is proposing to track metrics and indicators that can be frequently updated to allow PG&E staff, implementers, the CPUC, and other stakeholders understand and manage the sector. While we recognize that there are longer-term outcome and satisfaction/quality metrics and indicators that are important to track through research studies), we are not proposing study-based metrics at the Business Plan level as they are measured less frequently, and require EM&V dollars that may or may not be available. These studies will be needed to support the program; however, we recommend that these be determined through a different process (i.e., EM&V Roadmap) once the programs are finalized.

### Metrics Measuring Residential Goals

The draft metrics proposed are aligned with the overall program goals. Specifically, within the next-10-year period, PG&E's primary goal for the residential sector is to:

- Save 817 GWh, 65 MW, and 11.7 MM therms by 2025 by focusing on high savings opportunities within both single family and multi-family properties

These goals are based on past PG&E performance relative to Potential Study targets.

Secondary goals that we intend to track include:

- Increase savings from MF properties by focusing efforts on these properties
- Increase customers' ability to manage energy by increasing the number of customers utilizing EMTs and advancing the capabilities of EMTs over the next 10 years
- Increase operational efficiencies by reducing costs of the residential energy-efficiency programs, (i.e., reducing the ratio of \$/kWh and \$/therm saved) by 10% in the mid-term through the use of cost-effective scalable program models such as P4P, financing and behavioral
- Assist California in reaching the CEESP goal of ZNE for 100% of all new residential construction by engaging builders and other market actors, and supporting new C&S

PG&E's proposed sector-level metrics that can be tracked and monitored with some frequency (i.e., monthly, quarterly, or annually) are described in **Table 2.20**.

## N. EM&V Research Needs

Evaluation, Measurement and Verification (EM&V) conducts research studies with the guidance of the CPUC Framework<sup>158</sup> and Protocols.<sup>159</sup> The main source of planned research will be the annual EM&V Research Plan<sup>160</sup> put together jointly by the CPUC and the PAs. This ongoing process enables stakeholders to understand and comment on research at PG&E. The PG&E-led research for this sector will be contingent upon the needs of the portfolio as a whole and the annual sector-specific research budget.<sup>161</sup>

The bullets below show currently known information needs that may or may not be detailed in the most recent EM&V Evaluation Plan. For those study types under PG&E's purview, PG&E plans to conduct this research as much as practical given annual EM&V budgets, although the specifics may change over time. Specific research needs for this sector, by study category, include:

- *EM&V framework and methods based studies to understand best ways to apply NMEC or options for determining impacts from market transformation efforts*
  - **AB 802 Implementation Research** – AB 802 provides for utilities to claim energy savings based on differences observed in normalized metered energy consumption (NMEC). Energy savings will be based on the overall reduction in usage that is observed at the meter, including savings resulting from operational, behavioral, and Retrocommissioning activities. PG&E is undertaking a number of research efforts to establish best practices for estimating NMEC including:

<sup>158</sup> California Public Utilities Commission and the Project Advisory Group. The California Evaluation Framework. June 2004. [http://www.calmac.org/publications/California\\_Evaluation\\_Framework\\_June\\_2004.pdf](http://www.calmac.org/publications/California_Evaluation_Framework_June_2004.pdf).

<sup>159</sup> California Public Utilities Commission. California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals. April 2006.

<sup>160</sup> The most recent EM&V Evaluation Plan is here: <http://www.energydataweb.com/cpuc/search.aspx#>.

<sup>161</sup> While PG&E provides several studies in this section, the current budgets are relatively small. The 2016 budgets in the most recent EM&V plan show approximately \$4 million for Energy Division-led impact studies and \$250,000 to \$300,000 for IOU-led process studies. These budgets cover the large commercial and industrial programs, as well as agricultural programs. The CPUC, PAs, and other stakeholders will need to discuss EM&V priorities and determine the relative availability of budget to cover any of the studies.

- Identifying best practices for the use of quasi-experimental designs when experimental methods are not available or practical,
  - Selecting appropriate comparison groups and understanding when their use results in gross savings, net savings, or somewhere between the two, and
  - In collaboration with SCE, re-examining the Energy Efficiency Evaluation Framework to meet future energy efficiency needs.
- **Retail Products Platform (RPP) Research** – Research is needed on the development of a method to appropriately characterize the national market share of RPP products and to investigate how to transition from a traditional resource-based evaluation framework to a market transformation evaluation framework.
- *Market and baseline studies to understand program gaps, needs, and inform design and metrics*
    - **Lighting Research** – Lighting has a variety of needs since it makes up a large portion of the savings. As such, research needs for lighting include:
      - The Energy Independence and Security Act (EISA) does not affect low lumen and high lumen output products. What are the savings opportunities for these specialty lamps and where would program resources be best targeted after the upcoming standards take effect?
      - LED prices have not stabilized for any high-priority LED product category and average LED lamp prices will decrease by 21% per year and luminaires by 20% per year, according to a 2015 Navigant study.<sup>162</sup> The IOUs should use the updated costs data from the study for the next 2 to 3 years only, and continue to track LED prices in 2017 or 2018 and beyond.
      - Better understanding of customer preferences and decision making around lighting purchases would help the programs better connect with customers to encourage efficient choices.
- **Retail Products Platform (RPP) Research** – Research is needed on the national market share of RPP products
  - **Zero Net Energy (ZNE) Research** – ZNEs face significant challenges to widespread adoption such as builder and consumer education, consistent tracking and labeling methods, inclusion of real estate agents and lenders in the ZNE marketing process, and community-scale solutions for homes that cannot reach ZNE on an individual basis. Future research needs to address technologies and strategies that can be applied across a significant subset of the building volume in order to achieve the greatest overall gains in moving the state toward its ZNE goals.
  - Market studies to better understand plugloads, market barriers and best ways to overcome barriers.
- *Process studies to understand whether pilots, new programs, and new strategies are working*
    - **AB 793 Research** – AB 793 pilots in their early stages should provide valuable insight to enable PAs to make program adjustments to maximize the effectiveness of these programs, both from a customer participation and experience perspective, and from a cost perspective. Process evaluation is needed to assess the fast-moving nature of these “smart” and connected technologies, and the varied appeal of these technologies to different residential customer segments. Research is needed to fully understand program participation and customer experience, motivation, and satisfaction. PG&E has started to explore this research area and this study effort may be expanded in early 2018 to include the other IOUs.
    - Process evaluations such as bottom-up review of mid- and upstream partners.
    - Studies to examine new outreach and education strategies.

<sup>162</sup> California LED Workpaper Update Study, Navigant Consulting [2015].

- *Energy impact studies (and studies that look at potential impacts) that are specific to measures, end uses, or sectors*
  - Studies to support workpaper processes – Current workpapers do not differentiate between the CEC-Specification compliant lamps incentivized through the Primary Lighting Program and other LEDs. However, these bulbs have different technical attributes, including efficacy, and different prices than standard lamps. Quantifying these differences would enable more accurate savings claims.
  - Data collection for parabolic aluminized reflectors (PARs) workpaper updates. PARs are currently predominantly inefficient halogen bulbs and could therefore provide a significant savings opportunity in 2018.
  - A new residential lighting metering study is needed to update the hours of use workpaper parameter and to understand customers' household lighting usage patterns

Within the residential sector, PG&E expects to use EM&V 2.0 methods--those which leverage the increased availability of information and communications technologies including Smart Meters and communicating smart thermostats, as well as cloud-based software that can facilitate improved data access and advanced analytics—where they and CPUC evaluation teams believe these offer more accurate and cost-effective evaluations. Specific examples of PG&E's embedded evaluation include early development of a new framework for documenting market changes for the evaluation of the Retail Products Portfolio, built-in experimental designs for the evaluation of Home Energy Reports, and the use of normalized metered energy consumption for the evaluation of residential Pay-for-Performance program, as described below:

- **Retail Products Platform (RPP).** This midstream market transformation program leverages the embedded evaluation model by having a dedicated EM&V team member share project ownership and leadership with the greater project team. Evaluability lies at the heart of any successful project or program, especially for RPP given its dedicated market transformation goal. The innovative design of RPP makes it essential that EM&V is integrated into project decision-making processes to ensure that evaluation goals are kept at the forefront of all project activities. For RPP, this entailed early M&V efforts to detail a feasible evaluation methodology and plan based on the availability of data under various operating constraints. This plan was documented and vetted with the California Technical Forum (CalTF) and the CPUC prior to program launch to ensure all relevant feedback had been considered and integrated into an agreed-upon evaluation framework. On an ongoing basis, EM&V co-manages the RPP program by assuming project management responsibilities for various research and strategy program activities and guiding the program team to incorporate research findings and best practices.
- **Home Energy Reports (HER).** The HER program uses experimental design whereby customer residences are randomly assigned to treatment (that is, they receive detailed neighbor comparisons of energy use) or control conditions. For the past five years, evaluation staff has worked hand-in-hand with the program team to design each HER experiment to ensure that the principles of randomized control trials are applied, that adequate records are kept, and that scientific principles are respected. The result of embedding evaluation into the HER program has been continuity in program operations in the face of multiple program managers over the years and full acceptance of PG&E's savings claims by third-party evaluation has been achieved.



- **Residential Pay-for-Performance** (Res P4P).

PG&E is applying the principles of embedded evaluation in its Res P4P pilot, a High Opportunity Programs and Projects (HOPP) that will be using normalized metered energy consumption as the basis for estimating savings. Evaluation specialists are participating in the development of savings estimation protocols through a working group for the CalTRACK initiative, defining and establishing measurement plans for key program performance metrics, and in procedures to gauge and document program influence on an ongoing basis rather than after-the-fact. The development and launch of the Res P4P HOPP was a large effort that required ongoing interaction of program and evaluation specialists.

As the EM&V environment changes, PG&E is preparing to address the associated EM&V needs. PG&E will identify specific data collection strategies early in a program's history to support internal performance analysis and program evaluations, and will embed data collection and evaluation into the program designs whenever possible to reduce evaluation costs and increase feedback to the programs. Additionally, PG&E will ask third-party program designers to include an EM&V plan demonstrating their program evaluability, documenting what data will be collected through the program, and to propose a method for assessing impacts.

The specifics on data collection and reporting will be provided in as much detail as possible in PG&E's Implementation Plans (IPs). Ultimately, both PG&E-led and third-party programs, PG&E will collaborate with CPUC staff and their evaluation consultants to ensure that appropriate data collection and reporting capabilities are in place to facilitate accurate evaluation.

# WHAT PG&E IS DOING TO SUPPORT: RESIDENTIAL ZNE



## PG&E's ZNE Outreach Activities



PG&E's ZNE outreach activities include workshops and educational series. Workshops will help design professionals learn about creating ZNE buildings and are offered through PG&E's Pacific Energy Training Center and PG&E's Stockton Energy Training Center. PG&E also holds speaker forums and presentations on key ZNE topics for building professionals and residential customers.

## Residential New Construction



The California Advanced Homes Program (CAHP), the California Multifamily New Homes Program (CMFNH), and the CAHP Master Builder initiative support residential builders as they take steps towards ZNE construction. These programs provide builders with incentives, design assistance, verification support and recognition for constructing projects better than code and on the pathway to ZNE. CAHP and CMFNH work with builder project teams, Title 24 consultants, and HERS raters to shift the market towards designing and building efficient, low energy use buildings. Incentives increase as buildings get closer to ZNE. Large incentive bonuses are available for homes designed to be ZNE-ready, or that are incorporating the most impactful and challenging efficiency measures that are necessary for ZNE construction.

## CUSTOMER SPOTLIGHT:



PG&E helped De Young homebuilders construct a ZNE home — which looks like any other home — and has an impressive list of features all designed to save money and energy consumption.

The home includes:

- A rooftop solar photovoltaic system (5.88 kW)
- High efficiency heating and cooling
- Dual-pane, triple-layer ENERGY STAR®-qualified windows
- An electric vehicle charging station in the garage
- Cool roof tiles to reflect sunlight and heat away from the home (important during hot summers in the Valley)
- Ducts in conditioned space to increase energy efficiency

## STATE VISION:



The California Long Term Energy Efficiency Strategic Plan includes the Zero Net Energy Homes Goal that new construction will reach ZNE performance - including clean, onsite distributed generation - for all new single family homes by 2020. To address this goal, the CPUC set forth a New Residential ZNE Action Plan for 2014-2020. That plan, which includes detailed guidance on an early adopter program and ZNE demonstration pilots, provides clear direction on how to move the residential new construction industry toward the 2020 goals.



# WHAT PG&E IS DOING TO SUPPORT: DISADVANTAGED COMMUNITIES

## Energy Savings Assistance Program (ESA)



Uses a prescriptive, direct install approach to provide free home weatherization, energy efficient appliances and energy education services to income-qualified PG&E customers throughout the company's service area. The ESA program is ratepayer-funded and is available to PG&E customers living in all housing types (single family, multifamily, and mobile homes, regardless of whether they are homeowners or renters.

## Moderate Income Direct Install (MIDI)



The MIDI program provides audit and installation services to hard-to-reach moderate income residential customers. A portion of customers not qualified for the ESA program due to income thresholds and the inability to produce the appropriate documentation are still served by the MIDI program. Through MIDI, ESA contractors are able to serve these residential customers instead of turning them away.

## STATE VISION:

The Long Term Energy Efficiency California Strategic Plan vision for the ESA Program is to have 100 percent of all eligible and willing low-income customers receive all cost-effective ESA Program measures by 2020. The California Strategic Plan lays out two goals for achieving the ESA Program vision: (1) by 2020, all eligible customers will be given the opportunity to participate in the ESA Program; and (2) the ESA Program will be an energy resource by delivering increasingly cost-effective and longer-term savings.



Senate Bill 350 declares that there is insufficient understanding of the barriers for low-income customers to energy efficiency and weatherization investments, including those in disadvantaged communities. As such, the California Energy Commission (CEC) recently published a report entitled *SB 350 Low-Income Barriers Study, Part A: Overcoming Barriers to Energy Efficiency and Renewables for Low-Income Customers and Small Business Contracting Opportunities in Disadvantaged Communities* to identify barriers and highlight recommendations to address these barriers.

## CUSTOMER SPOTLIGHT:

Long-time Bakersfield resident Rosie Serrata received upgrades through PG&E's Energy Savings Assistance Program. Through the program, she received a new window air conditioner, a water cooler, new doors, light fixtures, low-flow shower heads, compact fluorescent light bulbs (CFLs), and weather stripping at no cost to her. She credited the more than \$3,000 in upgrades with cutting her monthly energy bill in half.



"It makes me feel good that we are able to save all that money, we are already budgeting as it is, but now we are able to save money to pay for other stuff we've been wanting to do."

— Rosie Serrata, Bakersfield Resident

## ESA 2016

(THROUGH OCTOBER 31)

EXPENDITURES: **\$88,385,720**

HOMES TREATED: **60,293**

## ENERGY SAVINGS AND DEMAND REDUCTION

KWH: **21,642,207**

KW: **4,432**

THERMS: **1,276,513**

## MEASURE INSTALLATIONS

WATER HEATERS: **171,397**

ENCLOSURE: **43,735 Homes**

REFRIGERATORS: **7,155**

SMART POWER STRIPS: **15,147**

MICROWAVES: **11,896**

LIGHTING: **478,817**

COOLING: **15,226**

HEATING: **902**



# WHAT PG&E IS DOING TO SUPPORT: MULTIFAMILY SECTOR

## MULTIFAMILY SECTOR VISION:



Multifamily owners and tenants save money and enhance comfort with greater adoption of energy efficiency practices and equipment. A single point of contact (SPOC) serves property managers and owners with coordinated information on the variety of available savings and upgrade opportunities. The SPOC drives awareness of opportunities for deep common area and individual dwelling retrofits, as well as specific options for low-income qualifying customers, including those available through the Energy Savings Assistance Program (ESA). Builders of multifamily properties adopt zero net energy practices with the assistance of code readiness support.

## SECTOR CHARACTERISTICS:



- In PG&E service territory, 23% of residential customers live in multifamily housing.
- 80% of multifamily households are renters who pay the utility bill.
- 43% of low income customers in PG&E service territory live in multifamily housing.

## BRINGING SOLUTIONS:

The split incentive barrier inherent in the multifamily energy efficiency market enhances the need for compelling and coordinated value propositions for both building owners and facility managers. PG&E understands that it is also important to establish ongoing relationships with these decision makers to drive awareness of program options as they are planning building upgrades. With an effective SPOC, PG&E believes it is possible to provide streamlined, personalized, and comprehensive information that will lead to more comfortable dwellings, savings for low/mid income customers, and deeper retrofits of common and outdoor areas.

Because of the unique offerings available specifically for low income customers, a key goal of the SPOC will be to educate building owners and facilities managers on the ESA program and obtain information on qualifying tenants who could benefit.

The multifamily design and build communities operate largely independently from their single family counterparts. PG&E will continue to support code readiness and ZNE goals for the multifamily sector with design assistance and financial incentives for builders to adopt practices to meet future code early.



## ELEMENTS OF PG&E'S MULTIFAMILY STRATEGY:

PG&E's approach to the multifamily sector draws from the nine intervention strategies. Similar to single family households, the multifamily sector can benefit from data analytics and access, incentives and financing options, workforce development, and upstream programs. However, the multifamily sector also presents unique complexities, barriers and opportunities that must be addressed. In the short term, PG&E plans to establish a SPOC who can provide coordinated information to a multifamily building owner or facility manager on energy efficiency and upgrade options, including:

- Energy efficiency program offerings
- ESA support for income-qualifying tenants
- Financing options
- Federal and State tax credits and programs
- Demand Response and Distributed Generation programs
- Middle Income Direct Install (MIDI) opportunities
- Electric Vehicle infrastructure support
- Common and outdoor upgrade rebates
- Water efficiency opportunities

# Appendices

# Residential Appendices

## Appendix A: Compliance Checklist

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
<b>Portfolio Summary</b>		
0	<b>Executive Summary</b>	
	<i>Company description</i>	Executive Summary p. A
	<i>Definition of market</i>	Executive Summary p. A
	<i>Mission Statement</i>	Executive Summary p. A
	<i>Purpose of Business Plan</i>	Executive Summary p. A
I.A.1, II.D.2	<b>Overview</b>	
	<i>About EE/DSM</i>	Energy Efficiency and It's Role in Helping PG&E Meet Its Energy Needs, pp. 11-16
	<i>CA Energy Needs</i>	California's Evolving Energy Efficiency Landscape, pp. 21-26
	<i>Regulatory Requirements</i>	California's Evolving Energy Efficiency Landscape, pp. 22-23
	<i>Strategic Plan</i>	California's Evolving Energy Efficiency Landscape, pp. 20-21
	<i>Legislation (e.g., AB 758, SB 350, AB 802, AB 793)</i>	California's Evolving Energy Efficiency Landscape, pp.

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		22-23
	<i>IOUs/PAs/CPUC/etc. overall role</i>	Roles in the Changing Landscape, pp. 8-9
I.A.2	<i>Broad socioeconomic and utility industry trends relevant to PA's EE programs (population, economics and markets, technology, environment/climate)</i>	California's Evolving Energy Efficiency Landscape pp. 23-26
I.B.1	<i>Vision (e.g., How PA thinks about and uses EE over next 10 years)</i>	PG&E's Vision, p. 1
I.5	<i>Compare/contrast to past cycles</i>	PG&E's Portfolio Evolution: Comparison to Past Cycles, pp. 9-11
I.B.2	<b>Goals &amp; Budget</b>	
I.B.2 & I.C.2.a	<i>Energy Saving Goals</i>	Goals, Budget and Cost-Effectiveness, pp. 27-28
I.C.2.a	<i>Portfolio Budget (sector and portfolio level per xls checklist)</i>	Goals, Budget and Cost-Effectiveness, pp. 28-30
I.C.2.a, I.C.2.d	<i>Cost-effectiveness (sector and portfolio level per xls checklist)</i>	Goals, Budget and Cost-Effectiveness, pp. 30-34
I.C.2.b	<i>Explanation of Admin Budgets (e.g., Direct/Indirect Labor, Professional/Admin personnel)</i>	Goals, Budget and Cost-Effectiveness, pp. 28-29
I.C.2.c	<i>Explanation of accounting practices</i>	Goals, Budget and Cost-

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		Effectiveness, p. 30
I.C.3 and I.C.4	<b>Intervention strategies (high level)</b>	
	<i>Overall issues/challenges/barriers</i>	PG&E's Portfolio Plan, pp. 4-7
	<i>High level summary of strategies and tools (e.g., AMI data, AB 802, procurement model, up/mid/downstream, etc.)</i>	PG&E's Portfolio Plan, pp. 4-7
I.C.4; I.D	<b>Solicitation plan</b>	
I.C.4	<i>Solicitation strategies/areas that could be SW</i>	Solicitation Strategy and Transition Timeline, pp. 35-42
I.D; II.F	<i>Proposal for transitioning the majority of portfolios to be outsourced by the end of 2020.</i>	Solicitation Strategy and Transition Timeline, pp. 35-42
<b>Sector Chapter (commercial, residential, public, agricultural, industrial, x-cutting)</b>		
II.A	<b>Summary tables</b>	
II.A	<i>Table with CE, TRC, PAC, emissions, savings, budget</i>	Goals, Budget and Cost-Effectiveness, pp. 8-11
I.C.7; II.E.1.b	<i>Metrics for sector</i>	Metrics, pp. 58-62
II.D	<b>Market characterization (overview and market/gap and other analysis)</b>	
II.D.1	<i>Electricity/NG</i>	Sector Overview, pp. 11-20
II.D.2	<i>State goals include acknowledgement of goals set by Strategic Plan, SB 350, AB758, guidance as appropriate)</i>	PG&E's Residential Sector Vision, pp. 1-4



Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
II.D.3	<i>EE potential and goals</i>	Sector Overview, pp. 11-20
II.D.5	<i>Customer landscape (e.g., segments/subsegments, major end uses, participation rates, etc.)</i>	Sector Overview, pp. 11-20
II.D.6	<i>Major future trends that are key for the PA and its customers</i>	Residential Sector Trends and Challenges, pp. 20-26
II.D.7	<i>Barriers to EE and other challenges to heightened EE (e.g., regulatory, market, data)</i>	Residential Sector Trends and Challenges, pp. 20-26
II.2.a	<b>Description of overarching approach to the sector</b>	
	<i>Goals/strategies/approaches</i>	PG&E's Residential Sector Vision, pp. 1-4
I.C.6; I.D	<i>How portfolio meets Commission guidance</i>	PG&E's Residential Sector Vision, pp. 1-4
II.C	<i>Description of how this chapter addresses the performance challenges/barriers</i>	PG&E's Approach to Achieving Goals, pp. 27-49
I.C.4 a-c	<b>Intervention strategies (detailed)</b>	
II.D.2.a; II.E.3	<i>What specific strategies are being pursued (e.g., near, mid, long AND existing, modified, new)</i>	PG&E's Approach to Achieving Goals, pp. 27-49
I [cmt with excerpt]	<i>Why specific strategies were chosen (e.g., ID current weaknesses, best practices, or other rationale to support choice)</i>	PG&E's Approach to Achieving Goals, pp. 27-49
II.E.1.a; II.E.4	<i>How approaches advance goals discussed above</i>	PG&E's Approach to Achieving Goals, pp. 27-49

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
I.C.4; I.E; II.D.4	<i>How strategies use lessons learned from past cycles and EM&amp;V</i>	PG&E's Residential Sector Proposal Compared to Prior Program Cycles, pp. 4-8
I	<i>How will interventions support/augment current approaches or solve challenges</i>	PG&E's Approach to Achieving Goals, pp. 27-49
II.D.2	<i>Explanation for how these strategies address legislative mandates from AB 802, SB350, and AB 793, as well as other Commission directives for this sector, including strategic plan.</i>	PG&E's Approach to Achieving Goals, pp. 27-49
I.C.4	<i>Future expectations for intervention strategies</i>	PG&E's Approach to Achieving Goals, pp. 27-49
I.C.1; II.E.6	<i>Description of pilots</i>	PG&E's Approach to Achieving Goals, pp. 36-40
II.F	<i>Key Partners</i>	PG&E's Partners and Commitment to Coordination, pp. 56-57
I.C.5; I.D; II.B; II.C	<b>Compare/contrast to past cycles</b>	
	<i>Budget changes as appropriate</i>	Goals, Budget and Cost-Effectiveness, pp. 8-11
	<i>Modification to sector strategies</i>	PG&E's Residential Sector Proposal Compared to

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		Prior Program Cycles, pp. 4-8
	<b>Cross-cutting (sector chapters and ME&amp;O)</b>	
II.E.2; II.H, II.K	<i>Program Administrator marketing and integration with SW MEO as applicable</i>	Leveraging Cross-Cutting Resources, pp. 49-50
II.E.5; II.H	<i>Workforce, education, and training</i>	Leveraging Cross-Cutting Resources, pp. 49-50
II.H	<i>Emerging Technologies</i>	Leveraging Cross-Cutting Resources, pp. 49-50
II.H	<i>Codes &amp; Standards</i>	Leveraging Cross-Cutting Resources, pp. 49-50
II.G	<b>Cross PA and Offering Coordination</b>	
II.G	<i>How strategies are coordination among regional PAs</i>	PG&E's Partners and Commitment to Coordination, pp. 56-57
II.G	<i>Proposal of statewide program administrator/approaches for this sector</i>	See Statewide Administration chapter
II.G	<i>How the sector strategies are coordinated with statewide program activities</i>	See Statewide Administration chapter
II.G	<i>How are strategies coordinated with other state agencies and initiatives (e.g., AB 758)</i>	PG&E's Partners and Commitment to Coordination, pp. 56-57
II.I	<b>EM&amp;V Considerations (statement of needs)</b>	
II.I	<i>Data collection needs</i>	EM&V Research Needs, pp. 62-65
II.I	<i>Anticipated study needs</i>	EM&V Research Needs, pp. 62-

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		65
II.J	<b>Demand Response</b>	
ED Guidance (p.8)	<i>How EE measures use up-to-date DR enabling technologies to be "DR ready"</i>	Integrated Demand Side Management, pp. 50-53
ED Guidance (p.8)	<i>How duplication of costs for ME&amp;O, site visits, etc. is avoided for dual-purpose technologies</i>	Integrated Demand Side Management, pp. 50-53
ED Guidance (p.9)	<i>How strategies facilitate customer understanding of peak load, cost, and opportunities to reduce</i>	Integrated Demand Side Management, pp. 50-53
II.K	<b>Residential Rate Reform</b>	
ED Guidance (p.9)	<i>How BPs will help reduce load during TOU periods</i>	Integrated Demand Side Management, pp. 50-53
ED Guidance (p.9)	<i>How BP will diminish barriers to load reduction during TOU periods</i>	Integrated Demand Side Management, pp. 50-53
ED Guidance (p.9)	<i>How strategies will provide info to customers and/or provide a tool to show how program may impact customer energy usage during different TOU periods</i>	Integrated Demand Side Management, pp. 50-53
ED Guidance (p.9)	<i>How strategies will analyze whether a customer may experience greater savings by switching to a different, opt-in TOU rate</i>	Integrated Demand Side Management, pp. 50-53
ED guidance (p.9)	<i>ME&amp;O re: rate reform</i>	Integrated Demand Side Management, pp. 50-53
II.L	<b>Integrated Demand Side Resources</b>	Integrated Demand Side Management, pp. 50-53
II.M	<b>Zero-Emission Vehicles(EVs)</b>	Integrated Demand Side Management, pp. 50-53
II.N	<b>Energy Savings Assistance (Multi-family Focused)</b>	Appendix, One-Pager, and PG&E's

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		Partners and Commitment to Coordination, pp. 56-57
	<b>Appendices</b>	
	<i>Additional Customer Data</i>	Appendix C
	<i>Cited research</i>	Appendix B
	<i>CAEECC stakeholder input resolution</i>	See Input Tracker

## Appendix B: References

- Accenture Research. 2014. *The New Energy Consumer: Architecting for the Future*.  
<https://www.accenture.com/acnmedia/Accenture/next-gen/insight-unlocking-value-of-digital-consumer/PDF/Accenture-2014-The-New-Energy-Consumer-Architecting-for-the-Future.pdf>
- Agard, T. May 11, 2016. *Financing Building Energy Upgrades with Tariffed On-Bill Investments*.  
[https://betterbuildingssolutioncenter.energy.gov/sites/default/files/Energy\\_Efficiency\\_Financing\\_for\\_Low\\_Income\\_Communities\\_Finance%20WED.pdf](https://betterbuildingssolutioncenter.energy.gov/sites/default/files/Energy_Efficiency_Financing_for_Low_Income_Communities_Finance%20WED.pdf)
- Alliance of Automobile Manufacturers. December 2016. *U.S. Light-Duty Zero Emission Vehicle (ZEV) Sales (2011–2016)*. <http://www.zevfacts.com/sales-dashboard.html>
- American Council for an Energy-Efficient Economy. June 2014. *Best Practices for Working with Utilities to Improve Access to Energy Usage Data*. <http://aceee.org/files/pdf/toolkit/utility-data-access.pdf>
- Apex Analytics. 2016. *2013-2014 Residential Roadmap, Multifamily Focused Impact Evaluation – Final*.  
[http://www.calmac.org/warn\\_dload.asp?e=0&id=3298](http://www.calmac.org/warn_dload.asp?e=0&id=3298)
- ARUP. December 31, 2012. *The Technical Feasibility of Zero Net Energy Buildings in California*.  
[http://www.energydataweb.com/cpucfiles/pdadocs/904/california\\_zne\\_technical\\_feasibility\\_report\\_final.pdf](http://www.energydataweb.com/cpucfiles/pdadocs/904/california_zne_technical_feasibility_report_final.pdf)
- Assembly Bill 802. October 8, 2015.  
[https://leginfo.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160AB802](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB802)
- Binley, Kari et al. 2016. *Insights from PG&E’s Marketplace Initiative on Influencing Purchasing Decisions*. 2016 ACEEE Summer Study on Energy Efficiency in Buildings.  
[http://aceee.org/files/proceedings/2016/data/papers/6\\_361.pdf](http://aceee.org/files/proceedings/2016/data/papers/6_361.pdf)
- Boomhower, Judson and Lucas W. Davis. June 2016. *Do Energy Efficiency Investments Deliver at the Right Time?* <https://ei.haas.berkeley.edu/research/papers/WP271.pdf>
- Borgeson, Sam et al. 2015. *Learning from Hourly Household Energy Consumption: Extracting, Visualizing and Interpreting Household Smart Meter Data*. In *Design, User Experience, and Usability: Interactive Experience Design*. [http://aceee.org/files/proceedings/2016/data/papers/12\\_199.pdf](http://aceee.org/files/proceedings/2016/data/papers/12_199.pdf)
- Cadmus. 2015. *Saturation Comparison of Massachusetts, California, and New York: Final Report*.  
<http://www.neep.org/sites/default/files/resources/Efficient-Bulb-Saturation-Comparison-of-Massachusetts-California-and-New-York-Final-Report1.pdf>
- California Energy Commission. January 2011. *CA Energy Efficiency Strategic Plan*.  
[http://www.energy.ca.gov/ab758/documents/CAEnergyEfficiencyStrategicPlan\\_Jan2011.pdf](http://www.energy.ca.gov/ab758/documents/CAEnergyEfficiencyStrategicPlan_Jan2011.pdf)
- California Energy Commission. July 2011. *Achieving Energy Savings in California Buildings: Saving Energy in Existing Buildings and Achieving a Zero-Net-Energy Future*.  
<http://www.energy.ca.gov/2011publications/CEC-400-2011-007/CEC-400-2011-007-SD.pdf>.

California Energy Commission. 2014. *Voluntary California Quality Light-Emitting Diode (LED) Lamp Specification*. <http://www.energy.ca.gov/2015publications/CEC-400-2015-001/CEC-400-2015-001.pdf>

California Energy Commission. 2015. *Resolution Updating the Voluntary California LED Lamp Specification*. [http://www.energy.ca.gov/appliances/led\\_lamp\\_spec/documents/2014-12-10\\_Resolution\\_Voluntary\\_California\\_Quality\\_Led\\_Lamp\\_Specification\\_Resolution\\_No\\_14-1210-09\\_TN-74289.pdf](http://www.energy.ca.gov/appliances/led_lamp_spec/documents/2014-12-10_Resolution_Voluntary_California_Quality_Led_Lamp_Specification_Resolution_No_14-1210-09_TN-74289.pdf)

California Energy Commission. June 29, 2016. *2015 Integrated Energy Policy Report (IEPR)*. Docket # 15-IEPR-01, CEC-100-2015-001-CMF. [http://www.energy.ca.gov/2015\\_energy\\_policy/](http://www.energy.ca.gov/2015_energy_policy/)

California Energy Commission. July 6, 2016. *Senate Bill 350 & Assembly Bill 802 – Implementation Timeline & Related Proceedings*. <http://www.energy.ca.gov/sb350/timeline.pdf>

California Energy Commission. December 14, 2016. *Existing Building Energy Efficiency Plan Update December 2016*. [http://docketpublic.energy.ca.gov/PublicDocuments/16-EBP-01/TN214801\\_20161214T155117\\_Existing\\_Building\\_Energy\\_Efficiency\\_Plan\\_Update\\_December\\_2016\\_Thi.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/16-EBP-01/TN214801_20161214T155117_Existing_Building_Energy_Efficiency_Plan_Update_December_2016_Thi.pdf)

California Energy Commission. December 16, 2016. *SB 350 Low-Income Barriers Study, Part A - Commission Final Report – A Study of Barriers and Solutions to Energy Efficiency, Renewables and Contracting Opportunities Among Low-Income Customer and Disadvantaged Communities*. [http://docketpublic.energy.ca.gov/PublicDocuments/16-OIR-02/TN214830\\_20161215T184655\\_SB\\_350\\_LowIncome\\_Barriers\\_Study\\_Part\\_A\\_Commission\\_Final\\_Report.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/16-OIR-02/TN214830_20161215T184655_SB_350_LowIncome_Barriers_Study_Part_A_Commission_Final_Report.pdf)

California Independent System Operator. 2016. *What the duck curve tells us about managing a green grid*. [https://www.caiso.com/Documents/FlexibleResourcesHelpRenewables\\_FastFacts.pdf](https://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf)

California Public Utilities Commission. April 2006. *California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals*. [www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5212](http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5212)

California Public Utilities Commission. July 2010. *Fact Sheet: Energy Efficiency Zero Net Energy Program*. [www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=10729](http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=10729)

California Public Utilities Commission. January 2011. *California Energy Efficiency Strategic Plan*. <http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5303>

California Public Utilities Commission. October 22, 2015. *Decision 15-10-028: Decision Re Energy Efficiency Goals for 2016 and Beyond and Energy Efficiency Rolling Portfolio Mechanics*. <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M155/K511/155511942.pdf>

California Public Utilities Commission. August 18, 2016. *Decision 16-08-019: Decision Providing Guidance for Initial Energy Efficiency Rolling Portfolio Business Plan Filings*. <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M166/K232/166232537.PDF>

California Public Utilities Commission. September 29, 2016. *California's Distributed Energy Resources Action Plan: Aligning Vision and Action*.

[http://www.cpuc.ca.gov/uploadedFiles/CPUC\\_Public\\_Website/Content/About\\_Us/Organization/Commissioners/Michael\\_J\\_Picker/2016-09-26%20DER%20Action%20Plan%20FINAL3.pdf](http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Commissioners/Michael_J_Picker/2016-09-26%20DER%20Action%20Plan%20FINAL3.pdf)

California Public Utilities Commission and California Energy Commission. *New Residential Zero Net Energy Action Plan 2015-2020*. <http://www.californiaznehomes.com/>

Cluett, Rachel and Jennifer Amann. October 12, 2016. *Scaling Up Participation and Savings in Residential Retrofits*. <http://aceee.org/research-report/a1605>

Denholm, Paul, Matthew O'Connell, Gregory Brinkman, and Jennie Jorgenson. November 2015. *Overgeneration from Solar Energy in California: A Field Guide to the Duck Chart*. <http://www.nrel.gov/docs/fy16osti/65023.pdf>

DNV GL – Energy. September 10, 2014. *California Residential Replacement Lamp Market Status Report: Upstream Lighting Program Market Activities in California through 2013*. [http://www.calmac.org/warn\\_dload.asp?e=0&id=3067](http://www.calmac.org/warn_dload.asp?e=0&id=3067)

DNV GL – Energy. October 10, 2014. *HVAC Permitting: A Study to Inform IOU HVAC Programs*. [http://www.calmac.org/warn\\_dload.asp?e=0&id=3078](http://www.calmac.org/warn_dload.asp?e=0&id=3078)

DNV GL – Energy. January 16, 2015. *2013 PG&E Home Energy Reports Program Review and Validation of Impact Evaluation ED Res 3.1*. [http://www.calmac.org/startDownload.asp?Name=DNVGL\\_PGE\\_HERs\\_2013\\_final\\_20150116-cleanES.pdf&Size=532KB](http://www.calmac.org/startDownload.asp?Name=DNVGL_PGE_HERs_2013_final_20150116-cleanES.pdf&Size=532KB)

DNV GL – Energy. April 6, 2015. *2013 PG&E Home Energy Reports Program Review and Validation of Impact Evaluation*. [http://www.calmac.org/warn\\_dload.asp?e=0&id=3097](http://www.calmac.org/warn_dload.asp?e=0&id=3097)

DNV GL – Energy. March 22, 2016. *Focused Impact Evaluation of the 2013-2014 Home Upgrade Program*. <http://www.energydataweb.com/cpucFiles/pdaDocs/1497/Focused%20Impact%20Evaluation%20of%20the%202013-2014%20Home%20Upgrade%20Program%20draft%20for%20comment%204-1-16.pdf>

DNV GL – Energy. April 1, 2016. *Impact Evaluation of 2013-14 Upstream and Residential Downstream Lighting Programs*. [http://www.calmac.org/warn\\_dload.asp?e=0&id=3308](http://www.calmac.org/warn_dload.asp?e=0&id=3308)

DNV GL – Energy. July 18, 2016. *Results of HVAC6 Phase One Market Assessment of Residential HVAC Installations*. [http://www.energydataweb.com/cpucFiles/pdaDocs/1598/HVAC6%20Market%20Assessment%20of%20Residential%20HVAC%20Installations%20Results%20Phase%20One\\_FINAL.pdf](http://www.energydataweb.com/cpucFiles/pdaDocs/1598/HVAC6%20Market%20Assessment%20of%20Residential%20HVAC%20Installations%20Results%20Phase%20One_FINAL.pdf)

DNV GL – Energy. December 6, 2016. *Impact Evaluation of 2013-14 HVAC3 Commercial Quality Maintenance Programs*. [http://www.calmac.org/warn\\_dload.asp?e=0&id=3384](http://www.calmac.org/warn_dload.asp?e=0&id=3384)

Elkind, Ethan. March 1, 2016. *Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings*. <http://scholarship.law.berkeley.edu/cleopubs/4/>



Energy Information Administration. 2013. *Estimated U.S. Residential Electricity Consumption by End-use, 2011*. (Updated 2013) <http://www.eia.gov/consumption/residential/>

Energy Market Innovations Consulting. 2015. *California HVAC Contractor & Technician Behavior Study, Phase II*. [http://www.calmac.org/warn\\_dload.asp?e=0&id=3118](http://www.calmac.org/warn_dload.asp?e=0&id=3118)

Energy Market Innovations Consulting. 2015. *California HVAC Quality Installation/Quality Maintenance Customer Decision-Making Study*. [http://www.calmac.org/warn\\_dload.asp?e=0&id=3117](http://www.calmac.org/warn_dload.asp?e=0&id=3117)

Energy Market Innovations Consulting. September 12, 2016. *Energy Upgrade California – Home Upgrade Program Process Evaluation 2014-2015*. <http://www.energydataweb.com/cpucFiles/pdaDocs/1633/EUC%20Home%20Upgrade%20Final%20Draft%20Report.docx>

Evergreen Economics. February 23, 2016. *AMI Billing Regression Study (Phase I)*. [http://www.calmac.org/publications/AMI\\_Report\\_Volume\\_1\\_FINALS.pdf](http://www.calmac.org/publications/AMI_Report_Volume_1_FINALS.pdf)

First Tuesday Journal. September 30, 2016. *The Rising Trend In California Construction Starts*. <http://journal.firsttuesday.us/the-rising-trend-in-california-construction-starts/17939/>.

Fogel, Cathy. September 28, 2016. “Overarching Comments on Program Administrator Business Plans Focus on Market Transformation Strategies.” Energy Efficiency Branch, Energy Division, CPUC.

Fuller, Merrian et al. Lawrence Berkeley National Laboratory. 2010. *Driving Demand for Home Energy Improvements*. <http://drivingdemand.lbl.gov/>

Goebes Marian et al. 2016. *Clearing the Path to Market Transformation in the Rapidly Evolving World of Residential Lighting*. 2016 ACEEE Summer Study on Energy Efficiency in Buildings. [http://aceee.org/files/proceedings/2016/data/papers/2\\_677.pdf](http://aceee.org/files/proceedings/2016/data/papers/2_677.pdf)

Governor’s Office of Planning and Research. July 2002. *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects*. [http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf)  
Itron. July 8, 2013. *2010-2012 CPUC HEES Impact Evaluation*. [http://calmac.org/publications/HEES\\_Final\\_Report\\_20130708.pdf](http://calmac.org/publications/HEES_Final_Report_20130708.pdf)

Kwatra, Sameer, Jennifer Amann, and Harvey Sachs. June 2013. *Miscellaneous Energy Loads in Buildings*. <http://aceee.org/sites/default/files/publications/researchreports/a133.pdf>

Mitchell, Cynthia. May 15, 2015. *A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach*. TURN IDSM Comments in R.14-10-003.

Mowris, Robert et al. 2008. *Peak Demand and Energy Savings from Properly Sized and Matched Air Conditioners*. 2008 ACEEE Summer Study on Energy Efficiency in Buildings. [http://aceee.org/files/proceedings/2008/data/papers/1\\_692.pdf](http://aceee.org/files/proceedings/2008/data/papers/1_692.pdf)

Natural Resources Defense Council. August 2015. *California's Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals*.  
<https://www.nrdc.org/sites/default/files/ca-energy-efficiency-opportunity-report.pdf>

Navigant Consulting. 2013. *Market Research on Builder's Selling Practices and Strategies for Energy Efficiency Homes*. [http://www.calmac.org/warn\\_dload.asp?e=0&id=2973](http://www.calmac.org/warn_dload.asp?e=0&id=2973)

Navigant Consulting. 2015. *California LED Workpaper Update Study*.  
[http://www.calmac.org/warn\\_dload.asp?e=0&id=3155](http://www.calmac.org/warn_dload.asp?e=0&id=3155)

Navigant Consulting, Inc. 2015. *Energy Efficiency Potential and Goals Study for 2015 and Beyond. Prepared for the California Public Utility Commission. Final September 25, 2015*.  
<http://www.cpuc.ca.gov/General.aspx?id=2013>

Nexant. 2015. *Behavioral Demand Response Study - Load Impact Evaluation Report*  
[http://www.calmac.org/warn\\_dload.asp?e=0&id=3216](http://www.calmac.org/warn_dload.asp?e=0&id=3216)

Next Ten. 2016. *California Green Innovation Index*. <http://next10.org/sites/next10.org/files/2016-california-green-innovation-index-1.pdf>

NMR Group. 2015. *Baseline Characterization Market Effects Study of Investor-Owned Utility Residential and Small Commercial HVAC Quality Installation and Quality Improvement Programs in California (Work Order 054)*. [http://www.calmac.org/warn\\_dload.asp?e=0&id=3108](http://www.calmac.org/warn_dload.asp?e=0&id=3108)

Pacific Gas and Electric Company. October 2006. *The Pacific Energy Center's Guide to: California Climate Zones and Bioclimatic Design*.  
[http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california\\_climate\\_zones\\_01-16.pdf](http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zones_01-16.pdf)

Pacific Gas and Electric Company. April 29, 2016. *Application of PG&E for Authority to Increase Revenue Requirements to Recover the Costs to Upgrade Its SmartMeter Program*.  
<http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M163/K484/163484176.PDF>

Pacific Gas and Electric Company. June 2, 2016. *Advice Letter 3698-G-A/4813-E-A, PG&E's Residential Pay for Performance Program, as a High Opportunity Program*.  
[https://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS\\_3698-G-A.pdf](https://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS_3698-G-A.pdf)

Pacific Gas and Electric Company. September 20, 2016. *Advice Letter 3744-G-B/4886-E-B, Second Supplemental: Request for Approval of PG&E's Assembly Bill 793 Implementation Plan*.  
[https://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS\\_3744-G-B.pdf](https://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS_3744-G-B.pdf)

Pacific Northwest National Laboratory. 2006. *Compact Fluorescent Lighting In America: Lessons Learned on the Way to Market*.  
<https://pdfs.semanticscholar.org/7cb8/7b36c9d4c202d4c25c1dda520290a6239440.pdf>

Parago Energy. June 17, 2014. *Turn Up Demand Response: Educate and Incent Energy Consumers*.  
<https://cdn2.hubspot.net/hubfs/2646491/Consumer%20Incentives/Consumer%20Incentive%20Infographics/BES-Infographic-Energy.pdf>

Patel, S. Borgeson, R. Rajagopal et al. 2016. *Time Will Tell: Using Smart Meter Time Series Data to Derive Household Features and Explain Heterogeneity in Pricing Programs*. 2016 ACEEE Summer Study on Energy Efficiency in Buildings. [http://aceee.org/files/proceedings/2016/data/papers/12\\_199.pdf](http://aceee.org/files/proceedings/2016/data/papers/12_199.pdf)

Perrin, Burt. September 1998. *Effective Use and Misuse of Performance Measurement*. *American Journal of Evaluation*.  
[https://www.researchgate.net/publication/238224436\\_Effective\\_Use\\_and\\_Misuse\\_of\\_Performance\\_Measurement](https://www.researchgate.net/publication/238224436_Effective_Use_and_Misuse_of_Performance_Measurement)

Proctor, John et al. *Deep Energy Retrofits - Lessons Learned from Central Valley Research Homes*. 2016 ACEEE Summer Study on Energy Efficiency in Buildings  
[http://aceee.org/files/proceedings/2016/data/papers/1\\_776.pdf](http://aceee.org/files/proceedings/2016/data/papers/1_776.pdf)

Research into Action and Energy Market Innovators. August 30, 2012. *Program & Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER) / Business & Consumer Electronics (BCE)*. [http://calmac.org/publications/HEER\\_\\_BCE\\_083012\\_FINAL.pdf](http://calmac.org/publications/HEER__BCE_083012_FINAL.pdf)

Ridge and Associates et al. 2006. *Evaluation, Measurement, and Verification of the California Local Energy Efficiency Program*. [http://www.calmac.org/warn\\_dload.asp?e=0&id=2568](http://www.calmac.org/warn_dload.asp?e=0&id=2568)

Russell, Christopher, Brendon Baatz, Rachel Cluett, and Jennifer Amann. December 2, 2015. *Recognizing the Value of Energy Efficiency's Multiple Benefits*. <http://aceee.org/research-report/ie1502>

Senate Bill No. 1414. September 26, 2016. *California Legislative Information*.  
[https://leginfo.ca.gov/faces/billTextClient.xhtml?bill\\_id=201520160SB1414](https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB1414)

*Senate Bill 1953*. September 22, 1994. [http://www.leginfo.ca.gov/pub/93-94/bill/sen/sb\\_1951-2000/sb\\_1953\\_bill\\_940922\\_chaptered](http://www.leginfo.ca.gov/pub/93-94/bill/sen/sb_1951-2000/sb_1953_bill_940922_chaptered)

SBW Consulting Inc. December 31, 2013. *2010–2012 PG&E Whole House Retrofit Program Phase II Process Evaluation Study– Methods and Findings– PGE0302.06*.  
[http://www.calmac.org/publications/2010-2012\\_PG%26E\\_Whole\\_House\\_Retrofit\\_Program\\_Phase\\_II\\_Process\\_Evaluation\\_Study\\_Volume\\_2.pdf](http://www.calmac.org/publications/2010-2012_PG%26E_Whole_House_Retrofit_Program_Phase_II_Process_Evaluation_Study_Volume_2.pdf)

SBW Consulting Inc. 2014. *Process Evaluation for PG&E's Energy Upgrade California™ Multifamily Pilot Program*. [http://www.calmac.org/warn\\_dload.asp?e=0&id=3021](http://www.calmac.org/warn_dload.asp?e=0&id=3021)

Scott Madden Management Consultants. October 2016. *Revisiting the California Duck Curve: An Exploration of Its Existence, Impact, and Migration Potential*. [http://www.scottmadden.com/wp-content/uploads/2016/10/Revisiting-the-Duck-Curve\\_Article.pdf](http://www.scottmadden.com/wp-content/uploads/2016/10/Revisiting-the-Duck-Curve_Article.pdf)

Singh, Harinder, and Ken Rider. 2015. *Staff Analysis of Computer, Computer Monitors, and Signage Displays*. California Energy Commission. CEC-400-2015-009-SD.  
[http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN213548\\_20160909T092318\\_2016\\_Appliance\\_Efficiency\\_Rulemaking\\_Docket\\_Number\\_16AAERO2Sta.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/16-AAER-02/TN213548_20160909T092318_2016_Appliance_Efficiency_Rulemaking_Docket_Number_16AAERO2Sta.pdf)

Stuart, Elizabeth (Department of Energy). 2015. *Capturing Energy Efficiency in Residential Real Estate Transactions*. <https://emp.lbl.gov/publications/capturing-energy-efficiency>

TRC Energy Services. February 27, 2015. *Residential ZNE Market Characterization*. [http://www.calmac.org/publications/TRC\\_Res\\_ZNE\\_MC\\_Final\\_Report\\_CALMAC\\_PGE0351.01.pdf](http://www.calmac.org/publications/TRC_Res_ZNE_MC_Final_Report_CALMAC_PGE0351.01.pdf)

TRC Energy Services. 2016. *Availability of ENERGY STAR® and CEC-Spec LEDs in the California Shelf Survey*. [http://www.energydataweb.com/cpucFiles/pdaDocs/1711/TRC%20PG&E%20Availability%20of%20EStar%20and%20CEC%20Spec%20LEDs%20in%20CA%20Shelf%20Survey%20White%20Paper\\_Draft%20Final.pdf](http://www.energydataweb.com/cpucFiles/pdaDocs/1711/TRC%20PG&E%20Availability%20of%20EStar%20and%20CEC%20Spec%20LEDs%20in%20CA%20Shelf%20Survey%20White%20Paper_Draft%20Final.pdf)

Ungar, Lowell et al. 2012. *Guiding the Invisible Hand: Policies to Address Market Barriers to Energy Efficiency*. 2012 ACEEE Summer Study on Energy Efficiency in Buildings. [http://aceee.org/files/proceedings/2016/data/papers/12\\_199.pdf](http://aceee.org/files/proceedings/2016/data/papers/12_199.pdf)

United States Environmental Protection Agency. February 2010. *Customer Incentives for Energy Efficiency through Program Offerings: A Resource of the National Action Plan for Energy Efficiency*. [https://www.epa.gov/sites/production/files/2015-08/documents/program\\_incentives.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/program_incentives.pdf)

United States Environmental Protection Agency. December 2016. *Green Vehicle Guide* <https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle-0>

Vigen, Michelle et. al. 2012. *Reaching the 'High-Hanging Fruit' through Behavior Change: How Community-Based Social Marketing Puts Energy Savings within Reach*. American Council for an Energy-Efficient Economy. <http://aceee.org/white-paper/high-hanging-fruit>

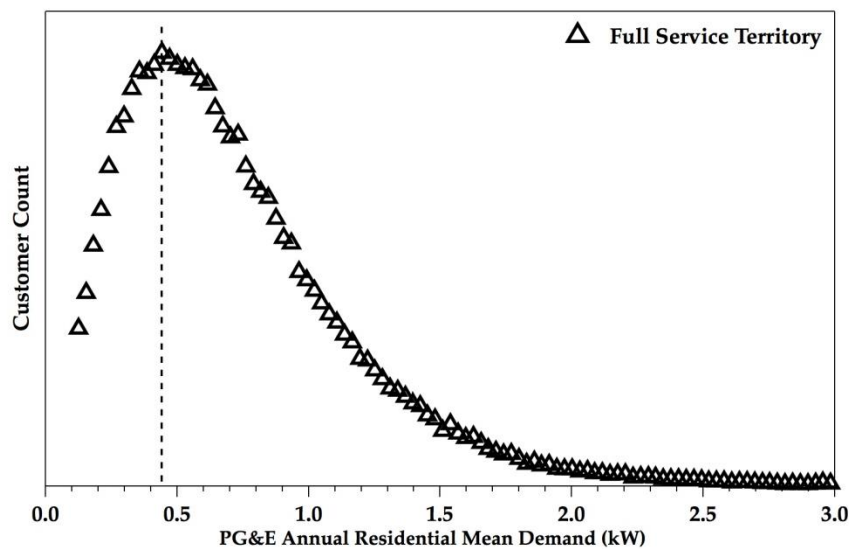
Zawadzki, Lin, Dahlquist, Bao, et al. *Personalized energy efficiency program targeting with association rule mining*. 2016 ACEEE Summer Study on Energy Efficiency in Buildings. [http://aceee.org/files/proceedings/2016/data/papers/8\\_404.pdf](http://aceee.org/files/proceedings/2016/data/papers/8_404.pdf)

## Appendix C: Residential Sector Insights from Customer AMI Data

While general overviews and trends within the residential sector are valuable, much richer insights into customer energy usage are enabled and achieved with Advanced Metering Infrastructure (AMI) data.<sup>1</sup> The data and figures presented below are the result of analysis from one year of AMI data (Aug. 2015 – July 2016) for approximately 150,000 randomly selected residential PG&E customers. The analysis was conducted with VISDOM, or Visualization and Insight System for Demand, Operations, and Management,<sup>2,3</sup> an open source<sup>4</sup> energy data analytics toolkit.

Figure C.1 shows the distribution of mean electricity demand throughout the year for PG&E residential customers.

**Figure C.1: Distribution of PG&E Residential Mean Electricity Demand**



These data reveal the top 20% of households across the service territory account for nearly 40% of total residential electricity demand. Similarly, the bottom 20% of residences are responsible for less than 10% of demand. The peak of the distribution occurs near 450 W, and the mean at 730 W indicates that PG&E

<sup>1</sup> Much of the analysis was enabled by the VISDOM software package developed at Stanford. Throughout PG&E's Residential Business Plan we will present key results and insights from this effort.

<sup>2</sup> VISDOM was developed in professor Ram Rajagopal's Sustainable Systems Lab at Stanford University during a multi-year ARPA-e funded collaboration with PG&E. It provides implementations of statistical, regression, state estimation, disaggregation, and load shape clustering algorithms that run against large samples of smart meter data from residential, commercial, industrial, and agricultural customers and has applications in program planning, segmentation, targeting, and evaluation.

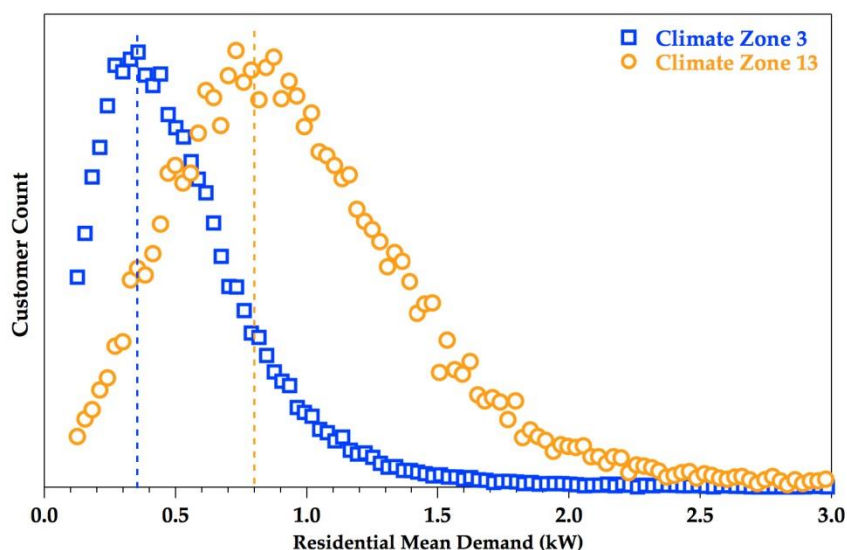
<sup>3</sup> Borgeson, Sam, June A Flora, Jungsuk Kwac, Chin-Woo Tan, and Ram Rajagopal. "Learning from Hourly Household Energy Consumption: Extracting, Visualizing and Interpreting Household Smart Meter Data." In *Design, User Experience, and Usability: Interactive Experience Design*, 337–345. Springer, 2015.

<sup>4</sup> Sam Borgeson, Jungsuk Kwac and Ram Rajagopal (2015). visdom: R package for energy data analytics. R package version 0.9. <https://github.com/convergedca/visdom>

residential customers have an average demand of 730 W, which translates to 6.4 MWh of total annual consumption.<sup>5</sup>

Energy usage also varies widely across climate zones. This can be seen in Figure C.2, which shows the distribution of mean demand throughout the year for residential customers in the temperate Climate Zone (CZ) 3,<sup>6</sup> and in CZ 13,<sup>7</sup> which is part of the hot central valley. Average customer energy usage in CZ 13 is more than 50% greater than in CZ 3. The comparison given in A.2 also shows there are many more low energy users (< 0.4 kW mean demand) in CZ 3 and high energy users (> 1.0 kW mean demand) in CZ 13, something expected considering the smaller average occupancy, home size, and lower air conditioning needs of CZ 3.

**Figure C.2: Distribution of Mean Electricity Demand, Climate Zones 3 and 13**



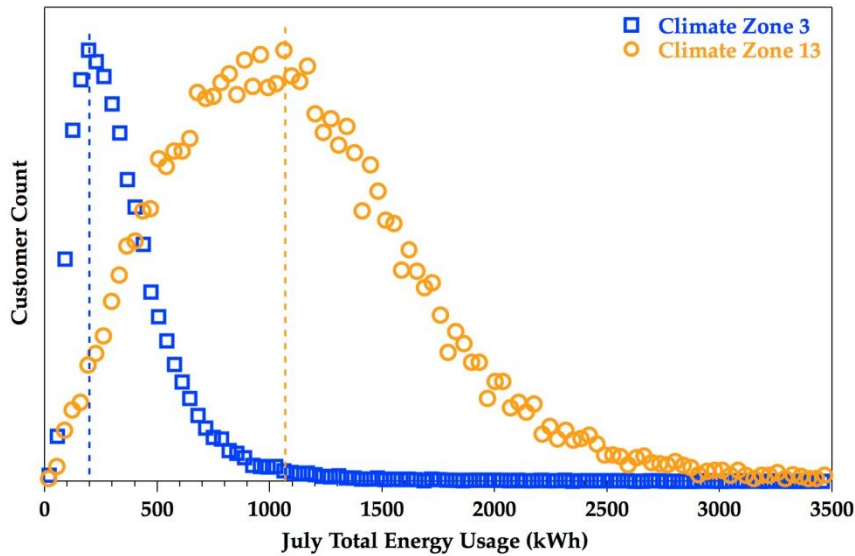
In the summer months when cooling needs increase electricity consumption in Central Valley homes, the regional difference is much more pronounced. This can be seen in Figure C.3, which shows total consumption, again for CZ 3 and CZ 13. For Central Valley homes, a significant tail still exists in the distribution of monthly summertime energy consumption above 2,000 kWh. Monthly electricity bills for these customers reach \$500 or more.

<sup>5</sup> These data yield a somewhat higher average consumption than one obtains from Figure 1 in Section D (5.2 MWh). This may be due to the different sample timeframe (Figure 1 is exclusively 2015 data), and different mix of multifamily and single family customers.

<sup>6</sup> Climate Zone 3 includes of the Bay Area, including San Francisco and Oakland

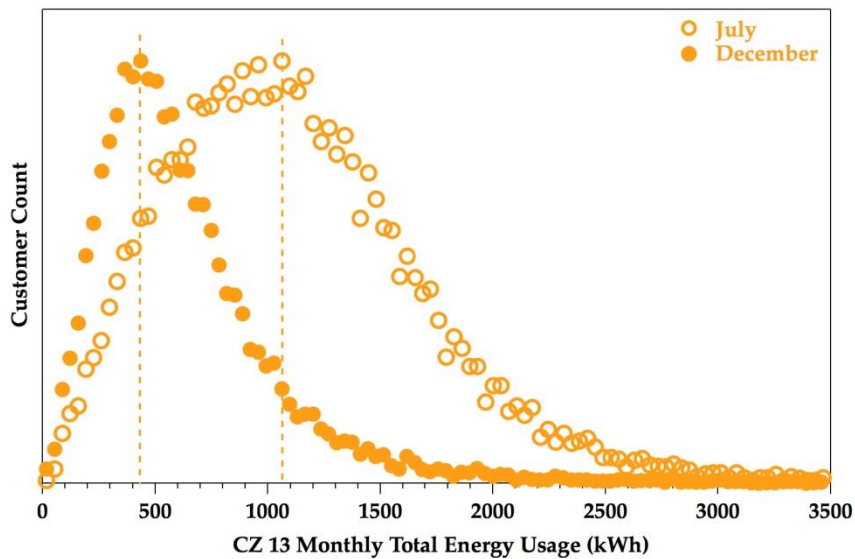
<sup>7</sup> Climate Zone 13 includes Fresno and surrounding cities.

Figure C.3: Distribution of Total July Electricity Consumption, Climate Zones 3 and 13



Similarly, energy usage can vary widely in the same CZ, depending on the season. Figure C.4 compares the distributions of total usage for CZ 13 in the summer and winter.<sup>8</sup> In the winter, the tail above 2,000 kWh has nearly disappeared and total household consumption averages less than half that of the summer months.

Figure C.4: Distribution of Total Electricity Usage in Climate Zone 13, July and December

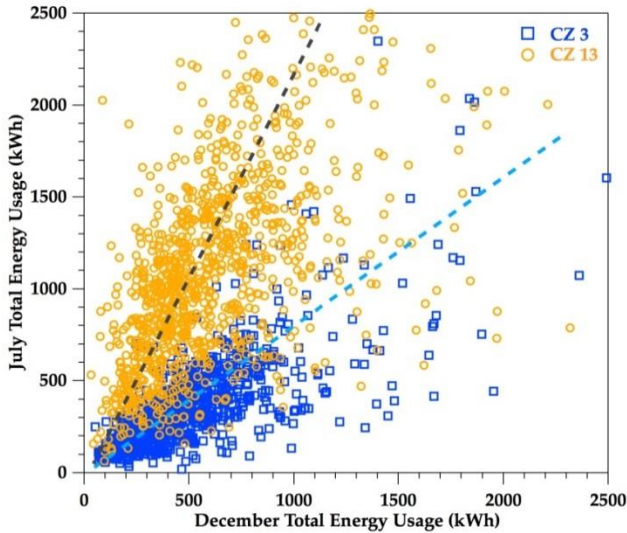


The dramatic shift in electricity needs in the Central Valley from summer to winter is in stark contrast to the experiences of customers in PG&E's more temperate areas. Higher consumption is observed in CZ 3 in December than in July, as shown in Figure C.5, along with the analogous data from CZ 13. Each data

<sup>8</sup>In Fresno, average July high and low temperatures are 96 and 66 °F. Average November high and low temperatures are 66 and 43 °F: <http://www.usclimatedata.com/climate/fresno/california/united-states/usca2234>

point in this figure represents a randomly selected customer's total December electricity consumption (x-axis) vs. total July electricity consumption (y-axis) for CZ 3 (blue) and 13 (yellow).

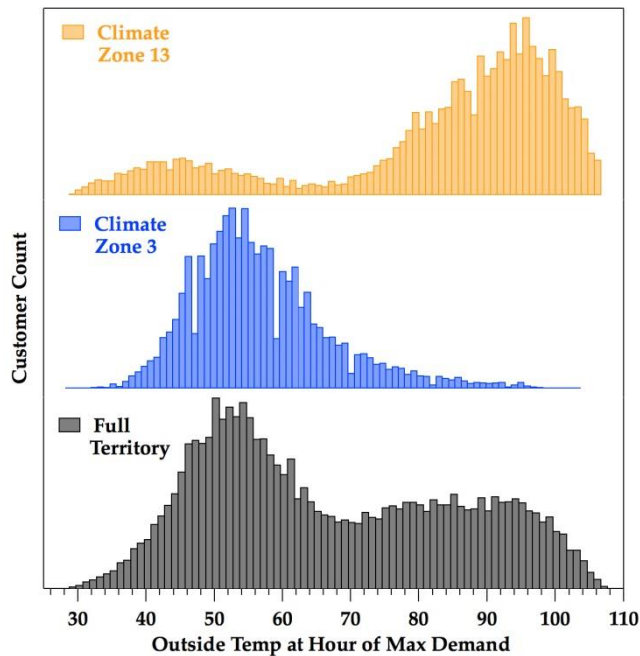
**Figure C.5: December vs. July Electricity Usage, Climate Zones 3 and 13**



Many households in CZ 3 do not require air conditioning and turn to electric heating in the winter months. Evidence that cooling drives demand in the Central Valley is not surprising. However, whether cooling or electric heating is generally responsible for peak usage both across the service territory and in Coastal regions is not as intuitively apparent. AMI data analysis reveals durable clues into customer energy usage patterns that shed light on PG&E customer needs. The bottom panel of Figure C.6 displays the distribution of the outside temperature coincident with the hour of maximum demand for a random sampling of residential customers across the service territory.



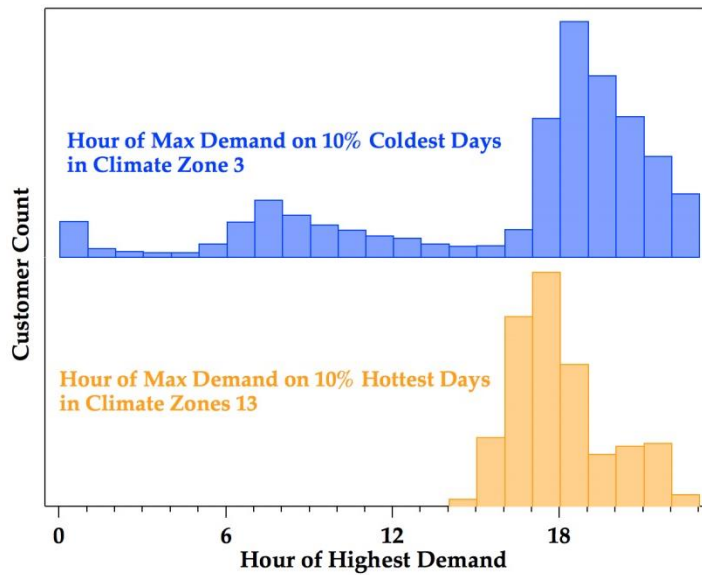
Figure C.6: Distribution of Outside Temperature at Hour of Max Demand



The pattern is bimodal with strong peaks around 50 °F and a less pronounced peak near 95 °F. This is an indication that heating may be an important contributor to instances of high demand for roughly half of the residences PG&E serves. When parsed by climate zone (middle and upper panels of Figure C.6), it is apparent that the peak centered at lower temperature originates from the Coastal regions while the higher temperature peak is largely due to hot days in the Central Valley regions. That the full territory plot shows a more pronounced peak near 50 °F is attributable to the large Bay Area population, which results in a higher portion of randomly sampled residences.

But is heating the main driver of peak demand for residential customers in Coastal regions? If this were the case, one might expect that times of peak demand would overlap strongly with the coldest hours of the year. The top panel of Figure C.7 shows this is not true. In fact, during the coldest days of the year, the hours of highest demand in coastal areas actually occur in the early evening, with the distribution showing a peak from 6 – 7 pm. By comparison, the early morning hours are the coldest on average. This does not negate a contribution from heating, but demonstrates that other factors are likely more important. In fact, the coldest months of the year in both San Francisco and Oakland are December and January, which are also the shortest for daylight. Therefore, lighting needs along with plug load usage are also likely to push the low temperature peak in the bottom and middle panels of Figure C.7.

**Figure C.7: Hour of Max Demand on 10% of Coldest Days (Climate Zone 3) and 10% of Hottest Days in Climate Zone 13**



The bottom panel of Figure C.7 shows the hour of highest demand for inland region households during the hottest days of the year. In this instance, the case is much clearer. The peak in the distribution occurs slightly after the hottest hour of the summer months (2 – 3 pm).

A much deeper dive into all of these data reveals more details, more answers, and more questions. Analysis of gas usage data also offers important lessons. Above all, this brief tour of residential data highlights the incredible customer diversity that defines PG&E. The dramatic disparity in energy usage patterns among different customers in different areas showcases that energy efficiency programs must become more tailored to the unique requirements that different regions, climates, and lifestyles demand, something we discuss in detail throughout PG&E’s Residential Business Plan.

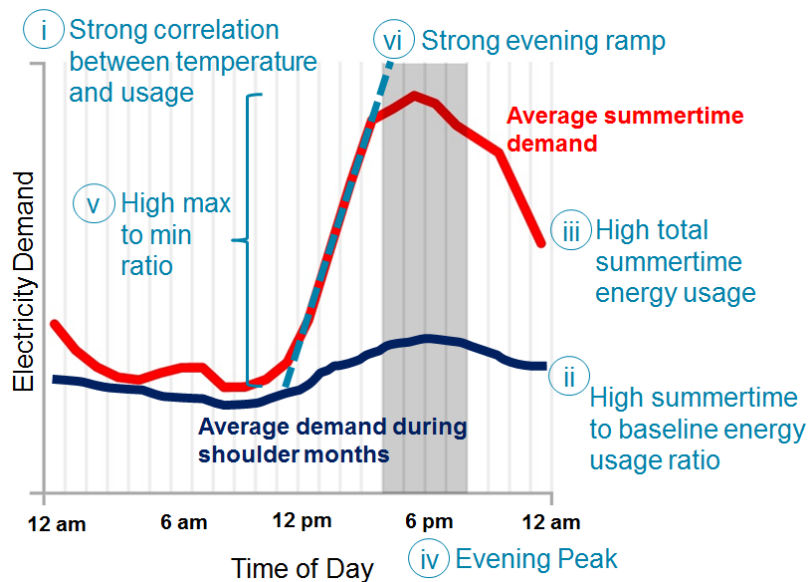
## Appendix D: Targeting Customers with AMI Data

The best way to showcase the opportunity that customer targeting through AMI data analysis offers is through a few straightforward examples. In this section, we detail approaches that use AMI data analysis, providing insights for future innovative program design. These examples highlight how interval data can be used to reveal customers who stand to benefit most from particular programs.

### Example 1: Customer Targeting for Building Shell and HVAC Maintenance/System Programs

Even without extensive modeling, AMI data can reveal characteristics of a customer's energy usage pattern that indicate air conditioning usage. Several factors that might inform potential HVAC savings are illustrated in Figure D.1, which shows a general customer's load shape over a 24-hour period.

**Figure D.1: Schematic Customer Daily Load Profiles**



An ideal customer for HVAC program participation is likely to have the following characteristics:

- i. High temperature to load correlation
- ii. High summertime to baseline<sup>9</sup> electricity usage
- iii. High total summertime energy usage

Selecting customers meeting thresholds for these characteristics ensures electricity savings for building shell and AC measures are maximized. Further criteria can be used to target peak demand reduction:

- iv. Evening peaking customers
- v. High minimum demand to maximum demand in summertime load shape

<sup>9</sup>Summertime is taken as June – September and Baseline is taken as February, March and November. Cooling needs are expected to be greatest in the summer months while electricity usage for combined heating and cooling is expected to be minimal during the baseline months.

vi. High slope in the ramp-up period to evening peak

To better understand the effectiveness of targeting customers with these parameters, PG&E conducted an assessment of 855 recent program participants in the residential Air Conditioning Quality Control program, which provides HVAC maintenance services to customers. One year of AMI data before and after participation was analyzed. Customers were filtered into targeted and non-targeted samples based on their pre-program energy usage and load shapes using loose, medium, and strict criteria detailed in Table D.1. Note that with loose targeting criteria, load shape requirements were not applied.

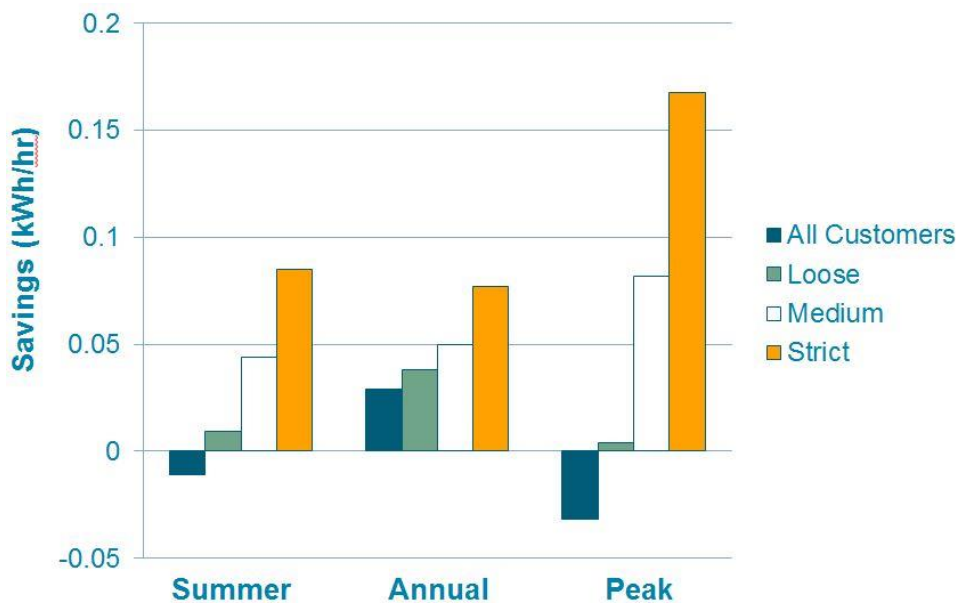
**Table D.1: HVAC Customer Targeting Criteria**

	Loose (top 90%) Targeted 672/855	Medium (top 75%) Targeted 310/855	Strict (top 50%) Targeted 102/855
1. Temperature to load correlation <sup>1</sup>	> 0.85	> 1.25	> 1.75
2. Peak ramp up speed (kW/hr)	-	> 0.25	> 0.40
3. Min to max ratio	-	< 0.5	< 0.2
4. Summertime energy usage	> 19 kWh/day	> 26 kWh/day	> 36 kWh/day
5. Summertime to baseline usage ratio	> 1.2	> 1.7	> 1.85
6. Evening Peak	Anytime, > 1.6 kW	4-9 pm, > 2.2 kW	5-8 pm, > 3.0 kW

1. The correlation between temperature time series and kW reading time series; a unitless value

Most (79%) customers passed the loose criteria, while only 36% and 12% of customers passed the medium and strict criteria, respectively. Figure D.2 displays a simple, pre/post billing analysis for summer, annual, and peak savings, given as kWh/hour for the four groups of customers.

**Figure D.2: Pre/Post Billing Analysis**



These findings highlight that savings dramatically increase as targeting criteria become more stringent. During peak summer hours (4 – 9 pm), customers who would have been targeted based on the strict criteria saved 0.17 kWh/hour, while the entire sample of 855 customers actually used more energy in the post period than the pre period.<sup>10</sup> Recent evaluation results are consistent with this analysis.<sup>11</sup> More sophisticated targeting schemes, including HVAC disaggregation modeling, have the potential to improve ideal customer selection further. Expanding this analysis will be the subject of a forthcoming whitepaper to be shared with the CPUC and then all stakeholders.

With millions of customers living in hot service territories and program budgets sufficient to reach only a small fraction of them for substantial retrofits, resources should be targeted at the customers who are expected to yield the most energy savings and the greatest reductions in their energy bills. For these customers, the value proposition of the program is real and demonstrable, even without rebates. In Appendix F Comprehensive HVAC we build off this analysis with a more detailed plan to address the challenges of the HVAC market through a new Comprehensive HVAC vision, for which customer targeting is a central tenet.

#### Example 2: Customer Targeting for Appliance Recycling and Baseload Measures

Many residential customers have old equipment that runs constantly, such as refrigerators and various other motorized devices. Some of this equipment is well past its useful life but continues to be repaired indefinitely. Replacement may necessitate a substantial upfront cost, but models that use a fraction of the energy can save the customer money in the long term. Interval data can enable PG&E and third party implementers to target customers who could benefit from specific messaging and targeted interventions.

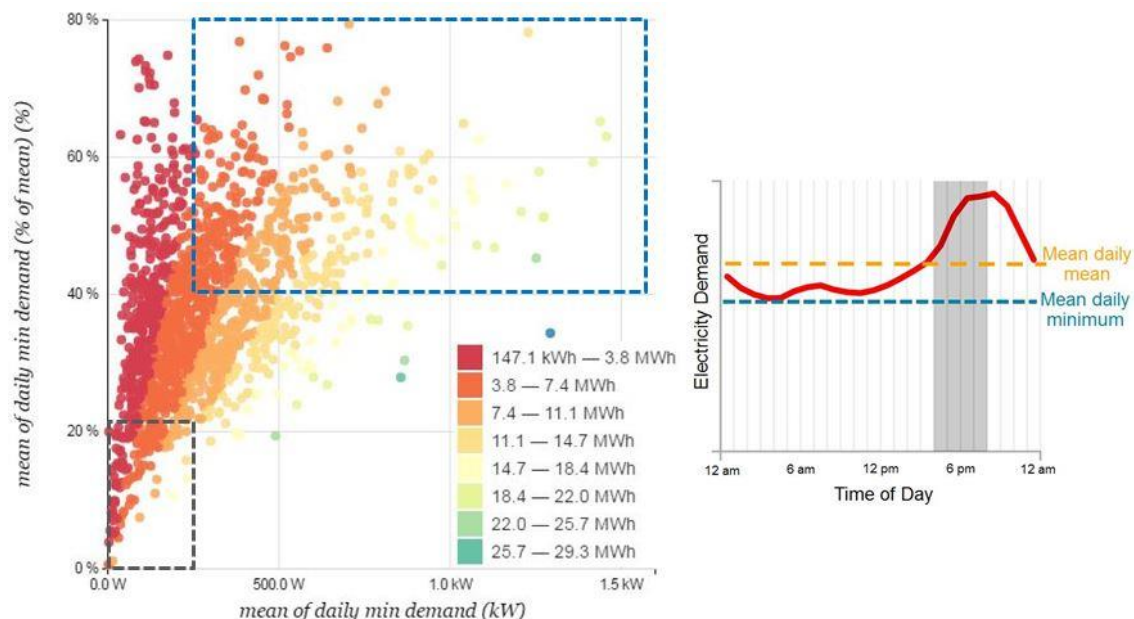
The left-hand plot below (Figure D.3) shows a random sampling of 1,500 PG&E residential customers. The horizontal-axis is the mean value of *minimum* daily demand, which is illustrated schematically by the dashed blue line in the right-hand plot. Customers with higher minimum daily demand have consistently high usage. In other words, these customers have high baseload usage. The vertical axis of the left-hand plot shows the percentage of a customer's total usage that can be attributed to baseload. The example load shape in the right-hand plot shows a customer with a relatively high baseload usage that also comprises a high fraction of his/her total electricity consumption.

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<sup>10</sup>The increased energy usage observed in this analysis may be the result of a takeback effect, higher cooling needs in year two, which are not captured due to unnormalized data, or both.

<sup>11</sup> AMI Billing Regression Study, Evergreen Economics (2016). This research shows that a significant fraction of participating customers in PG&E's AC/QC program and SCE's Residential Quality Installation program used more energy after program intervention than before.

Figure D.3: Sampling of 1,500 Residential Customers



The 1,500 customers in the left-hand plot are cataloged by colors corresponding to total annual energy usage bins. Customers within the dashed blue box have both high baseload usage (at least 250 W) and a high fraction of their total usage (at least 40%) attributable to baseload. These customers are constantly using enough energy to power at least three large refrigerators, but have relatively flat load shapes. This indicates these customers are likely consuming baseload power inefficiently. In contrast, customers in the grey box have low baseload usage but a high ratio of minimum to peak daily demand. These customers have inconsistent power usage and most have very low total usage.

Those in the blue box are likely to benefit from offerings that target systems constantly using energy, such as:

- **Appliance Recycling and Plug Loads** – Refrigerators, freezers, and other plug load appliances constantly use energy. When running inefficiently, customers stand to lose hundreds of dollars per year. Customers in the blue box are also more likely to have large appliances running in unconventional applications (e.g., second refrigerator outside or in a garage).
- **Smart Thermostat Installation or Thermostat Reprogramming** – Many customers are unaware they can save energy and still maintain a comfortable home by scheduling thermostats. If fans and air conditioning/heating equipment are running constantly, customers are more likely to appear in the blue box.
- **Quality Maintenance**– A third cause of high baseload consumption is malfunctioning HVAC equipment. For example, if evaporator coils are dirty or air filters are clogged, an AC unit may need to work in overdrive to meet minimum cooling needs.

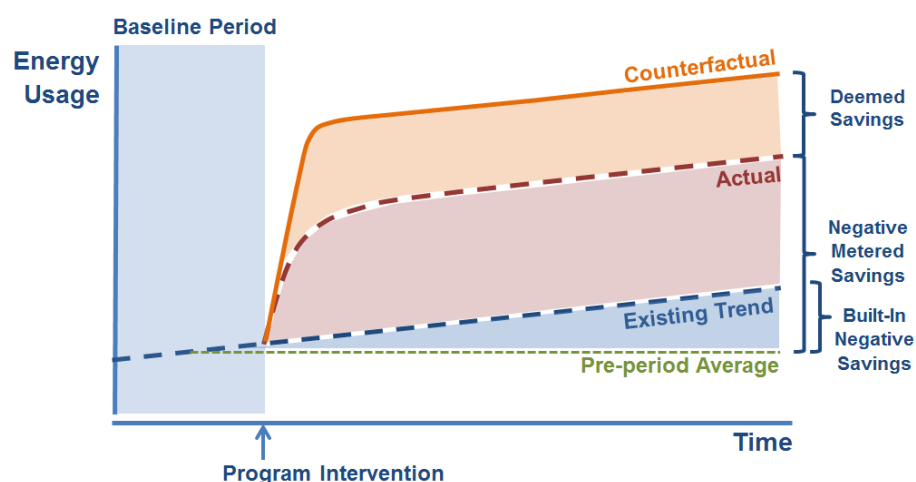
These types of targeting strategies should select customers who stand to be higher than average energy savers. Therefore, the traditional deemed approach is not expected to be appropriate for determining

savings. Each downstream program based on customer targeting will need an alternative method to definitively demonstrate savings.

### Reaching Stranded Potential

The residential sector offers higher savings potential if programs reach customers with old appliances, hollow building shells, and HVAC systems in need of major renovation. Many of these projects require large amounts of capital that customers are disinclined to invest. With the passage of AB 802, a new avenue has been established to pursue these projects. However, PG&E does not plan to convert existing programs to existing conditions baselines with only incremental changes. In fact, this approach would expose PG&E’s portfolio and ratepayers to unprecedented risk. Consider the schematic energy usage trends shown in Figure D.4 for a hypothetical household that will be evaluated via billing analysis.

**Figure D.4: Hypothetical Customer Targeted via Billing Analysis**



This household had an upward trajectory in energy usage before intervention. The customer then participates in a program that installs new energy efficient equipment either replacing non-functioning equipment or serving as an addition. This may take the form of installing central air conditioning or purchasing a second refrigerator. This scenario is represented by the red curve labeled “Actual.” Without the program, the customer may have installed inefficient equipment, which is represented by the orange “counterfactual” curve. In this case, the program ensured the increase in energy usage was minimized and savings are real in a “deemed” sense. However, potentially large negative savings would be observed at the meter as post period energy usage could be significantly higher than the pre period. Even a small percentage of these cases when added to a larger billing analysis sample could drive meter-based savings considerably downward. The rising energy usage trend, if true for an average participant household, could have a significantly negative effect.

How might these risks be averted? Program design to find the subsets of customers who will save the most energy from the specific interventions can help alleviate risk. In the case of a program offering new energy efficient equipment, the ideal case, and the case that holds to the spirit of AB 802, is replacement of old, functioning equipment under a pattern of indefinite repair. By proactively promoting this program model to customers with inefficient usage patterns, ratepayer dollars would be invested in long-term, deep energy savings that would also be readily apparent on a customer’s bill.

These are the same customers who offer the highest potential for greenhouse gas reductions as well as the most avoided procurement costs and enhanced grid reliability in load constrained areas. These are benefits shared by all customers. The new paradigm offered by AB 802 constructively aligns with PG&E's desire to proactively target individual customers based on AMI data analysis.



## Appendix E: Additional Customer Data

Figures E.1 and E.2 compare 2015 energy savings and median household income by county. For the programs for which locational end use information is available, savings tend to decrease as median household income decreases. We note that savings from upstream and midstream programs, ESA and Home Energy Reports are not represented in these data. Bay Area counties (Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma) fall into the top 15 median household incomes. These counties also account for 38% and 57% of PG&E’s 2015 electric and gas savings respectively as seen in Figure E.1.

**Figure E.1: 2015 Electric Savings and Median Household Income by County**

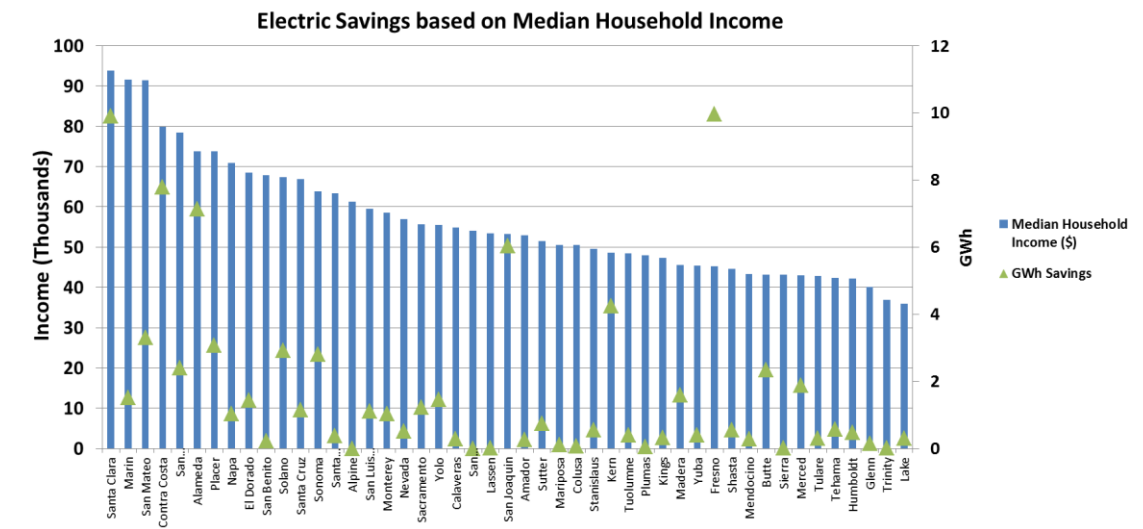


Figure E.2: 2015 Gas Savings and Median Household Income by County

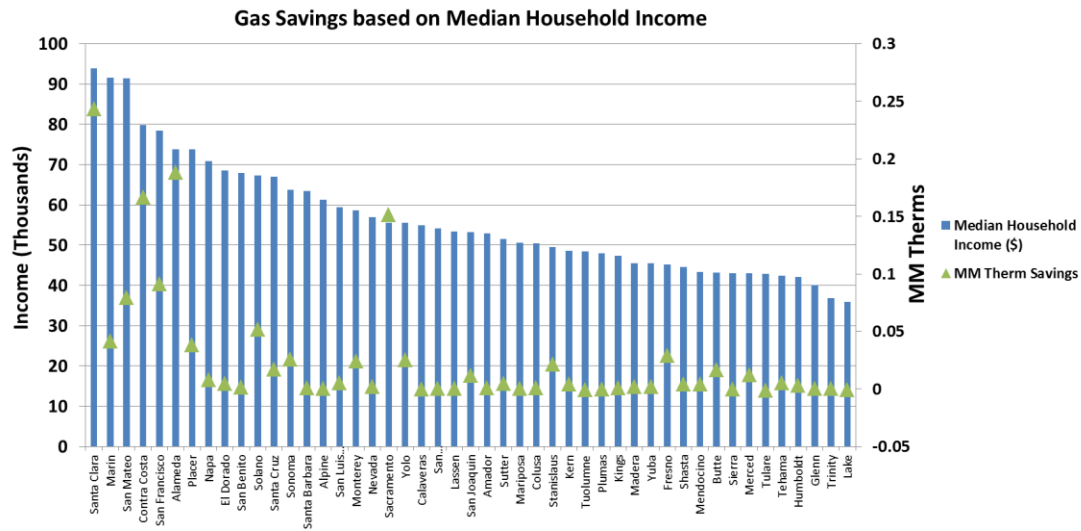


Figure E1 and E2: Median Household Income is based on the 2010-2014 American Community Survey 5-Year Estimates. Savings are first year, ex ante, gross and include interactive effects. Electric savings and participants include only those with zip code data. Other residential programs account for an additional 151.5 GWh, and 3.7 MM Therms and include upstream programs such as the Primary Lighting Program and the Upstream HVAC Program as well as Home Energy Reports. A small fraction of savings (<0.5%) originate from local government partnerships (MIDI is covered in this chapter).

## Appendix F: Comprehensive HVAC

### Background

Heating, Ventilation and Air Conditioning (HVAC) performance improvement is one of the most significant opportunities for realizing stranded potential. However, HVAC programs have historically underperformed and have not been cost effective. There are no simple solutions to the compound problems ingrained in the market. As a result, PG&E recognizes that a new approach is needed. Before detailing PG&E's strategy to modify existing residential HVAC programs going forward, it is essential to understand the specific barriers that must be addressed.

### Current Barriers

#### 1. Lack of enforcement has spawned a largely unregulated market.

- A significant percentage of HVAC contractors in California operate without a license.<sup>12</sup>
- A very small fraction of new HVAC installations are permitted,<sup>13</sup> as is required by law.
- A link between permitting and code compliance is tenuous and even permitted jobs often fall well short of code compliance.<sup>14</sup>
- Currently central registry or tracking systems for the sale and installation of new HVAC equipment are lacking,<sup>15</sup> making it more difficult to enforce compliance requirements and accurately gauge permitting and compliance rates.

*These issues cause not just concern over wasted energy, but raise fundamental safety, health and comfort concerns for customers across California.*

#### 2. Inadequate workforce knowledge, skills, and ability leads to poor installation quality and inadequate maintenance.

- Less than half of HVAC technicians operating in California are aware of the Air Conditioning Contractors of America (ACCA) standards<sup>16</sup> for work quality.<sup>17</sup>
- Despite high failure rates for job performance on routine tasks,<sup>18</sup> most technicians report needing no or very limited additional training.<sup>19</sup>

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<sup>12</sup>Baseline Characterization Market Effects Study of Investor-Owned Utility Residential and Small Commercial HVAC Quality Installation and Quality Improvement Programs in California (Work Order 054), NMR Group, Inc. (2015) pg. 23 - 24; This study reports that the California Contractors State License Board estimates there are 12,000 – 16,000 licensed contractors (C-20), but up to 3,000 unlicensed contractors operating in California.

<sup>13</sup>Recent research report residential permitting rates estimates between 8% (*Top-down permit rate draft report (HVAC6)*, DNV-GL (2016)) to 38% (*HVAC Permitting: A Study to Inform IOU HVAC Programs*, DNV GL (2014)).

<sup>14</sup>*California HVAC Contractor & Technician Behavior Study, Phase II*, Energy Market Innovations Consulting, (2015).

<sup>15</sup> California Existing Building Energy Efficiency Action Plan October 2016 Plan Update. Page 22 identifies an HVAC equipment tracking database as a possible tool to aid in compliance improvement. While PG&E is not positioned to create and maintain such a database (our programs only impact a small fraction of California HVAC equipment sales), we support this goal.

<sup>16</sup><http://www.acca.org/standards/quality>

<sup>17</sup> ACCA Standards

<sup>18</sup>NMR - Field observations of 13 technicians servicing units with preset faults revealed that even basic maintenance tasks were often performed incorrectly. Often the most impactful tasks for improved energy performance were not even attempted. None of the technicians were knowledgeable in ACCA 4 standards.

<sup>19</sup> *California HVAC Contractor & Technician Behavior Study, Phase II*, Energy Market Innovations Consulting, (2015). p. 45

*A competent and knowledgeable workforce is essential to deliver solutions and communicate the value of improved HVAC performance to customers.*

### 3. Customers do not understand HVAC systems and do not value standards-based installation and maintenance.

- More than half of residential customers do not have maintenance performed on their HVAC systems. Many others only have maintenance performed sparsely.<sup>20</sup>
- The vast majority of customers do not consider energy performance when assessing the quality of HVAC maintenance or installation. The most common metric to judge HVAC service is only whether the system functions.<sup>21</sup>
- Concern over cost is the leading reason customers are not willing to pay more for standards-based installation and maintenance. Technicians also report that customer cost concern is the biggest barrier to selling standards-based maintenance.<sup>22</sup>

*These results indicate that California customers are very unlikely to demand the quality installation and maintenance that ensure existing systems operate optimally throughout their lifecycle.*

### 4. Uncertainty and variability in savings for specific HVAC measures and difficulty developing engineering parameters has limited program offerings and effectiveness.

- Currently, there is no reliable method to assess savings for quality installation. Data on standard installation practices are sparse, in part because it is difficult to track and sample non-permitted installations.
- The current maintenance savings are assessed on a task-by-task basis. The determination of savings for each task is highly uncertain and does not adequately account for interactive effects.<sup>23</sup> Several important maintenance tasks are not incentivized because no savings are assigned.<sup>24</sup> This can lead to a skewed approach that does not result in thorough full-system maintenance and adjustments.
- Verification of each measure and pre/post states of the system requires extensive data collection that is burdensome for implementers and time-consuming for contractors and technicians. This diverts program resources from core goals, including providing service for the most possible customers.

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<sup>20</sup>California HVAC Quality Installation/Quality Maintenance Customer Decision-Making Study, Energy Market Innovations Consulting, (2015); 58% of program non-participants surveyed report not having regular HVAC maintenance. For customers who do have maintenance performed but do not have a maintenance contract, 60% report having one or fewer maintenance visits per year.

<sup>21</sup>California HVAC Quality Installation/Quality Maintenance Customer Decision-Making Study, Energy Market Innovations Consulting, (2015)

<sup>22</sup>California HVAC Contractor & Technician Behavior Study, Phase II, Energy Market Innovations Consulting, (2015).

<sup>23</sup>Impact Evaluation of 2013-14 HVAC3 Commercial Quality Maintenance Programs, DNV GL (2016). Achieved precision at the 90% confidence level for the five measures in the Commercial Quality Maintenance Programs that accounted for highest statewide ex ante savings ranged from  $\pm 24\%$  –  $\pm 72\%$ . Residential programs were not assessed.

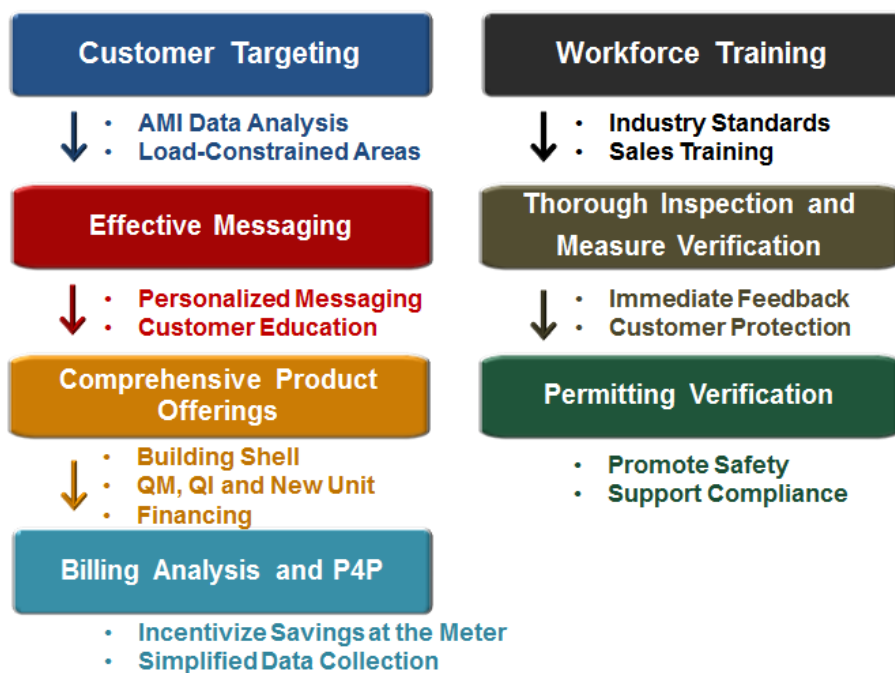
<sup>24</sup>For example, the utilities are allowed to claim savings for refrigerant charge adjustment and coil cleaning, but not for a number of other ACCA 4 and 5 tasks that impact energy performance.

These issues prevent quality installation and maintenance programs from rewarding contractors and technicians who follow a common-sense approach to enhance performance and achieve maximum energy savings on a case-by-case basis.

## Opportunities for Future Comprehensive HVAC Program Design

With residential HVAC accounting for a large fraction of peak load in California depending on the location, and the number of households with centralized air conditioning continuing to steadily increase,<sup>25</sup> HVAC must be addressed to meet the state’s energy efficiency goals. Drawing from industry expertise and the intervention strategies described in our Residential Business Plan, PG&E believes it is possible to lay the foundation for workforce development and scalable energy savings. In Figure F.1 PG&E outlines a potential approach to transition residential HVAC programs into a robust suite of offerings that addresses the major market and program barriers. The left track relates to the product design, marketing and evaluation while the right track shows workforce and work quality controls.

Figure F.1: Elements of a Comprehensive HVAC Program Vision



**Customer Targeting** – As discussed in intervention strategy 1 of the Residential Business Plan, AMI data holds incredible potential to both better understand customer energy usage at an individual household level, and to tailor offerings that benefit customers most in need of specific programs. By mining data, customers can be matched to the best programs. Because of the strong correlation between outside temperature and household HVAC energy usage, numerous HVAC disaggregation modeling schemes have been created. However, identifying customers who are high HVAC users is only a start.

Because HVAC usage is likely to scale with home size, it is important to find the intersection of customers with high disaggregated HVAC usage *and* high HVAC usage relative to total household usage. These are the customers most likely to be using HVAC inefficiently. When also combined with evening-

<sup>25</sup>HVAC6 Top Down Permit Rate Draft11, DNV GL (2016).

peaking customers, such a targeting scheme can be employed to enhance the value of energy efficiency programs for both the customer and the utility. In turn, by deploying targeted HVAC programs in load-constrained areas with temperature-driven peaks, energy procurement costs during the most expensive periods can be kept to a minimum.

**Effective Messaging** – While AMI data analysis is a powerful tool to identify energy waste among individual households, it does little to actually enroll the customer in a program and successfully encourage a deep retrofit. PG&E is a trusted energy advisor among our customer base, especially for energy usage and saving recommendations. In partnership with contractors in the field, PG&E can provide marketing material and identify the highest potential customers.

**Comprehensive Product Offerings** – Currently PG&E’s residential HVAC programs operate entirely independently of each other and independently of other residential programs that offer HVAC services such as Energy Upgrade California Home Upgrade. Quality Installation contractors are not able to offer incentivized quality maintenance contracts. Quality Maintenance contractors cannot offer a customer a rebate for an above-code new unit with quality installation, and are therefore disincentivized to upsell efficient replacement equipment. PG&E believes each of these programs can have a positive influence in select arenas, but none alone will lead to a market in which customers benefit from customary high performing HVAC systems. To address the ingrained barriers enumerated above, PG&E believes the following elements could help bridge these gaps:

Participating contractors assess HVAC systems and building shell needs and discuss options with the customer. Depending on the individual situation, the contractor would recommend one or more of the following:

- i. Service packages and maintenance contracts that include the option for duct sealing, duct insulation, duct repair and building shell measures, in addition to the standard unit maintenance measures currently offered.
- ii. Quality installation of a new, above-code unit, including options for split system variable refrigerant charge technologies. For all new unit installations, contractors should right-size the system. Oversized systems are common<sup>26</sup> and result in a high degree of energy waste.
- iii. Installation of a energy management system as well as customer education on scheduling, connectivity and usage.
- iv. A financing package for the customer to ensure that the most extensive retrofit possible is completed with the least financial burden possible, and minimized incentive spend.

While some customers may be willing to undertake a comprehensive building shell/HVAC retrofit, most will adopt only certain actions or will take an incremental approach to a longer term retrofit. Ensuring that customers have choices and are guided to the best options must be a priority. Recent research suggests that addressing the building shell, especially in older vintage homes, can have a greater effect than HVAC system replacement with no building shell enhancements.<sup>27</sup> Nevertheless, providing

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<sup>26</sup> R. Mowris and I. Jones. “Peak Demand and Energy Savings from Properly Sized and Matched Air Conditioners,” 2008 ACEEE Summer Study on Energy Efficiency in Buildings

<sup>27</sup> J. Proctor and B. Wilcox. “Deep Energy Retrofits - Lessons Learned from Central Valley Research Homes,” 2016 ACEEE Summer Study on Energy Efficiency in Buildings

customers with a data-driven recommendation for where their limited dollars, coupled with program support, can be used most wisely can enhance the value proposition of the HVAC programs.

**Billing Analysis and Pay for Performance** – HVAC systems consist of complex and interconnected individual components. Optimization of any one of these subsystems in isolation will yield an energy savings impact that is dependent on the state of the remaining system.<sup>28</sup>

The data collection required for verification of each individual task is time-consuming for technicians who already operate under intense time pressure and detracts from their ability to serve more customers or provide thorough service to existing participants. Furthermore, because only certain tasks are approved for financial incentives (and energy savings claims), a bias exists toward completion of those tasks, at the expense of others that may be the root cause of an underperforming system.

With the planned approach to target individual customers in load constrained areas, higher energy savings and more valuable peak load reduction are expected compared to the status quo.<sup>29</sup> Developing detailed workpapers to estimate deemed savings for each set of targeted customers adds yet another layer of complexity to achieve accurate savings.

While incremental progress is possible, the current paradigm for program design is not built to facilitate more comprehensive and agile solutions for the customer. A pay-for-performance (P4P) approach as discussed in intervention strategy 5 in the Residential Business Plan could benefit all parties involved and lead to greater savings. The comprehensive building shell and systems design would enable contractors and technicians to pursue the true limiting factors to achieving more efficient HVAC usage on a case-by-case basis. Such a design would reward implementers for savings observed at the meter. By incorporating a P4P model, contractors and technicians would be inherently incentivized to improve performance and learn the skills to achieve standards-based service. Larger payments could be made for more savings and an up-front payment for installed measures, possibly from a third-party aggregator, could be made to ensure participation and help contractors with their short-term business needs.

PG&E anticipates that multiple options may exist for determination of normalized meter-based savings. On behalf of the statewide IOUs, PG&E is leading Phase II of the AMI Billing Regression study. This research focuses on developing new billing analysis methodologies that use interval data, particularly the Random Coefficients Model, which proved to be promising in Phase I research that focused on assessing savings from residential HVAC programs.<sup>30</sup> The CalTRACK billing analysis platform, which is being built and piloted for the residential P4P program described above, could also be refined and used for Comprehensive HVAC.

**Workforce Training** – Even with a sophisticated targeting effort, willing customers, a state-of-the-art product package, and refined billing analysis evaluation, no program can be successful without a dedicated workforce to execute the program. PG&E recognizes the importance of industry partners and

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<sup>28</sup>As a simple example, consider adding refrigerant to two undercharged HVAC systems. The first system has clean condenser coils and the second system has dirty coils. Adjusting refrigerant charge in the first system will yield different savings than in the second system because heat transfer efficiency depends on both refrigerant charge level and the state of the coils.

<sup>29</sup>The energy usage profiles of these specific subsets of customers will be different from average customers. A targeted customer is expected to have greater total usage, more HVAC usage relative to total usage, greater summertime usage relative to other months, and have a more exacerbated evening peak than an average customer. For these reasons, targeted customers are most need of the program and will deliver greater cost savings per program dollar.

<sup>30</sup>AMI Billing Regression Study; Evergreen Economics (2016).

high-quality training that is based on industry standard protocols and rooted in adult learning principals. PG&E also understands that technicians rate utility training, apprenticeship, and in-field training as more effective than online or classroom training programs.<sup>31</sup> In the last decade, PG&E has worked with industry experts to develop and enhance training programs and has required their completion as a prerequisite for participation in the HVAC energy efficiency programs.

In addition, most technicians in the residential sector report being responsible for selling customers maintenance contracts and new HVAC equipment.<sup>32</sup> However, only about half of technicians report receiving sales training from their company and three quarters responded that additional sales training would be helpful. Therefore, PG&E views sales training in conjunction with technical training as a beneficial offering to technicians and will explore providing the combined package going forward.

**Thorough Inspection and Measure Verification** – PG&E recognizes inspection as an effective method to reinforce training with real-time feedback as skills and methods are taken to the field. Inspection of in-field work also protects customers and ensures that any necessary modifications are completed in a timely fashion.

**Permitting Verification** – Safety is the number one priority at PG&E. The permitting process for new HVAC installations helps ensure customer and workforce safety. Therefore, for any new HVAC installation completed through a comprehensive HVAC program for which SB 1414 mandates a permit,<sup>33</sup> proof of permitting will be required. PG&E also recognizes the need for building departments throughout our service territory to streamline permitting processes and encourage enforcement of permitting laws.

PG&E also plans to learn from programs around the country, including the SCE Commercial HVAC High Opportunity Program or Pilot (HOPP), which contains some important synergies with the program described here. In developing the Comprehensive HVAC program, PG&E will lean on industry expertise, including that offered by the Western HVAC Performance Alliance, to solicit feedback, incorporate the most advanced workforce training methods, optimize program design elements, and motivate participation.

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<sup>31</sup>California HVAC Contractor & Technician Behavior Study, Phase II, Energy Market Innovations Consulting, (2015), Pg. 41; For residential technicians who received the following trainings, the fraction who rated the training as “very effective” or “effective” is given in parentheses. On the Job Training (99%), Union Apprenticeship Training (100%), Utility Training (85%) Online HVAC Course Training (69%), Community College Training (64%).

<sup>32</sup>California HVAC Contractor & Technician Behavior Study, Phase II, Energy Market Innovations Consulting, (2015), Pg. 66 - 71; of technicians operating in the residential HVAC sector, 93% report being responsible for selling new HVAC equipment directly to customers and 89% report being responsible for selling maintenance agreements directly to customers. 54% of technicians report having sales training through their current employer and 75% report that additional sales training would be helpful.

<sup>33</sup> For more information, see “Senate Bill No. 1414,” *California Legislative Information*, [https://leginfo.ca.gov/faces/billTextClient.xhtml?bill\\_id=201520160SB1414](https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB1414)



## Appendix G: Upstream Lighting Opportunities

### Background

Since 2006, the IOUs have implemented an Upstream Lighting Program, which has aimed to transform residential lighting markets, first with promotion of high quantities of compact fluorescent bulbs (CFLs), and more recently by incentivizing high quality light emitting diode (LED) lamps. With more than half of residential sockets in California still using inefficient incandescent or halogen lamps,<sup>34</sup> residential lighting represents a major savings opportunity.

Implemented in 2014, the Energy Independence and Security Act (EISA) essentially bans the manufacturing of traditional incandescent bulbs in the 40, 60, 75 and 100 W categories. This EISA mandate was adopted one year early in California by Assembly Bill 1109. The AB 1109 legislation also set a goal to reduce residential lighting electricity use in California by 50% by 2018 from a 2007 baseline. The combination of utility-sponsored programs, technology improvements, and AB 1109 regulations has made a major difference. However, recent analysis suggests California is still well short of the 50% target.<sup>35</sup>

### The Advent of Halogen Lamps

One major barrier to deeper lighting savings is the recent advent of inexpensive halogen lamps, which meet the current EISA efficiency (lumens/watt) criteria. Compared to compact fluorescents (CFLs) and LEDs, replacing an incandescent with an equivalent halogen yields only about one third of the savings.<sup>36</sup> Because PG&E has dramatically scaled down CFL rebates<sup>37</sup> per CPUC direction, and because LED bulbs remain expensive, halogens are most often the lowest purchase price option for the customer. The 2013 – 2014 Impact Evaluation of the Primary Lighting Program stated, “without IOU discounts, incandescent and halogens were the lowest-cost options within each replacement lamp category at the end of 2014.”<sup>38</sup> For customers sensitive to up-front cost, halogens have largely taken the place of the traditional incandescent market. This trend is evident in Fig. G.1, which shows halogen sales estimates from three different sources. Each estimate shows a dramatic increase in halogen adoption after implementation of AB 1109/EISA.

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<sup>34</sup>Goebes et al. ACEEE (2016); Analysis indicates that California is 31% of the way to the 50% target. 19% remains in the next two years.

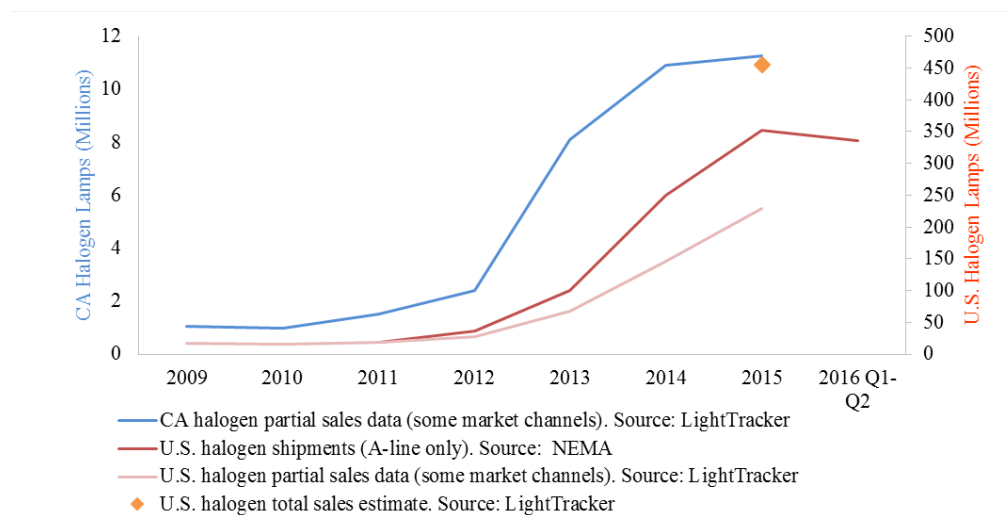
<sup>35</sup>*Clearing the Path to Market Transformation in the Rapidly Evolving World of Residential Lighting*, M. Goebes et al. ACEEE (2016).

<sup>36</sup>For example, EISA requires that the maximum wattage for a 750 – 1049 lumen lamp (60 W-equivalent) is 43 W, which results in a delta watts value of 17 W. An equivalent CFL or LED would be approximately 13 W or 8 W respectively, yielding delta watts of 47 W and 52 W respectively.

<sup>37</sup>In 2008 PG&E rebated approximately 24 million CFLs. By 2016 that number had fallen to less than 0.5 million.

<sup>38</sup>Impact Evaluation of 2013-14 Upstream and Residential Downstream Lighting Programs, p. 9

**Figure G.1: Halogen Sales after AB 1109/EISA**



To mitigate the trend of increasing halogen purchases, in the near-term, PG&E will continue to offer incentives for CFLs in hard-to-reach markets that serve low income customers. PG&E will also continue to offer rebates for high lumen output CFLs for product categories not affected by EISA or AB 1109 and for which no current LED products are manufactured. However, we note that these CFL rebates are a small fraction of the support we provide for LEDs.<sup>39</sup> PG&E also plans to encourage development of LED products in the non-EISA categories (less than 310 lumen and greater than 2600 lumen) through its relationships with manufacturers. PG&E will work closely with the statewide administrator of upstream lighting to accomplish these objectives.

### Support for LED Market Transformation and Current Challenges

With their long lifetime, capability for integration into interconnected homes, and substantial efficiency improvements, market transformation to LEDs poses an opportunity for substantial greenhouse gas savings and permanent load reduction across PG&E’s service territory. However, despite recent growth in LED product availability and sales, market transformation is not a foregone conclusion. Due in part to poor initial experiences<sup>40</sup> with early-generation products, CFL market saturation peaked near 30%, with inefficient technologies, including standard incandescents and halogens, retaining the majority of the market.<sup>41</sup> The same risk exists today in the LED market as manufacturers and retailers race to capitalize on the profit opportunity presented by rapid LED sales. Few current quality controls exist in the LED market, and customers who switch from other technologies are largely uneducated about comparable product attributes. For instance, while incandescents, halogens, and many CFLs are dimmable, many lower cost LEDs are not. If a customer purchases a non-dimmable LED into a dimming socket, quality and burnout issues are expected that can ruin that customer’s impression of LED technology. Similarly, by definition incandescent bulbs provide near perfect color rendering (CRI = 100) and naturally achieve a warmer color temperature as they are dimmed. Currently, most standard LEDs have CRI values of 85 or lower and do not change color temperature when dimmed, which creates a much different feeling for customers used to filament-based technology.

<sup>39</sup> More than 85% of the lamps rebated through PG&E’s Primary Lighting Program in 2016 were LEDs.

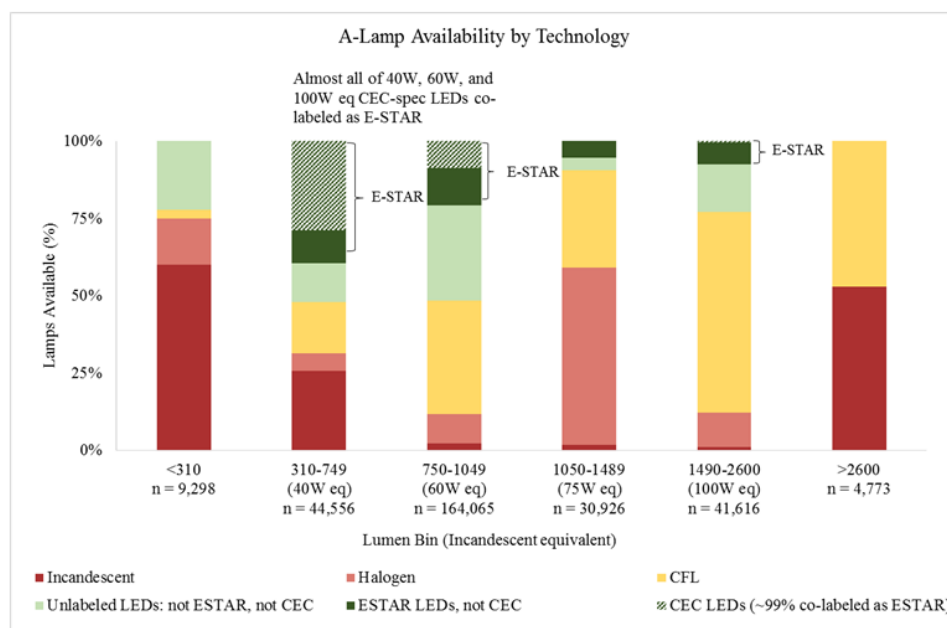
<sup>40</sup> *Compact Fluorescent Lighting In America: Lessons Learned on the Way to Market*, June 2006 (DOE)

<sup>41</sup> *Saturation Comparison of Massachusetts, California, and New York: Final Report*, March 2015 (Cadmus)

To promote quality products and positive customer experiences, LEDs sold through the statewide Upstream Lighting Program must meet rigorous voluntary product specifications developed by the California Energy Commission (CEC-Spec).<sup>42,43,44</sup> If the ULP effectively pushes manufacturers to adopt the CEC-Spec throughout their product portfolio, high customer satisfaction with LEDs should enable complete market transformation.

Significant work remains to reach this goal. Taking common screw-based A-lamps as an example, in-store product availability for CEC-Spec products remains low. Figure G.2 displays results from an analysis of 2015-2016 California lighting shelf surveys conducted by DNV GL. Red and pink segments designate inefficient incandescent and halogen lamps, respectively, yellow represents CFLs, and shades of green show saturation of LEDs. The light green and solid dark green are categories of LEDs that do not meet the CEC-Spec quality standard, while the patterned green are CEC-Spec compliant products. From left to right, the bars represent lower light output lamps to high light output lamps.

**Figure G.2: Analysis of 2015-2016 California Lighting Shelf Surveys**



No CEC-Spec lamps are available for four of the six product categories defined by incandescent equivalence. CEC-Spec LEDs are available only where the IOUs have focused incentives (40 W-equivalent and 60 W-equivalent). With the exception of the 40W-equivalent category, CEC-Spec lamps either are unavailable or are a minority of products.

However, due largely to cost effectiveness challenges for the support of CEC-Spec compliant LEDs,<sup>45</sup> the PG&E Primary Lighting Program is currently an order of magnitude smaller than its peak in 2008.

<sup>42</sup>D.12.11.015, Nov. 2012, p. 30

<sup>43</sup>Voluntary California Quality Light-Emitting Diode (LED) Lamp Specification, December 2014 (CEC)

<sup>44</sup>Resolution Updating the Voluntary California LED Lamp Specification, January 2015, Resolution Number 14-1210-09, Docket Number 12-BSTD-03

<sup>45</sup>Low ex ante Net-to-Gross (NTG) values (0.55 – 0.6), 2017 DEER baseline updates and low ex post NTG (0.30) reported in the Impact Evaluation of 2013-14 Upstream and Residential Downstream Lighting Programs greatly suppress the TRC of upstream LED measures.

Without cost effective measures, IOUs cannot provide the robust support needed to saturate the market with high quality LEDs across product categories and safeguard future market transformation.

Despite the challenges posed for the Upstream Lighting Program to achieve market transformation under current constructs, the IOUs have made strides in preparing the market for implementation of new Title 20 code and the second phase of the Energy Independence and Security Act (EISA), set to take effect Jan. 1, 2018.<sup>46</sup> When the directive was issued that all LEDs incentivized through the Upstream Lighting Program had to meet CEC-Specification criteria in 2012, no products existed that could meet these strict requirements. PG&E and the statewide IOUs have collaborated to educate manufacturers on the quality and customer satisfaction goals of the program and used incentives to spur the requisite production innovation. Since then, more manufacturers have developed capabilities needed to participate and the number of manufacturers producing CEC-Spec bulbs in the program has more than doubled each year since 2013. Currently, 15 manufacturers are participating and providing CEC-Spec quality bulbs to retailers across PG&E's service territory.

In 2017, PG&E will continue to promote high quality LEDs. Working in collaboration with the statewide IOUs PG&E will continue to develop new partnerships with manufacturers. When updated Title 20 code and EISA Phase II take effect in 2018, the Upstream Lighting Program will also shift to statewide implementation.<sup>47</sup> At this point, the number of cost effective measures are expected to decrease dramatically due to baseline changes—a reassessment of the product types and program scope will likely be needed.

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<sup>46</sup>New EISA efficiency standards are expected to essentially eliminate the manufacture of all filament based bulbs in the 301 – 2600 lumen range.

<sup>47</sup> Southern California Edison (SCE) has been proposed as the statewide lead administrator for this program. Please see PG&E's Statewide Administration Business Plan chapter for more details.

## Appendix H: EM&V Lessons Learned in the Residential Sector

### Impact Evaluation Results

Table H.1 gives a brief synopsis of ex ante and ex post energy savings delivered in 2014 by PG&E's residential energy efficiency portfolio (not including codes and standards). For comparison, ex ante and ex post savings from the portfolio as a whole (again not including codes and standards) is given in Table H.2. Values in these tables result from querying the 2014 ESPI Database.<sup>48</sup> The 2014 program year is chosen because it is the last for which impact evaluation data is available to provide verification of reported values.

The evaluated first year residential savings account for 43%, 42% and 12% of PG&E portfolio GWh, MW and Therm savings, respectively.<sup>49</sup> That evaluated (ex post) savings in the residential sector are greater than reported (ex ante) savings results from several factors, including higher savings than predicted found for upstream lighting measures. The average lifetime of the residential sector kWh savings is 5.7 years, compared to 9.1 years for the entire portfolio (ex post). The lower average residential effective useful life (EUL) for savings results primarily from the 1.0 year EUL assigned to savings achieved through Home Energy Reports, which account for 36% of 2014 residential first year ex post gross savings. Accounting for free ridership, PG&E's 2014 residential portfolio is estimated to save customers more than \$210 million on their energy bills.<sup>50</sup> The 2014 ex post net to gross ratio for the Residential sector was 0.72, compared to 0.63 for the portfolio as a whole.

**Table H.1: 2014 PG&E Residential Gross Energy Savings**

	2014 PG&E Residential Energy Efficiency Portfolio					
	First Year Savings*			Lifecycle Savings*		
	GWh	MW	MMTherms	GWh	MW	MMTherms
<b>Reported (ex ante)</b>	<b>277</b>	<b>57.3</b>	<b>2.4</b>	<b>1,594</b>	<b>454</b>	<b>17.9</b>
<b>Evaluated (ex post)</b>	<b>323</b>	<b>65.4</b>	<b>2.3</b>	<b>1,831</b>	<b>480</b>	<b>15.5</b>

\*Gross Savings, Includes Home Energy Reports and Primary Lighting

<sup>48</sup>Values in these tables are obtained from the 2014 PG&E ESPI database, available publicly here:

<http://www.cpuc.ca.gov/General.aspx?id=4137>

<sup>49</sup>These totals do not including our Codes and Standards Advocacy programs.

<sup>50</sup>This analysis assumes an average rate of \$0.21/kWh. 2014 residential lifecycle ex post net savings = 1,005 GWh. 1,005 GWh x 10<sup>6</sup> kWh/GWh x \$0.21/kWh = \$211 million.

**Table H.2: 2014 PG&E Gross Energy Savings**

	2014 PG&E Energy Efficiency Portfolio					
	First Year Savings*			Lifecycle Savings*		
	GWh	MW	MMTherms	GWh	MW	MMTherms
<b>Reported (ex ante)</b>	<b>800</b>	<b>156</b>	<b>25.6</b>	<b>7,838</b>	<b>1,558</b>	<b>324</b>
<b>Evaluated (ex post)</b>	<b>748</b>	<b>149</b>	<b>19.8</b>	<b>6,811</b>	<b>1,449</b>	<b>241</b>

\*Gross Savings

### Key Findings

Evaluation studies completed to date provide the following general findings that can be used to inform future residential program design and implementation.

#### Overarching Findings

- 1) Some residential end uses, such as plug load, would benefit from a transition from traditional downstream rebate programs to market transformation-centered programs that more effectively address market barriers. One such program that embodies this approach is the Retail Products Platform (RPP) midstream incentive market transformation program.<sup>51</sup>
- 2) Uptake of energy efficiency upgrades would be improved by increased customization of energy efficiency measure and practice recommendations to participants. This could include information on an individual’s estimated payback period associated with energy efficiency upgrades.<sup>52</sup>
- 3) To help address gaps in effective program performance, training for retailers and contractors should be aligned and improved across various residential programs such as Home Energy Efficiency Rebate, Business and Consumer Electronics, Multifamily Energy Efficiency Rebate, and Energy Upgrade California.<sup>53</sup>
- 4) There are still savings to be realized in residential lighting. Lighting accounts for a significant percentage of residential energy consumption, 17% according to recent estimates.<sup>54</sup> With more than half of residential sockets in California still containing inefficient incandescent or halogen lamps, residential lighting still represents a major savings opportunity.<sup>55</sup>
- 5) Targeted demand response is an emerging energy efficiency tool that uses smart meter data to realize previously inaccessible savings. Using a targeted energy efficiency framework allows for

<sup>51</sup> See Program and Technology Review of Two Residential Programs: Home Energy Efficiency Rebate (HEER)/Business and Consumer Electronics (BCE), September 2012, at <http://calmac.org/publications/HEER%5F%5FBCE%5F083012%5FFINAL%2Epdf>

<sup>52</sup> See 2010-2012 CPUC HEES Impact Evaluation, July 2013, at <http://calmac.org/publications/HEES%5FFinal%5FReport%5F20130708%2Epdf>

<sup>53</sup> See Program/Technology Review of Two Residential Product Programs: Home Energy Efficiency Rebate (HEER)/Business & Consumer Electronics (BCE), September 2012, at <http://calmac.org/publications/HEER%5F%5FBCE%5F083012%5FFINAL%2Epdf>; See also SCE and PG&E Whole House Process Evaluation, Opinion Dynamics and SBW, May 2012, at <http://www.energydataweb.com/cpuc/search.aspx>

<sup>54</sup> Goebes, M. TRC Energy Services. 2016. ACEEE. *Clearing the Path to Market Transformation in the Rapidly Evolving World of Residential Lighting*.

<sup>55</sup> Ibid.

increased identification of savings opportunities and more tailored energy savings approaches that can result in greater program cost effectiveness.<sup>56</sup>

Zero net energy (ZNE) homes, while technically feasible, face significant challenges to widespread adoption such as builder and consumer education, consistent tracking and labeling methods, inclusion of real estate agents and lenders in the ZNE marketing process, and community-scale solutions for homes that cannot reach ZNE on an individual basis. Technologies and strategies that can be applied across a significant subset of the building volume will likely show the greatest overall gains in moving the state toward its ZNE goals.<sup>57</sup>

## **Detailed Findings**

### **Key Learnings from Recent EM&V Reports of California’s Single Family and Multifamily Home Upgrade Programs**

#### **Single Family (SF) Home Upgrade Program**

##### *Introduction/Background*

Home Upgrade is a statewide retrofit program targeted at improving the energy efficiency of existing single family homes. The program offers rebates to customers to encourage comprehensive energy efficiency upgrades at the whole house level. Program participation is primarily contractor-driven, with contractors conducting the majority of the marketing activities on behalf of the program.

Homeowners have two options for participation: Home Upgrade (HU) and Advanced Home Upgrade (AHU). The HU pathway provides incentives for multi-measure, whole-home projects. It offers a limited set of deemed measures. The AHU pathway is a custom approach that requires a “test-in” and “test-out” assessment and energy simulation model to develop savings estimates. An expanded group of measures is available compared to the HU pathway.

##### *Key Learnings from Recent Evaluations*

- The 2013-14 Home Upgrade Program is more effective at saving gas and reducing demand than saving electric energy.<sup>58</sup> The findings are encouraging given the high greenhouse gas reduction potential of both therm savings and peak demand savings, and the high value of the grid of demand reduction at peak hours.<sup>59</sup>

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<sup>56</sup> See 2013 “PG&E Home Energy Reports Program Review and Validation of Impact Evaluation,” CalMAC ID CPU0096.00, “Behavioral Demand Response Study - Load Impact Evaluation Report,” CalMAC ID PGE0367.01, and “Focused Impact Evaluation of the 2013-2014 Home Upgrade Program,” CALMAC Study ID CPU0118.01

<sup>57</sup> Refer to the report “Residential ZNE Market Characterization” available at [http://www.calmac.org/publications/TRC\\_Res\\_ZNE\\_MC\\_Final\\_Report\\_CALMAC\\_PGE0351.01.pdf](http://www.calmac.org/publications/TRC_Res_ZNE_MC_Final_Report_CALMAC_PGE0351.01.pdf) and the report “The Technical Feasibility of Zero Net Energy Buildings in California” available at [http://www.energydataweb.com/cpucfiles/pdadocs/904/california\\_zne\\_technical\\_feasibility\\_report\\_final.pdf](http://www.energydataweb.com/cpucfiles/pdadocs/904/california_zne_technical_feasibility_report_final.pdf)

<sup>58</sup> DNVGL, Focused Impact Evaluation of the 2013-14 Home Upgrade Program for the California Public Utilities Commission, May 2, 2016, CALMAC Study ID CPU0118.01, p. 24.

<sup>59</sup> RTR for the Focused Impact Evaluation of the 2013-2014 Home Upgrade Program, Utility responses to recommendations in the Focused Impact Evaluation of the 2013-2014 Home Upgrade Program (DNV GL, ED WO #ED\_D\_Res\_5, Calmac ID #CPU0118.01), September 19, 2016. CALMAC Study ID CPU0118.02, p. 1.

- Inland climate zones show higher electric energy savings and demand reductions.<sup>60</sup> Climate zones with more defined seasons should be targeted to enhance savings. In 2013-14 PG&E targeted marketing to inland climate zones, resulting in increased participation in those areas.<sup>61</sup>
- Research is needed to better understand drivers for participants' significant reductions, increases, and instances in which little change in energy usage in order to create programs such as pay for performance that incentivize only savings achieved at the meter.<sup>62 63</sup> Past process evaluations have shown that negative or neutral savers experienced take-back due to behavior changes primarily consisting of additional persons residing in the home, new or increased HVAC use when HVAC use was low or not present previously, and addition of plug loads or appliances.<sup>64</sup>
- The cost of equipment continues to be a major barrier to participation, particularly among households with an annual income below \$100,000.<sup>65</sup> Training participating contractors on the available energy efficiency and income-qualified options for homeowners can mitigate the first-cost barrier.
- Continuation of focus on pre-1978 homes will likely provide a greater opportunity for energy savings due to the adoption of California's Building Energy Efficiency Standards.<sup>66</sup> Increasing the frequency with which the program serves homes built prior to 1978 will likely increase the realized energy savings per home, also increasing the cost-effectiveness of the program.

### **Multifamily (MF) Home Upgrade**

#### *Introduction/Background*

PG&E offers the MF Energy Efficiency Rebate (MFEER) program along with whole building incentives through the MF Upgrade Program (MUP), also known as MF-Whole Building (MF-WB).

#### *Key Learnings from Recent Evaluations*

- Most MUP projects have been brought to the program by energy raters hired by MF building owners and operators.<sup>67</sup> Raters<sup>68</sup> have served an important role in MUP since its pilot stage in 2013 and perform comprehensive whole-building ASHRAE Level 2 assessments. Raters then work with the property owner to develop a scope of work that improves a building's energy efficiency by at least 10%. Raters also prioritize measures by energy savings and incentive earnings, and they check the work once it is complete. The role of energy raters needs to be recognized and supported.
- The MF market segment typically does not proactively perform early replacement of equipment. Instead, the market segment is more likely to "repair indefinitely."<sup>69</sup> The use of a dual baseline on a

<sup>60</sup> Op. Cit., CALMAC Study ID CPU0118.01, p. 24.

<sup>61</sup> Op.Cit., CALMAC Study ID CPU0118.02, p. 1.

<sup>62</sup> Op. Cit., CALMAC Study ID CPU0118.01, p. 24.

<sup>63</sup> Op.Cit., CALMAC Study ID CPU0118.02, p. 2.

<sup>64</sup> Op.Cit., CALMAC Study ID CPU0118.02, p. 2.

<sup>65</sup> EMI Consulting, Energy Upgrade California – Home Upgrade Program Process Evaluation 2014-2015, Final Report, September 12, 2016, pp. 65-66 and 69-70.

<sup>66</sup> Ibid., pp. 68-69

<sup>67</sup> September 19, 2016, I. Bran in-person conversation with PG&E MF Program Manager K. Contreras.

<sup>68</sup> SBW Consulting, Inc., Process Evaluation for PG&E's Energy Upgrade California™ Multifamily Pilot Program, submitted to PG&E, CALMAC Study ID PGE0339.01, May 2014, p. 3

<sup>69</sup> RTR for the 2013-2014 Multifamily Focused Impact Evaluation Study (Apex Analytics and DNVGL, Calmac ID #CPU0119.02), including the Multifamily Energy Upgrade California and the Multifamily Energy Efficiency Rebate Programs, May 25, 2016.



WB program impacts program efforts negatively. Programs should be able to use the more favorable single baseline approach.<sup>70</sup>

PG&E has provided national leadership in the design and evaluation of its Home Energy Reports program and built the program to its current state of over 1.5 million participating households. Two key initiatives have extended the utility of Home Energy Reports program:

- The deployment of Smart Meter technology has enabled PG&E to collect residential electric usage data at one-hour intervals throughout its service territory. In 2013, PG&E pioneered a methodology for estimating energy savings coincident with periods of high electricity demand by taking advantage of this hourly data. The kW savings have led to an increased focus on the utility of energy efficiency programs to curtail load at peak demand.<sup>71</sup> PG&E continues to estimate kW savings for this program and the other California IOUs have followed suit.
- Following this peak demand research, PG&E, in partnership with Opower, conducted a behavioral demand response study during the summer of 2015 to investigate the load impacts that could be produced by engaging customers using communications and social comparisons prior to designated “Summer Saving Days.” The study targeted residential customers in 31 substations within PG&E’s system that have been identified as high priority areas for reducing peak loads. The study found a 2.4% reduction in peak usage for Home Energy Reports control customers and a 1.8% reduction for HER recipients and represents a viable synergy between achieving energy efficiency as well as peak load curtailment<sup>72</sup>.

## Key Learnings from Recent EM&V Studies of California’s Residential Lighting Sector

### *Introduction/Background*

Many changes have arisen in the California residential lighting market over the past several years. The EISA banned the production and import of traditional incandescent bulbs for common lamp types. PG&E has significantly reduced the number of CFL rebates in our Upstream Lighting Programs, while focusing LED incentives on driving quality instead of pushing high sales volumes. Less efficient halogen lamp availability and sales have increased dramatically.

Following are key learnings from recent EM&V efforts that provide insights into the residential lighting market and future program design.

- Savings opportunities continue to exist in residential lighting. Lighting accounts for a significant percentage of residential energy consumption, 17% according to recent estimates.<sup>73</sup> With more

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<sup>70</sup> For detailed information on dual baselines for the MF sector (Early Replacement and Replace on Burnout), see 2013-2014 Residential Roadmap, Multifamily Focused Impact Evaluation – Final, Prepared by Apex Analytics for the California Public Utilities Commission, February 29, 2016, p. 13.

<sup>71</sup> 2013 PG&E Home Energy Reports Program Review and Validation of Impact Evaluation, CalMAC ID CPU0096.00, by DNV GL

<sup>72</sup> Behavioral Demand Response Study - Load Impact Evaluation Report, CalMAC ID PGE0367.01, by Nexant

<sup>73</sup> Goebes, M. TRC Energy Services. 2016. ACEEE. *Clearing the Path to Market Transformation in the Rapidly Evolving World of Residential Lighting*.

than half of residential sockets in California still containing inefficient incandescent or halogen lamps, residential lighting still represents a major savings opportunity.<sup>74</sup>

- California has made progress toward Assembly Bill 1109, but much work remains. AB 1109 legislation sets a goal to reduce residential lighting electricity use in California by 50% by 2018 from a 2007 baseline. The combination of utility-sponsored programs, technology improvements, and AB 1109 regulations has made a major difference. However, recent analysis suggests that California is still well short of the 50% target.<sup>75</sup>
- LED prices are unstable and on a downward trend. IOUs should stay on top of LED prices. LED prices have not stabilized for any high-priority LED product category and average LED lamp prices will decrease by 21% per year and luminaires by 20% per year, according to a 2015 Navigant study.<sup>76</sup> The IOUs should use the updated costs data from the study for the next two to three years only, and continue to track LED prices in 2017 or 2018 and beyond.
- Halogen lamp availability and sales have increased dramatically, which poses a significant barrier to deeper lighting savings. In a 2014 study, DNV GL reported that EISA and AB 1109 drove increases in halogen lamps' market presence between 2012 and 2013.<sup>77</sup>
- Low availability of CEC-spec LEDs is another potentially important barrier to wider adoption of energy efficient lighting. Despite rapid growth of total LED sales, CEC-Spec lamp availability remains very low, less than 5% in most retail channels,<sup>78</sup> and CEC-Spec bulbs remain significantly more expensive than competing LEDs.<sup>79</sup> A recent ACEEE study recommends the following strategies for California IOUs:
  - Rebate ENERGY STAR LEDs, at least temporarily in California, particularly for lamp types where there are no CEC-spec products available, and where the cost of CEC-spec products are high enough that even their rebated price may exceed the price of low efficacy lamps.<sup>80</sup> Current policy does not permit this approach.

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<sup>74</sup>Goebes, M. TRC Energy Services. 2016. ACEEE. *Clearing the Path to Market Transformation in the Rapidly Evolving World of Residential Lighting*.

<sup>75</sup> Analysis indicates that California is 31% of the way to the 50% target. 19% remains in the next two years.

<sup>76</sup>Navigant. 2015. *California LED Workpaper Update Study*. August 28, 2015.

<sup>77</sup>DNV GL. 2014. *California Residential Replacement Lamp Market Status Report: Upstream Lighting Program Market Activities in California through 2013*. September 10, 2014.

<sup>78</sup>TRC. 2016. *Availability of ENERGY STAR® and CEC-Spec LEDs in the California Shelf Survey*.

[http://www.energydataweb.com/cpucFiles/pdaDocs/1711/TRC%20PG&E%20Availability%20of%20EStar%20and%20CEC%20Spec%20LEDs%20in%20CA%20Shelf%20Survey%20White%20Paper\\_Draft%20Final.pdf](http://www.energydataweb.com/cpucFiles/pdaDocs/1711/TRC%20PG&E%20Availability%20of%20EStar%20and%20CEC%20Spec%20LEDs%20in%20CA%20Shelf%20Survey%20White%20Paper_Draft%20Final.pdf); October 2015. Analysis of 2014 – 2015

DNV GL California Shelf Survey data reveals that in most market channels CEC-Spec LED availability is 0 - 5%.

<sup>79</sup>Navigant. 2015. *California LED Workpaper Update Study*. August 28, 2015.

<sup>80</sup>M. Goebes. TRC Energy Services. 2016. ACEEE. *Clearing the Path to Market Transformation in the Rapidly Evolving World of Residential Lighting*.

- Temporarily continue CFL rebates, particularly in market channels where customers are likely to be driven primarily by first costs (e.g., discount stores, small grocery stores).<sup>81</sup>
- Research consumer preferences to guide lamp quality requirements. The CEC-spec was inspired by lessons learned from early CFL rebates, when product quality was not prioritized. More research is needed on what level of performance consumers consider preferable and their willingness to pay for this performance, to best inform requirements for rebates and code.<sup>82</sup> The IOUs are partially addressing this in their upcoming Statewide Residential Lighting Customer Decision Study.
- Future upstream and residential downstream lighting impact evaluations must distinguish between program-qualified CEC-Spec LEDs and other LEDs in the net-to-gross (NTG) analysis. The 2013-14 upstream and residential downstream lighting impact evaluation made no distinction between CEC-Spec and other LEDs in the NTG analysis, resulting in a statewide ex post NTG of 0.30 for the Upstream Lighting Program LED measures.<sup>83</sup> This has contributed to statewide the Upstream Lighting Program's cost effectiveness challenges.

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<sup>81</sup>M. Goebes. TRC Energy Services. 2016. ACEEE. *Clearing the Path to Market Transformation in the Rapidly Evolving World of Residential Lighting.*

<sup>82</sup>M. Goebes. TRC Energy Services. 2016. ACEEE. *Clearing the Path to Market Transformation in the Rapidly Evolving World of Residential Lighting.*

<sup>83</sup>DNV GL. 2016. *Impact Evaluation of 2013-14 Upstream and Residential Downstream Lighting Programs*

## Appendix I: Multifamily Strategy

### Multifamily Sector Vision

Multifamily owners and tenants save money and enhance comfort with greater adoption of energy efficiency practices and equipment. A single point of contact (SPOC) serves property managers and owners with coordinated information on the variety of available savings and upgrade opportunities. The SPOC drives awareness of opportunities for deep common area and individual dwelling retrofits, as well as specific options for low-income qualifying residents, including those available through the Energy Savings Assistance Program (ESA). Builders of multifamily properties adopt zero net energy practices with the assistance of code readiness support.

### Sector Characteristics

- In PG&E service territory 23% of residential customers live in multifamily housing.
- 80% of multifamily households are renters who pay the utility bill.
- 43% of low income customers in PG&E service territory live in multifamily housing.<sup>84</sup>

### Elements of PG&E's Multifamily Strategy

PG&E's approach to the multifamily sector draws from the nine intervention strategies articulated in PG&E's Residential Business Plan. Similar to single family households, the multifamily sector can benefit from data analytics and access, incentives and financing options, workforce development, and upstream programs. However, the multifamily sector also presents unique complexities, barriers and opportunities that must be addressed. In the short term, PG&E plans to establish a single point of contact (SPOC) who can provide coordinated information to a multifamily building owner or facility manager on energy efficiency and upgrade options, including:

- Energy efficiency program offerings
- ESA support for income-qualifying tenants
- Financing options
- Federal and State tax credits and programs
- DR and DG programs
- MIDI opportunities
- EV infrastructure incentives
- Common and outdoor upgrade rebates
- Water efficiency opportunities

The split incentive barrier inherent in the multifamily energy efficiency market enhances the need for compelling and coordinated value proposition for both building owners and facility managers. PG&E understands that it is also important to establish ongoing relationships with these decision makers to

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<sup>84</sup> "A Study of Barriers and Solutions to Energy Efficiency, Renewables, and Contracting Opportunities Among Low-Income Customers and Disadvantaged Communities," *California Energy Commission*, September 9, 2016, p. 17, [http://docketpublic.energy.ca.gov/PublicDocuments/16-OIR-02/TN214830\\_20161215T184655\\_SB\\_350\\_LowIncome\\_Barriers\\_Study\\_Part\\_A\\_Commission\\_Final\\_Report.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/16-OIR-02/TN214830_20161215T184655_SB_350_LowIncome_Barriers_Study_Part_A_Commission_Final_Report.pdf)

drive awareness of program options as they are planning building upgrades. With an effective SPOC, PG&E believes it is possible to provide streamlined, personalized, and comprehensive information that will lead to more comfortable dwellings, savings for low/mid income customers, and deeper retrofits of common and outdoor areas. Because of the unique offerings available specifically for low income customers, a key goal of the SPOC will be to educate building owners and facilities managers on the ESA program and obtain information on qualifying tenants who could benefit.

The multifamily design and build communities operate largely independently from their single family counterparts. PG&E will continue to support code readiness and ZNE goals for the multifamily sector with design assistance and financial incentives for builders to adopt practices to meet future code early.

Looking to the long term, as with single family programs, a pay for performance model with incentive rewards tied to savings observed at the meter is also an attractive option to facilitate third party design and implementation of multifamily programs. However the multifamily sector poses unique challenges to evaluation. PG&E anticipates the need to develop meter-based savings methodologies that can be utilized in the multifamily sector. Because of high tenant turnover, variable occupancy rates, and complexities of metering single units separately from common and external areas, establishing accurate experimental and quasi-experimental designs poses a greater challenge to billing analysis than for the single family home market.

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# COMMERCIAL

## CHAPTER 03

MARKET  
CHARACTERIZATION  
& APPROACH

COMMERCIAL

SETTING THE STAGE



USAGE:

**34% OF ELECTRIC  
8% OF GAS**

More than **530,000** customers

**Nearly two-thirds** of participants in 2015 commercial energy efficiency programs were small and medium-sized businesses

KEY APPROACH  
& STRATEGIES

**Targeted value propositions**

to make a strong business case for energy efficiency and motivate customers to act



**New financial solutions**

and transaction structures, moving away from traditional incentives

**Technical assistance, tools, partnerships, and training**

to move the market towards greater adoption of Zero Net Energy (ZNE)



**New program models**

that use meter-based data to cost-effectively scale energy efficiency

TRENDS



Energy management delivers cost savings and intangible benefits that drive business results

Customers increasingly expect new technologies to be accessible through utility programs

The size and occupancy of commercial buildings is rapidly changing due to the rise of online shopping, customers' premium on convenience, and rising labor and construction costs



## A. PG&E's Commercial Sector Vision

**PG&E's Commercial Portfolio Vision:** PG&E's vision for energy efficiency in the commercial sector centers on empowering large and small and medium business (SMB) customers to better understand, manage, and eliminate unnecessary energy use. The three central tenets of PG&E's vision for the commercial sector include:

- Targeted value propositions to make a strong business case for energy efficiency
- Ramping down the use of rebates and incentives, while scaling financing and new financial structures that use private capital to facilitate a doubling of savings without increasing budgets
- A suite of assistance, tools, partnerships, and training to move the market towards greater adoption of Zero Net Energy (ZNE)

To achieve this vision, PG&E seeks to increase market adoption of energy efficiency and drive deeper, more persistent energy savings through targeted market transformation and integrated solutions that support customers and grid reliability. PG&E's approach is customer-centric and aims to overcome barriers to energy efficiency through discrete approaches that take into consideration a customer's size and familiarity with energy management.

Since the commercial sector accounts for 34% of electric and 8% of gas usage in PG&E's service territory, the commercial portfolio will play a leading role in achieving the policy goals of Senate Bill (SB) 350, SB 32, SB 1414, Assembly Bill (AB) 758, AB 793, AB 802, AB 1109, and the California Energy Efficiency Strategic Plan (CEESP).

PG&E's strategies to address the existing building stock are also intertwined with the vision and goals delineated in the California Existing Buildings Energy Efficiency Action Plan.<sup>1</sup> In particular, PG&E envisions new program models that capture "stranded" potential, new financial solutions to overcome financial barriers, and behavioral, retrocommissioning, and operational (BROS) opportunities to more cost effectively target energy waste.<sup>2</sup>

PG&E uses a variety of delivery channels, from self-service to custom project installation, and diverse partners such as local governments, third party implementers, trade professionals, and industry partners to guide commercial customers on their energy management journeys. As a trusted energy advisor,<sup>3,4</sup> PG&E will empower customers to make the right energy management decisions to drive deeper, more persistent energy savings based on their resources and needs.

<sup>1</sup> "California Existing Buildings Energy Efficiency Action Plan," *California Energy Commission*, September 2015, p. 1-4. [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN206015\\_20150904T153548\\_Existing\\_Buildings\\_Energy\\_Efficiency\\_Action\\_Plan.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN206015_20150904T153548_Existing_Buildings_Energy_Efficiency_Action_Plan.pdf).

<sup>2</sup> Bender, Berman, and Skala, 2016. "Perspectives on Doubling Energy Efficiency in California." ACEEE Summer Study 2016. p. 6-5.

<sup>3</sup> Utilities are considered the most trusted resource for energy advice (62 percent) by large business customers when asked to pick their top-three resources." [Source: E-Source Large Business Gap and Priority Benchmark 2015, December 2015]

<sup>4</sup> Accenture Research, 2015. *The New Energy Consumer: "Unleashing Business Value in a Digital World,"* p. 16.



**Table 3.1**

Customers by the Numbers: The commercial sector accounts for 34% of electric usage and 8% of gas usage in PG&E's service territory

Source: PG&E program and customer data, does not include schools and other public sector customers.

	Commercial Sector			Large Businesses			Small/Medium Businesses		
	2011-2015 Average	Trend <sup>a</sup>	2015 Total	2011-2015 Average	Trend	2015 Total	2011-2015 Average	Trend	2015 Total
<b>Customer Counts (Number of customers)<sup>b</sup></b>									
Electric	438,930		441,516	91,307		94,970	292,417		338,443
Gas	186,766		186,593	28,081		30,222	133,904		153,082
<b>Total</b>	<b>528,472</b>		<b>530,738</b>	<b>111,979</b>		<b>116,909</b>	<b>350,210</b>		<b>404,119</b>
<b>Annual Sales (GWh, MM Therms)</b>									
Electric	28,601		28,770	19,776		21,142	7,030.8		7,579.2
Gas	683.5		665.8	377.27		393.62	258.8		270.6
<b>Gross First Year Ex Ante Energy Savings (GWh, MW, MM Therms)</b>									
Electric	309.0		250.4	194		165	92.5		82.9
Demand	55.7		46.0	33		28	18.9		17.5
Gas	4.1		4.2	3		3	0.9		1.4
<b>Program Participation (% of total)</b>									
Electric	3.9%		3.2%	5.6%		5.4%	8.1%		6.2%
Demand	3.6%		3.0%	5.0%		4.1%	7.6%		5.9%
Gas	6.5%		6.1%	11.4%		11.2%	13.1%		12.1%
<b>Segment Program Participation (% of segment)<sup>c</sup></b>									
<b>Electric (GWh) Savings participants</b>									
Retail	8.1%		5.7%	13.3%		8.5%	3.9%		2.6%
Offices	2.5%		1.7%	4.8%		4.4%	4.6%		2.9%
High Tech	1.2%		1.1%	1.2%		1.2%	2.6%		1.2%
Hospitality	7.4%		7.6%	12.0%		14.3%	11.5%		10.5%
Healthcare	2.6%		2.2%	5.0%		5.3%	4.7%		3.4%
Biotech	7.1%		5.3%	15.5%		10.9%	14.5%		10.4%
<b>Gas (Therms) Savings participants</b>									
Retail	10.9%		8.2%	16.8%		12.2%	5.3%		2.1%
Offices	3.3%		2.3%	6.1%		5.6%	6.7%		2.3%
High Tech	7.8%		5.2%	12.5%		9.1%	7.0%		1.2%
Hospitality	8.2%		10.6%	13.9%		20.1%	13.2%		7.3%
Healthcare	4.8%		3.8%	9.1%		8.3%	9.7%		4.2%
Biotech	9.9%		8.9%	13.8%		10.3%	22.4%		11.8%

<sup>a</sup> Sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively.

<sup>b</sup> Customer count by unique combination of Account ID and Premise ID.

<sup>c</sup> Showing all segments of Commercial Sector except 'Other.'

## PG&E's Commercial Sector Goals

PG&E has five overarching goals for the commercial sector, starting with a primary savings goal:

- Save 1,416 GWh, 222 MW, and 40 MM therms and track the following indicators:
  - Targeted business segments
  - Size (small, medium, and large)
  - Geography (Bay Area, Coastal, Central Valley, Mountain, Unknown)

Secondary goals that we intend to track include:

- Increase average savings per participant by 0.5% per year from 2018 through 2025 using 2015 ex ante savings as the baseline (4% average savings for electric customers and 18% average savings for gas customers) while tracking the following indicators:
  - Targeted business segments
  - Size (small, medium, and large)
  - Geography (Bay Area, Coastal, Central Valley, Mountain, Unknown)
- Increase customers' ability to manage energy by increasing the proportion of customers utilizing Energy Management Technologies (EMTs) from 2018 through 2025 using 2017 data as a baseline (baseline and goals will be established once the AB 793 Advice Letter is approved and 2017 results are in).

- PG&E recognizes California's strategic plan that 100% of all new construction and 50% of existing commercial buildings will be ZNE by 2030. In an effort to prime the market for the 2030 ZNE goals, PG&E has created a market-level goal to assist California in reaching its 2030 ZNE targets. In alignment with Codes & Standards, PG&E has created ZNE indicators by building type to track progress towards this goal. The saturation of retrofit and new construction ZNE buildings by building type include:

Building Type	2015 Saturation	2025 Saturation Target	Codes & Standards ZNE Code Timeline
Warehouses	<1%	8%	2022
Small Office*	<1%	4%	2025
Schools**	<1%	8%	2025
Retail	<1%	4%	2025
Restaurants	0%	1%	2028
Health-care*	0%	1%	2028
High/Bio Tech	0%	1%	2028

\*Applicable to Public Sector and Commercial Sectors

\*\* Applicable to Public Sector

- Increase operational efficiency by reducing the ratio of \$/kWh and \$/therm saved by 10% in the mid-term through the use of cost-effective scalable program models such as financing and third-party programs

Greater detail on the intervention strategies supporting these goals can be found in *Section F: PG&E's Approach to Achieving Goals*. **Table 3.2** identifies how PG&E's intervention strategies support these goals.

## COMMERCIAL SECTOR AND THE CALIFORNIA ENERGY EFFICIENCY STRATEGIC PLAN (CEESP)

**CEESP Vision:** *Commercial buildings will be put on a path to zero net energy by 2030 for all new and a substantial proportion of existing buildings. Innovative technologies and enhanced building design and operation practices will dramatically grow in use in the coming years through a combination of comprehensive whole building programs, technology development, market pull, professional education, targeted financing and incentives, and codes and standards.*

The Strategic Plan identifies three strategies to achieve this vision. These are linked to PG&E's intervention strategies below:

**Codes and Standards:** Code Readiness is a key component supporting market transformation to achieve ZNE goals and is a key element of Assistance to the Design and Building Communities.

**Access to Information:** Data Analytics and Data Access focus on both giving customers access to their energy usage information but also maximizing its impact on their energy savings goals.

**Financing:** Rebates, loans, and incentives detail PG&E's innovative financing options, while Upstream and Midstream Partnerships aim to prime the market and drive down costs.



Since 2010, PG&E has helped grocery stores save 217 million kilowatts of electricity and nearly 1.3 million therms of natural gas. That's enough energy saved to power nearly 12,000 homes a year or remove 31,000 cars from the road for one year.

**Table 3.2**  
Goal to Intervention Strategy Map

Goal	Data Analytics	Data Access	Technical Assistance and Tools	Loans, Rebates and Incentives	Assistance to the Design and Building Communities	Upstream and Midstream Partnerships
Save energy and reduce demand	X	X	X	X	X	X
Increase average savings per participant	X	X	X	X		X
Increase proportion of customers utilizing EMTs	X	X	X	X		
Increase saturation of retrofit and new construction ZNE buildings by building type	X	X	X	X	X	
Increase operational efficiency (i.e., reduce \$/kWh)	X	X	X	X		X

## B. PG&E’s Commercial Sector Proposal Compared to Prior Program Cycles

To meet the goals laid out in its vision, PG&E identifies six intervention strategies (further detailed in *Section F: PG&E’s Approach to Achieving Goals*) for the commercial sector, with particular emphasis on where they part from past practice:<sup>5</sup>

- **Data analytics to enhance customer targeting:** In prior cycles, PG&E used customer data to inform the design of programs and offerings that aligned with portfolio goals. Due to the development of technologies and techniques to analyze customer data from advanced metering infrastructure (AMI), PG&E will expand these efforts to target outreach to individual customers that yield the greatest energy savings, energy bill reductions, and added value to the grid as a whole.

- **Data access to facilitate understanding of energy efficiency and inspire scalable, market-driven program designs:** Building on the development of platforms that enable customers to view energy usage trends and share this information with authenticated third parties, PG&E will launch an online benchmarking portal in the short-term that provides access to whole-building usage data. Data sharing platforms such as Share My Data and Stream My Data will play a key role in enabling authenticated third parties to deliver verifiable and persistent energy savings in accordance with Decision (D.) 16-08-019.

<sup>5</sup> For more information on PG&E’s commercial program in the 2013-2015 program cycle, see the 2013-2014 program implementation plans (PIPs) at <http://eestats.cpuc.ca.gov/>.

- **Technical assistance and tools to make energy efficiency easy, accessible and relevant:** PG&E's historical approach to technical assistance included strategic energy planning support, facility audits, and calculation and design assistance focused on specific technologies, segments, and approaches.<sup>6</sup> Moving forward, PG&E's approach will leverage insights from customer data to provide targeted value propositions that make a strong business case for energy efficiency. This includes interacting with customers using relevant financial metrics, deploying new technologies such as energy management technologies (EMTs), engaging large customers through strategic energy management (SEM) plans, and providing post-installation feedback to reinforce the value of energy efficiency. This customer-centric approach will be driven by PG&E's partnerships with third parties who are well positioned to deliver innovative market-based solutions, as well as with local government partnerships (LGPs) who are connected to SMBs through local business networks.
- **Rebates, loans, and incentives to mitigate cost barriers to energy efficiency:** In prior cycles, PG&E provided rebates, incentives, and zero-interest project financing to overcome financial barriers to energy efficiency. In the future, PG&E will move away from a widget-based approach driven by individual rebates and incentives and towards new financing structures that facilitate meter-based savings to achieve whole-building solutions.
- **Assistance to the design and building communities to achieve the CEESP's ZNE goals:** In prior years, PG&E's approach to ZNE in the commercial sector focused on emerging technology (ET) projects, ZNE demonstrations, and outreach and education opportunities at its energy centers. While these tactics will be continued moving forward, PG&E recognizes that increased support for ZNE and improved coordination across ZNE stakeholders must be deployed in the short-term to achieve the CEESP's 2030 ZNE goals. PG&E's approach is three-pronged and includes:

  - Supporting the regulatory framework through development of ETs and complementary code readiness projects that deconstructs the 2030 ZNE goals into discrete research projects focused on low energy intensity building types (e.g., warehouses in 2022, small offices and schools in 2025, etc.)
  - Encouraging customers and market actors to move to ZNE by exploring new incentive structures that encourage deep retrofits and reward first-movers, as well as post-occupancy technical assistance to ensure ZNE buildings are operating as designed
  - Partnerships with advisory firms, builders, developers, designers, and building owners to continue developing ZNE demonstrations, spotlighting ZNE champions through awards and other recognition, and increasing the availability and awareness of ZNE-specific Workforce Education and Training (WE&T) opportunities.. Partnerships will also be expanded for local governments to develop and advocate for a ZNE reach code, and to provide technical assistance in support of ZNE projects involving state buildings and schools

<sup>6</sup> For more information on PG&E's commercial program in the 2013-2015 program cycle, see the 2013-2014 program implementation plans (PIPs) at <http://eestats.cpuc.ca.gov/>.

- Upstream and midstream partnerships to promote energy efficient products, components and systems:** PG&E has historically established upstream and midstream partnerships since downstream incentives alone may not be sufficient to inspire customers to adopt energy efficiency. Moving forward, PG&E will place greater emphasis on encouraging manufacturers, distributors, retailers, and other market actors in the supply chain to create, distribute, and stock the most effective energy solutions for customers. In light of the fact that technologies continue to develop at a rapid rate, these partnerships will play a key role in introducing and supporting emerging technologies in the marketplace. Given the new statewide administration model, PG&E envisions an opportunity for California to truly leverage its buying power in a centralized, collaborative, coordinated, and strategic way.

These six intervention strategies will be deployed in stages, over the short-, mid-, and long-term. The individual tactics for each of these strategies are discussed in greater detail in *Section F: PG&E's Approach to Achieving Goals*. Below is a brief summary of key time horizons<sup>7</sup>:

- In the short-term (1-3 years):** PG&E will deploy data analytics to target individual, high-value customers, and continue to develop data sharing platforms that facilitate the transition to 60% of PG&E's portfolio being "proposed, designed, implemented, and delivered by non-utility personnel" by 2020.<sup>8</sup> PG&E will also provide customers with targeted value propositions by providing tailored energy management solutions and using financial metrics (e.g., cost per-square foot) that make a strong business case for energy efficiency. A particular emphasis will be placed on an integrated approach to achieving 2030 ZNE goals that includes assessments of emerging technologies and code readiness projects, ZNE-specific technical assistance and financial

solutions, and partnerships with ZNE stakeholders. PG&E will begin to ramp down the use of rebates and incentives in support of its long-term vision that includes a greater emphasis on financing and new financial structures that leverage private capital.

- In the mid-term (4-7 years):** PG&E will complement its short-term approach by introducing SEM plans for large commercial customers that promote persistent savings. In addition, the split incentives barrier will be targeted in the early mid-term through the introduction of green lease templates and associated training opportunities for large office owners, operators, and tenants. At this point, PG&E will be working closely with third parties to deliver deep, cost-effective savings through new financial structures that capitalize on meter-based savings. PG&E will also streamline ZNE energy modeling processes and offer design document templates and training to mitigate operational barriers to pursuing ZNE projects.
- In the long-term (8-10 years):** Customers will view energy use as a key part of business operations due to the growth of EMTs, accessibility of accurate benchmarking data, and programs that use meter based savings. PG&E's role as a portfolio administrator will enable it to determine the need for programs and identify the means of fulfilling those needs, while focusing on scaling energy efficiency cost-effectively.

To achieve its vision, Implementation Plans (IPs) will be strategically deployed within the timeframes listed above to achieve the State of California's energy efficiency goals for the commercial sector. PG&E also anticipates meeting energy savings goals for investment levels, as shown in *Section C*.

<sup>7</sup> Email communication from Administrative Law Judge Julie Fitch, on November 15, 2016 clarified program administrators' Business Plan timeline. "Because D.14-10-046 only authorizes funding through the end of 2025, it is my expectation that this would be the timeframe for the Business Plans as well, covering calendar years 2018-2025." However, PG&E has built its Business Plan around a ten year vision, and has identified short (1-3 years), medium (4-7 years) and long-term (8-10 years) time periods used to indicate when strategies and tactics will be deployed, and targets will be met. PG&E believes this structure is in line with the intent of the rolling portfolio concept.

<sup>8</sup> D.16-08-019, p.74.

## Key Learnings from Recent EM&V Studies of California's Commercial Energy Efficiency Programs

EM&V evaluations from prior cycles also inform the design of PG&E's intervention strategies moving forward. In particular, the following six key learnings from EM&V reports influenced the strategies and tactics proposed in this plan:

- Commercial customers are diverse (sectors, building types, occupancies, lease arrangements) and a range of products and technologies are needed to address their needs.<sup>9</sup>
- Technical assistance for customers has proven valuable. Customers participating in Savings By Design (SBD) routinely request this assistance and it increases persistence of savings. For example, this theme has repeated itself in reviews of SBD process evaluations over the past 15 years.<sup>10</sup>
- Implementing building controls technologies create opportunities for demand and energy savings. Adopting controls technologies empowers customers with energy usage data, automates actions to reduce energy, promotes savings persistence, and overcomes a significant barrier to realize energy savings — time to understand all of the energy efficiency options available and act upon them.<sup>11</sup>
- Lighting, HVAC and refrigeration account for the majority of electric savings in the commercial sector according to the California Commercial End Use survey—a trend that is anticipated to continue through 2024.<sup>12</sup>
- Midstream partnerships are effective in increasing the market uptake of energy efficiency. For example, in PG&E's Lighting Innovation Midstream Trial, midstream incentives for LED replacement lamps outpaced sales of LED replacement lamps and/or fixtures through PG&E's other commercial deemed incentive programs. Market actors and

end-users noted high levels of satisfaction with the rebate application and payment process.<sup>13</sup>

- Awareness of trainings for nonresidential lighting contractors is a greater obstacle than availability. A recent study determined the wide variety of trainings available for nonresidential lighting programs sufficiently met the training needs of contractors and technicians, but that awareness should be improved.<sup>14</sup>

## C. Goals, Budget and Cost-Effectiveness

As Business Plans were envisioned as “a comprehensive vision outlining long-term strategic initiatives and intervention strategies,”<sup>15</sup> PG&E provides energy and demand savings goals, budgets, and cost-effectiveness forecasts that represent its best estimates to realize its portfolio vision, while retaining flexibility to accommodate potential market or regulatory changes. Each year, PG&E will file a Tier 2 advice letter (AL) that provides detailed goals, budgets and cost-effectiveness for the Commission's review and approval.<sup>16</sup>

### Annual Net Market Potential

PG&E's primary goal is to save energy. PG&E has used the energy and demand savings targets provided in the “Energy Efficiency Potential and Goals Study for 2015 and Beyond,” (Potential Study) approved in D.15-10-028, as the foundation for its projected energy savings goals for 2018-2025, and shows 2016 and 2017 for reference. Energy and demand savings goals are shown as net annual goals, per D.16-08-019. **Table 3.3** shows the annual net market potential for the commercial sector.

<sup>9</sup> “PY 2013-2014 Third Party Commercial Program Value and Effectiveness Study Report (Volume 1 of II), *Opinion Dynamics Corporation*, June 15, 2016, pp. 18-20.

<sup>10</sup> RLW Associates. (2001) *Final Report 1999-2001 Building Efficiency Assessment (BEA) Study: An Evaluation of the Savings by Design Program*.

<sup>11</sup> Rovito, M., Subramony, G., Laurentia D, et al. “Advanced Thermostats for Small- to Medium-Sized Commercial Buildings,” 2014 ACEEE Summer Study Buildings. Asilomar, CA.

<sup>12</sup> “California Commercial End Use Survey,” Itron, March 2006.

<sup>13</sup> “Pacific Gas and Electric Company's Lighting Innovation Midstream Trial Evaluation,” *Evergreen Economics*, October 13, 2015. [http://www.calmac.org/publications/PGandE\\_Commercial\\_Midstream\\_LED\\_Trial\\_Assessment\\_Final\\_Report.pdf](http://www.calmac.org/publications/PGandE_Commercial_Midstream_LED_Trial_Assessment_Final_Report.pdf).

<sup>14</sup> “PY2013-2014 California Statewide Workforce Education and Training Program, Contractor Training Market Characterization.” *Opinion Dynamics*. June 2016. [http://www.energydataweb.com/cpucFiles/pdaDocs/1631/CPUC%20WET%20Contractor%20Training%20Market%20Characterization\\_FINAL\\_V5.docx](http://www.energydataweb.com/cpucFiles/pdaDocs/1631/CPUC%20WET%20Contractor%20Training%20Market%20Characterization_FINAL_V5.docx).

<sup>15</sup> D.15-10-028, p.48.

<sup>16</sup> D.15-10-028, OP 4.



**Table 3.3**  
Commercial Sector Annual Net Market Potential

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
<b>GWhs</b>	157	167	132	136	140	148	158	167	180	180
<b>MWs</b>	30.9	34.1	28.7	30.5	32.5	36.7	41.2	44.7	48.6	48.6
<b>MMTherms</b>	1.0	1.2	1.9	2.1	2.3	2.5	2.7	2.8	3.0	3.0

PG&E’s net annual energy and demand savings goals are directional in nature, and meant to reflect our best estimates of energy and demand savings potential. PG&E requests flexibility to accommodate potential market or regulatory changes. PG&E will file an annual Tier 2 AL that provides detailed sector-level energy and demand goals.

PG&E recognizes energy and demand savings goals will be updated to meet the SB 350 energy efficiency targets set by the Energy Commission no later than November 1, 2017,<sup>17</sup> and the net goals framework adopted in D.16-08-019.<sup>18</sup> PG&E will update its energy savings forecasts once the Commission approves new energy and demand savings targets.

### Sector Budget

PG&E’s Business Plan budget provides general information on the expected levels of annual spending for 2018-2025, along with 2016 and 2017 approved budgets for reference. As provided in D.15-10-028, PG&E’s Business Plan budget represents its best estimates of spending for the life of the Business Plan.<sup>19</sup> The intent is to allow program administrators flexibility to adjust spending during the life of the Business Plan.<sup>20</sup> PG&E will file Tier 2 AL annually, containing a detailed budget for the next calendar year’s energy efficiency portfolio.<sup>21</sup> The Tier 2 AL budgets will include detailed budgets for cost recovery, transfer, and contracting purposes.<sup>22</sup> See **Table 3.4** for a summary of the commercial sector budget.

<sup>17</sup> SB 350 requires the Energy Commission to develop and establish statewide targets that lead to a cumulative doubling of energy efficiency savings from all retail electric and natural gas end-users by 2030. <http://www.energy.ca.gov/sb350/timeline.pdf>.

<sup>18</sup> “Commission staff should work with its consultants to prepare a net goals framework in time for the start of 2018, if not sooner.” D.16-08-019, p.20.

<sup>19</sup> D.15-10-028 “It [the budget] will establish a “ballpark” figure for spending for the life of the business plan.” p. 55.

<sup>20</sup> D.15-10-028, p.56.

<sup>21</sup> D.15-10-028, OP 4.

<sup>22</sup> D.15-10-028, p.56.

**Table 3.4**  
PG&E Commercial Sector Budget Summary

Cost Category	2016	2017	2018	2019	2020-2025 Annual Budget <sup>a</sup>
<b>Administration</b>	\$17,464,111	\$11,851,427	\$10,317,047	\$8,782,668	\$7,838,869
<b>Marketing</b>	\$7,335,783	\$9,180,217	\$4,185,398	\$3,690,580	\$3,195,762
<b>Implementation</b>	\$51,021,139	\$36,929,715	\$36,652,010	\$36,374,304	\$36,096,599
<b>Incentive</b>	\$57,510,150	\$47,538,909	\$47,538,909	\$46,638,909	\$46,638,909
<b>Total</b>	<b>\$133,331,183</b>	<b>\$105,500,268</b>	<b>\$98,693,364</b>	<b>\$95,486,461</b>	<b>\$93,770,138</b>

<sup>a</sup> The Annual Budget from 2020 through 2025 will remain the same.

For more discussion on PG&E portfolio and sector-level budgets, please see the Portfolio Overview chapter.

### Cost-effectiveness

PG&E presents its sector-level cost-effectiveness for its 2018-2025 Business Plan. See **Table 3.5** for cost-effectiveness results, **Table 3.6** for net annual savings impacts, and **Table 3.7** for emission reductions.

**Table 3.5**  
Projected Commercial Cost-Effectiveness Results 2018-2020

	Results
<b>TRC</b>	1.50
<b>PAC</b>	1.89

Note: Does not include Market Effects.

**Table 3.6**  
Projected Commercial Net Annual Savings Impacts from Cost-Effectiveness Scenario 2018-2020

	PG&E Target	PGS Goal
<b>Energy Savings (Net GWh/yr)</b>	191.06	140.5
<b>Demand Reduction (Net MW)</b>	26.31	32.50
<b>Gas Savings (Net MMTh/yr)</b>	3.94	2.29

Note: Does not include Market Effects.

**Table 3.7**

### Projected Commercial Emission Reductions from Cost-Effectiveness Scenario 2018-2020

Annual tons of CO2 avoided	Lifecycle tons of CO2 avoided	Annual tons of NOx avoided	Lifecycle tons of NOx avoided	Annual tons of SOx avoided	Lifecycle tons of SOx avoided	Annual tons of PM10 avoided	Lifecycle tons of PM10 avoided
<b>73,194</b>	739,115	100,583	999,798	—	—	21,937	248,474

PG&E conducted a cost-effectiveness analysis of its proposed portfolio in compliance with D.15-10-028, and with the California Standard Practice Manual.<sup>23</sup> PG&E used the 2017 updated avoided costs and cost-effectiveness inputs approved in Resolution E-4801.

PG&E’s cost effectiveness calculation represents the near-term years of its Business Plans (2018-2020), and is directional in nature. Meaning, PG&E will strive to meet the cost-effectiveness projections set forth for the sector. However, PG&E requests flexibility to accommodate potential market or regulatory changes. Through the annual Tier 2 ALs, PG&E will provide the Commission updated cost-effectiveness forecasts for each year of Business Plan implementation.

Through implementation of its Business Plan, PG&E seeks to make significant impact in reducing energy waste cost-effectively and maximizing the value of energy efficiency for customers, for the grid, and for the state. To do that, PG&E recognizes the need to take “a more integrated, cost-effective approach”<sup>24</sup> to scale energy savings. For more discussion on PG&E’s key strategies to scale energy efficiency and continue to deliver cost-effective energy efficiency portfolios, please see the Portfolio Overview chapter.

<sup>23</sup> California Standard Practice Manual: Economic Analysis of Demand Side Management Programs and Projects, 2002. [http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf).

<sup>24</sup> Mitchell, Cynthia 2014. “A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach.” p. 1, TURN May 15, 2015 iDSM comments in R.14-10-003, p. 9.

## D. Sector Overview

PG&E's commercial customer base is large and diverse, requiring flexible strategies and approaches to drive active energy management. As a result, PG&E uses AMI data to understand how customers use energy and which intervention strategies are best suited to achieve persistent energy savings. The following section provides insight into PG&E's commercial customers through three lenses: segment, size, and geography.

PG&E served approximately 442,000 commercial electric customers and 186,593 commercial gas customers in 2015. These customers accounted for 34% of electricity consumption and 8% of gas consumption in PG&E's service territory.

**Segment:** PG&E divides the market into segments based on the type of business customers conduct. Segments include biotech, healthcare, high tech, hospitality, offices, retail, and "other."<sup>25</sup> See **Table 3.8** for examples of customers in each segment.<sup>26</sup> Segmentation enables PG&E to craft customized solutions based on a customer's specific business needs. For example, PG&E currently administers third party programs that are targeted to healthcare, hospitality, and retail customers, among others.

<sup>25</sup> The "other" segment captures all other segments that are not included in biotech, healthcare, high tech, hospitality, offices, and retail. PG&E will continue to evaluate its data analytics to identify additional segments embedded within "other," which comprises nearly 15 percent of its commercial customer base. Once identified, these segments can be tracked to inform the design of new offerings.

<sup>26</sup> This list of customers is illustrative and does not include all customers included in each segment. Overlapping customers exist in some cases (e.g., biotech/high tech), and are sorted through a more detailed layer of filtering that is not shown here due to space reasons.

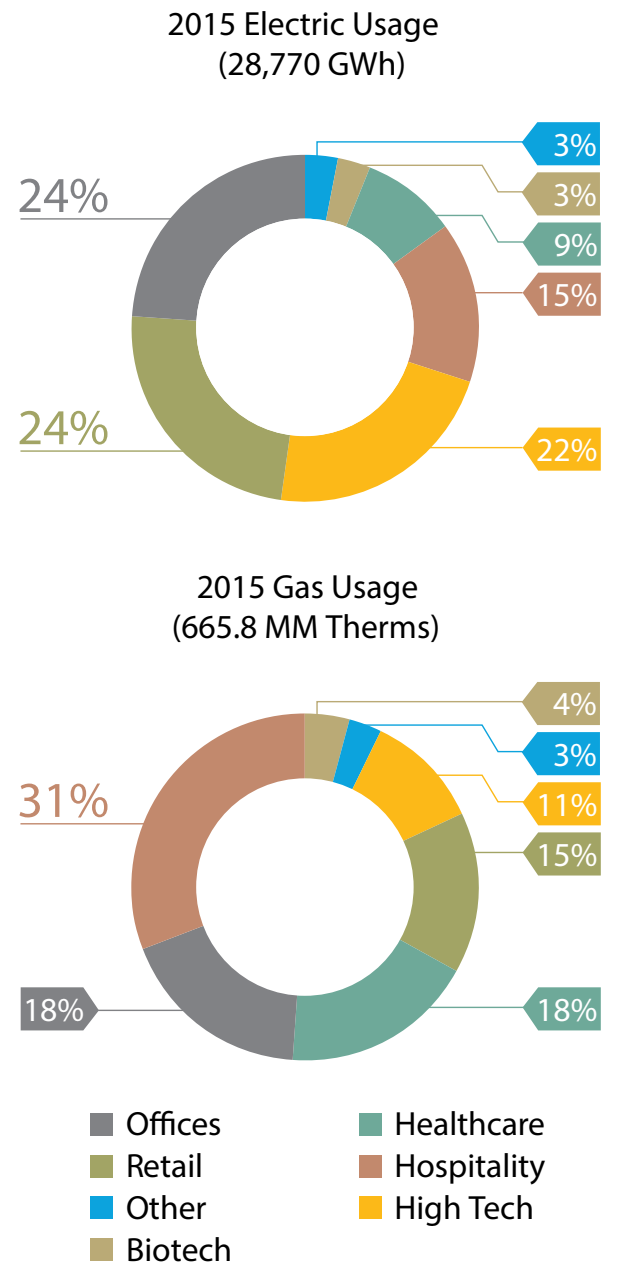
**Table 3.8**  
Commercial Customers by Segment

Segment	Customers
<b>Biotech</b>	Drug and Pharmaceutical Manufacturing
<b>Healthcare</b>	Hospitals Nursing and Residential Care Facilities Social Assistance
<b>High tech</b>	Computer and Electronic Product Manufacturing Internet Service Providers, Web Search Portals, and Data Processing Services Telecommunications Computer and Electronic Product Manufacturing
<b>Hospitality</b>	Accommodation Food Services and Drinking Places Performing Arts and Spectator Sports
<b>Offices</b>	Finance and Insurance Management of Companies and Enterprises Real Estate and Rental and Leasing Transportation and Warehousing
<b>Retail</b>	Clothing Stores Electronics and Appliances Stores Food and Beverage Stores Sporting Goods, Hobby, Books, and Music Stores

The largest consumers of electricity in the commercial sector are offices (24%), retail (24%), high tech (22%), and hospitality (15%).<sup>27</sup> The largest consumers of gas are hospitality (31%), offices (18%), healthcare (18%), and retail (15%).<sup>28</sup> This information is displayed in greater detail in **Figure 3.2**.

**Figure 3.2**  
2015 Energy Usage by Commercial Customer Segment

Source: PG&E Internal Data.



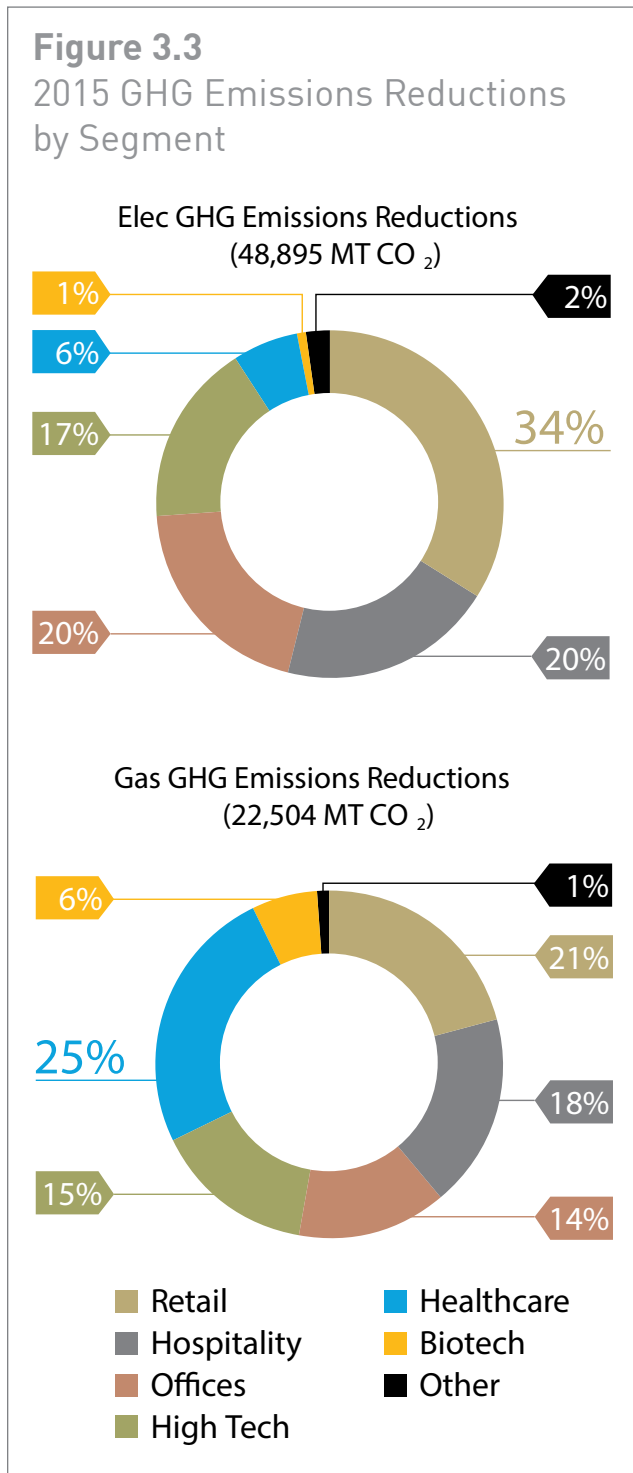
<sup>27</sup> According to the California Commercial End Use Survey, the end uses that consume the most electricity in the commercial sector are interior lighting (29%), cooling (15%), refrigeration (13%), and ventilation (12%). For more, see "California Commercial End-Use Survey," Itron, Inc., March 2006, p. 7.

<sup>28</sup> According to the California Commercial End Use Survey, the end uses that consume the most gas in the commercial sector are space heating (36%) and water heating (32%).

SB 32 was approved in 2016 and requires California to reduce GHG emissions to 40% below 1990 levels by 2030. In support of these efforts, PG&E estimates GHG equivalencies for its energy savings across the portfolio. Within each sector, this information is further categorized by customer segment to identify where opportunities exist to support SB 32 goals. This information is provided in greater detail in **Figure 3.3**.

As a result of participating in PG&E's 2015 energy efficiency programs, commercial customers avoided emitting more than 70,000 metric tons (MT) of CO<sub>2</sub>—the equivalent of removing nearly 15,000 cars from the road for one year.

Nearly 50,000 MT of CO<sub>2</sub> were avoided as a result of electricity savings, while more than 20,000 MT of CO<sub>2</sub> were avoided due to gas savings. At the segment level, the largest contributors to GHG savings from more efficient electricity usage were retail (34%), hospitality (20%), offices (20%), and high tech (17%) customers. The leading contributors to GHG savings from more efficient gas usage were healthcare (25%), retail (21%), hospitality (18%), and high tech (15%) customers.



**Size:** PG&E defines size based on how much electricity or gas a customer uses per year. **Table 3.9** illustrates the annual usage thresholds that are used to categorize a customer as small, medium, or large.<sup>29</sup> Defining customers based on usage enables PG&E to tailor solutions based on a customer’s resources and savings potential.

**Table 3.9**  
Annual Usage Thresholds  
for Customer Size

Customer Size	Electricity Usage	Gas Usage
<b>Large</b>	≥ 500,000 kWh	≥ 250,000 Therms
<b>Medium</b>	40,000-500,000 kWh	10,000-250,000 Therms
<b>Small</b>	< 40,000 kWh	< 10,000 Therms
<b>Unknown</b>	Insufficient data (< 12 months)	

Based on these parameters, 78% of PG&E’s commercial electric customers and 84% of gas customers in 2015 can be characterized as SMBs. Not only are more than three-quarters of PG&E’s commercial customers SMBs, but small businesses alone comprise more than half of PG&E’s commercial customer base.

**Figure 3.4** builds on this discussion by illustrating 2015 energy efficiency program participation and savings by customer size. While nearly two-thirds of the participants in commercial energy efficiency programs were SMBs in 2015, only a quarter of participants were small businesses. This illustrates there may be more opportunities to drive energy management activities for small businesses in the commercial sector based on current customer and participation data.

In addition, **Figure 3.4** identifies that although large customers comprised only one-third of participation in 2015, they accounted for nearly two-thirds of electric and gas savings. Conversely, SMBs represented only a third of savings.

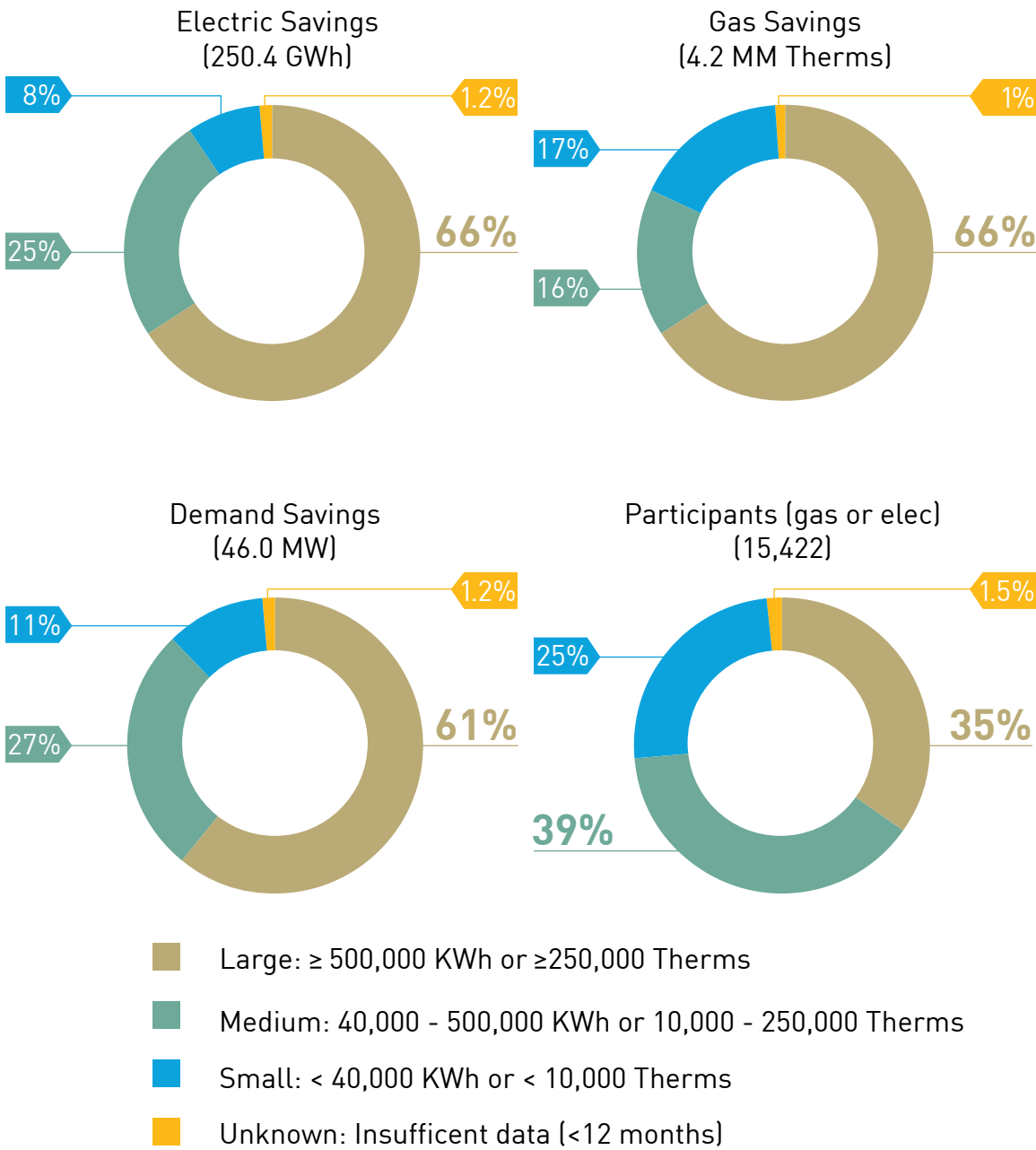
<sup>29</sup> Approximately two percent of commercial customers were categorized as “unknown” in 2015 because these customers did not have at least 12 months of usage data. “Unknown” customers are categorized small, medium, or large as sufficient data becomes available over time.



**Figure 3.4**

2015 Commercial Energy Efficiency Participation and Savings by Size

Source: PG&E Internal Data.



This disparity reflects the fact that large businesses tend to have greater energy usage, and therefore greater energy saving opportunities. In addition, large commercial customers typically have building management staff that are dedicated to optimizing building performance and reducing operating costs. Based on experience, PG&E finds that large commercial customers also have longer tenure as

gas and electric customers, with 70% of program participants having been PG&E customers for more than 10 years.

In contrast, SMBs tend to have shorter business lifecycles, no dedicated energy management staff, and more limited access to capital, making it difficult to invest in energy efficiency projects that do not provide a relatively quick return on investment without disrupting cash flows. Barriers to adoption of energy efficiency are discussed in greater detail in *Section E: Commercial Sector Trends and Challenges*.

**Table 3.10** and **Table 3.11** add additional context to this discussion by analyzing 2015 energy savings and participation, accounting for both segment and size. **Table 3.10** provides this information for electric customers while **Table 3.11** provides it for gas customers.

**Table 3.10**  
2015 Electricity Savings and Participation by Commercial Customer Segment

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Electricity Savings (MWh)</b>													
Retail	45,658	27,045	10,455	607	83,765	54.5%	32.3%	12.5%	99%	18.2%	10.8%	4.2%	33%
Offices	32,355	11,938	4,775	507	49,576	65.3%	24.1%	9.6%	99%	12.9%	4.8%	1.9%	20%
High Tech	41,727	699	40	793	43,259	96.5%	1.6%	0.1%	98%	16.7%	0.3%	0.0%	17%
Hospitality	26,854	19,311	2,753	778	49,696	54.0%	38.9%	5.5%	98%	10.7%	7.7%	1.1%	20%
Healthcare	14,440	1,493	613	15	16,560	87.2%	9.0%	3.7%	100%	5.8%	0.6%	0.2%	7%
Biotech	2,481	43	1	2	2,527	98.2%	1.7%	0.0%	100%	1.0%	0.0%	0.0%	1%
Other	999	1,551	2,147	344	5,041	19.8%	30.8%	42.6%	93%	0.4%	0.6%	0.9%	2%
<b>Total</b>	<b>164,515</b>	<b>62,081</b>	<b>20,783</b>	<b>3,045</b>	<b>250,424</b>	<b>66%</b>	<b>25%</b>	<b>8%</b>	<b>99%</b>	<b>66%</b>	<b>25%</b>	<b>8%</b>	<b>99%</b>
<b>Participants (Number of Participants)</b>													
Retail	1,567	1,956	1,626	63	5,212	30.1%	37.5%	31.2%	99%	11.0%	13.7%	11.4%	36%
Offices	1,296	947	887	50	3,180	40.8%	29.8%	27.9%	98%	9.1%	6.6%	6.2%	22%
High Tech	457	41	8	1	507	90.1%	8.1%	1.6%	100%	3.2%	0.3%	0.1%	4%
Hospitality	1,477	2,074	446	48	4,045	36.5%	51.3%	11.0%	99%	10.3%	14.5%	3.1%	28%
Healthcare	237	153	167	8	565	41.9%	27.1%	29.6%	99%	1.7%	1.1%	1.2%	4%
Biotech	50	5	1	1	57	87.7%	8.8%	1.8%	98%	0.3%	0.0%	0.0%	0.4%
Other	20	224	436	47	727	2.8%	30.8%	60.0%	94%	0.1%	1.6%	3.1%	5%
<b>Total</b>	<b>5,104</b>	<b>5,400</b>	<b>3,571</b>	<b>218</b>	<b>14,293</b>	<b>36%</b>	<b>38%</b>	<b>25%</b>	<b>98%</b>	<b>36%</b>	<b>38%</b>	<b>25%</b>	<b>98%</b>
<b>Average Savings (kWh per Participant)</b>													
Retail	29,137	13,827	6,430	9,637	16,072								
Offices	24,966	12,606	5,383	10,140	15,590								
High Tech	91,306	17,051	4,953	792,942	85,323								
Hospitality	18,182	9,311	6,172	16,202	12,286								
Healthcare	60,926	9,757	3,672	1,834	29,310								
Biotech	49,627	8,637	660	2,132	44,339								
Other	49,968	6,925	4,924	7,315	6,934								
<b>Average</b>	<b>32,233</b>	<b>11,496</b>	<b>5,820</b>	<b>13,969</b>	<b>17,521</b>	<b>36%</b>	<b>38%</b>	<b>25%</b>	<b>98%</b>	<b>36%</b>	<b>38%</b>	<b>25%</b>	<b>98%</b>
<b>Participation Rates (% Participants per Cust.)</b>													
Retail	10.9%	7.5%	2.9%	3.6%	5%								
Offices	5.3%	2.3%	1.2%	2.9%	2%								
High Tech	1.2%	1.0%	0.3%	1.2%	1%								
Hospitality	14.3%	7.5%	3.1%	5.3%	8%								
Healthcare	4.4%	2.0%	0.9%	2.4%	2%								
Biotech	8.5%	1.8%	0.7%	14.3%	6%								
Other	1.0%	2.4%	0.8%	1.4%	1%								
<b>Average</b>	<b>5.4%</b>	<b>4.6%</b>	<b>1.6%</b>	<b>2.7%</b>	<b>3%</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

Key takeaways from this 2015 data include:

**Table 3.11**  
2015 Gas Savings and Participation by Commercial Customer Segment

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>e</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Gas Savings (Therms)</b>													
Retail	303,182	117,937	476,617	1,748	899,484	33.7%	13.1%	53.0%	100%	7.2%	2.8%	11.3%	21%
Offices	287,768	166,397	93,416	23,859	571,440	50.4%	29.1%	16.3%	96%	6.8%	3.9%	2.2%	13%
High Tech	608,521	10,712	(147)	651	619,738	98.2%	1.7%	0.0%	100%	14.4%	0.3%	0.0%	15%
Hospitality	347,520	325,835	84,437	10,355	768,146	45.2%	42.4%	11.0%	99%	8.2%	7.7%	2.0%	18%
Healthcare	1,023,914	28,209	19,285	3,732	1,075,140	95.2%	2.6%	1.8%	100%	24.2%	0.7%	0.5%	25%
Biotech	242,047	367	101	-	242,515	99.8%	0.2%	0.0%	100%	5.7%	0.0%	0.0%	6%
Other	(1,411)	38,329	20,356	2,012	59,286	-2.4%	64.7%	34.3%	97%	0.0%	0.9%	0.5%	1%
<b>Total</b>	<b>2,811,542</b>	<b>687,786</b>	<b>694,065</b>	<b>42,357</b>	<b>4,235,749</b>	<b>66%</b>	<b>16%</b>	<b>16%</b>	<b>99%</b>	<b>66%</b>	<b>16%</b>	<b>16%</b>	<b>99%</b>
<b>Participants (Number of Participants)</b>													
Retail	848	1,626	1,569	43	4,086	20.8%	39.8%	38.4%	99%	7.4%	14.2%	13.7%	35%
Offices	756	782	731	44	2,313	32.7%	33.8%	31.6%	98%	6.6%	6.8%	6.4%	20%
High Tech	214	23	7	1	245	87.3%	9.4%	2.9%	100%	1.9%	0.2%	0.1%	2%
Hospitality	1,316	1,931	385	41	3,673	35.8%	52.6%	10.5%	99%	11.5%	16.9%	3.4%	32%
Healthcare	185	141	157	9	492	37.6%	28.7%	31.9%	98%	1.6%	1.2%	1.4%	4%
Biotech	45	4	1	-	50	90.0%	8.0%	2.0%	100%	0.4%	0.0%	0.0%	0.4%
Other	11	197	348	41	597	1.8%	33.0%	58.3%	93%	0.1%	1.7%	3.0%	5%
<b>Total</b>	<b>3,375</b>	<b>4,704</b>	<b>3,198</b>	<b>179</b>	<b>11,456</b>	<b>29%</b>	<b>41%</b>	<b>28%</b>	<b>98%</b>	<b>29%</b>	<b>41%</b>	<b>28%</b>	<b>98%</b>
<b>Average Savings (Therms per Participant)</b>													
Retail	358	73	304	41	220								
Offices	381	213	128	542	247								
High Tech	2,844	466	(21)	651	2,530								
Hospitality	264	169	219	253	209								
Healthcare	5,535	200	123	415	2,185								
Biotech	5,379	92	101	-	4,850								
Other	(128)	195	58	49	99								
<b>Average</b>	<b>833</b>	<b>146</b>	<b>217</b>	<b>237</b>	<b>370</b>								
<b>Participation Rates (% Participants per Cust.)</b>													
Retail	10.3%	15.6%	5.9%	5.0%	9%								
Offices	8.3%	4.9%	2.1%	7.0%	4%								
High Tech	9.1%	2.0%	0.6%	2.5%	5%								
Hospitality	20.1%	11.3%	3.7%	7.1%	11%								
Healthcare	5.6%	3.1%	1.2%	4.6%	2%								
Biotech	12.2%	2.9%	1.1%	0.0%	8%								
Other	3.8%	5.7%	2.5%	4.2%	3%								
<b>Average</b>	<b>11.2%</b>	<b>8.9%</b>	<b>3.2%</b>	<b>5.4%</b>	<b>6%</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

- Large retail (18%), large high tech (17%), large offices (13%), and medium retail (11%) saved the largest proportion of electricity savings in the commercial sector
- Large healthcare (24%), large high tech (14%), large hospitality (8%), and medium hospitality (8%) saved the largest proportion of gas savings in the commercial sector
- The highest participation rates<sup>30</sup> for electric customers include hospitality (8%) biotech (6%), retail (5%), and offices (2%)
- The highest participation rates for gas customers include hospitality (11%), retail (9%), biotech (8%), and high tech (5%)
- The lowest participation rates were gas healthcare customers (2%) and high tech electric customers (1%)
- The highest electric savings on a per participant basis were achieved in large high tech (91,000 kWh), large healthcare (61,000 kWh), large biotech (50,000 kWh), and large retail (29,000 kWh)
- The highest gas savings on a per participant basis were achieved in large healthcare (5,500 therms), large biotech (5,400 therms), large high tech (2,800 therms), and medium high tech (500 therms)

See **Appendix C: Customer Data** for greater detail on program participation, energy usage, and savings for each segment.

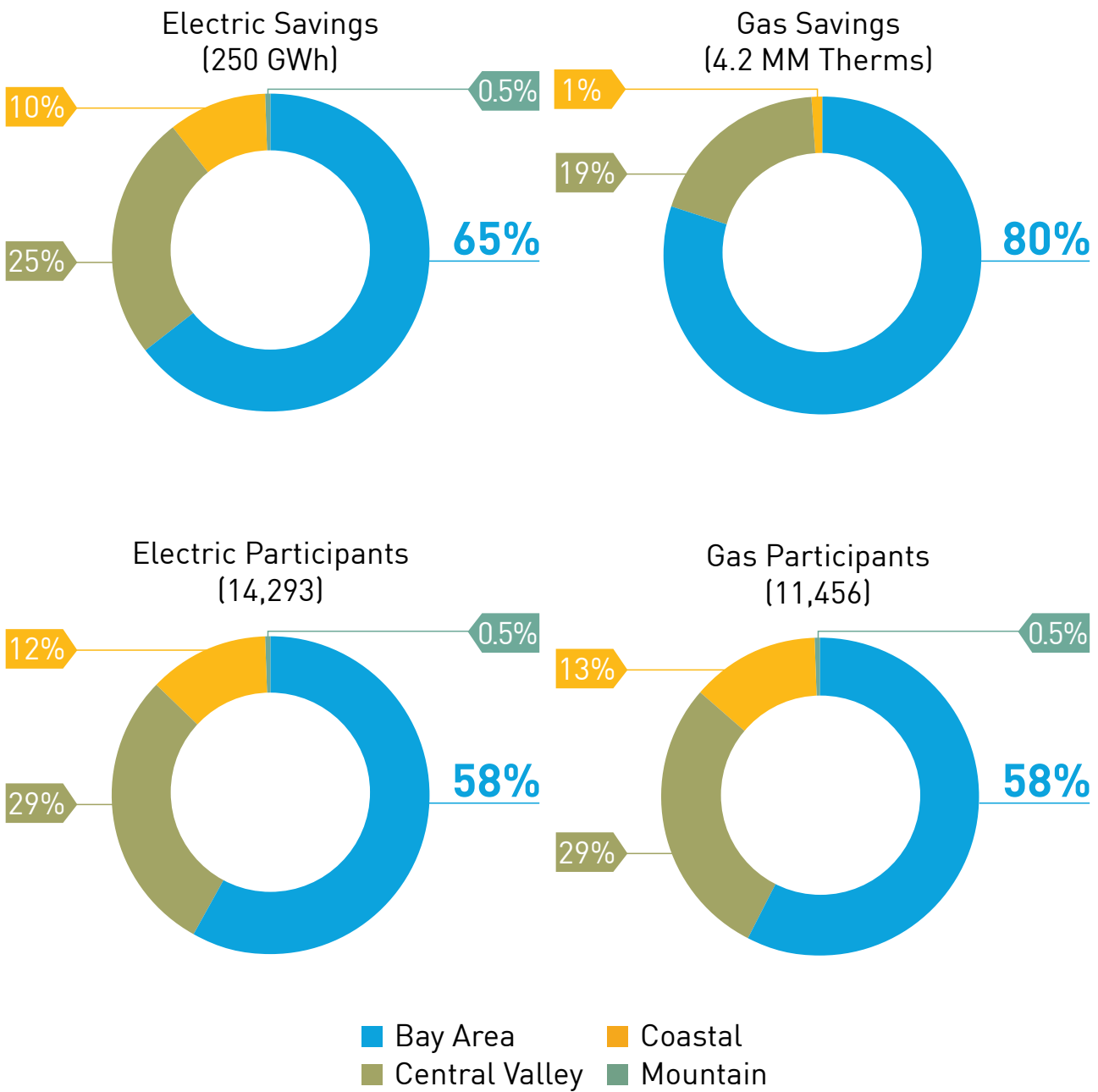
**Geography:** PG&E's service territory includes 13 of the 16 climate zones in California. As a result, PG&E analyzes its commercial customers based on their location in the San Francisco Bay Area, Central Valley, Coastal, and Mountain regions. Moving forward, savings and participation performance will be tracked geographically as an indicator, and may be added as a metric with associated targets in subsequent updates to this plan. For more information on the distinction between indicators and metrics, see Section M: Metrics. **Figure 3.5** provides greater detail on 2015 energy efficiency program participation and savings by region. Notably, nearly 60% of participation was concentrated in the Bay Area and 30% was in the Central Valley. The predominance of the Bay Area extends into savings, where two-thirds of electric savings and 80% of gas savings were driven by Bay Area customers. This trend identifies that an opportunity may exist to increase customer outreach and the availability of energy efficiency offerings to non-Bay Area customers.

<sup>30</sup> The participation rate is derived by dividing the number of participants into the number of customers.

**Figure 3.5**

2015 Commercial Customers and Participants by Climate Region

Source: PG&E Internal Data.



<sup>a</sup> Regions are aggregates of Climate Zones (Z01 - Z16). There are 16 zones but not all are in PG&E's territory.

- Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma.
- Central Valley includes: Z11-Z13.
- Coastal includes: Z01-Z06 & Z09 (excludes Bay Area Counties).
- Mountain includes Z14-Z16.

In addition to analyzing commercial customers' energy usage at the climate zone level, PG&E also assesses which counties consume and save the most energy to help inform our portfolio strategy. **Figure 3.6** provides an overview of electric and gas usage and savings at the county level. Please see *Appendix C: Customer Data* for more detailed maps that display usage and savings by segment.

The counties that used the most electricity in 2015 are largely Coastal, including Santa Clara (6,500 GWh), Alameda (4,100 GWh), San Mateo (2,200 GWh),

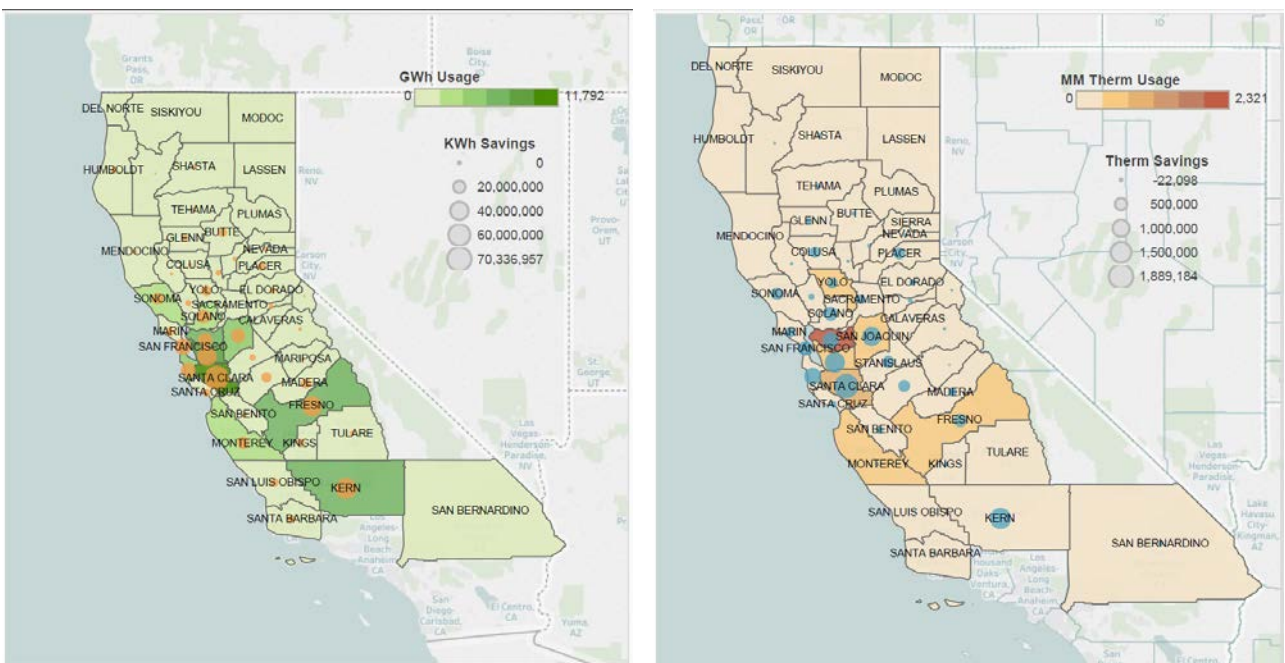
and Contra Costa (1,800 GWh). Electric savings in 2015 were highest among Santa Clara (53.1 million kWh), San Francisco (28.1 million kWh), Alameda (25.8 million kWh), and San Mateo (20 million kWh) counties.

In addition, the counties that used the most gas in 2015 are Contra Costa (2,300 MM therms), Santa Clara (820 MM therms), Alameda (600 MM therms), and Yolo (520 MM therms). Gas savings in 2015 were highest among Santa Clara (1.9 MM therms), Kern (1.4 MM therms), Alameda (1.3 MM therms), and San Joaquin (1.2 MM therms) counties.

**Figure 3.6**

### 2015 Commercial Customer Energy Usage and Savings by County

Source: PG&E Internal Data.



## Energy Efficiency Potential

### The Potential Study

The Potential Study provides measure-level forecasts of savings and is used to define utility savings goals.

**Figure 3.7** highlights how PG&E program savings compare to the Potential Study.

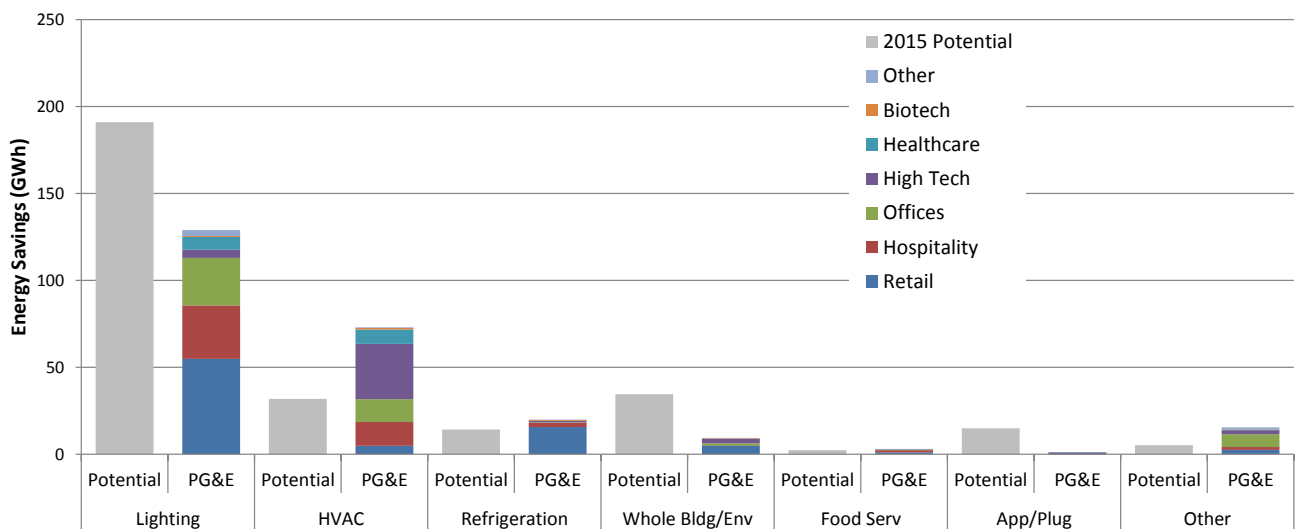
The Potential Study identifies the greatest savings potential in lighting, whole building/envelope, HVAC, appliances/plug loads, and refrigeration. When comparing the Potential Study's savings opportunities with PG&E's achieved savings through 2015 energy efficiency programs, it is evident that significant savings potential exists in lighting,

despite strong performance in the retail, hospitality, and offices segments. PG&E will continue to support lighting upgrades through audits, rebates and incentives, and upstream and midstream partnerships to ensure efficient lighting is being manufactured, distributed, and sold to customers.

In addition, PG&E more than doubled energy savings potential in HVAC in 2015, due largely to significant savings from the high tech segment. PG&E also exceeded refrigeration potential due to significant savings in the retail segment. For the most part, this data reveals that end-use targeting has been an effective in identifying saving opportunities and informing approaches that realize those savings. PG&E looks forward to the 2017 Potential Study update to identify additional savings opportunities by end use and refine our strategies.

**Figure 3.7**  
2015 Energy Efficiency Potential and Program Savings by Segment

Source: Navigant Consulting 2015 and PG&E Internal Data.



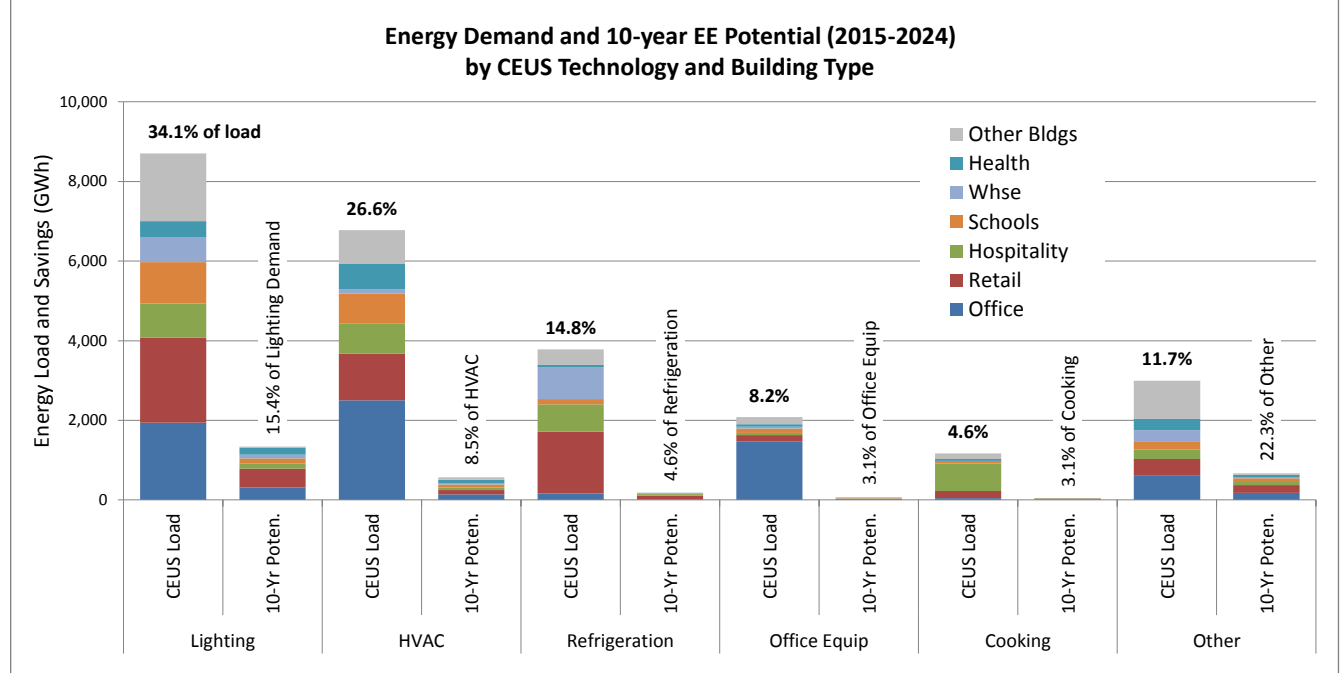
## California Commercial End Use Survey (CEUS)

The CEUS provides additional insight into energy usage and ten-year savings potential specific to

end uses within the commercial sector. This data is presented in greater detail in **Figure 3.8**.

**Figure 3.8**  
Commercial Energy Load and Energy Efficiency Potential by Building Type and End Use

Source: California Commercial End Use Survey, 2006.





The CEUS data echoes the key takeaways from the Potential Study by identifying lighting (29% interior and 5% exterior), HVAC (27%), and refrigeration (15%) as the greatest opportunities for electricity savings. CEUS also finds that gas consumption is driven by heating (44%), water heating (30%), and cooking (20%). At the segment level, key takeaways include:

- **Offices:** HVAC uses the most energy, followed by lighting and office equipment
- **Retail:** lighting uses the most energy, followed by refrigeration and HVAC
- **Healthcare:** HVAC uses the most energy, followed by lighting and “other”
- **Hospitality:** usage is evenly spread throughout lighting, HVAC, refrigeration, and cooking

However, **Figure 3.8** also reveals a gap in available data. The CEUS informs both regulatory policy and energy efficiency program design in California, but relies on data collected in 2005. Over the last decade, California’s economy has shifted significantly, energy efficiency technologies have advanced at a rapid pace, and policies such as AB 802 have prompted a reconceptualization of how to account for energy savings. For example, both the Potential Study and CEUS reflect only above code savings. AB 802 now provides an opportunity to capture below code stranded savings. As a result, updating the CEUS is critical as PG&E and other program administrators work towards California’s energy efficiency goals, such as increasing the efficiency of existing buildings (AB 758), meeting the CEESP’s ZNE goals by 2030, and doubling energy efficiency savings by 2030 (SB 350).

## Commercial Saturation Study (CSS)

### Lighting

Whereas the CEUS estimated that 29% of commercial usage was due to interior lighting in 2006, the 2014 CSS contends this percentage of usage attributed to interior lighting has likely decreased. The CSS identifies three contributing factors based on its survey data:<sup>31</sup>

- The use of inefficient T12 lighting decreased relative to CEUS
- The use of high efficiency T8 lighting increased relative to base efficiency T8s in CEUS
- The use of incandescents decreased significantly across all segments relative to CEUS, accompanied by an increase in compact fluorescent lamps (CFLs)

Although interior lighting usage appears to have decreased as a portion of total energy usage within the commercial sector, PG&E will continue to engage with its commercial customers to encourage adoption of more efficient lighting. This approach is supported by the CSS’ finding that participants in utility programs are less likely to have inefficient T12s and more likely to have high efficiency T8s and T5s compared to non-participants<sup>32</sup> In addition, the fact that the CSS identifies lighting is responsible for up to 31% of SMBs’ whole business usage supports PG&E’s approach to engage SMBs on their customer journey with an early and persistent focus on lighting upgrades.<sup>33</sup> For more information on PG&E’s approach to engaging customers on their customer journey, see *Section F: PG&E’s Approach to Achieving Goals*.

### HVAC

The CSS also supports the findings of the Potential Study and the CEUS by identifying savings potential in HVAC systems. In particular, seven in ten commercial customers surveyed used packaged single zone (PSZ) and split single zone (SSZ) systems, and 81% of these units were classified as small with capacities of less than 65,000 British Thermal Units per hour (BTUh).<sup>34</sup>

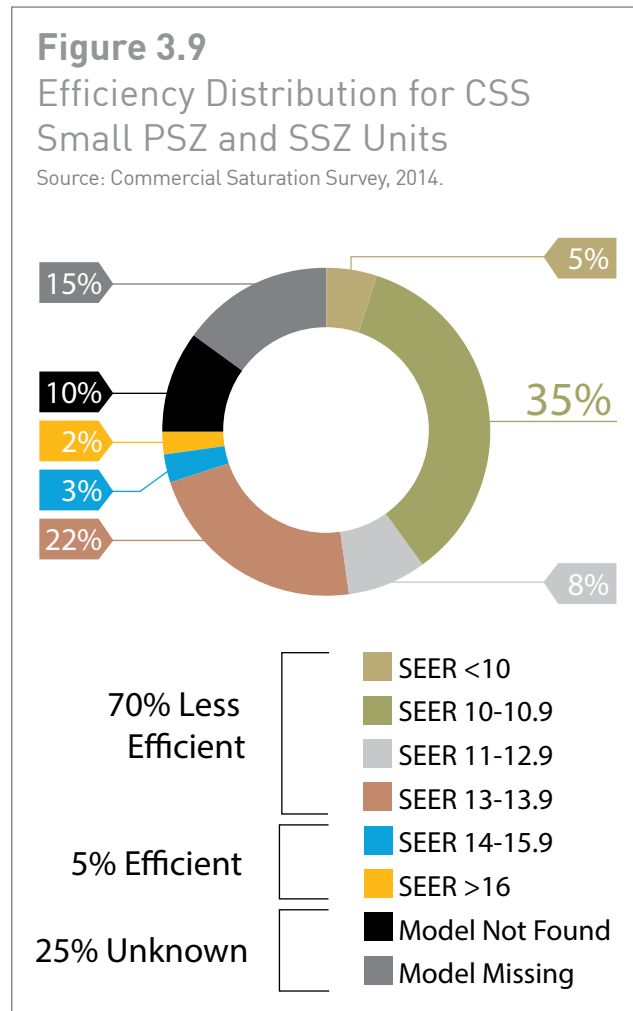
<sup>31</sup> “California Commercial Saturation Survey,” Itron, Inc., August 26, 2014, p. ES-7-ES-12.

<sup>32</sup> Ibid.

<sup>33</sup> Ibid.

<sup>34</sup> Ibid, p. ES-14-ES-16.

When analyzing the efficiency of these small PSZ and SSZ systems, the CSS concludes that efficient HVAC technologies comprise only five percent of the market in California.<sup>35</sup> In this case, efficiency is defined as being up to current code, which is based on a seasonal energy efficiency rating (SEER) of 14. This information is displayed in greater detail in **Figure 3.9**.



In light of these findings, PG&E will continue to target HVAC optimization and replacement opportunities in partnership with PAs, industry stakeholders, upstream and midstream actors, and WE&T resources. This approach is identified in greater detail in *Section F: PG&E's Approach to Achieving Goals*.

### Refrigeration

The CSS finds commercial refrigeration equipment is most prevalent in food and liquor stores and restaurants. Within these segments, food and liquor stores tend to use glass door cases while restaurants use solid door cases. According to the CSS, 30% of solid door cases still use incandescent lighting while 20% of glass door cases use T12 lighting.<sup>36</sup> Additional opportunities exist in food and liquor stores due to the fact that 35% of walk-in refrigerators do not have strip curtains and 65% do not have door auto-closers.<sup>37</sup>

Moving forward, PG&E will identify opportunities for upgrades to refrigeration technologies through audits and technical assistance and tools, with a particular emphasis on the hospitality and retail segments. This targeting of refrigeration is identified as a targeted end use during the customer journey in *Section F: PG&E's Approach to Achieving Goals*.

<sup>35</sup> Ibid.

<sup>36</sup> Ibid., p. ES-21-ES-23.

<sup>37</sup> Ibid.

## E. Commercial Sector Trends and Challenges

PG&E's service territory is large and diverse, which necessitates a multi-pronged approach when addressing the commercial sector. PG&E has identified trends that impact its commercial customers through experience and market research analysis.

### Trends

#### • Energy management delivers cost savings and intangible benefits that drive business results.

- A 2016 survey of more than 1,000 energy and facility management executives by Johnson Controls reveals 82% cited cost reduction as an extremely or very significant benefit of energy efficiency projects.<sup>38</sup>
- The Building Owners and Managers Association (BOMA) International's Experience Exchange Report reveals commercial properties reduced total operating expenses from \$8.18 to \$7.86 per square foot from 2011 to 2012. Two-thirds of these savings are credited to utilities.<sup>39</sup>
- McGraw Hill Construction's 2011 Green Outlook finds 67% of corporate leaders believe their customers have sustainability needs.<sup>40</sup>
- A 2015 report by the New Buildings Institute finds "a greater focus on Corporate Responsibility is driving leading CRE (corporate real estate) companies to develop Sustainability and Energy Policies."<sup>41</sup>

- A 2010 survey of 278 executives by the Economist Intelligence Unit identifies the intangible benefits of energy efficiency as a significant advantage for businesses. Intangible benefits include an enhanced ability to hire and retain talent as well as the ability to increase sales through new energy efficient goods and services.<sup>42</sup>
- A 2016 presentation by the Institute for Market Transformation finds investing in high-performance buildings lowers operating expenses, provides greater revenue through rental and occupancy premiums, and increases property value due to higher net operating income.<sup>43</sup>
- Energy efficiency contributes to improved patient care within the healthcare sector. For example, upgrading HVAC systems improves indoor air quality and reduces the frequency of hospital-acquired airborne infections. Lighting upgrades can also decrease the frequency of patient falls.<sup>44</sup>

<sup>38</sup> "2016 Energy Efficiency Indicator Survey," Johnson Controls, [http://www.johnsoncontrols.com/media-center/news/press-releases/2016/06/23/~/\\_media/b8b0f06132bf41509f22d79db53dfdbb.ashx..](http://www.johnsoncontrols.com/media-center/news/press-releases/2016/06/23/~/_media/b8b0f06132bf41509f22d79db53dfdbb.ashx..)

<sup>39</sup> "Analysis: Commercial Real Estate Industry Continues to Achieve Utilities Savings," *Building Owners and Managers Association International*, <http://www.boma.org/research/newsroom/press-room/2013/Pages/Commercial-Real-Estate-Industry-Continues-to-Achieve-Utilities-Savings.aspx>.

<sup>40</sup> "Green Outlook 2011: Green Trends Driving Growth," *McGraw Hill Construction*, <http://aiacc.org/wp-content/uploads/2011/06/greenoutlook2011.pdf>.

<sup>41</sup> "Commercial Real Estate (CRE) Market Test Assessment: Understanding Delivery, Partnership Strategies and Program Channels," *Northwest Energy Efficiency Alliance*, March 16, 2015, p. 20.

<sup>42</sup> "Unlocking the benefits of energy efficiency," *The Economist Intelligence Unit*, February 22, 2011, <https://www.eiuperspectives.economist.com/energy/unlocking-benefits-energy-efficiency>.

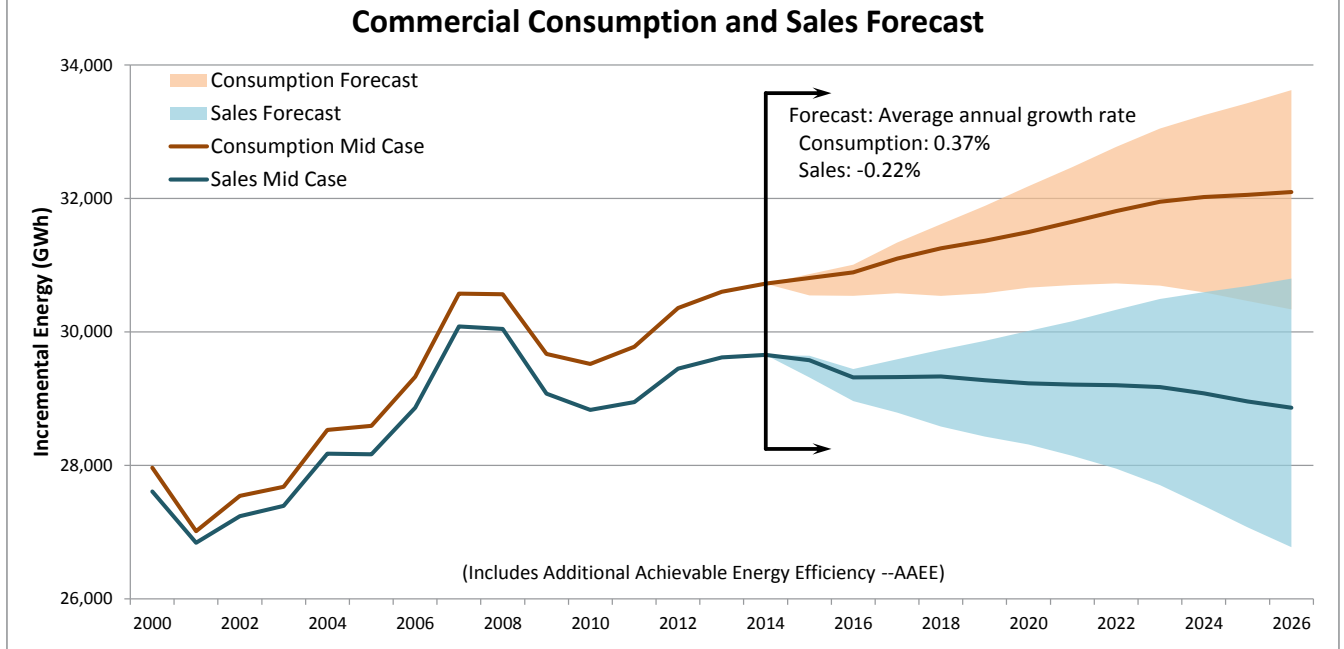
<sup>43</sup> "Investing in High-Performance Buildings," *Presentation by Leonard Kolstad, Institute for Market Transformation*, April 20, 2016, Slide 4.

<sup>44</sup> "Advanced Energy Retrofit Guide: Practical Ways to Improve Energy Performance—Healthcare Facilities," *U.S. Department of Energy*, p. 13 <http://www.nrel.gov/docs/fy13osti/57864.pdf>.

- **Commercial customers are increasingly turning to self-generation.** Figure 3.10 displays the mid case forecasts for consumption and sales from the Integrated Energy Policy Report (IEPR) through 2025.

The projected decrease in mid case sales is driven by the fact that commercial customers are expected to satisfy an increasing portion of their demand through self-generation.

**Figure 3.10**  
Commercial Consumption and Sales Forecast



- **Customers expect innovative energy efficiency technologies and processes entering the market will be accessible through a utility's energy efficiency programs.**

- More than seven in ten American mayors believe the utility is a city's most important partner in deploying new energy efficiency technologies.<sup>45</sup>
- A 2015 survey of 200 commercial stakeholders by Ecova finds 82% have installed energy management systems (EMS) at some or all of their facilities.<sup>46</sup> Respondents identified utility-incentive advantages as a motivator for installing an EMS due to the ability to load shift into periods with lower rates. EMS technology will be a key feature of PG&E's AB 793 implementation strategy to promote greater adoption of these technologies.
- Innovation in energy efficiency technologies is driving demand for energy solutions in the high tech sector. Innovations in more efficient cooling and powering strategies as well as improved power management software have contributed to only a modest increase in energy consumption in enterprise-level data centers. From 2005 to 2010, energy consumption increased 24% compared with an increase of only 4% between 2010 and 2014.<sup>47</sup>

<sup>45</sup> Energy Efficiency and Technology in America's Cities," *Mayors Climate Protection Center*, January 2014, p. 6, <http://usmayors.org/pressreleases/uploads/2014/0122-report-energyefficiency.pdf>.

<sup>46</sup> "Energy Management System Survey Analysis," *Ecova, Inc.*, June 2015, pp. 6, 9, <http://s3.amazonaws.com/uploads.ecova.com/2016/04/27220809/ems-survey-analysis-findings-from-industry-professionals.pdf>.

<sup>47</sup> Data Centers Continue to Proliferate While Their Energy Use Plateaus," *Lawrence Berkeley National Laboratory*, June 27, 2016, <http://newscenter.lbl.gov/2016/06/27/data-centers-continue-proliferate-energy-use-plateaus/>.

- **The size and occupancy of commercial buildings is rapidly changing due to the rise of online shopping, customers' premium on convenience, and rising labor and construction costs.** This trend creates an opportunity for PG&E's energy efficiency programs to intervene in the re-design of these new building types and aligns with AB 758's emphasis on improving energy efficiency in existing buildings.

California's AB 758 Existing Building Energy Efficiency Action Plan identifies four trigger points for improvements in commercial buildings: building sale, tenant change, or lease renewal; redesign of a space; maintenance agreement renewal; and mortgage refinance.<sup>48</sup>

- National retail chains are evolving to supersize for one-stop-shop convenience or downsize into smaller stores for quick grab-and-go trips.<sup>49</sup>
- Online retailers are racing to secure urban warehouse space to fulfill a higher volume of orders in a shorter amount of time.<sup>50</sup> More office buildings or tenant spaces may be converted to storage spaces, where operating hours and energy needs may not be the same as traditional offices.

<sup>48</sup> California Existing Buildings Energy Efficiency Action Plan," *California Energy Commission*, September 2015, p. 19, [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN206015\\_20150904T153548\\_Existing\\_Buildings\\_Energy\\_Efficiency\\_Action\\_Plan.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN206015_20150904T153548_Existing_Buildings_Energy_Efficiency_Action_Plan.pdf).

<sup>49</sup> (<http://www.nielsen.com/us/en/insights/reports/2012/retail-usa-whats-in-store-2016.html>)

<sup>50</sup> Emily Johnson and Taylor Johnson, "Experts predict commercial real estate trends for 2016," *Building Design and Construction Network*, December 21, 2015 <http://www.bdcnetwork.com/TaylorJohnson>.

- In response to the Affordable Care Act and evolving patient preferences, health systems are taking a page from the retail handbook as they look for ways to deliver the most convenient and cost-effective care to patients.<sup>51</sup> As a result, health systems are moving primary and urgent care services to shopping centers, backfilling vacancies left behind by big-box retailers that downsized or went out of business during the recent recession.
  - The rise of labor and construction costs is leading developers to focus on existing commercial buildings as opposed to new ground-up development, particularly in urban areas where vacant land is in low supply.<sup>52</sup> “Adaptive reuse” of existing buildings is appealing not only because of its cost-effectiveness, but also because adapting and reusing buildings is faster to develop than new construction.
- **SMBs continue to comprise a majority of commercial buildings.**
    - More than 50 percent of commercial buildings are 5,000 square feet or less and nearly three-fourths are 10,000 square feet or less.<sup>53</sup> California’s AB 758 Existing Building Energy Efficiency Action Plan identifies the importance of addressing energy efficiency opportunities in SMBs, particularly buildings with a single tenant instead of larger buildings with multiple tenants.<sup>54</sup>

<sup>51</sup> Ibid.

<sup>52</sup> Ibid.

<sup>53</sup> “A Look at the U.S. Commercial Building Stock: Results from EIA’s 2012 Commercial Buildings Energy Consumption Survey (CBECS),” *U.S. Energy Information Agency*, <http://www.eia.gov/consumption/commercial/reports/2012/buildstock/index.cfm>.

<sup>54</sup> “California Existing Buildings Energy Efficiency Action Plan,” *California Energy Commission*, September 2015, p. 18. [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN206015\\_20150904T153548\\_Existing\\_Buildings\\_Energy\\_Efficiency\\_Action\\_Plan.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN206015_20150904T153548_Existing_Buildings_Energy_Efficiency_Action_Plan.pdf).

## Challenges

Due to the diversity of PG&E’s commercial customers, barriers to energy efficiency vary based on a customer’s size, segment, and level of engagement. PG&E groups these barriers into the following categories based on market analysis, experience, and stakeholder feedback:

**Organizational barriers** emerge due to the structure, culture, and behavior of a business. Examples of organizational barriers include:

- **Capacity to Act:** customers have limited capacity for energy management and may not have technical expertise or understand the value of energy efficiency to take action
  - Customers may not have technical expertise
    - i. Commercial customers generally have a limited understanding of HVAC technology. This leads to insufficient maintenance budgets, indefinite repair, energy waste, higher bills, and reactive decision making<sup>55</sup>
    - ii. Progressive commercial real estate teams understand the value of energy efficiency but do not know which emerging energy efficiency measures constitute best practice<sup>56</sup>
    - iii. ZNE buildings are still in the “proof-of-concept” stage<sup>57</sup>
  - Customers may not understand the value of energy efficiency to take action
    - i. Building owners lack regular access to whole building usage data<sup>58</sup>
    - ii. The energy efficiency industry tends to communicate the value of energy efficiency using percent savings relative to a reference value (e.g., percent above code), whereas the commercial real estate industry uses costs on a per-square foot basis<sup>59</sup>

<sup>55</sup> Multi-Year Program Plan: Fiscal Years 2016-2020,” *United States Department of Energy: Building Technologies Office*, February 2016, pp. 50-51.

<sup>56</sup> “Commercial Real Estate (CRE) Market Test Assessment,” *New Buildings Institute*, March 16, 2015, p. 21.

<sup>57</sup> “The Road to ZNE: Mapping Pathways to ZNE Buildings in California,” *Heschong Mahone Group, Inc.* December 20, 2012, p. 10, <http://www.trcsolutions.com/writable/images/The-Road-to-Zero-Net-Energy.pdf>.

<sup>58</sup> “California Legislation Aims for Big Gains in Energy Efficiency,” *Center for Sustainable Energy*, September 17, 2015.

<sup>59</sup> “Commercial New Construction Market Assessment,” *Northwest Energy Efficiency Alliance*, May 20, 2015, p. 5.

- Customers may lack actionable insights about their energy usage<sup>60</sup>
- Downstream incentives may not always be sufficient to increase customer adoption of energy efficiency
- **Split Incentives:** split-incentives exist when building owners are responsible for paying for all capital upgrades and energy costs are passed through to tenants, who see the benefit of capital upgrades on their bills.
  - 77% of commercial floor space in offices is owned, and the majority of this is split evenly between owner- and non-owner occupied. Efficiency efforts in office buildings must target the concerns of decision-makers, who may or may not be the building's occupants<sup>61</sup>
  - Ownership and contractual structures at hotels make it difficult to determine who is best positioned to implement energy efficiency measures<sup>62</sup>
  - Approximately 60% of PG&E's SMB customers lease their facility, resulting in split incentives between the tenant and building owner
- **Multiple decision makers:** commercial projects involve multiple levels of decision makers each with their own values and priorities
  - Commercial real estate executives find decisions on energy efficiency investments involves a "messy matrix of inputs and decisions from several organizational levels"<sup>63</sup>
  - A lack of coordination exists between ZNE stakeholders such as the utilities, CPUC, Energy Commission, building owners, builders, designers, developers, and local governments<sup>64</sup>

**Operational barriers** refer to impediments to energy efficiency due to conflicts with the everyday operations of a business. The primary operational barrier for PG&E's diverse commercial customers is:

- **Competing business priorities:** customers have competing priorities with energy efficiency projects that vary based on operations, building type, size, and vintage
  - Healthcare, high tech, and bio tech facilities operate 24 hours per day, meaning they cannot afford for their systems to go out of service for the time needed to implement deep retrofits<sup>65</sup>
  - Large tech companies have significant resources and must deploy energy solutions on an expedited timeframe (e.g., to optimize the capacity of a data center)<sup>66</sup>
  - The number one priority in the hospitality segment is guest satisfaction, so energy efficiency may not always be perceived as an attractive investment<sup>67</sup>
  - SMB customers that are less engaged in energy efficiency lack the time and resources to engage in issues not directly related to business operations<sup>68</sup>

<sup>60</sup> "California Existing Buildings Energy Efficiency Action Plan," California Energy Commission, September 2015, p. 19. [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN206015\\_20150904T153548\\_Existing\\_Buildings\\_Energy\\_Efficiency\\_Action\\_Plan.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN206015_20150904T153548_Existing_Buildings_Energy_Efficiency_Action_Plan.pdf).

<sup>61</sup> "Energy Efficiency Trends in Residential and Commercial Buildings," *Department of Energy*, October 2008, p. 21.

<sup>62</sup> "Overcoming Barriers to Efficiency Investments: A Guide for NEMA Members," National Electrical Manufacturers Association, 2009, p. 7.

<sup>63</sup> "Commercial Real Estate (CRE) Market Test Assessment," *New Buildings Institute*, March 16, 2015, p. 22.

<sup>64</sup> "The Road to ZNE: Mapping Pathways to ZNE Buildings in California," p. 18.

<sup>65</sup> "Business Energy Advisor," *E Source*, <https://bizenergyadvisor.com/>.

<sup>66</sup> Johnson, Priscilla, Geoff Wickes, and Michelle Lichtenfels, "Baking from Scratch: How a Tiny EM&V Study Disrupted the Status Quo in Utility Program Design," *Pacific Gas and Electric Company—2016 ACEEE Summer Study on Energy Efficiency in Buildings*, pp. 4-2.

<sup>67</sup> "Hotels: An Overview of Energy Use and Energy Efficiency Opportunities," *ENERGY STAR*, <https://www.energystar.gov/sites/default/files/buildings/tools/SPP%20Sales%20Flyer%20for%20Hospitality%20and%20Hotels.pdf>.

<sup>68</sup> "California Existing Buildings Energy Efficiency Action Plan," California Energy Commission, September 2015, p. 19. [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN206015\\_20150904T153548\\_Existing\\_Buildings\\_Energy\\_Efficiency\\_Action\\_Plan.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN206015_20150904T153548_Existing_Buildings_Energy_Efficiency_Action_Plan.pdf).

**Financial barriers** can prevent an energy efficiency project from getting off the ground due to high upfront costs, customer payback requirements, and the difficulty in valuing investments in energy management. Examples of financial barriers include:

- **Lack of upfront capital:** customers frequently lack the capital needed to invest in energy efficiency
  - California hospitals are required to meet upgraded seismic standards (SB 1953) by 2030. This creates large capital burdens on healthcare organizations and further deprioritizes energy efficiency improvements from a funding perspective<sup>69</sup>
- **Constraining payback criteria:** customers often prioritize non-energy projects and energy projects with shorter paybacks
  - Large office tenants and landlords are hesitant to make an investment with a payback of more than 3-5 years.<sup>70</sup>
  - Hotels prioritize capital investments that bring new properties up to brand standards.<sup>71</sup>
  - SMB often face high levels of debt, repayment concerns among lenders, elevated transaction costs, and risk-averse owners when considering financing options for energy efficiency upgrades.<sup>72</sup>

**Table 3.12** combines the information presented in *Section D: Sector Overview and Section E: Commercial Sector Trends and Challenges* to provide a clear picture of leading savings opportunities, customer motivators, and customer barriers for each customer segment.

Based on these findings, PG&E designed six intervention strategies that aim to overcome the key barriers that impede greater adoption of energy efficiency among commercial customers. These strategies are mapped to their respective barriers in **Table 3.13**.

<sup>69</sup> [http://www.leginfo.ca.gov/pub/93-94/bill/sen/sb\\_1951-2000/sb\\_1953\\_bill\\_940922\\_chaptered](http://www.leginfo.ca.gov/pub/93-94/bill/sen/sb_1951-2000/sb_1953_bill_940922_chaptered).

<sup>70</sup> "Improving the Energy Efficiency of Non-owner Occupied Commercial Buildings," *Joint Venture Silicon Valley*, p. 4.

<sup>71</sup> "Overcoming Barriers to Efficiency Investments: A Guide for NEMA Members," *National Electrical Manufacturers Association*, 2009, p. 7.

<sup>72</sup> Freehling, Joel and Brian Stickles, "Energy Efficiency Finance: A Market Reassessment," American Council for an Energy-Efficient Economy, February 2016, p. 8, <http://aceee.org/sites/default/files/market-reassessment-0216.pdf>.



**Table 3.12**

## Saving Opportunities, Customer Motivators, and Key Barriers by Segment

Segment	Saving Opportunities	Motivators	Key Barriers
<b>Office</b>	<ul style="list-style-type: none"> <li>• HVAC</li> <li>• Lighting</li> <li>• Office Equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Tenant comfort</li> <li>• Cost savings/asset improvement</li> <li>• Regulatory compliance</li> <li>• Sustainability</li> </ul>	<ul style="list-style-type: none"> <li>• Length of holding period</li> <li>• Complicated approval processes</li> <li>• Limited work hours for projects to minimize tenant disruption</li> </ul>
<b>Retail</b>	<ul style="list-style-type: none"> <li>• Refrigeration</li> <li>• Lighting</li> <li>• HVAC</li> </ul>	<ul style="list-style-type: none"> <li>• Customer comfort</li> <li>• Product presentation</li> <li>• Refrigeration consistency</li> </ul>	<ul style="list-style-type: none"> <li>• Balance energy efficiency with merchandise display</li> <li>• Complex decision making structure</li> <li>• Split incentives — lease vs. own</li> </ul>
<b>Hospitality</b>	<ul style="list-style-type: none"> <li>• Lighting</li> <li>• Food Service</li> <li>• Cooling/HVAC</li> <li>• Water</li> </ul>	<ul style="list-style-type: none"> <li>• Guest satisfaction</li> <li>• Reducing operating costs</li> <li>• Increasing asset value</li> <li>• Efficiency/sustainability</li> </ul>	<ul style="list-style-type: none"> <li>• Large upfront costs/long payback periods</li> <li>• Internal competition with other projects</li> <li>• Corporate pressure/approval</li> <li>• Occupancy/guest habits</li> <li>• Reactive, based on economy</li> </ul>
<b>Healthcare</b>	<ul style="list-style-type: none"> <li>• Lighting</li> <li>• HVAC</li> <li>• Water Heating</li> </ul>	<ul style="list-style-type: none"> <li>• Medical equipment, patient comfort/care, safety</li> <li>• Employee comfort, data center cooling</li> <li>• Rationalize to bottom line</li> </ul>	<ul style="list-style-type: none"> <li>• Desire holistic solutions</li> <li>• Offering must fit into regulations, process/schedules</li> </ul>
<b>High Tech /Bio Tech</b>	<ul style="list-style-type: none"> <li>• Lighting</li> <li>• HVAC</li> <li>• Plug Load</li> </ul>	<ul style="list-style-type: none"> <li>• Require 24/7 highly regulated ventilation, temperature, and pressure settings.</li> <li>• Cost Savings</li> <li>• Attracting top talent</li> <li>• Sustainability values</li> <li>• Reliability</li> </ul>	<ul style="list-style-type: none"> <li>• Tech organizations are constrained by a lack of predictability/ need to be nimble</li> <li>• Dynamic business environment</li> <li>• Desire credible proof that savings won't dwindle after year two</li> <li>• In organizations with a small energy/facilities staff, projects that are "repeatable" or scalable are favored</li> </ul>

**Table 3.13**

## Commercial Market Trends and Barriers to Energy Efficiency Program Participation

Commercial Sector Interventions	Key Barriers for the Commercial Sector
Data analytics to enhance customer targeting	<ul style="list-style-type: none"> <li>• Capacity to act</li> </ul>
Data-access to facilitate customer understanding of energy efficiency and inspire scalable, market-driven program designs	<ul style="list-style-type: none"> <li>• Capacity to act</li> <li>• Split incentives</li> <li>• Multiple decision makers</li> </ul>
Technical assistance and tools to make energy efficiency easy, accessible, and relevant	<ul style="list-style-type: none"> <li>• Capacity to act</li> <li>• Multiple decision makers</li> <li>• Competing business priorities</li> </ul>
Rebates, loans, and incentives to mitigate cost barriers to energy efficiency	<ul style="list-style-type: none"> <li>• Split incentives</li> <li>• Multiple decision makers</li> <li>• Lack of upfront capital</li> <li>• Constraining payback criteria</li> </ul>
Assistance to the design and building communities to achieve the CEESP's ZNE goals	<ul style="list-style-type: none"> <li>• Capacity to act</li> <li>• Multiple decision makers</li> <li>• Lack of upfront capital</li> <li>• Constraining payback criteria</li> </ul>
Upstream and midstream partnerships to promote efficient products, components, and systems	<ul style="list-style-type: none"> <li>• Capacity to act</li> </ul>

## F. PG&E's Approach to Achieving Goals

### Strategic Interventions Overview

PG&E has a long and successful history of providing a diverse range of energy efficiency offerings to its commercial customers. As California's commercial sector changes and the energy efficiency technological and policy landscape evolves, PG&E has identified six strategic interventions building on past strategies.

- **Data Analytics** will be refined to target customers with high savings potential.
- **Data Access** enables customers to better understand how they use energy so they can make informed decisions about energy management, and inspires the market to design scalable program offerings.
- **Technical Assistance and Tools** empower customers with tailored solutions they need to realize their energy savings potential. Connecting customers with bundled solutions that make economic sense for their segment, helping them navigate the complexity of regulations, and integrating energy efficiency offerings into day-to-day operations are all important components of this intervention strategy.

- **Rebates, Loans, and Incentives** involves continuing to offer customers and other stakeholders in the supply chain with rebates and incentives, but scaling newer approaches such as financing and green leases.
- **Assistance to the Design and Building Communities** includes research and development, utility program support, and partnerships to meet the CEESP's goals of establishing 50% of existing commercial buildings and 100% of new commercial buildings as ZNE by 2030.
- **Upstream and Midstream Partnerships** increase adoption of energy efficiency within the commercial sector by collaborating with stakeholders who also interact with customers. These partnerships aim to increase market awareness of new energy efficient products and equipment while driving down their cost in the long-term.
- **Customers on the "green slopes"** may have no experience with energy efficiency, and have a limited capacity to act due to factors such as inadequate technical expertise, limited understanding the value of energy efficiency, or low awareness of how their business uses energy.
- **Customers on the "blue slopes"** understand the value of taking action, but may require more engagement with PG&E to identify energy saving opportunities. These customers are more likely to use project development assistance to achieve deep energy savings.
- **Customers on the "black diamond slopes"** have implemented a number of energy efficiency projects and desire a close partnership with PG&E to develop advanced program models, such as SEM, ZNE, or a meter-based savings, pay-for — performance approach.

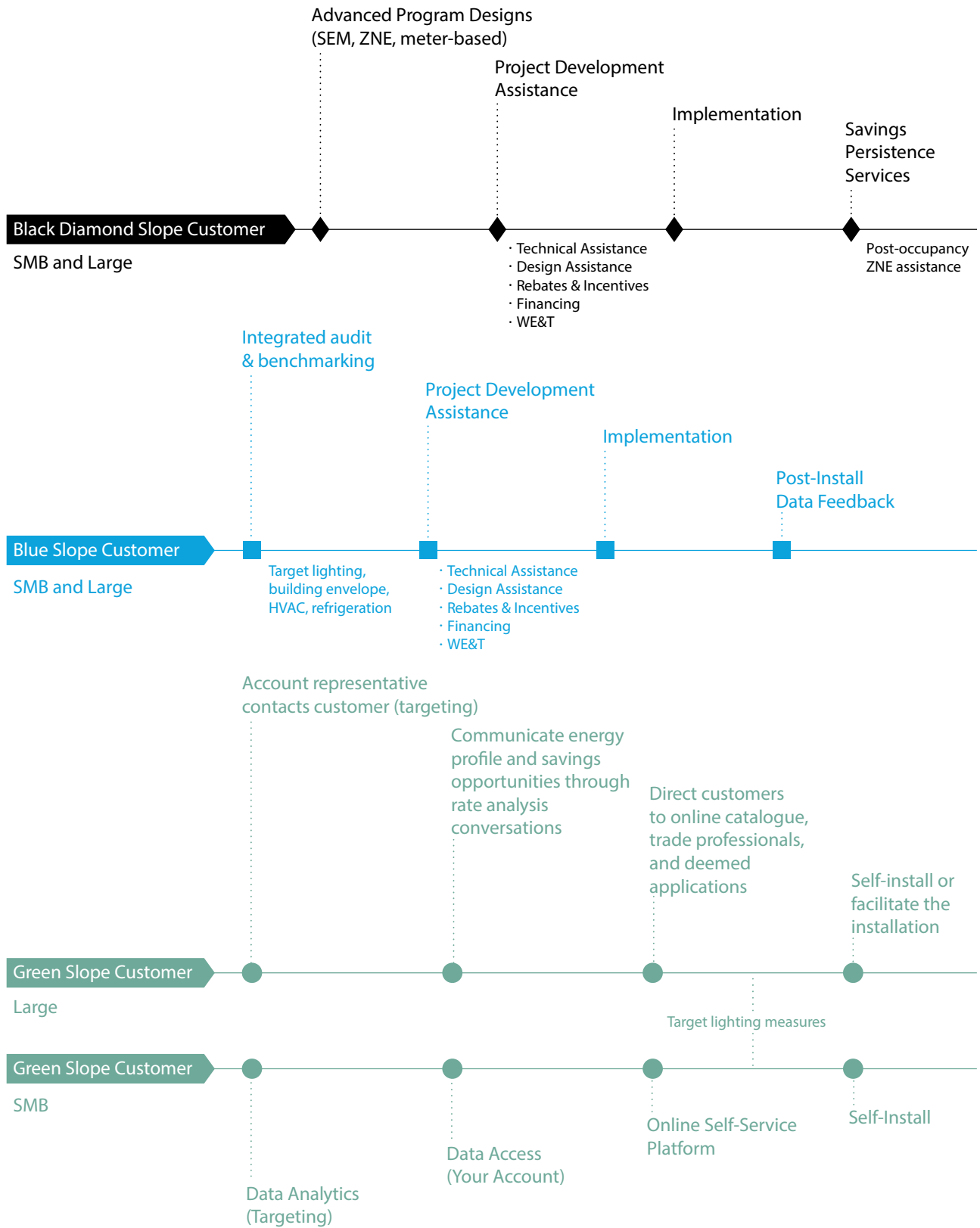
## Commercial Customer Journeys

The data presented in *Section D: Sector Overview* reveals PG&E's commercial customers are diverse and include different segments and sizes, while *Section E: Commercial Sector Trends and Challenges* identified unique barriers to energy efficiency for commercial customers. As a result, PG&E understands every customer approaches energy management differently and may require varying levels of engagement to overcome barriers that impede them from taking action. To this point, PG&E identifies three types of customers based on their level of interest and expertise in energy management. To convey this idea, we are going to use a downhill skiing analogy.

At the start of a customer's energy management journey, the customer will take advantage of low involvement offerings on the "green slopes." Once the customer has down a few runs on the green slopes, the customer will feel confident to make more involved commitments to energy management, along the lines of the offerings on the "blue slopes." Finally, the most savvy of customers will participate in the "black diamond slopes," which are intended for the customer who is already actively motivated by his or her energy use.

**Figure 3.11** displays the customer journey for commercial customers, and identifies the steps a customer can take to move from "green" to "black diamond" energy management. PG&E recognizes that certain customers are content to remain where they are currently on their journey. This underscores the importance of designing intervention strategies that meet customers wherever they are on their energy management journeys and directly addressing their needs.

**Figure 3.11**  
Commercial Customer Journey



## Green Slopes

There are two distinct paths for large and SMB customers on the green slope. A SMB customer may be a small customer who is using outdated, inefficient lighting, and may operate their business with energy costs as a low priority. Without an intervention, this customer would continue to waste energy through inefficient operations. To move them through their journey, PG&E can use its data analytics to identify the savings potential for lighting upgrades, encourage the customer to view their energy usage, and drive them to My Account to learn about available rebates and incentives. These projects also tend to be installed directly by customers.

While large customers follow similar steps to SMBs, outreach to them is typically conducted by an individual account representative that is specialized based on the customer's segment. The representative walks the customer through their energy usage trends, directs them to the appropriate resources (e.g., trade professionals, rebate applications), and facilitates installation.

## Blue Slopes

The distinction between customers on green slopes and blue slopes includes the need for greater engagement with PG&E to identify energy saving opportunities and the use of project development assistance to achieve deep energy savings. Blue slope customers include large customers and SMBs and typically coordinate with PG&E to identify savings opportunities through audits or benchmarking assistance. As a result, they tend to develop projects with multiple measures (e.g., lighting, whole building/envelope, HVAC, refrigeration) that may require more technical assistance, financing, or training to install. Once the project is completed, PG&E provides post-install feedback that makes the business case for efficiency through verifiable energy and cost savings.

## Black Diamond Slopes

Customers on diamond slopes differentiate themselves by pursuing advanced program models, such as SEM, ZNE, or a meter-based savings, pay-for-performance approach. Although SMB customers can participate, this pathway may be more suitable for large and medium-sized customers due to the complexity of offerings. These customers are actively engaged with their energy data and use near real-time insights to drive energy management decisions that optimize building performance.

The next section provides further detail on the selected intervention strategies and exploratory tactics. Before proceeding with implementation, PG&E will expose each tactic described to a rigorous internal development process to assess its relative viability and cost effectiveness.

## Intervention Strategy 1 — Data Analytics to Enhance Customer Targeting

The spark lines presented in “Customers by the Numbers” demonstrate that participation in commercial energy efficiency programs has decreased in recent years. Given the diversity of PG&E's commercial customer base, a one-size-fits-all approach to customer outreach is inadequate to motivate customers to incorporate energy efficiency into their businesses.

As a result, data analytics will be used to provide targeted value propositions to individual customers who are prime candidates to deliver large energy savings, achieve significant bill reductions, and add value to the grid as a whole. The customer journey graphic shows that targeting represents the first step of the customer journey by connecting those who stand to gain the most from energy efficiency with recommendations that meet their needs. This proactive strategy will be closely coordinated with marketing, education, and outreach (ME&O) activities to provide customers with actionable and tailored messaging based on what may be driving high energy bills. Additional discussion on supporting ME&O can be found in Intervention Strategy 3: Technical Assistance and Tools to Make Energy Efficiency Easy, Accessible, and Relevant.

In support of this approach, PG&E developed its EE Recommender platform, an internal tool that uses “association rule learning” to provide a targeted value proposition for large commercial customers with untapped savings potential, such as high HVAC users in the Central Valley or constrained substations as part of targeted demand side management (TDSM).<sup>73</sup> Association rule learning links energy efficiency offerings with unique customer characteristics, enabling PG&E to provide tailored energy management solutions to its commercial customers.<sup>74</sup>

In 2016, PG&E began working with a vendor to expand the use of data analytics to target SMB customers. PG&E is currently using this data to conduct targeted outreach to high potential SMB customers. Once the customer has been targeted, PG&E works collaboratively with implementers and its LGPs to encourage the customer to take action. This approach aligns with the Existing Buildings Energy Efficiency Action Plan’s call for ME&O that is “...customer-centric, targeted, data-and-research driven, disruptive, and comprehensive” to drive SMB customers to the right solutions based on their resources and needs.<sup>75</sup>

Ultimately, data analytics will play a critical role in doubling energy efficiency by 2030 because it enables PG&E to more accurately deploy resources for the largest impacts. In this way, insights into customer trends not only enhance targeting efforts, but also inform strategies to promote data access and the design of technical assistance, tools, and financial incentives to get energy efficiency measures off the ground. **Table 3.14** summarizes Intervention 1: Data Analytics.

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<sup>73</sup> Zawadzki, Lin, Dahlquist, Bao, et al. “Personalized energy efficiency program targeting with association rule mining,” *Pacific Gas and Electric Company—2016 ACEEE Summer Study on Energy Efficiency in Buildings*, p. 7.

<sup>74</sup> Zawadzki, Lin, Dahlquist, Bao, et al. “Personalized energy efficiency program targeting with association rule mining,” *Pacific Gas and Electric Company—2016 ACEEE Summer Study on Energy Efficiency in Buildings*, p. 7.

<sup>75</sup> “California Existing Buildings Energy Efficiency Action Plan,” August 2015, p. 84.

**Table 3.14**

Intervention 1: Data Analytics to Enhance Customer Targeting

GOALS:					
<ul style="list-style-type: none"> <li>• Save energy and reduce demand</li> <li>• Increase average savings per participant</li> <li>• Increase proportion of customers utilizing EMTs</li> <li>• Increase saturation of retrofit and new construction ZNE buildings by building type</li> <li>• Increase operational efficiency</li> </ul>					
Intervention Strategy	Barriers	Example Tactics	SMB or Large	Existing, New or Modified	Short, Mid, Long-Term
Data analytics to enhance customer targeting	<b>Capacity to Act</b> <ul style="list-style-type: none"> <li>• Customers may lack technical expertise</li> <li>• Customers may not understand the value of energy efficiency to take action</li> </ul>	Refine the EE Recommender platform to better match customers with energy efficiency offerings that maximize cost-effective savings <sup>a</sup>	Large	E	S
		Continue to use data analytics to better understand and target SMB customers <sup>b</sup>	SMB	E	S

**Partners:** Third party energy management providers; local government partnerships; data service providers; customers; implementers; contractors; online vendors; trainers

<sup>a</sup> Zawadzki, Lin, Dahlquist, et al. "Personalized energy efficiency program targeting with association rule mining," p. 7.

<sup>b</sup> Laurain, Bao, Zawadzki, et al. "Better Understanding Customers: Developing SMB DNA to Improve Customer Interactions and Catalyze Positive Behavior Changes," p. 11.

PG&E recognizes the importance of targeting, educating, and empowering SMBs to adopt energy solutions that are best suited for their needs. The 2014 Commercial Saturation and Market Share Tracking Study supports a sustained effort to increase targeted outreach for small businesses. In particular, the report finds, “the relatively low incidence of EE program participation among smaller sites (11% participation for very small sites versus 56% for large sites) and their self-reported lack of knowledge of programs available may indicate that hard to reach goals are needed to reach these customers.”<sup>76</sup> This finding supports PG&E’s energy savings metrics and tracking of participation to measure the impact of concentrated efforts to target and equip SMBs with the tools they need to participate in energy efficiency programs.

### Intervention Strategy 2 — Data Access to Facilitate Understanding of Energy Efficiency and Inspire Scalable, Market-Driven Program Designs

A lack of awareness of savings opportunities and what to do to take action are two of the primary barriers to greater efficiency in commercial buildings.<sup>77</sup> Successfully overcoming these barriers requires ensuring customers and authenticated third parties can access actionable insights from energy usage in an accessible and timely fashion.<sup>78</sup> PG&E’s approach to this strategy is divided into tactics that involve customers and third parties.

## Whole Building Usage Data

Building owners often struggle to access usage data for their entire buildings when its tenants are separately metered and pay their utility bills directly.

AB 802’s aggregation provision overcomes this barrier by empowering commercial building owners with the necessary information to identify energy efficiency opportunities and measure their progress over time.

**Customers:** This intervention strategy is the second step in the customer journey and aims to increase participation in energy efficiency programs by empowering customers with actionable data. In the short-term, PG&E will continue to drive customers to engage with their usage data through My Account, PG&E’s online platform that enables customers to pay their bills, compare their usage over time, and compare rate plans.

<sup>76</sup> “Commercial Saturation and Commercial Market Share Tracking Study Telephone Survey Findings,” *Itron*, September 22, 2014, p. ES-11 [http://www.calmac.org/publications/California\\_CSS\\_CMST\\_Phone\\_Survey\\_Report\\_updatedES.pdf](http://www.calmac.org/publications/California_CSS_CMST_Phone_Survey_Report_updatedES.pdf).

<sup>77</sup> “California Existing Buildings Energy Efficiency Action Plan,” *California Energy Commission*, September 2015, p. 17. <http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR->

<sup>78</sup> *Ibid*, p. 58.



Also in the short-term, PG&E will engage commercial customers with their energy usage through an online benchmarking portal in accordance with AB 802. The portal will enhance the State of California’s Building Energy Use Benchmarking and Public Disclosure Program by reporting whole-building energy data for commercial customers with three or more active utility accounts.<sup>79</sup> This initiative will enable commercial customers to more accurately assess their usage and identify a whole-building baseline to measure their progress.

**Third Parties:** PG&E will optimize its existing data sharing platforms, such as Share My Data and Stream My Data. These platforms permit PG&E to provide energy usage data to third party service providers who have been granted access to a customer’s dataset through a secure open authentication process that is accessible through the My Account page. While Share My Data provides third parties with commercial customer data in 15 minute intervals approximately 24 to 36 hours after the meter is read, Stream My Data can provide near instantaneous data due to wireless devices installed on the premises and provisioned to SmartMeters. The continued refinement of data sharing platforms aligns with customer demand for a wider variety of timely, related information to realize the value of the smart grid, and also fosters market innovation for new energy efficiency technologies.

In addition, actionable insights from data analytics will be used to inspire stakeholders to identify high opportunity areas for innovative and scalable programs that maximize energy savings. In light of the transition to 60% of PG&E’s portfolio being “proposed, designed, implemented, and delivered by non-utility personnel” by 2020;<sup>80</sup> the continued development of data analytics discussed in Intervention Strategy 1 and continued support for third party data access will inspire scalable, market-driven program designs that deliver cost-effective savings. **Table 3.15** summarizes Intervention 2: Data Access.

<sup>79</sup> “Assembly Bill No. 802,” *California Legislative Information*, October 8, 2015, [https://leginfo.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160AB802](https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB802).

<sup>80</sup> D.16-08-019, p.74.

**Table 3.15**

Intervention 2: Data Access to Facilitate Customer Understanding of Energy Efficiency and Inspire Scalable, Market-Driven Program Designs

**GOALS:**

- Save energy and reduce demand
- Increase average savings per participant
- Increase proportion of customers utilizing EMTs
- Increase saturation of retrofit and new construction ZNE buildings by building type
- Increase operational efficiency

Intervention Strategy	Barriers	Example Tactics	SMB or Large	Existing, New or Modified	Short, Mid, Long-Term
<b>Data-access to facilitate customer understanding of energy efficiency and inspire scalable, market-driven program designs</b>	<b>Capacity to act</b>	Continue to refine third party data sharing platforms such as Share My Data and Stream My Data for commercial customers to facilitate data-driven awareness <sup>a</sup>	SMB & Large	E	S
		Increase customer adoption of the MyAccount platform where customers can engage with personalized energy usage data and tools <sup>b</sup>	SMB & Large	E	S
	<b>Split Incentives</b>	Share insights into areas of high savings opportunities so third parties can design innovative programs to meet customer needs	SMB & Large	M	S
		<b>Multiple Decision Makers</b>	Develop and launch an online benchmarking portal that provides commercial building owners with access to whole building usage data <sup>c</sup>	SMB & Large	N

**Partners:** Third party energy management providers; local government partnerships; data service providers; customers; implementers; contractors; online vendors; trainers

<sup>a</sup> Laurain, Bao, Zawadzki, et al. "Better Understanding Customers: Developing SMB DNA to Improve Customer Interactions and Catalyze Positive Behavior Changes," p. 5.

<sup>b</sup> Ibid.

<sup>c</sup> For more information, please see "Assembly Bill No. 802" at [https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160AB802](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB802).

The link between data access and the identification of opportunities for energy efficiency is supported by a 2013 process evaluation of commercial customers who used the ENERGY STAR Portfolio Manager tool for benchmarking. Although Portfolio Manager “is not designed to identify specific energy-saving opportunities within buildings,” 84% of those surveyed reported leveraging improved awareness of their energy usage to identify energy efficiency opportunities, 67% used data access to identify which buildings needed the most improvement, and 63% used the information to set goals for facility performance.<sup>81</sup> These findings demonstrate commercial customers’ desire access to actionable insights on their energy usage.

### **Intervention Strategy 3 — Technical Assistance and Tools to Make Energy Efficiency Easy, Accessible, and Relevant**

Technical assistance and tools play a critical role in making the business case for energy efficiency through targeted value propositions. Due to the diversity of the commercial customer base, customers may not adopt energy efficiency due to organizational and operational barriers that result in energy efficiency being perceived as a low priority. For example, customers may not understand the value of energy efficiency because it is not communicated in the most relevant financial terms for their businesses (e.g., cost per-square foot). Commercial customers also often struggle with competing priorities. For instance, hospitality customers tend to prioritize customer satisfaction and comfort, so energy management may be overlooked if it cannot be directly linked to these needs.

Building on the data analytics and data access strategies, PG&E will engage customers at the appropriate point of their business cycles, using financial metrics (e.g., cost per-square foot, return on investment) and communication preferences best suited to their needs. Targeted value propositions are designed to make a strong business case for energy efficiency, in recognition of the fact that commercial customers’ organizational structures can lead to a “messy matrix of inputs and decisions from several organizational levels.”<sup>82</sup> This highlights the need to understand the audience, ranging from C-suite leaders to individual contributors, and formulate messaging concisely and with the right information.

<sup>81</sup> “Statewide Benchmarking Process Evaluation Volume 1: REPORT,” NMR Group, Inc, April 2012, p. 82.

<sup>82</sup> “Commercial Real Estate (CRE) Market Test Assessment,” *New Buildings Institute*, March 16, 2015, p. 22

To this point, PG&E will continue to communicate with customers through account representatives that are specialized based on customer segment and size, and are well equipped to deliver targeted value propositions. LGPs and local government agencies also play a significant role in communicating to SMB customers as the trusted local voice in the community. At the broader community level, PG&E will continue to develop community-based outreach initiatives, such as Step Up and Power Down, to increase awareness of energy efficiency and reduce energy waste.

Crafting a meaningful and targeted value proposition requires understanding where a customer is on their energy journey and providing the appropriate action to meet their needs. SMB customers that are new to managing their business's energy will be guided through the Business Energy Checkup. By answering a few survey questions, this tool enables SMB customers to identify which end uses use the most energy and access personalized energy saving recommendations. In the short-term, PG&E will introduce new EMTs for SMB customers based on its AB 793 implementation plan, and will track the growth of EMTs over time. Fostering adoption of EMTs will enable SMB customers to become familiar with their energy usage, improve their decision-making as rates change, and take advantage of an increasingly custom set of solutions from PG&E and third party providers.<sup>83</sup>

Also in the short-term, customers with moderate experience in energy management will continue to be served through audits that identify energy saving opportunities, assistance with PG&E's benchmarking tools to set baselines and develop energy saving plans, and project development support to facilitate implementation. While every customer has different needs, PG&E anticipates partnering with third parties and LGPs to maximize savings from lighting building envelope, HVAC, and refrigeration, based on the opportunities identified in *Section D: Sector Overview*.

In the mid-term, PG&E will work closely with select customers who already actively manage their energy but need help navigating future energy projects through the development of strategic energy management plans. Once a project is implemented, PG&E will coordinate with program implementers to empower customers with their energy usage data for greater savings persistence. This post-install feedback is critical to moving customers through their energy journeys because it provides a "before and after" comparison with objective energy and cost savings that demonstrates the value of energy efficiency. **Table 3.16** summarizes Intervention 3: Technical Assistance and Tools.

The PY 2013-2014 Third Party Commercial Program Value and Effectiveness Study Report reinforces the idea that comprehensive energy solutions are more effective than programs with a single offering. Specifically, it finds more third party programs "with single rather than multiple end-uses closed during 2013-2014, indicating that programs with a more-comprehensive measure mix might have more flexibility to find ways to save energy despite market or policy changes."<sup>84</sup> Moving forward, PG&E will prioritize bundled solutions and project that drive comprehensiveness for its commercial customers. This includes complementing energy audits with project development assistance and partnering with large customers to develop long-term strategic energy management plans.

<sup>83</sup> "Advice Letter 3744-G-B/4886-E-B: Second Supplemental: Request for Approval of PG&E's Assembly Bill 793 Implementation Plan," *Pacific Gas and Electric Company*, September 20, 2016.

<sup>84</sup> "PY 2013-2014 Third Party Commercial Program Value and Effectiveness Study Report," *California Public Utilities Commission Energy Division*, pp. 34, 95.

**Table 3.16**

Intervention 3: Technical Assistance and Tools to Make Energy Efficiency Easy, Accessible, and Relevant

GOALS:					
<ul style="list-style-type: none"> <li>• Save energy and reduce demand</li> <li>• Increase average savings per participant</li> <li>• Increase proportion of customers utilizing EMTs</li> <li>• Increase saturation of retrofit and new construction ZNE buildings by building type</li> <li>• Increase operational efficiency</li> </ul>					
Intervention Strategy	Barriers	Example Tactics	SMB or Large	Existing, New or Modified	Short, Mid, Long-Term
<b>Technical assistance and tools to make energy efficiency programs and services, easy, accessible, and relevant</b>	<b>Multiple Decision Makers</b> <b>Competing Business Priorities</b> <ul style="list-style-type: none"> <li>• Healthcare, high tech, and bio tech facilities operate 24 hours a day, meaning they cannot afford the time needed to implement deep retrofits</li> <li>• Large tech companies must deploy energy solutions on an expedited timeframe (e.g., to optimize the capacity of a data center).<sup>a</sup></li> <li>• The hospitality industry prioritizes guest comfort over energy efficiency</li> <li>• SMB customers that are less engaged in energy efficiency lack the time and resources to engage in issues not directly related to business operations</li> </ul>	Improve existing technical, project development and project management support to drive project completion. Continue to offer on-site consultative engineering assistance through both statewide and targeted (third-party) offerings to guide customers toward energy efficiency activities	SMB & Large	E	S
		Promote audits to identify energy savings opportunities; remarket solutions where projects are not initiated <sup>b</sup>	SMB & Large	E	S
		Continue to use PG&E’s account representatives to target customers, aligning the outreach with customer opportunity. Reps are organized to support SMB and Segment — focused customer outreach.	SMB & Large	E	S
		Continue multi-touch on-boarding communications to new SMB customers to drive awareness and engagement with PG&E’s energy efficiency offerings	SMB	E	S

**Partners:** Third-party energy management providers, data service providers, customers, implementers, contractors, distributors, retailers, trainers, LGPs, state and local governments

<sup>a</sup> Johnson, Priscilla, Geoff Wickes, and Michelle Lichtenfels, “Baking from Scratch: How a Tiny EM&V Study Disrupted the Status Quo in Utility Program Design,” Pacific Gas and Electric Company—2016 ACEEE Summer Study on Energy Efficiency in Buildings, p. 4-2.

<sup>b</sup> “A Guide to Energy Audits,” U.S. Department of Energy, [http://www.pnnl.gov/main/publications/external/technical\\_reports/pnnl-20956.pdf](http://www.pnnl.gov/main/publications/external/technical_reports/pnnl-20956.pdf).

**Table 3.16** (continued)

Intervention 3: Technical Assistance and Tools to Make Energy Efficiency Easy, Accessible, and Relevant

GOALS:					
<ul style="list-style-type: none"> <li>• Save energy and reduce demand</li> <li>• Increase average savings per participant</li> <li>• Increase proportion of customers utilizing EMTs</li> <li>• Increase saturation of retrofit and new construction ZNE buildings by building type</li> <li>• Increase operational efficiency</li> </ul>					
Intervention Strategy	Barriers	Example Tactics	SMB or Large	Existing, New or Modified	Short, Mid, Long-Term
<b>Technical assistance and tools to make energy efficiency programs and services, easy, accessible, and relevant</b>	<b>Multiple Decision Makers</b> <b>Competing Business Priorities</b> <ul style="list-style-type: none"> <li>• Healthcare, high tech, and bio tech facilities operate 24 hours a day, meaning they cannot afford the time needed to implement deep retrofits</li> <li>• Large tech companies must deploy energy solutions on an expedited timeframe (e.g., to optimize the capacity of a data center).</li> <li>• The hospitality industry prioritizes guest comfort over energy efficiency</li> <li>• SMB customers that are less engaged in energy efficiency lack the time and resources to engage in issues not directly related to business operations</li> </ul>	Continue testing community-based outreach initiatives, such as Step Up and Power Down, to increase awareness of energy efficiency and reduce energy waste	SMB & Large	E	S
		Design outreach strategies that speak to customers using metrics that are most important to their needs (e.g., cost per-square foot) at the right time in their business cycle	SMB & Large	M	S
		Expand Business Energy Checkup as a comprehensive online solution to encourage self-service (e.g., identify qualified products and rebates, find a trade professional, submit application)	SMB	M	S
		Develop strategic energy management (SEM) plans for select customers (e.g., national chain accounts)	Large	M	M

**Partners:** Third-party energy management providers, data service providers, customers, implementers, contractors, distributors, retailers, trainers, LGPs, state and local governments

**Table 3.16** (continued)

Intervention 3: Technical Assistance and Tools to Make Energy Efficiency Easy, Accessible, and Relevant

GOALS:					
<ul style="list-style-type: none"> <li>• Save energy and reduce demand</li> <li>• Increase average savings per participant</li> <li>• Increase proportion of customers utilizing EMTs</li> <li>• Increase saturation of retrofit and new construction ZNE buildings by building type</li> <li>• Increase operational efficiency</li> </ul>					
Intervention Strategy	Barriers	Example Tactics	SMB or Large	Existing, New or Modified	Short, Mid, Long-Term
<b>Technical assistance and tools to make energy efficiency programs and services, easy, accessible, and relevant</b>	<b>Multiple Decision Makers</b> <b>Competing Business Priorities</b> <ul style="list-style-type: none"> <li>• Healthcare, high tech, and bio tech facilities operate 24 hours a day, meaning they cannot afford the time needed to implement deep retrofits</li> <li>• Large tech companies must deploy energy solutions on an expedited timeframe (e.g., to optimize the capacity of a data center).</li> <li>• The hospitality industry prioritizes guest comfort over energy efficiency</li> <li>• SMB customers that are less engaged in energy efficiency lack the time and resources to engage in issues not directly related to business operations</li> </ul>	Use personalized product or program recommendations to bundle solutions that are most relevant to specific customers <sup>c</sup>	SMB & Large	M	S
		Empower customers with energy usage data after project implementation to promote savings persistence <sup>d</sup>	SMB & Large	M	S
		Incorporate EMTs into the Business Energy Checkup	SMB	M	S

**Partners:** Third party energy management providers, data service providers, customers, implementers, contractors, distributors, retailers, trainers, LGPs, state and local governments

<sup>c</sup> “Commercial Real Estate (CRE) Market Test Assessment,” p. 21

<sup>d</sup> “Utility Best Practices Guidance for Providing Business Customers with Energy Use and Cost Data,” U.S. Environmental Protection Agency, Section 3: The Case for Increasing Customer Access to Energy Use and Cost Data, [https://www.epa.gov/sites/production/files/2015-08/documents/utility\\_data\\_guidance.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/utility_data_guidance.pdf).

## Intervention Strategy 4 — Rebates, Loans, and Incentives to Mitigate Cost Barriers to Energy Efficiency

Rebates, loans, and incentives aim to overcome the split incentive barrier and financial barriers such as a lack of upfront capital and constraining payback criteria. Moving forward, PG&E will gradually shift away from its historical approach centered on rebates and incentives to scaling financing options and alternative contract models such as green leases.

In the short-term, PG&E will continue to provide downstream, midstream, and upstream rebates and incentives to mitigate financial barriers to energy efficiency. Traditional downstream incentives will play a key role in the customer journey for customers on the “green slopes” by targeting high potential end uses such as lighting. This includes continuing to explore kickers for hard-to-reach segments, which advances the AB 758 Existing Buildings Energy Efficiency Action Plan’s goal of promoting “affordable and accessible energy efficiency solutions.”<sup>85,86</sup> As customers become more energy savvy, PG&E will emphasize the availability of non-traditional financial solutions such as On-Bill Financing (OBF) and On-Bill Financing-Alternative Pathway (OBF-AP). These financing structures will be a particularly critical component of project development assistance for high energy management customers who are pursuing advanced program designs such as SEM or ZNE.

Based on PG&E data, half of the loans made through OBF in 2015 were for commercial customers. From these loans, a majority of volume was driven by medium-sized businesses in the retail sector, with lighting being the most popular measure. PG&E recently started testing On-Bill Repayment (OBR), in which loans provided by non-utility lenders are repaid through a customer’s energy bill. Compared to OBF, OBR does not have a minimum threshold of \$5,000, a cap of \$100,000, or a payback period of five years. PG&E will pursue OBR as an opportunity to achieve deeper retrofits that may be limited by OBF eligibility requirements. PG&E is also piloting micro loan approaches in coordination with LGPs (via non-

resource Strategic Energy Resources funding). PG&E plans to take the lessons learned from these efforts, and if successful, scale them across the portfolio of LGP programs.

In the mid-term, PG&E will target the split incentives barrier through the introduction of alternative contract models, such as green leases. Specifically, PG&E will adopt a two-pronged approach to introducing green leases to its customers. First, PG&E will collaborate with advisory firms and commercial real estate associations to develop a green lease template that incorporates best practices from existing approaches adopted across the country. Second, PG&E will couple the template with a training offering that educates the commercial real estate community on how to operate within a green lease structure. PG&E plans to initially target this offering to large office customers due to the predominance of leases and high energy usage in this segment. Specifically, the large office segment drove 18% of energy savings, 24% of electric usage, and 18% of gas usage in the commercial sector in 2015 (See *Section D: Sector Overview and Appendix C: Customer Data for more information*).

Ultimately, this intervention strategy plays a critical role in spurring customers to take action. To recap, data analytics target customers, data access and awareness help customers identify energy saving opportunities, technical assistance and tools provide the means to realize savings, and financial solutions help customers overcome cost barriers by mitigating cost barriers without obstructing cash flows from operations. In this way, PG&E’s customer intervention strategies can be thought of sequentially and as mutually reinforcing. Moving forward, all four strategies must be implemented in sync to reach stranded potential in existing buildings and double energy efficiency savings by 2030. **Table 3.17** summarizes Intervention 4: Rebates, Loans and Incentives.

<sup>85</sup> “California Existing Buildings Energy Efficiency Action Plan,” p. 3.

<sup>86</sup> PG&E currently offers kickers for hard to reach customers who meet two of the following criteria: the primarily language spoken is not English, the customer is located outside of the San Francisco Bay Area or Greater Sacramento Area, the business has annual electric demand <20kW or has fewer than 10 employees, and the customer is located in a leased or rented facility.



**Table 3.17**

Intervention 4: Rebates, Loans, and Incentives to Mitigate Cost Barriers to Energy Efficiency

GOALS:					
<ul style="list-style-type: none"> <li>• Save energy and reduce demand</li> <li>• Increase average savings per participant</li> <li>• Increase proportion of customers utilizing EMTs</li> <li>• Increase saturation of retrofit and new construction ZNE buildings by building type</li> <li>• Increase operational efficiency</li> </ul>					
Intervention Strategy	Barriers	Example Tactics	SMB or Large	Existing, New or Modified	Short, Mid, Long-Term
Rebates, loans, and incentives to mitigate cost barriers to energy efficiency	Split incentives Multiple Decision Makers Lack of upfront capital Constraining payback criteria	Continue (and ramp down) existing energy efficiency program rebate and incentive offerings	SMB & Large	E	S, M, L
		Continue to explore offering kickers to hard-to-reach customers <sup>a</sup>	SMB	E	S
		Incentivize action through new program models that provide grid benefits (e.g., meter-based savings, behavioral, etc.); explore ways to move away from traditional rebate and incentive programs to achieve the greatest and most cost-effective savings impact	SMB & Large	N	S, M
		Target large offices and tenant customers with a best-in-class green lease template paired with specialized training to overcome the split incentives barrier <sup>b</sup>	SMB & Large	N	M
		Coordinate with LGPs to explore offering micro loans to SMB customers	SMB	N	S

**Partners:** Capital providers, developers, customers, solutions providers, contractors, implementers, trade professionals, Local Government Partnerships

<sup>a</sup> “Draft Report—A Study of Barriers and Solutions to Energy Efficiency, Renewables and Contracting Opportunities Among Low-Income Customer and Disadvantaged Communities,” California Energy Commission, pp. 17-18.

<sup>b</sup> “California Existing Buildings Energy Efficiency Action Plan,” p. 82.



### FOOD SERVICES TECHNOLOGY CENTER

Developed through a partnership between PG&E and Fisher-Nickel, Inc., the Food Services Technology Center (FSTC) is an industry leader in commercial kitchen energy efficiency and appliance performance testing. The FSTC provides the following services to restaurant owners and operators, cooking equipment manufacturers, and kitchen designers:

- Kitchen equipment test reports
- Design consultation services
- On-site facility surveys
- Free educational seminars
- Equipment testing services

NRDC notes green leases benefit landlords by “tying capital cost recovery to associated savings, imposing controls on rising tenant demand for electric service, separating energy expenses from other operating costs for better tracking and expense recovery, and attributing energy consumption to tenants more accurately.”<sup>87</sup> Green leases also benefit tenants by instituting “greater assurance of efficiency operations and control over operating costs, the ability to measure energy consumption, and better measurement of base building energy use for accurate allocation of operating expenditures.”<sup>88</sup>

### Intervention Strategy 5 — Assistance to the Design and Building Communities to Achieve the CEESP’s ZNE Goals

Although seventy ZNE commercial buildings have been constructed in California since 2007,<sup>89</sup> significant barriers to achieve the CEESP’s ZNE goals remain.<sup>90</sup> The most salient barriers include the fact that ZNE is still in the “proof-of-concept” stage, split incentives impede customers from taking action, and multiple decision-makers results in coordination challenges. To overcome these challenges, PG&E is adopting a comprehensive approach to assist, test, and continue to support innovation that results in a larger percentage of the design community and builders consistently building to ZNE specifications. ZNE will be incorporated into the customer journey for those highly engaged with energy management.

<sup>87</sup> “Energy Efficiency Lease Guidance,” *National Resource Defense Council*, November 2011, p. 1.

<sup>88</sup> *Ibid.*

<sup>89</sup> “Updating the CPUC’s 2030 ZNE Commercial Building Goals,” *California Public Utilities Commission*, October 29, 2015.

<sup>90</sup> “California Energy Efficiency Strategic Plan: January 2011 Update,” *California Public Utilities Commission and California Energy Commission*, January 2011, p. 28.

## The CEESP's Vision for Commercial ZNE

“Commercial buildings will be put on a path to zero net energy by 2030 for all new and a substantial proportion of existing buildings. Innovative technologies and enhanced building design and operation practices will dramatically grow in use in the coming years through a combination of comprehensive whole building programs, technology development, market pull, professional education, targeted financing and incentives, and codes and standards.”

The foundation of this strategy is close coordination and alignment between internal parties (i.e., utility resource programs, codes & standards, WE&T) and external stakeholders i.e., (developers, building owners, contractors, designers, local governments). In addition, a majority of the example tactics provided in support of this strategy are identified as short-term efforts (1-3 years) based on the recognition that immediate actions are required to achieve 2030 ZNE goals. These can be perceived as a three-pronged approach that includes:

**Supporting the Regulatory Framework:** PG&E will continue to assess the performance of technologies and systems that support ZNE design and operation. While the Emerging Technologies program will continue to test the feasibility of individual products, PG&E's C&S program will adopt a macro-level approach to understanding how technologies perform once installed in buildings through code readiness efforts. For example, PG&E will identify building types with low energy intensities that are low hanging fruit to target ZNE research and development (e.g., warehouses in 2022, small offices and schools in 2025).

**Encouraging Customers and Market Actors to Move to ZNE:** Also in the short-term, PG&E will deploy new incentive structures targeting ZNE projects. For example, PG&E will explore using kickers to encourage early adopters such as building owners, contractors, and developers to take the lead in pursuing ZNE. PG&E will assess the effectiveness of the kicker and phase it out based on uptake. In addition to the kicker, PG&E may offer technical assistance for deep retrofits that place buildings on the path to ZNE. Detail on incentive levels, measure types, technical assistance and eligibility will be provided in the Implementation Plans.

Additional support for ZNE includes providing post-occupancy monitoring and feedback for building owners, contractors, and developers after a ZNE building is constructed.<sup>91</sup> This intervention will ensure that the building is operating as designed, and provides an opportunity to market targeted WE&T to improve the building's effectiveness and maintain customer satisfaction.

<sup>91</sup> “The Road to ZNE: Mapping Pathways to ZNE Buildings in California,” *Heschong Mahone Group, Inc*, December 20, 2012, p. 16-17. <http://www.trcsolutions.com/writable/images/The-Road-to-Zero-Net-Energy.pdf>.

## Architecture at Zero

PG&E and the American Institute of Architects launched the Architecture at Zero competition in 2011 to encourage new, innovative ideas for ZNE construction to help achieve the CEESP's ZNE goals.

In 2016, the competition awarded \$25,000 to teams that provided the best ZNE designs for a student housing project at San Francisco State University.

**Partnerships:** PG&E will continue to partner with leading advisory firms, builders, developers, designers, and building owners to develop ZNE demonstration projects that aim to achieve knowledge transfer through design and technical assistance and to help demystify “proof of concept” concerns. This includes identifying opportunities for integrated design that maximize energy savings without adding costs. Furthermore, ZNE stakeholders, including local governments, counties, RENs, and industry associations, will be engaged through PG&E's marketing and outreach strategy to spotlight ZNE champions (e.g., Architecture at Zero competition).

In addition, PG&E will leverage its relationships with local governments through LGPs to develop and advocate for a comprehensive ZNE reach code that integrates energy efficiency, renewables, alternative fuels and electric vehicle infrastructure, energy storage, demand response, and water savings measures with prescriptive measures for each targeted area. Local governments will also be engaged to advance ZNE in state buildings and schools.<sup>92</sup> Additional discussion on PG&E's approach to ZNE in the public sector can be found in the Public chapter. PG&E also recognizes that increasing the capacity for stakeholders to take action requires increasing the availability and awareness of WE&T opportunities related to ZNE. In support of this effort, PG&E's WE&T chapter contains a technical upskill strategy for the current workforce that includes:

- Collaborating with trade and professional organizations to focus participation on the right audiences
- Matching course content to course attendees
- Aligning course delivery method to post-course expected student actions
- Developing and delivering integrated design courses for project managers
- Targeting trade site supervisors and superintendents to guide apprentices and journeymen

**Table 3.18** summarizes Intervention 5: Assistance to the Design and Building Communities.

<sup>92</sup> Executive Order B-18-12 requires California to (1) reduce grid-based electricity purchase for state-owned buildings by 20% by 2018, (2) construct 50% of new state buildings designed after 2020 as ZNE, (3) construct all new state buildings after 2025 as ZNE, and (4) require 50% of existing state-owned buildings to be ZNE by 2025.

**Table 3.18**

Intervention 5: Assistance to the Design and Building Communities to Achieve the CEESP’s ZNE Goals

GOALS:					
<ul style="list-style-type: none"> <li>Increase saturation of retrofit and new construction ZNE buildings by building type</li> </ul>					
Intervention Strategy	Barriers	Example Tactics	SMB or Large	Existing, New or Modified	Short, Mid, Long-Term
<b>Assistance to the design and building communities to achieve the CEESP’s ZNE goals</b>	<p><b>Capacity to Act: the ZNE market is still in the “proof-of-concept” stage</b></p> <ul style="list-style-type: none"> <li>Limited awareness and commitment to market that ZNE is here to stay<sup>a</sup></li> <li>ZNE impacts on the grid and the costs of achieving ZNE goals remain uncertain<sup>b</sup></li> <li>Builders have established designs and subcontractor and supply chain relationships<sup>c</sup></li> <li>Long-term cost considerations<sup>d</sup></li> </ul> <p><b>Multiple decision makers</b></p> <ul style="list-style-type: none"> <li>A lack of coordination exists between ZNE stakeholders such as the utilities, CPUC, Energy Commission, building owners, builders, designers, developers, and local governments<sup>e</sup></li> </ul> <p><b>Lack of upfront capital</b></p> <p><b>Constraining payback criteria</b></p>	Continue ZNE demonstrations to equip designers and builders with the assistance and tools to meet ZNE goals <sup>f</sup>	SMB & Large	E	S
		Continue to support emerging technology projects in support of ZNE solutions	SMB & Large	E	S
		Continue partnering with LGPs to advance ZNE projects in state buildings and schools	SMB & Large	E	S
		Prioritize code-readiness activities by building type in alignment with C&S (i.e., warehouses in 2022, small offices and schools in 2025, etc.)	SMB & Large	N	S
		Offer technical assistance for customers to reach deep energy saving measures that accelerate progress towards ZNE	SMB & Large	N	S
		Explore providing ZNE “first mover” kickers to developers, building owners, and contractors	SMB & Large	N	S
		Promote ZNE by streamlining processes for energy modeling, design document templates, and training during the application process <sup>g</sup>	SMB & Large	N	M
		Develop post-occupancy ZNE technical assistance to drive savings persistence <sup>h</sup>	SMB & Large	N	S

**Partners:** AIA, ASHRAE, BOMA, USGBC, ASE, LGPs and local government agencies, CPUC, Energy Commission, land use planners

<sup>a</sup> “Updating the CPUC’s 2030 ZNE Commercial Building Goals,” California Public Utilities Commission, October 29, 2015  
<sup>b</sup> “The Road to ZNE: Mapping Pathways to ZNE Buildings in California,” p. 10.  
<sup>c</sup> Pigman, Larue, Brown, et al. “Lessons Learned from a Zero Net Energy Production Builder Demonstration,” Resource Refocus LLC, PG&E, BIRAenergy, Design AVenues LLC, and David Energy Group—2016 ACEEE Summer Study on Energy Efficiency in Buildings, p. 2.  
<sup>d</sup> “Updating the CPUC’s 2030 ZNE Commercial Building Goals,” California Public Utilities Commission, October 29, 2015.

<sup>e</sup> “The Road to ZNE: Mapping Pathways to ZNE Buildings in California,” p. 18.  
<sup>f</sup> “Fact Sheet: Energy Efficiency Zero Net Energy Program,” California Public Utilities Commission.  
<sup>g</sup> “California Energy Efficiency Strategic Plan: January 2011 Update,” California Public Utilities Commission and California Energy Commission, p. 35.  
<sup>h</sup> “California Energy Efficiency Strategic Plan: January 2011 Update,” California Public Utilities Commission and California Energy Commission, p. 31.

The 2012 Technical Feasibility of Zero Net Energy Buildings in California study finds it is technically feasible for California to meet its ZNE goals. Despite this feasibility, the report identifies “the ‘best’ answer to reach any ZNE metric will differ for each specific building, owner, and site.”<sup>93</sup> This finding is particularly relevant for the commercial market, where the diversity of the customer base makes a product-by-product approach untenable for scaling ZNE design and construction. In this way, the study underscores the importance of “integrated design,” which “involves engaging all of the stakeholders and communicating the energy goals and expectations early on in the design process.”<sup>94</sup> PG&E will continue this approach to greater ZNE adoption through further development of meter-based savings models and demonstration projects that aim “to achieve an integrated, whole building approach to achieving ZNE.”<sup>95</sup>

### Intervention Strategy 6 — Upstream and Midstream Partnerships to Promote Efficient Products, Components, and Systems

Upstream and midstream partnerships work at the broader market level to empower customers with the capacity to take action.

Since downstream incentives alone may not always be sufficient for customers to take action, upstream and midstream partnerships ensure that the most efficiency products, components, and systems are readily available in the marketplace. This approach is supported by the Environmental Protection Agency’s finding that upstream and midstream incentives “can affect larger markets than direct incentives targeted to individual customers, because upstream and midstream players are able to offer the desired products or service to all the customers they serve, not just those who learn about direct customer rebates.”<sup>96</sup>

In the short-term, PG&E will continue to partner with upstream and midstream actors to increase the availability and awareness of equipment and solutions that aid commercial customers in effectively reducing their energy usage (e.g., EMTs). In the new statewide administration model<sup>97</sup>, PG&E will work closely with statewide administrators leading upstream and midstream opportunities focused on the Commercial sector. As part of this, PG&E will support the “bottom-up” review of its current partnerships to promote their continued success and cost-effectiveness.<sup>98</sup> Ultimately, upstream and midstream partnerships will enable PG&E, and California, to continue to encourage supply chain actors to create, distribute, and stock the most effective energy solutions for customers. Through partnerships with manufacturers, distributors, retailers, and other market actors in the supply chain, this intervention strategy will enable PG&E to continue to promote the availability of energy efficient equipment and solutions in the market and cost-effectively scale over time, leveraging the buying power of California.

**Table 3.19** summarizes Intervention 6: Upstream and Midstream Partnerships.

<sup>93</sup> “The Technical Feasibility of Zero Net Energy Buildings in California,” *ARUP*, December 31, 2012, p. 7.

<sup>94</sup> “The Technical Feasibility of Zero Net Energy Buildings in California,” *ARUP*, December 31, 2012, p. 65.

<sup>95</sup> Pigman, Larue, Brown, et al. “Lessons Learned from a Zero Net Energy Production Builder Demonstration,” *Resource Refocus LLC, PG&E, BIRAenergy, Design AVenues LLC, and David Energy Group—2016 ACEEE Summer Study on Energy Efficiency in Buildings*, p. 2.

<sup>96</sup> “Customer Incentives for Energy Efficiency Through Program Offerings,” p. 6.

<sup>97</sup> Please refer to PG&E Statewide Administration Business Plan chapter for more information on statewide programs.

<sup>98</sup> For more information, see Fogel, Cathy “Overarching Comments Program Administrator Business Plans Focus on Market Transformation Strategies,” September 27, 2016, or D.16-08-019, p. 60.

**Table 3.19**

Intervention 6: Upstream and Midstream Partnerships to Promote Efficient Products, Components, and Systems

GOALS:					
<ul style="list-style-type: none"> <li>• Save energy and reduce demand</li> <li>• Increase average savings per participant</li> <li>• Increase operational efficiency</li> </ul>					
Intervention Strategy	Barriers	Example Tactics	SMB or Large	Existing, New or Modified	Short, Mid, Long-Term
Upstream and midstream partnerships to promote efficient products, components, and systems	Capacity to Act <ul style="list-style-type: none"> <li>• Downstream incentives may not always be sufficient to increase customer adoption of energy efficiency</li> </ul>	Continue to partner with manufacturers, distributors, and other market actors to make purchasing energy efficiency equipment easy and affordable via the statewide program model	SMB & Large	E	S
		Work with statewide program administrator leads to perform a bottom-up review of upstream and midstream activities to optimize them into the most cost-effective configurations and identify opportunities for market leading interventions aimed at market transformation <sup>a</sup>	SMB & Large	N	S

**Partners:** Manufacturers, distributors, contractors, design community, retailers, other market actors

<sup>a</sup> Fogel, Cathy September 27, 2016. "Overarching Comments Program Administrator Business Plans Focus on Market Transformation Strategies."

A 2013 assessment of PG&E's "Lighting Innovation Midstream Trial" by Evergreen Economics finds upstream and midstream partnerships are effective in increasing the market uptake of energy efficiency and eventually achieving market transformation.<sup>99</sup> PG&E first offered LEDs through its Lighting Innovation Midstream Trial, where incentives were given to distributor-level suppliers for the sale of LED replacement lamps to commercial customers. The evaluators analyzed trial sales data, compared the sales data with PG&E program sales data through the LGPs, third party direct install programs, and downstream program (including sales through the "self-service" trade professional alliance), conducted in-depth interviews with LED market actors, conducted commercial end-user telephone surveys

with trial LED lamp recipients, and developed recommendations for likely market indicators.<sup>100</sup>

The overall findings indicate the midstream incentives were effective, pointing to sales of midstream incentivized LED replacement lamps outpacing sales of LED replacement lamps and/or fixtures through PG&E's other commercial deemed incentive programs during the study period, as well as high levels of satisfaction with the rebate application and payment process from market actors and end-users.<sup>101</sup>

PG&E will work with Commission staff, statewide lead administrators, and stakeholders to assess technologies and appropriate delivery channel to meet California's market transformation goals; in particular, commercial ZNE goals. For example, PG&E will evaluate the connections between up/

<sup>99</sup> "Pacific Gas and Electric Company's Lighting Innovation Midstream Trial Evaluation," *Evergreen Economics*, October 13, 2015, p. vii, [http://www.calmac.org/publications/PGandE\\_Commercial\\_Midstream\\_LED\\_Trial\\_Assessment\\_Final\\_ReportES.pdf](http://www.calmac.org/publications/PGandE_Commercial_Midstream_LED_Trial_Assessment_Final_ReportES.pdf).

<sup>100</sup> Ibid.

<sup>101</sup> Ibid.

mid-stream initiatives and long-term SW C&S initiatives to advance C&S initiatives. See *Appendix D: Commercial Up/Midstream Strategies and Codes & Standards Connections* for examples of possible integration strategies. PG&E will work Commission staff, program administrators and stakeholders to refine and more fully develop this strategy.

Within *Section F: PG&E's Approach to Achieving Goals*, PG&E describes new and innovative strategies and tactics, some of which will lead to pilot efforts at the program level. PG&E will describe any unique and innovative aspects of each program, as well as any pilots contemplated or underway, within its program-level Implementation Plans.

Additionally, PG&E will consider the appropriate workforce standard requirements, such as any required certifications, minimum performance standards, or pre-qualification process for specific programs in support of its energy efficiency portfolio. As applicable, PG&E will detail workforce standard requirements in each Implementation Plan (IPs).

## G. Leveraging Cross-Cutting Resources

PG&E's cross-cutting sectors will play a pivotal role in advancing energy efficiency in the Commercial sector. Here, PG&E provides a brief review of how cross-cutting initiatives fit into its Commercial sector strategy.

- **Finance:** Finance offerings play a leading role in Intervention Strategy 4: Rebates, Loans, and Incentives as PG&E transitions towards a greater emphasis on financing and new financial structures that leverage private capital. This includes continuing to offer zero-interest financing such as OBF and OBF-AP, in addition to using non-utility capital through the launch of OBR.

In the future, PG&E is seeking to allow third-party lenders to lend to PG&E through OBR and have those repayments collected through their utility bill to finance distributed energy resources (DER) measures. PG&E will also pilot new financing structures that can help overcome transaction barriers for customers, for example, customers who are unable to take out new debt finance. These new financing structure will be developed to support DER investments.

- **Emerging Technologies (ET):** The statewide ET team supports *Intervention Strategy 3: Technical Assistance and Tools and Intervention Strategy 5: Assistance to the Design and Building Communities* by identifying technologies with verifiable energy savings and testing new technologies on a limited scale before greater deployment. In the short-term, ET is leading tests of EMTs in accordance with AB 793 and supporting further development of meter-based savings models to unlock deep savings in existing buildings and pave the way for greater ZNE adoption.
- **Workforce Education & Training (WE&T):** PG&E will continue to use WE&T resources to improve the skills and knowledge-base of its contractors and trade professionals. WE&T currently offers over 250 courses that are relevant for the commercial workforce, including the basics of conducting an energy audit, specific courses on lighting, HVAC, and refrigeration, and the zero net future. Moving forward, PG&E's WE&T program will support the long-term commercial vision by priming the future workforce through Career Connections, facilitating the entry of individuals from disadvantaged communities into the energy workforce through Career and Workforce Readiness efforts, collaborating with established training organizations that are preparing the incoming energy workforce, and increasing the capacity of the current workforce through technical upskill initiatives.
- **Marketing, Education, and Outreach (ME&O):** ME&O will play a central role in Intervention Strategies 1-4 due to the importance of engaging customers at the appropriate time, through the proper communication channel, and with the most effective messaging. For example, retail customers rarely implement energy efficiency projects during holiday seasons, healthcare customers require multiple years of lead time before implementing a project, and high tech customers desire solutions with a fast turnaround time. ME&O will also continue to work closely with PG&E's data analytics team to conduct targeted outreach to customers based on insights from AMI data.



- **Codes and Standards (C&S):** C&S plays a key role in achieving the CEESP’s ZNE goals for commercial buildings. Specifically, the C&S code readiness initiative leads primary data collection efforts to support market transformation for measures that are critical to achieving ZNE goals. In this way, C&S research will inform the design of technical assistance and tools as well as financial solutions related to ZNE (see *Intervention Strategy 5: Assistance to the Design and Building Communities*).

While the ET program takes a product-based approach to understand how an individual technology functions within a broader system, code readiness adopts a macro-level approach to understanding how a particular piece of equipment impacts overall building performance and its relationship with the grid as a whole. These insights are critical not only in informing the design of future code cycles, but also in understanding how commercial customers can successfully implement integrated demand side management solutions while maintaining grid stability.

## H. Integrated Demand Side Management (DSM)

PG&E’s role is to help its Commercial sector customers to think about energy efficiency within the context of all of the Demand-Side Management (DSM) offerings available to them. PG&E seeks an integrated approach, breaking down barriers to DSM integration. As outlined in the 2015 Integrated Energy Policy Report, a “more siloed approach to energy planning in which renewable energy goals are considered separately from energy efficiency or demand response or storage goals, for example, does not generate the best results. Each area progresses towards the respective goals but is not integrated and not necessarily part of an effective strategy to meet climate goals. A more integrated approach aimed at GHG reductions is needed.”<sup>102</sup>

<sup>102</sup> California Energy Commission. 2015. 2015 Integrated Energy Policy Report. Publication Number: CEC-100-2015-001-CMF. Retrieved from [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN210279\\_20160211T152803\\_2015\\_Integrated\\_Energy\\_Policy\\_Report\\_\\_Small\\_Size\\_File.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN210279_20160211T152803_2015_Integrated_Energy_Policy_Report__Small_Size_File.pdf).

### Coordinating With Associated CPUC Proceedings:

The CPUC has recently issued a discussion draft of its “California’s Distributed Energy Resources Action Plan: Aligning Vision and Action”. Please also review our portfolio wide discussion of PG&E’s work to support the action plan in our Portfolio chapter.

Energy efficiency is most effective when coordinated with other efforts to influence demand side energy usage. Coordination with locational targeting, distributed energy resources, and rates are discussed more fully below.

### Locational Targeting and Targeted Demand Side Management (TDSM)

PG&E’s TDSM effort integrates energy efficiency, distributed generation, storage and demand response with distribution planning to support cost effective distribution and transmission system reliability.<sup>103</sup> PG&E will expand this locational effort by utilizing the existing framework of offerings as well as supporting the solicitation framework being discussed within the DRP and IDER proceedings. When assessing opportunities at specific target locations (constrained substations), PG&E analyzes customer usage data to identify the dominant sector(s) and segment(s) at that location.<sup>104</sup> PG&E’s analytics platform enables the targeting of marketing and outreach efforts to deliver savings; similar information could be used within a DRP solicitation framework.

In PG&E’s initial deployment of TDSM efforts, load reduction has been required in less than two years. Due to this short time frame, fast-acting projects have been required to effectively meet load reduction needs. Within this framework, targeted supplemental incentives have been particularly effective in enlisting the support of SMB customers within the requisite timeframe. Additionally, as the new solicitation framework is adopted and processes mature, projects requiring longer planning may also be leveraged. PG&E looks forward to exploring opportunities to integrate ZNE projects into its TDSM strategy.

<sup>103</sup> Russell, Baatz, Cluett, et al. “Recognizing the Value of Energy Efficiency’s Multiple Benefits,” *American Council for an Energy-Efficient Economy*, December 2015, pp. 28-29.

<sup>104</sup> Zawadzki, Lin, Dahlquist, Bao, et al. “Personalized energy efficiency program targeting with association rule mining,” *Pacific Gas and Electric Company—2016 ACEEE Summer Study on Energy Efficiency in Buildings*, pp. 8-9.

## Commercial and Distributed Energy Resources (DER)

The IDSM effort is a conduit to better integrating controls and data analytics into the operations of PG&E's customers. PG&E leverages the following programs:

Demand Response (DR) programs can take advantage of new controls to better integrate commercial customers into DR programs, building a more robust response to potential grid events and leveraging control over localized commercial activities. Understanding the commercial customer mix is important in offering the right DR program for a customer's business needs.

PG&E will also support energy efficiency measures that are DR enabling by providing SMBs with EMTs, per AB 793. PG&E will introduce EMTs that are "DR ready" through research and testing procedures occurring in the emerging technologies and codes and standard programs. In addition, PG&E closely coordinates the development of energy efficiency measures that include DR enabling technologies with its DR programs to avoid a duplication of costs. PG&E will also work with customers to facilitate a greater understanding of peak load, cost, and opportunities to reduce usage through its data access intervention strategy. See *Section F: PG&E's Approach to Achieving Goals* for more information.

PG&E is preparing for storage growth in the coming years. The DER action plan provides a vision that supports appropriate payments to DERs including storage for services provided to the wholesale market and distribution grid.<sup>105</sup> PG&E is engaged in setting the wholesale market rules and interconnection tariffs to support these activities while minimizing cross-subsidies. PG&E anticipates that the commercial segment will be active in this emerging technology.

## Time-of-Use (TOU) Rate Changes

PG&E may be moving the peak period rates for non-residential customers from mid-day to later in the evening beginning based on the 2017 General Rate Case (GRC) 2 proposal. The proposed mandatory TOU change would move peak rates from 12 PM-6 PM to 5-10 PM. Due to the diversity of the commercial customer base, certain customers may be impacted more than others.

If the change is implemented, PG&E will work with its account representatives to ensure commercial customers understand the implications of the change for their business operations. This conversation will also create an entry point to discuss available energy efficiency offerings. If a customer experiences an increase in energy costs due to the change, energy efficiency can be pitched as an opportunity to mitigate the negative cost impact. Alternately, if a customer experiences a decrease in energy costs due to the change, energy efficiency can be positioned as an opportunity to achieve even greater savings.

Most commercial sector customers reduce operations after 5:00 PM. However, this shift in rates will push greater workplace charging of electric vehicles (EVs) as this creates advantageous pricing in the middle of the day. PG&E is supporting the proposed build-out of 7,500 EV charging stations at workplaces, multi-unit dwellings and other commercial sites.

## I. PG&E Helping to Meet State Policy Goals

**Table 3.20** provides a summary of how PG&E's approach with the Commercial Sector will address key state policies.

<sup>105</sup> DER Action Plan, p. 6.

**Table 3.20**

Summary of Relevant Energy Efficiency Policies, Guidance, and PG&E Support

Policy Drivers	Guidance Given	PG&E’s Support for Policy
<b>SB350</b>	<ul style="list-style-type: none"> <li>• Doubling energy efficiency savings by 2030 where cost effective and feasible</li> <li>• Address barriers for low-income customers to energy efficiency and weatherization investments, including those in disadvantaged communities, as well as recommendations on how to increase access to energy efficiency and weatherization investments to low-income customers.</li> </ul>	<ul style="list-style-type: none"> <li>• Leverage data analytics and customer segmentation to target customers based on high savings potential and market transformation needs</li> <li>• Share insights into areas of high savings opportunities so third parties can design innovative programs to meet customer needs</li> <li>• Incentivize action through new program models that provide grid benefits (e.g., meter-based savings, behavioral, etc.); explore ways to move away from traditional rebate and incentive programs to achieve the greatest and most cost-effective savings impact</li> <li>• Ramping down the use of rebates and incentives, while scaling financing and new financial structures that use private capital to facilitate a doubling of savings without increasing budgets Develop strategic energy management (SEM) plans for large customers (e.g., chain accounts)</li> <li>• Continue to partner with manufacturers and distributors to make purchasing energy efficiency equipment easy and affordable</li> </ul>
<b>SB 32</b>	<ul style="list-style-type: none"> <li>• Reduce statewide greenhouse gas emissions to 40% below the 1990 level by 2030</li> </ul>	<ul style="list-style-type: none"> <li>• PG&amp;E’s support for SB 32 mirrors its approach to SB 350’s goals, as described above.</li> </ul>
<b>AB 758</b>	<ul style="list-style-type: none"> <li>• Access to data, partnering to increase awareness</li> <li>• Increase plug load efficiency</li> <li>• EE procurement model</li> <li>• Affordable and accessible energy efficiency solutions</li> </ul>	<ul style="list-style-type: none"> <li>• Leverage data analytics and customer segmentation to target customers based on high savings potential and market transformation needs</li> <li>• Improve existing technical, project development and project management support to drive project completion. Continue to offer on-site consultative engineering assistance through both statewide and targeted (third-party) offerings to guide customers toward energy efficiency activities</li> <li>• Promote audits to identify comprehensive solutions; remarket solutions where projects aren’t initiated</li> <li>• Empower customers with energy usage data after project implementation to promote savings persistence<sup>a</sup></li> <li>• Incentivize action through new program models that provide grid benefits (e.g., meter-based savings, behavioral, etc.); explore ways to move away from traditional rebate and incentive programs to achieve the greatest and most cost-effective savings impact</li> <li>• Ramping down the use of rebates and incentives, while scaling financing and new financial structures that use private capital to facilitate a doubling of savings without increasing budgets</li> </ul>

<sup>a</sup> “Utility Best Practices Guidance for Providing Business Customers with Energy Use and Cost Data,” U.S. Environmental Protection Agency, Section 3: The Case for Increasing Customer Access to Energy Use and Cost Data, [https://www.epa.gov/sites/production/files/2015-08/documents/utility\\_data\\_guidance.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/utility_data_guidance.pdf).

**Table 3.20** *(continued)*

Summary of Relevant Energy Efficiency Policies, Guidance, and PG&E Support

Policy Drivers	Guidance Given	PG&E’s Support for Policy
<b>AB 793</b>	<ul style="list-style-type: none"> <li>• Provide education on and incentives for EMTs</li> </ul>	<ul style="list-style-type: none"> <li>• Incorporate EMTs into the Business Energy Checkup</li> <li>• Provide incentives and rebates for EMTs</li> </ul>
<b>AB 802</b>	<ul style="list-style-type: none"> <li>• Disclosure of aggregated whole building energy data</li> <li>• Benchmarking</li> <li>• Provide financial incentives based on all estimated energy savings and considering the overall reduction in normalized metered energy consumption as a measure of energy savings</li> </ul>	<ul style="list-style-type: none"> <li>• Develop and launch an online benchmarking portal that provides commercial building owners with access to whole building usage data</li> <li>• Incentivize action through new program models that provide grid benefits (e.g., meter-based savings, behavioral, etc.); explore ways to move away from traditional rebate and incentive programs to achieve the greatest and most cost-effective savings impact</li> </ul>
<b>AB 1109</b>	<ul style="list-style-type: none"> <li>• California must reduce its lighting energy use between 2007 and 2018 by 50% for residential interior lighting and by 25% for commercial interior and outdoor lighting.</li> </ul>	<ul style="list-style-type: none"> <li>• PG&amp;E has strongly supported the intent of AB 1109’s lighting energy use reductions through codes and standards programs and through upstream and downstream energy efficiency incentive programs. PG&amp;E will continue to support AB1109’s objectives with guidance from the Energy Commission and CPUC. As envisioned by the AB 1109, this effort will continue beyond 2018.</li> </ul>
<b>SB 1414</b>	<ul style="list-style-type: none"> <li>• Proof of permit closure for all downstream central air conditioning or heat pumps</li> </ul>	<ul style="list-style-type: none"> <li>• PG&amp;E will collect proof of permit closure before paying rebates or incentives for all downstream central air conditioning or heat pumps and their related fans, in accordance with SB 1414</li> </ul>
<b>California Energy Efficiency Strategic Plan (CEESP)</b>	<ul style="list-style-type: none"> <li>• All new construction will be ZNE in 2030.</li> <li>• 50% of existing buildings will be ZNE by 2030</li> </ul>	<ul style="list-style-type: none"> <li>• Continue ZNE demonstrations to equip designers and builders with the assistance and tools to meet ZNE goals</li> <li>• Continue to support emerging technology projects in support of ZNE solutions</li> <li>• Prioritize code-readiness activities by building type in alignment with C&amp;S (i.e., warehouses in 2022, small offices and schools in 2025, etc.)</li> <li>• Offer higher incentives for customers to reach deep energy saving measures that accelerate progress towards ZNE</li> <li>• Provide ZNE “first mover” kickers to developers, building owners, and contractors</li> <li>• Promote ZNE by streamlining processes for energy modeling, design document templates, and training during the application process</li> <li>• Develop post-occupancy ZNE technical assistance to drive savings persistence</li> </ul>

## J. PG&E's Partners and Commitment to Coordination

PG&E's success in the commercial sector will rely on a broad range of program administrators, regulators, government agencies, universities and other educational entities, market actors, and stakeholders.

### Third-Party Implementers and Market Actors

In the rolling portfolio structure, IOUs turn to third party implementers to propose, design, and deliver the bulk of energy efficiency programs. D. 16-08-019 sets a minimum target of 60% of the utility's total portfolio budget to be devoted to third party programs by the end of 2020.<sup>106</sup> As such, by 2020, PG&E will have transitioned at least 60% of its program design and delivery to third parties. This transition allows PG&E to engage third parties to offer a more diverse and innovative portfolio of programs to help customers use energy more efficiently. PG&E will evolve its energy efficiency portfolio to maximize energy savings in support of California's goal to double energy efficiency by 2030, and achieve cost-effectiveness by offering programs that drive value and innovation for customers, cultivate relationships with new partners, and use its knowledge of customers to more efficiently and effectively deliver energy efficiency programs.

### Program Administrators

PG&E will continue to work with program administrators and utilities across the state and country to collaborate and implement best practices. Increased collaboration will allow customers operating throughout multiple service territories in California to experience cohesive program offerings. In addition, in the new statewide administration model, PG&E will work closely with statewide administrators leading the Commercial sector statewide programs such as SBD. Please refer to PG&E Statewide Administration Business Plan chapter for more information on statewide programs.

### California Public Utilities Commission (CPUC)

PG&E will work with the CPUC and staff to assess business plan performance, and identify opportunities for continuous improvement. Additionally, PG&E will coordinate with Commission staff to identify and perform market research studies and other studies to ensure the business plans metrics are effectively evaluated. As PG&E modifies existing commercial programs, and/or develops new programs, PG&E will work in close concert with Commission staff to ensure these programs are "EM&V-ready" and meet CEESP and other state policy directives.

### Bay Area Regional Energy Network (BayREN)

Both BayREN and PG&E work closely with local governments to deliver energy efficiency programs. While PG&E provides funding to BayREN, PG&E does not have oversight over BayREN's activities, and it will be important to ensure cooperation between the two PAs to create a positive experience for the customer and maximize energy savings for both parties. PG&E will continue to support collaboration as BayREN continues to grow and develop its services. In order to promote continued collaboration, PG&E and BayREN will participate in quarterly leadership meetings and monthly program meetings which will be facilitated by a dedicated PG&E Program Manager.

### Marin Clean Energy (MCE)

MCE is a Community Choice Aggregator (CCA) that implements energy efficiency programs for SMBs in PG&E's service territory. The collaboration between PG&E and MCE has been critical in ensuring that customers continue to receive the best possible service. In order to promote continued collaboration, PG&E and MCE will participate in quarterly leadership meetings and monthly program meetings which will be facilitated by a dedicated PG&E Program Manager.

<sup>106</sup> D.16-08-019, p.74.

### Local Government Partnerships (LGPs)

Local Government Partnerships (LGPs) foster deep collaboration and coordination between PG&E and local partners resulting in community-based programs that effectively serve small and medium businesses, local governments, K-12 Public schools, and lower income residential customers. Over the past 10 years, PG&E and local partners have established 22 LGPs covering all of PG&E's service territory, including 242 cities and 48 counties. This roster of local partners is uniquely positioned to understand and identify customers within their communities and effectively partner with program implementers to overcome barriers to EE adoption. In 2015, LGPs became the primary provider of SMB downstream energy savings for PG&E's EE Portfolio.

### Government Agencies

PG&E will maintain and/or develop new partnerships with government agencies to advance collective interests in the commercial sector. PG&E will work closely with these agencies to develop, refine, and implement, where applicable, key intervention strategies and programmatic activities. Agencies include but are not limited to local planning departments and chambers of commerce.

### Community Based Organizations

PG&E will maintain partnerships with community based organizations (CBOs) to educate small business customers on their PG&E accounts, PG&E online resources, and energy efficiency offerings. The CBOs have been instrumental in outreach efforts to PG&E's business customers located in hard to reach communities.

## K. Statewide Administration and Transition Timeline

D.16-08-019 modifies the program administration structure for all upstream and midstream programs, market transformation efforts, and select downstream programs, such that these programs become "statewide." D.16-08-019 defines statewide programs as being delivered uniformly throughout the IOU service territories and overseen by a single lead program administrator!<sup>107</sup> Statewide efforts are required to comprise at least 25% of each IOU's portfolio budget!<sup>108</sup> Please refer to the Statewide Administration Chapter for program administrators' proposals for statewide programs and/or subprograms.

## L. Solicitation Strategies and Transition Timeline

D. 16-08-019 sets a minimum target of 60% of the utility's total portfolio budget, including administrative costs and EM&V, to be proposed, designed, and delivered by third parties by the end of 2020!<sup>109</sup> Please refer to the Portfolio Overview Chapter for PG&E's complete solicitation strategy and transition timeline, by sector.

<sup>107</sup> D.16-08-019, pg. 51.

<sup>108</sup> D.16-08-019, p. 65.

<sup>109</sup> D.16-08-019, p.74.

## M. Metrics

PG&E and the other program administrators understand the importance of ensuring that all metrics provide value to the CPUC, program administrators, or other stakeholders. We also recognize that listed metrics can have powerful and unintended effects.<sup>110</sup>

These metrics are consistent with the agreed-upon statewide guiding principles for the metrics that was shared with the Energy Division on August 16, 2016.

Metrics should...
Be used and useful by PAs to manage portfolio
Be timely
Rely on data used in program implementation
Be simple to understand and clear of any subjectivity
Have longevity

The guiding principles also indicate that metrics are not a replacement for EM&V.

Additionally, not all metrics have a readily interpretable meaning, so context is needed. As such, we provide context on the metrics in the notes section of our table below.

<sup>110</sup> Perrin, in an article in the American Journal of Evaluation, discussed certain known limitations of performance metrics. Among these limitations, he described varying interpretation of the “same” term and concepts, goal displacement, use of meaningless and irrelevant measures, and cost-savings vs. cost-shifting. [Perrin, Burt. 1998. *Effective Use and Misuse of Performance Measurement*. American Journal of Evaluation 1998:19;367.]

Note that in the Business Plans, PG&E is proposing to track metrics and indicators that can be frequently updated to allow PG&E staff, implementers, the CPUC, and other stakeholders understand and manage the sector. While we recognize that there are longer-term outcome and satisfaction/quality metrics and indicators that are important to track through research studies, we are not proposing study-based metrics at the Business Plan level as they are measured less frequently, and require EM&V dollars that may or may not be available. These studies will be needed to support the program; however, we recommend that these be determined through a different process (i.e., EM&V Roadmap) once the programs are finalized.

PG&E has five overarching goals for the commercial sector, starting with a primary savings goal:

- Save 1,416 GWh, 222 MW, and 40 MM therms and track the following indicators:
  - Targeted business segments
  - Size (small, medium, and large)
  - Geography (Bay Area, Coastal, Central Valley, Mountain, Unknown)

These goals are based on past PG&E performance relative to Potential Study targets.

Secondary goals that we intend to track include:

- Increase average savings per participant by 0.5% per year from 2018 through 2025 using 2015 ex ante savings as the baseline (4% average savings for electric customers and 18% average savings for gas customers) while tracking the following indicators:
  - Targeted business segments
  - Size (small, medium, and large)
  - Geography (Bay Area, Coastal, Central Valley, Mountain, Unknown)

- PG&E recognizes California’s strategic plan goal that 100% of all new construction and 50% of existing commercial buildings will be ZNE by 2030. In an effort to prime the market for the 2030 ZNE goal, PG&E has created a market-level goal to assist California in reaching its 2030 ZNE targets. In alignment with Codes & Standards, PG&E has created ZNE indicators by building type to track the progress of this goal. The saturation of retrofit and new construction ZNE buildings by building type include:

Building Type	2015 Saturation	2025 Saturation Target	Codes & Standards ZNE Code Timeline
Warehouses	<1%	8%	2022
Small Office*	<1%	4%	2025
Schools**	<1%	8%	2025
Retail	<1%	4%	2025
Restaurants	0%	1%	2028
Health-care*	0%	1%	2028
High/Bio Tech	0%	1%	2028

\*Applicable to Public Sector and Commercial Sectors

\*\* Applicable to Public Sector

- Increase customers’ ability to manage energy by increasing the proportion of customers utilizing Energy Management Technologies (EMTs) from 2018 through 2025 using 2017 data as a baseline (baseline and goals will be established once the AB 793 Advice Letter is approved and 2017 results are in).
- Increase operational efficiency by reducing the ratio of \$/kWh and \$/therm saved by 10% in the mid-term through the use of cost-effective scalable program models such as financing and third-party programs

### Metrics Measuring Commercial Goals

PG&E’s proposed sector-level metrics that can be tracked and monitored with some frequency (i.e., monthly, quarterly, or annually) are shown in **Table 3.21**.



**Table 3.21**  
PG&E-Specific Commercial Sector Metrics

GOAL: Save 1,416 GWh, 222 MW, and 40 MM Therms						
Intervention Strategies	Metrics	Baseline (or Benchmark)	Metric Source	Short-Term Targets (1-3 years)	Mid-Term Targets (4-6 years)	Long-Term Targets (7-8+ years)
All	Electricity Saved (First Year Net)	Average of 309 Gross GWh/year across 2011-2015	Annual Ex Ante Net savings from program databases	155 Net GWh/yr (208 Gross GWh/yr)	180 Net GWh/yr (235 Gross GWh/yr)	205 Net GWh/yr (265 Gross GWh/yr)
	Demand Saved (First Year Net)	Average of 55.7 Gross MW/year across 2011-2015		22 Net MW/yr 29 Gross MW/yr)	29 Net MW/yr 38 Gross MW/yr)	35 Net MW/yr 45 Gross MW/yr)
	MM Therms Saved (First Year Net)	Average of 4.1 Gross MM Therms/year across 2011-2015		4.2 Net MM Therms/yr (5.2 Gross MM Therms/yr)	5.2 Net MM Therms/yr (6.5 Gross MM Therms/yr)	5.9 Net MM Therms/yr (7.2 Gross MM Therms/yr)
<b>Indicators</b>						
<ul style="list-style-type: none"> <li>• Targeted business sectors</li> <li>• Lifetime savings (GWh, MW, MM Therms)</li> <li>• Size (small, medium, and large)</li> <li>• Geography (Bay Area, Coastal, Central Valley, Mountain, Unknown)</li> </ul>						
<b>Notes</b>						
<ul style="list-style-type: none"> <li>• Goals are set on first year net energy savings</li> <li>• Net savings not available for baseline, therefore targets include gross savings to compare to baseline</li> </ul>						
GOAL: Increase average savings per participant by 0.5% per year from 2018 through 2025						
All	Average gross savings for electric customer participants and average gross savings for gas customer participants	4% average gross savings/ participant for electric participants and 18% average gross savings/ participant for gas participants in 2015	Ex Ante Gross savings and participation from program databases	5.5% electric annually 19.5% gas annually in the short-term	7% electric annually 21% gas annually in the mid-term	8.5% electric annually 22.5% gas annually in the long-term
<b>Indicators</b>						
<ul style="list-style-type: none"> <li>• Targeted Business Segments</li> <li>• Size (small, medium, and large)</li> <li>• Geography (Bay Area, Coastal, Central Valley, Mountain, Unknown)</li> </ul>						

Note: Metrics have baselines and targets, will be tracked, and when updated will compare the current value to the baseline and target. Indicators will be tracked but have no targets and may or may not have baselines. Indicators provide useful context for the metric.

**Table 3.21 (continued)**  
 PG&E-Specific Commercial Sector Metrics

GOAL: Increase customer's ability to manage energy by increasing the proportion of customers utilizing Energy Management Technology (EMTs)						
Intervention Strategies	Metrics	Baseline (or Benchmark)	Metric Source	Short-Term Targets (1-3 years)	Mid-Term Targets (4-6 years)	Long-Term Targets (7-9 years)
<b>Data Access</b> <b>Technical Assistance and Tools</b>	Proportion of customers who access their data through EMTs (or proactively use EMTs)	TBD (number of customers using EMTs)	PG&E Tracking databases	Finalized EMTs through Advice Letter  Determine baseline and set targets	TBD	TBD
	<b>Indicators</b>					
	None					
	<b>Notes</b>					
<ul style="list-style-type: none"> <li>EMTs will be defined by the list of EMTs in a future approved AB 793 Advice Letter. Note the short-term, this will include products that are available. In the mid-term, EMTs will evolve from what is currently available, to include technologies or services the allow management of energy. And in the long-term, this may lay the foundation for IDER efforts.</li> <li>Baseline will listed by product, technology or service.</li> </ul>						
GOAL: Increase operational efficiency by reducing the ration of \$/kWh saved and \$/therm saved						
All	Annual levelized cost of energy (kWh) <sup>a</sup>	\$0.075/kWh	PG&E Tracking Databases	Same as baseline <sup>b</sup>	10% lower than baseline	TBD <sup>c</sup>
	Annual levelized cost of energy (therm) <sup>a</sup>	\$0.447/therm	PG&E Tracking Databases	Same as baseline <sup>b</sup>	10% lower than baseline	TBD <sup>c</sup>
<b>Indicators</b>						
Operational efficiency for third party implementers and other implementers						
<b>Notes</b>						
<p><sup>a</sup> Levelized cost represent discounted lifecycle net savings using Program Administrator Costs</p> <p><sup>b</sup> PG&amp;E will strive to keep levelized costs flat from baseline. However, due to new program administration and implementation structures, and other portfolio/program changes, flexibility is required to adapt to the new paradigm.</p> <p><sup>c</sup> PG&amp;E will update its long term targets once more data is gathered on the new administration and implementation structures.</p>						

*Note: Metrics have baselines and targets, will be tracked, and when updated will compare the current value to the baseline and target. Indicators will be tracked but have no targets and may or may not have baselines. Indicators provide useful context for the metric.*

**Table 3.21** *(continued)*

PG&E-Specific Market Level Indicators for the Commercial Sector

Market Level Goals	Intervention Strategies	Indicators	Baseline	Indicator Source	Notes on Indicator
<b>Assist in reaching the CEESP goal of ZNE for 100% of all new commercial construction by 2030</b>	Assistance to the Design and Building Communities	Proportion of commercial new construction buildings that are ZNE	Varies by segment, see notes below	Tracking Study	We will work with the CPUC to determine the type and timing of a future study, an appropriate baseline, and what should be tracked.
<b>Assist in reaching the CEESP goal of 50% of existing commercial buildings being ZNE by 2030</b>	Assistance to the Design and Building Communities	Proportion of existing commercial buildings that are ZNE	Varies by segment, see notes below	Tracking Study	We will work with the CPUC to determine the type and timing of a future study, an appropriate baseline, and what should be tracked.

**Indicators**

- Warehouses: less than 1% in 2015 to 8% in 2025
- Small Office: less than 1% in 2015 to 4% in 2025
- Schools\*: less than 1% in 2015 to 8% in 2025
- Retail: less than 1% in 2015 to 4% in 2025
- Restaurants: 0% in 2015 to 1% in 2025
- Hospitals: 0% in 2015 to 1% in 2025
- High Tech/Bio-Tech: 0% in 2015 to 1% in 2025

**Notes**

- PG&E will track indicators by commercial and public sectors. Schools are solely in the public sector, while small offices and hospitals are split between commercial and public sectors. Warehouses, retail, restaurants, and high tech reside solely in the commercial sector.
- PG&E plans to perform activities outside of the statewide program to facilitate market change
- Schools fall under the public sector

*Note: Metrics have baselines and targets, will be tracked, and when updated will compare the current value to the baseline and target. Indicators will be tracked but have no targets and may or may not have baselines. Indicators provide useful context for the metric.*

## N. EM&V Research Needs

Evaluation, Measurement and Verification (EM&V) conducts research studies with the guidance of the CPUC Framework<sup>111</sup> and Protocols.<sup>112</sup> The main source of planned research will be the annual EM&V Research Plan<sup>113</sup> put together jointly by the CPUC and the PAs. This ongoing process enables stakeholders to understand and comment on research at PG&E. The PG&E-led research for this sector will be contingent upon the needs of the portfolio as a whole and the annual sector-specific research budget.<sup>114</sup>

The bullets below show currently known information needs that may or may not be detailed in the most recent EM&V Evaluation Plan. For those study types under PG&E's purview, PG&E plans to conduct this research as much as practical given annual EM&V budgets, although the specifics may change over time. Specific research needs for this sector, by study category, include:

- Energy impact studies that are specific to measures, end uses, or sectors

Research is needed to understand the following:

- What is the effect of real-time feedback on plug load energy use?
- How does behavior of occupants and facility managers affect commercial building operations and energy usage?
- What happens after lighting controls technologies are installed? Do the savings and maintenance persist? What are future uses of these technologies 5+ years down the road?

111 California Public Utilities Commission and the Project Advisory Group. The California Evaluation Framework. June 2004. [http://www.calmac.org/publications/California\\_Evaluation\\_Framework\\_June\\_2004.pdf](http://www.calmac.org/publications/California_Evaluation_Framework_June_2004.pdf)

112 California Public Utilities Commission. California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals. April 2006.

113 The most recent EM&V Evaluation Plan is here: <http://www.energydataweb.com/cpuc/search.aspx#>

114 While PG&E provides several studies in this section, the current budgets are relatively small. The 2016 budgets in the most recent EM&V plan show approximately \$4 million for Energy Division-led impact studies and \$250,000 to \$300,000 for IOU-led process studies. These budgets cover the large commercial and industrial programs, as well as agricultural programs. The CPUC, PAs, and other stakeholders will need to discuss EM&V priorities and determine the relative availability of budget to cover any of the studies.

- How can customers be influenced to adopt, operate and maintain energy efficient plug load devices for desktops, laptops and other pieces of computer equipment?
- What has been the effect of PG&E segmentation and targeting on customer uptake?
- Market and baseline studies to understand program gap, needs, and inform design and metrics

Research is needed to understand the following:

- How can LED adoption be increased given that awareness regarding this technology is already high?
  - How do Small/Medium Businesses (SMBs) use energy data?
  - California Commercial End-Use Survey (CEUS) – led by the CEC
    - i. CEUS is of major importance to providing visibility into the end uses of various commercial products including lighting, HVAC, boilers, process equipment, and computers. Last updated in March of 2006, CEUS is an essential compendium that captures detailed building systems data, building geometry, electricity and gas usage, thermal shell characteristics, equipment inventories, operating schedules, and other commercial building characteristics.<sup>115</sup> The IOUs have requested that an updated CEUS be conducted to inform future commercial program design. The more recent California Market Share Tracking Study and Commercial Saturation Study provided useful information, but did not include energy use intensity (EUI).
  - What are the dynamics behind energy efficiency competing with self-generation?
  - What are LED prices?
  - Process studies to understand how to improve current or new programs
- Research is needed to understand the following:
- What are best practices from Direct Install programs that lead to energy savings and that can be applied to other programs?

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<sup>115</sup> California Energy Commission. California Commercial End-Use Survey. March 2006. CEC-400-2006-005 <http://www.energy.ca.gov/2006publications/CEC-400-2006-005/CEC-400-2006-005.PDF>

## WHAT PG&E IS DOING TO SUPPORT:

# COMMERCIAL ZERO NET ENERGY (ZNE)

## Vision for Commercial Zero Net Energy



The California Long Term Energy Efficiency Strategic Plan identifies targets for the commercial sector:

- All new commercial construction will be ZNE by 2030
- 50% of existing commercial buildings will be equivalent to ZNE by 2030

## CUSTOMER SPOTLIGHT:

The Zero Net Energy Center is located in San Leandro, California and was re-opened in 2013 as the first existing commercial structure in the country to be retrofitted to ZNE. PG&E partnered on the design of the facility and shares curriculum materials on smart grid technology and integrated demand-side management. Upgrades such as more efficient lighting, a variable refrigerant flow (VRF) system, and occupancy sensors resulted in a 75% reduction in the building's energy usage.

## PG&E's Approach to Commercial ZNE:



PG&E recognizes that achieving the state's ZNE goals requires a response that is both immediate and coordinated across commercial energy efficiency programs, codes & standards, the building and design communities, and local governments. PG&E is adopting a three-pronged approach to achieving commercial ZNE goals that includes:

### PG&E Programs

#### Supporting the Regulatory Framework

- Test the technical feasibility of new technologies through the emerging technologies program
- Promote code readiness efforts phased by building type, starting with buildings that have low energy use intensities

#### Encouraging Customers and Market Actors to Move to ZNE

- Explore providing ZNE "first mover" kickers to developers, building owners, and contractors
- Provide technical assistance for deep retrofits that place buildings on the path to ZNE
- Offer post-occupancy technical assistance and tools to promote savings persistence
- Streamlining processes for energy modeling, design document templates, and training during the application process

#### Partnerships

- Partner with advisory firms, builders, developers, designers, and building owners to develop ZNE demonstration projects to help demystify "proof of concept" concerns
- Spotlight ZNE champions through marketing and outreach (e.g. Architecture at Zero competition)
- Develop and advocate for a comprehensive ZNE reach code with local governments

## STATISTICS:

According to the New Buildings Institute, there are 53 ZNE verified buildings and districts across the country as of 2016. From this total, **five out of the seventeen ZNE verified office buildings are located in PG&E's service territory.**



Source: New Buildings Institute 2016 List of Zero Net Energy Buildings



WHAT PG&E IS DOING TO SUPPORT:

# SMALL AND MEDIUM-SIZED BUSINESSES (SMB)

## SMB OVERVIEW



PG&E identifies SMBs as customers who use less than 500,000 kWh or 250,000 Therms per year. SMBs range from start-ups to multi-generational businesses and include everything from a local nail salon to a full-service grocery store. While some SMB customers are energy savvy and seek their own efficiency solutions, others have a limited understanding of energy efficiency and rely on PG&E and its network of local government partnerships and trade professionals to provide a targeted value proposition based on their needs.

## PG&E'S APPROACH TO SMBs



Currently, PG&E serves SMB customers in the following ways:

- Nine regional direct install programs
- Energy audits and technical assistance
- Local outreach and education
- Incentives and loans such as on-bill financing (OBF)

In the future, PG&E will also:

- Target SMB customers for outreach based on load and demographic characteristics
- Create an online self-service platform that includes:
  - Identifying qualified products and rebates
  - Finding a qualified trade professional
  - Submitting a rebate application
- Empower customers with usage data after implementation to promote savings persistence

## STATISTICS (2015)

CUSTOMERS:

**338,443** SMB ELECTRIC CUSTOMERS

**153,082** SMB GAS CUSTOMERS

PARTICIPATION:

**8,971** PARTICIPATING ELECTRIC  
(63% OF ALL CUSTOMERS)

**7,902** PARTICIPATING GAS ACCOUNTS  
(69% OF ALL CUSTOMERS)

USAGE:

ELECTRIC USAGE: **7,579.2 GWh**  
(26% OF ALL CUSTOMERS)

GAS USAGE: **270.6 MM Therms**  
(41% OF ALL CUSTOMERS)

SAVINGS:

ELECTRIC SAVINGS: **82,864 MWh**  
(33% OF ALL CUSTOMERS)

GAS SAVINGS: **729,422 Therms**  
(33% OF ALL CUSTOMERS)



The North State Food Bank is located in Oroville, California and provides food to organizations in six counties. In 2015, PG&E worked with local installers through its partnership with the North Valley Energy Watch to install LED lighting and high efficiency refrigeration motors at the food bank. As a result, the food bank is estimated to save nearly \$10,000 per year and recovered its investment in about six months.



# Appendices



# Commercial Appendices

## Appendix A: Compliance Checklist

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
<b>Portfolio Summary</b>		
0	<b>Executive Summary</b>	
	<i>Company description</i>	Executive Summary p. A
	<i>Definition of market</i>	Executive Summary p. A
	<i>Mission Statement</i>	Executive Summary p. A
	<i>Purpose of Business Plan</i>	Executive Summary p. A
I.A.1, II.D.2	<b>Overview</b>	
	<i>About EE/DSM</i>	Energy Efficiency and It's Role in Helping PG&E Meet Its Energy Needs, pp. 11-16
	<i>CA Energy Needs</i>	California's Evolving Energy Efficiency Landscape, pp. 21-26
	<i>Regulatory Requirements</i>	California's Evolving Energy Efficiency Landscape, pp. 22-23
	<i>Strategic Plan</i>	California's Evolving Energy Efficiency Landscape, pp. 20-21
	<i>Legislation (e.g., AB 758, SB 350, AB 802, AB 793)</i>	California's Evolving Energy Efficiency Landscape, pp.

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		22-23
	<i>IOUs/PAs/CPUC/etc. overall role</i>	Roles in the Changing Landscape, pp. 8-9
I.A.2	<i>Broad socioeconomic and utility industry trends relevant to PA's EE programs (population, economics and markets, technology, environment/climate)</i>	California's Evolving Energy Efficiency Landscape pp. 23-26
I.B.1	<i>Vision (e.g., How PA thinks about and uses EE over next 10 years)</i>	PG&E's Vision, p. 1
I.5	<i>Compare/contrast to past cycles</i>	PG&E's Portfolio Evolution: Comparison to Past Cycles, pp. 9-11
I.B.2	<b>Goals &amp; Budget</b>	
I.B.2 & I.C.2.a	<i>Energy Saving Goals</i>	Goals, Budget and Cost-Effectiveness, pp. 27-28
I.C.2.a	<i>Portfolio Budget (sector and portfolio level per xls checklist)</i>	Goals, Budget and Cost-Effectiveness, pp. 28-30
I.C.2.a, I.C.2.d	<i>Cost-effectiveness (sector and portfolio level per xls checklist)</i>	Goals, Budget and Cost-Effectiveness, pp. 30-34
I.C.2.b	<i>Explanation of Admin Budgets (e.g., Direct/Indirect Labor, Professional/Admin personnel)</i>	Goals, Budget and Cost-Effectiveness, pp. 28-29
I.C.2.c	<i>Explanation of accounting practices</i>	Goals, Budget and Cost-

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		Effectiveness, p. 30
I.C.3 and I.C.4	<b>Intervention strategies (high level)</b>	
	<i>Overall issues/challenges/barriers</i>	PG&E's Portfolio Plan, pp. 4-7
	<i>High level summary of strategies and tools (e.g., AMI data, AB 802, procurement model, up/mid/downstream, etc.)</i>	PG&E's Portfolio Plan, pp. 4-7
I.C.4; I.D	<b>Solicitation plan</b>	
I.C.4	<i>Solicitation strategies/areas that could be SW</i>	Solicitation Strategy and Transition Timeline, pp. 35-42
I.D; II.F	<i>Proposal for transitioning the majority of portfolios to be outsourced by the end of 2020.</i>	Solicitation Strategy and Transition Timeline, pp. 35-42
<b>Sector Chapter (commercial, residential, public, agricultural, industrial, x-cutting)</b>		
II.A	<b>Summary tables</b>	
II.A	<i>Table with CE, TRC, PAC, emissions, savings, budget</i>	Goals, Budget and Cost-Effectiveness, pp. 8-11
I.C.7; II.E.1.b	<i>Metrics for sector</i>	Metrics, pp. 63-67
II.D	<b>Market characterization (overview and market/gap and other analysis)</b>	
II.D.1	<i>Electricity/NG</i>	Sector Overview, pp. 12-26
II.D.2	<i>State goals include acknowledgement of goals set by Strategic Plan, SB 350, AB758, guidance as appropriate)</i>	PG&E's Commercial Sector Vision, pp. 1-4

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
II.D.3	<i>EE potential and goals</i>	Sector Overview, pp. 12-26
II.D.5	<i>Customer landscape (e.g., segments/subsegments, major end uses, participation rates, etc.)</i>	Sector Overview, pp. 12-26
II.D.6	<i>Major future trends that are key for the PA and its customers</i>	Commercial Sector Trends and Challenges, pp. 27-34
II.D.7	<i>Barriers to EE and other challenges to heightened EE (e.g., regulatory, market, data)</i>	Commercial Sector Trends and Challenges, pp. 27-34
II.2.a	<b>Description of overarching approach to the sector</b>	
	<i>Goals/strategies/approaches</i>	PG&E's Commercial Sector Vision, pp. 1-4
I.C.6; I.D	<i>How portfolio meets Commission guidance</i>	PG&E's Commercial Sector Vision, p. 1-4
II.C	<i>Description of how this chapter addresses the performance challenges/barriers</i>	PG&E's Approach to Achieving Goals, pp. 34-56
I.C.4 a-c	<b>Intervention strategies (detailed)</b>	
II.D.2.a; II.E.3	<i>What specific strategies are being pursued (e.g., near, mid, long AND existing, modified, new)</i>	PG&E's Approach to Achieving Goals, pp. 34-56
I [cmt with excerpt]	<i>Why specific strategies were chosen (e.g., ID current weaknesses, best practices, or other rationale to support choice)</i>	PG&E's Approach to Achieving Goals, pp. 34-56
II.E.1.a; II.E.4	<i>How approaches advance goals discussed above</i>	PG&E's Approach to Achieving Goals, pp. 34-56

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
I.C.4; I.E; II.D.4	<i>How strategies use lessons learned from past cycles and EM&amp;V</i>	PG&E's Commercial Sector Proposal Compared to Prior Program Cycles, pp. 5-8
I	<i>How will interventions support/augment current approaches or solve challenges</i>	PG&E's Approach to Achieving Goals, pp. 34-56
II.D.2	<i>Explanation for how these strategies address legislative mandates from AB 802, SB350, and AB 793, as well as other Commission directives for this sector, including strategic plan.</i>	PG&E's Approach to Achieving Goals, pp. 34-56
I.C.4	<i>Future expectations for intervention strategies</i>	PG&E's Approach to Achieving Goals, pp. 34-56
I.C.1; II.E.6	<i>Description of pilots</i>	PG&E's Approach to Achieving Goals, p. 48
II.F	<i>Key Partners</i>	PG&E's Partners and Commitment to Coordination, pp. 61-62
I.C.5; I.D; II.B; II.C	<b>Compare/contrast to past cycles</b>	
	<i>Budget changes as appropriate</i>	Goals, Budget and Cost-Effectiveness, pp. 8-11
	<i>Modification to sector strategies</i>	PG&E's Commercial Sector Proposal Compared to Prior Program

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		Cycles, pp. 5-8
	<b>Cross-cutting (sector chapters and ME&amp;O)</b>	
II.E.2; II.H, II.K	<i>Program Administrator marketing and integration with SW MEO as applicable</i>	Leveraging Cross-Cutting Resources, pp. 56-57
II.E.5; II.H	<i>Workforce, education, and training</i>	Leveraging Cross-Cutting Resources, pp. 56-57
II.H	<i>Emerging Technologies</i>	Leveraging Cross-Cutting Resources, pp. 56-57
II.H	<i>Codes &amp; Standards</i>	Leveraging Cross-Cutting Resources, pp. 56-57
II.G	<b>Cross PA and Offering Coordination</b>	
II.G	<i>How strategies are coordination among regional PAs</i>	PG&E's Partners and Commitment to Coordination, pp. 61-62
II.G	<i>Proposal of statewide program administrator/approaches for this sector</i>	See Statewide Administration chapter
II.G	<i>How the sector strategies are coordinated with statewide program activities</i>	See Statewide Administration chapter
II.G	<i>How are strategies coordinated with other state agencies and initiatives (e.g., AB 758)</i>	PG&E's Partners and Commitment to Coordination, pp. 61-62
II.I	<b>EM&amp;V Considerations (statement of needs)</b>	
II.I	<i>Data collection needs</i>	EM&V Research Needs, pp. 68-69
II.I	<i>Anticipated study needs</i>	EM&V Research Needs, pp. 68-69

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
II.J	<b>Demand Response</b>	
ED Guidance (p.8)	<i>How EE measures use up-to-date DR enabling technologies to be "DR ready"</i>	Integrated Demand Side Management, pp. 57-58
ED Guidance (p.8)	<i>How duplication of costs for ME&amp;O, site visits, etc. is avoided for dual-purpose technologies</i>	Integrated Demand Side Management, pp. 57-58
ED Guidance (p.9)	<i>How strategies facilitate customer understanding of peak load, cost, and opportunities to reduce</i>	Integrated Demand Side Management, pp. 57-58
II.K	<b>Residential Rate Reform</b>	
ED Guidance (p.9)	<i>How BPs will help reduce load during TOU periods</i>	N/A
ED Guidance (p.9)	<i>How BP will diminish barriers to load reduction during TOU periods</i>	N/A
ED Guidance (p.9)	<i>How strategies will provide info to customers and/or provide a tool to show how program may impact customer energy usage during different TOU periods</i>	N/A
ED Guidance (p.9)	<i>How strategies will analyze whether a customer may experience greater savings by switching to a different, opt-in TOU rate</i>	N/A
ED guidance (p.9)	<i>ME&amp;O re: rate reform</i>	N/A
II.L	<b>Integrated Demand Side Resources</b>	Integrated Demand Side Management, pp. 57-58
II.M	<b>Zero-Emission Vehicles (EVs)</b>	Integrated Demand Side Management, pp. 57-58
II.N	<b>Energy Savings Assistance (Multi-family Focused)</b>	N/A
	<b>Appendices</b>	
	<i>Additional Customer Data</i>	Appendix C
	<i>Cited research</i>	Appendix B
	<i>CAEECC stakeholder input resolution</i>	See Input Tracker

## Appendix B: References

Accenture Research. 2015. *The New Energy Consumer: Unleashing Business Value in a Digital World*. [https://www.accenture.com/t20151124T172734\\_w\\_us-en\\_acnmedia/Accenture/next-gen/insight-unlocking-value-of-digital-consumer/PDF/Accenture-New-Energy-Consumer-Final.pdf#zoom=50](https://www.accenture.com/t20151124T172734_w_us-en_acnmedia/Accenture/next-gen/insight-unlocking-value-of-digital-consumer/PDF/Accenture-New-Energy-Consumer-Final.pdf#zoom=50)

ARUP. December 31, 2012. *The Technical Feasibility of Zero Net Energy Buildings in California*. [http://www.energydataweb.com/cpucfiles/pdadocs/904/california\\_zne\\_technical\\_feasibility\\_report\\_final.pdf](http://www.energydataweb.com/cpucfiles/pdadocs/904/california_zne_technical_feasibility_report_final.pdf)

Assembly Bill 802. October 8, 2015.

[https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160AB802](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB802)

Bender, Sylvia, Jan Berman, and Pete Skala, 2016. 2016 ACEEE Summer Study on Energy Efficiency in Buildings. *Perspectives on Doubling Energy Efficiency in California*.

[http://aceee.org/files/proceedings/2016/data/papers/6\\_429.pdf](http://aceee.org/files/proceedings/2016/data/papers/6_429.pdf)

Building Owners and Managers Association International. November 5, 2013. *Analysis: Commercial Real Estate Industry Continues to Achieve Utility Savings*. <http://www.boma.org/research/newsroom/press-room/2013/Pages/Commercial-Real-Estate-Industry-Continues-to-Achieve-Utilities-Savings.aspx>

California Energy Commission. September 2015. *California Existing Buildings Energy Efficiency Action Plan*. [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN205919\\_20150828T153953\\_Existing\\_Buildings\\_Energy\\_Efficiency\\_Action\\_Plan.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-05/TN205919_20150828T153953_Existing_Buildings_Energy_Efficiency_Action_Plan.pdf)

California Energy Commission. June 29, 2016. *2015 Integrated Energy Policy Report (IEPR)*. Docket # 15-IEPR-01, CEC-100-2015-001-CMF. [http://www.energy.ca.gov/2015\\_energy\\_policy/](http://www.energy.ca.gov/2015_energy_policy/)

California Energy Commission. July 6, 2016. *Senate Bill 350 & Assembly Bill 802 – Implementation Timeline & Related Proceedings*. <http://www.energy.ca.gov/sb350/timeline.pdf>

California Energy Commission. September 9, 2016. *A Study of Barriers and Solutions to Energy Efficiency, Renewables and Contracting Opportunities Among Low-Income Customer and Disadvantaged Communities*. [http://docketpublic.energy.ca.gov/PublicDocuments/16-OIR-02/TN214830\\_20161215T184655\\_SB\\_350\\_LowIncome\\_Barriers\\_Study\\_Part\\_A\\_Commission\\_Final\\_Report.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/16-OIR-02/TN214830_20161215T184655_SB_350_LowIncome_Barriers_Study_Part_A_Commission_Final_Report.pdf)

California Public Utilities Commission. April 2006. *California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals*. [www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5212](http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5212)

California Public Utilities Commission. July 2010. *Fact Sheet: Energy Efficiency Zero Net Energy Program*. [www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=10729](http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=10729)

California Public Utilities Commission. January 2011. *California Energy Efficiency Strategic Plan*. <http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5303>

California Public Utilities Commission. October 22, 2015. *Decision 15-10-028: Decision Re Energy Efficiency Goals for 2016 and Beyond and Energy Efficiency Rolling Portfolio Mechanics*. <http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M155/K511/155511942.pdf>

California Public Utilities Commission. October 29, 2015. *Updating the CPUC's 2030 ZNE Commercial Building Goals*. <http://calplug.org/wp-content/uploads/cbest-mcraig-cws-10-29-2015.pdf>



California Public Utilities Commission. August 18, 2016. *Decision 16-08-019: Decision Providing Guidance for Initial Energy Efficiency Rolling Portfolio Business Plan Filings.*

<http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M166/K232/166232537.PDF>

California Public Utilities Commission. September 29, 2016. *California's Distributed Energy Resources Action Plan: Aligning Vision and Action.*

[http://www.cpuc.ca.gov/uploadedFiles/CPUC\\_Public\\_Website/Content/About\\_Us/Organization/Commissioners/Michael\\_J\\_Picker/2016-09-26%20DER%20Action%20Plan%20FINAL3.pdf](http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Commissioners/Michael_J_Picker/2016-09-26%20DER%20Action%20Plan%20FINAL3.pdf)

Center for Sustainable Energy. September 17, 2015. *California Legislation Aims for Big Gains in Energy Efficiency.* <https://energycenter.org/blog/california-legislation-aims-big-gains-energy-efficiency>

deLaski, Andrew, Joanna Mauer, Jennifer Amann, Michael McGaraghan, Bijit Kundu, Sameer Kwatra, and James E. McMahon. August 2016. *Next Generation Standards: How the National Energy Efficiency Standards Program Can Continue to Drive Energy, Economic, and Environmental Benefits.* Appliance Standards Awareness Project and American Council for an Energy-Efficient Economy.

[http://www.appliance-standards.org/sites/default/files/Next%20Gen%20Report%20Final\\_1.pdf](http://www.appliance-standards.org/sites/default/files/Next%20Gen%20Report%20Final_1.pdf)

Ecova, Inc. June 2015. *Energy Management System Survey Analysis.*

<http://s3.amazonaws.com/uploads.ecova.com/2016/04/27220809/ems-survey-analysis-findings-from-industry-professionals.pdf>

ENERGY STAR. *Hotels: An Overview of Energy Use and Energy Efficiency Opportunities.*

<https://www.energystar.gov/sites/default/files/buildings/tools/SPP%20Sales%20Flyer%20for%20Hospitality%20and%20Hotels.pdf>

E-Source. December 2015. *Large Business Gap and Priority Benchmark.* <https://www.esource.com/gpb>

E-Source. *Business Energy Advisor.* <https://bizenergyadvisor.com/>

Evergreen Economics. October 13, 2015. *Pacific Gas and Electric Company's Lighting Innovation Midstream Trial Evaluation.*

[http://www.calmac.org/publications/PGandE\\_Commercial\\_Midstream\\_LED\\_Trial\\_Assessment\\_Final\\_Report.pdf](http://www.calmac.org/publications/PGandE_Commercial_Midstream_LED_Trial_Assessment_Final_Report.pdf)

Fogel, Cathy. September 28, 2016. *Overarching Comments on Program Administrator Business Plans Focus on Market Transformation Strategies.* Energy Efficiency Branch, Energy Division, CPUC.

Freehling, Joel and Brian Stickles. February 2016. *Energy Efficiency Finance: A Market Reassessment.*

American Council for an Energy-Efficient Economy. <http://aceee.org/sites/default/files/market-reassessment-0216.pdf>

Governor's Office of Planning and Research. July 2002. *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects.* [http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf)

Heschong Mahone Group, Inc. December 20, 2012. *The Road to ZNE: Mapping Pathways to ZNE Buildings in California.*

<http://www.trcsolutions.com/writable/images/The-Road-to-Zero-Net-Energy.pdf>

Itron. March 2006. *California Commercial End-Use Survey*.

<http://www.energy.ca.gov/2006publications/CEC-400-2006-005/CEC-400-2006-005.PDF>

Itron. August 26, 2014. *California Commercial Saturation Survey*.

[http://www.calmac.org/publications/California Commercial Saturation Study Report Finalv2ES.pdf](http://www.calmac.org/publications/California%20Commercial%20Saturation%20Study%20Report%20Finalv2ES.pdf)

Itron. September 22, 2014. *Commercial Saturation and Commercial Market Share Tracking Study Telephone Survey Findings*.

[http://www.calmac.org/publications/California CSS CMST Phone Survey Report updatedES.pdf](http://www.calmac.org/publications/California%20CSS%20CMST%20Phone%20Survey%20Report%20updatedES.pdf)

Johnson Controls. 2016. *2016 Energy Efficiency Indicator Survey*.

[http://www.johnsoncontrols.com/media-center/news/press-releases/2016/06/23/~/\\_media/b8b0f06132bf41509f22d79db53dfdbb.ashx](http://www.johnsoncontrols.com/media-center/news/press-releases/2016/06/23/~/_media/b8b0f06132bf41509f22d79db53dfdbb.ashx)

Johnson, Emily and Taylor Johnson. December 21, 2015. *Experts predict commercial real estate trends for 2016*. Building Design and Construction Network. <http://www.bdcnetwork.com/TaylorJohnson>

Johnson, Priscilla, Geoff Wickes, and Michelle Lichtenfels, 2016. 2016 ACEEE Summer Study on Energy Efficiency in Buildings. *Baking from Scratch: How a Tiny EM&V Study Disrupted the Status Quo in Utility Program Design*. [http://aceee.org/files/proceedings/2016/data/papers/4\\_348.pdf](http://aceee.org/files/proceedings/2016/data/papers/4_348.pdf)

Joint Venture Silicon Valley. March 2012. *Improving the Energy Efficiency of Non-owner Occupied Commercial Buildings*.

[http://www.jointventure.org/images/stories/pdf/commercial\\_buildings\\_ee\\_report.pdf](http://www.jointventure.org/images/stories/pdf/commercial_buildings_ee_report.pdf)

Kolstad, Leonard. April 20, 2016. *Investing in High-Performance Buildings*. Institute for Market Transformation. Presentation. <http://www.imt.org/news/the-current/webinar-april-20-investing-in-high-performance-buildings>

Laurain, Anne-Lise, Tingwen Bao, Pawel Zawadzki, and Kevin Johnson, 2016. 2016 ACEEE Summer Study on Energy Efficiency in Buildings. *Better Understanding Customers: Developing SMB DNA to Improve Customer Interactions and Catalyze Positive Behavior Changes*.

[http://aceee.org/files/proceedings/2016/data/papers/8\\_403.pdf](http://aceee.org/files/proceedings/2016/data/papers/8_403.pdf)

Lawrence Berkeley National Laboratory. June 27, 2016. *Data Centers Continue to Proliferate While Their Energy Use Plateaus*. <http://newscenter.lbl.gov/2016/06/27/data-centers-continue-proliferate-energy-use-plateaus/>

Mayors Climate Protection Center. January 2014. *Energy Efficiency and Technology in America's Cities*.

<http://usmayors.org/pressreleases/uploads/2014/0122-report-energyefficiency.pdf>

McGraw Hill Construction. 2011. *Green Outlook 2011: Green Trends Driving Growth*.

<http://aiacc.org/wp-content/uploads/2011/06/greenoutlook2011.pdf>

Mitchell, Cynthia. May 15, 2015. *A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach*. TURN IDSM Comments in R.14-10-003.

National Electrical Manufacturers Association. 2009. *Overcoming Barriers to Efficiency Investments: A Guide for NEMA Members*.  
[https://www.nema.org/Policy/Energy/Efficiency/Documents/Overcoming\\_Barriers\\_to\\_Efficiency\\_Investments.pdf](https://www.nema.org/Policy/Energy/Efficiency/Documents/Overcoming_Barriers_to_Efficiency_Investments.pdf)

Natural Resources Defense Council. November 2011. *Energy Efficiency Lease Guidance*.  
<https://www.nrdc.org/sites/default/files/CMI-FS-Energy.pdf>

Navigant Consulting, Inc. 2015. *Energy Efficiency Potential and Goals Study for 2015 and Beyond. Prepared for the California Public Utility Commission. Final September 25, 2015*.  
<http://www.cpuc.ca.gov/General.aspx?id=2013>

Nielsen. March 8, 2012. *Retail USA: What's in Store 2016*.  
<http://www.nielsen.com/us/en/insights/reports/2012/retail-usa-whats-in-store-2016.html>

NMR Group, Inc. April 2012. *Statewide Benchmarking Process Evaluation Volume 1: REPORT*.  
[http://www.calmac.org/publications/Statewide\\_Benchmarking\\_Process\\_Evaluation\\_Report\\_CPU0055.pdf](http://www.calmac.org/publications/Statewide_Benchmarking_Process_Evaluation_Report_CPU0055.pdf)

Northwest Energy Efficiency Alliance. March 16, 2015. *Commercial Real Estate (CRE) Market Test Assessment: Understanding Delivery, Partnership Strategies and Program Channels*.  
[https://neea.org/docs/default-source/reports/nbi\\_cre\\_final\\_report\\_final.pdf?sfvrsn=4](https://neea.org/docs/default-source/reports/nbi_cre_final_report_final.pdf?sfvrsn=4)

Northwest Energy Efficiency Alliance. May 20, 2015. *Commercial New Construction Market Assessment*.  
<https://neea.org/docs/default-source/reports/commercial-new-construction-market-assessment.pdf?sfvrsn=8>

Opinion Dynamics. June 2016. *PY 2013-2014 California Statewide Workforce Education and Training Program, Contractor Training Market Characterization*.  
[http://www.energydataweb.com/cpucFiles/pdaDocs/1631/CPUC%20WET%20Contractor%20Training%20Market%20Characterization\\_FINAL\\_V5.docx](http://www.energydataweb.com/cpucFiles/pdaDocs/1631/CPUC%20WET%20Contractor%20Training%20Market%20Characterization_FINAL_V5.docx)

Opinion Dynamics. August 2, 2016. *PY 2013-2014 Third Party Commercial Program Value and Effectiveness Study Report (Volume I of II)*.  
[http://www.calmac.org/publications/CPUC\\_3P\\_Report\\_Vol\\_I\\_FINAL\\_Published\\_Aug\\_2\\_2016.pdf](http://www.calmac.org/publications/CPUC_3P_Report_Vol_I_FINAL_Published_Aug_2_2016.pdf)

Pacific Gas and Electric Company. September 20, 2016. *Advice Letter 3744-G-B/4886-E-B: Second Supplemental: Request for Approval of PG&E's Assembly Bill 793 Implementation Plan*.  
[https://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS\\_3744-G-B.pdf](https://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS_3744-G-B.pdf)

Perrin, Burt. September 1998. *Effective Use and Misuse of Performance Measurement. American Journal of Evaluation 1998:19(3); 367-379*.  
[https://www.researchgate.net/publication/238224436\\_Effective\\_Use\\_and\\_Misuse\\_of\\_Performance\\_Measurement](https://www.researchgate.net/publication/238224436_Effective_Use_and_Misuse_of_Performance_Measurement)

Pigman, Margaret, Anna LaRue, Carrie Brown, Conrad Asper, Peter Turnbull, Can Anbarlilar, Ian Hammon-Hogan, Ann Edminster, Bill Dakin, and Daniel Stuart. 2016. *Lessons Learned from a Zero Net*

*Energy Production Builder Demonstration*. 2016 ACEEE Summer Study on Energy Efficiency in Buildings. [http://aceee.org/files/proceedings/2016/data/papers/10\\_966.pdf](http://aceee.org/files/proceedings/2016/data/papers/10_966.pdf)

RLW Associates. *Final report 1999-2001 Building Efficiency Assessment (BEA) Study: An Evaluation of the Savings by Design Program*.

Rovito, Michael, Gita Subramony, Laurentia Duffy, and Peter Savio. 2014. *Advanced Thermostats for Small-to Medium-Sized Commercial Buildings*. 2014 ACEEE Summer Study on Energy Efficiency in Buildings. <http://aceee.org/files/proceedings/2014/data/papers/3-745.pdf>

Russell, Christopher, Brendon Baatz, Rachel Cluett, and Jennifer Amann. December 2, 2015. *Recognizing the Value of Energy Efficiency's Multiple Benefits*. <http://aceee.org/research-report/ie1502>

*Senate Bill 1953*. September 22, 1994. [http://www.leginfo.ca.gov/pub/93-94/bill/sen/sb\\_1951-2000/sb\\_1953\\_bill\\_940922\\_chaptered](http://www.leginfo.ca.gov/pub/93-94/bill/sen/sb_1951-2000/sb_1953_bill_940922_chaptered)

The Economist Intelligence Unit. February 22, 2011. *Unlocking the benefits of energy efficiency*. <https://www.eiuperspectives.economist.com/energy/unlocking-benefits-energy-efficiency>

United States Department of Energy. *Advanced Energy Retrofit Guide: Practical Ways to Improve Energy Performance—Healthcare Facilities*. <http://www.nrel.gov/docs/fy13osti/57864.pdf>

United States Department of Energy. October 2008. *Energy Efficiency Trends in Residential and Commercial Buildings*. [http://www.buildnative.com/wp-content/uploads/2016/10/bt\\_stateindustry.pdf](http://www.buildnative.com/wp-content/uploads/2016/10/bt_stateindustry.pdf)

United States Department of Energy: Building Technologies Program. September 25, 2011. *A Guide to Energy Audits*. [http://www.pnnl.gov/main/publications/external/technical\\_reports/pnnl-20956.pdf](http://www.pnnl.gov/main/publications/external/technical_reports/pnnl-20956.pdf)

United States Department of Energy. May 2014. *Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Electric Motors*. <https://www.regulations.gov/document?D=EERE-2010-BT-STD-0027-0108>

United States Department of Energy: Building Technologies Office. February 2016. *Multi-Year Program Plan: Fiscal Years: 2016-2020*. [https://energy.gov/sites/prod/files/2016/02/f29/BTO\\_MYPP\\_2016.pdf](https://energy.gov/sites/prod/files/2016/02/f29/BTO_MYPP_2016.pdf)

United States Department of Energy. May 2016. *Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Air Compressors*. <https://www.regulations.gov/document?D=EERE-2013-BT-STD-0040-0037>

United States Department of Energy. May 19, 2016. *2016-05-19 Energy Conservation Program: Energy Conservation Standards for Compressors; Noticed of proposed rulemaking (NOPR) and announcement of public meeting*. <https://www.regulations.gov/document?D=EERE-2013-BT-STD-0040-0038>

United States Energy Information Agency. March 4, 2015. *A Look at the U.S. Commercial Building Stock: Results from EIA's 212 Commercial Buildings Energy Consumption Survey (CBECS)*. <http://www.eia.gov/consumption/commercial/reports/2012/buildstock/index.cfm>

United States Environmental Protection Agency. November 2008. *Utility Best Practices Guidance for Providing Business Customers with Energy Use and Cost Data: A Resource of the National Action Plan for Energy Efficiency*. [https://www.epa.gov/sites/production/files/2015-08/documents/utility\\_data\\_guidance.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/utility_data_guidance.pdf)

United States Environmental Protection Agency. February 2010. *Customer Incentives for Energy Efficiency Through Program Offerings: A Resource of the National Action Plan for Energy Efficiency*. [https://www.epa.gov/sites/production/files/2015-08/documents/program\\_incentives.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/program_incentives.pdf)

Zawadzki, Pawel, Ye Lin, Frances Dahlquist, Tingwen Bao, Anne-Lise Laurain, and Kevin Johnson. 2016. *Personalized energy efficiency program targeting with association rule mining*. 2016 ACEEE Summer Study on Energy Efficiency in Buildings. [http://aceee.org/files/proceedings/2016/data/papers/8\\_404.pdf](http://aceee.org/files/proceedings/2016/data/papers/8_404.pdf)

## Appendix C: Customer Data

### Table C.1: Electric Usage and Participants by Climate Region and Size

	Customer by Size <sup>a</sup> and Region <sup>b</sup>					Percent of Region			
	Large	Medium	Small	Unk <sup>c</sup>	Total	Large	Medium	Small	Total <sup>d</sup>
<b>Usage (GWh)</b>									
Bay Area	15,678	3,354	942	4E-03	19,974	78%	17%	5%	100%
Central Valley	4,126	1,748	539	3E-03	6,414	64%	27%	8%	100%
Coastal	1,258	693	248	1E-03	2,199	57%	32%	11%	100%
Mountain	79	40	15	1E-04	134	59%	30%	11%	100%
<b>Total</b>	<b>21,142</b>	<b>5,835</b>	<b>1,745</b>	<b>0.008</b>	<b>28,721</b>	<b>74%</b>	<b>20%</b>	<b>6%</b>	<b>100%</b>
<b>Customers</b>									
Bay Area	54,929	64,029	109,823	4,244	233,025	24%	27%	47%	98%
Central Valley	29,203	37,250	73,156	2,590	142,199	21%	26%	51%	98%
Coastal	9,768	14,866	35,154	1,139	60,927	16%	24%	58%	98%
Mountain	1,070	1,255	2,909	130	5,364	20%	23%	54%	98%
<b>Total</b>	<b>94,970</b>	<b>117,400</b>	<b>221,042</b>	<b>8,103</b>	<b>441,515</b>	<b>22%</b>	<b>27%</b>	<b>50%</b>	<b>98%</b>
<b>Savings (GWh)</b>									
Bay Area	123	26	11	2.4	162	76%	16%	7%	99%
Central Valley	31	26	6	0.4	63	49%	41%	10%	99%
Coastal	10	10	4	0.3	24	40%	42%	17%	99%
Mountain	1	0	0	-	1	64%	25%	10%	100%
<b>Total</b>	<b>165</b>	<b>62</b>	<b>21</b>	<b>3.0</b>	<b>250</b>	<b>66%</b>	<b>25%</b>	<b>8%</b>	<b>99%</b>
<b>Participants</b>									
Bay Area	3,464	2,870	1,849	157	8,340	42%	34%	22%	98%
Central Valley	1,253	1,830	1,032	43	4,158	30%	44%	25%	99%
Coastal	368	674	667	18	1,727	21%	39%	39%	99%
Mountain	19	26	23	-	68	28%	38%	34%	100%
<b>Total</b>	<b>5,104</b>	<b>5,400</b>	<b>3,571</b>	<b>218</b>	<b>14,293</b>	<b>36%</b>	<b>38%</b>	<b>25%</b>	<b>98%</b>

Notes <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms

Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms

Small: < 40,000 KWh or < 10,000 Therms

Unknown: Insufficient data (<12 months)

<sup>b</sup> Regions are aggregates of Climate Zones (Z01 - Z16). There are 16 zones but not all are in PG&E's territory.

Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, & Sonoma

Central Valley includes: Z11 - Z13

Coastal includes: Z01 - Z06 & Z09 (excludes Bay Area Counties)

Mountain includes: Z14 - Z16

<sup>c</sup> "Unknown" size category included for completeness. Represents insufficient or partial-year data

<sup>d</sup> Column may not sum to 100% due to a small percentage of Unknowns not included

**Table C.2: Gas Usage and Savings by Climate Region and Size**

	Customer by Size <sup>a</sup> and Region <sup>b</sup>					Percent of Region			
	Large	Medium	Small	Unk <sup>c</sup>	Total	Large	Medium	Small	Total <sup>d</sup>
<b>Usage (MM Therms)</b>									
Bay Area	283	127	32.1	1.090	443	64%	29%	7%	100%
Central Valley	94	62	27.6	0.391	184	51%	34%	15%	100%
Coastal	16	16	5.4	0.06	37	44%	42%	14%	100%
Mountain	0.5	0.5	0.596	0.0	1.564	31%	31%	38%	100%
<b>Total</b>	<b>394</b>	<b>205</b>	<b>66</b>	<b>1.54</b>	<b>666</b>	<b>59%</b>	<b>31%</b>	<b>10%</b>	<b>100%</b>
<b>Customers</b>									
Bay Area	17,282	30,403	48,035	1,642	97,362	18%	31%	49%	98%
Central Valley	11,018	17,937	43,132	1,404	73,491	15%	24%	59%	98%
Coastal	1,847	4,236	8,534	219	14,836	12%	29%	58%	99%
Mountain	75	100	705	24	904	8%	11%	78%	97%
<b>Total</b>	<b>30,222</b>	<b>52,676</b>	<b>100,406</b>	<b>3,289</b>	<b>186,593</b>	<b>16%</b>	<b>28%</b>	<b>54%</b>	<b>98%</b>
<b>Savings (MM Therms)</b>									
Bay Area	2.2	0.62	0.567	0.037	3.4	64%	18%	17%	99%
Central Valley	0.6	0.06	0.108	5E-03	0.8	79%	7%	13%	99%
Coastal	(0.0)	0.01	0.018	-5E-04	0.024	-10%	37%	75%	102%
Mountain	(0.0)	-2E-04	2E-03	-	(0.0)	691%	87%	-677%	100%
<b>Total</b>	<b>2.8</b>	<b>0.69</b>	<b>0.69</b>	<b>0.042</b>	<b>4</b>	<b>66%</b>	<b>16%</b>	<b>16%</b>	<b>99%</b>
<b>Participants</b>									
Bay Area	2,317	2,576	1,628	130	6,651	35%	39%	24%	98%
Central Valley	833	1,504	921	35	3,293	25%	46%	28%	99%
Coastal	214	601	628	14	1,457	15%	41%	43%	99%
Mountain	11	23	21	-	55	20%	42%	38%	100%
<b>Total</b>	<b>3,375</b>	<b>4,704</b>	<b>3,198</b>	<b>179</b>	<b>11,456</b>	<b>29%</b>	<b>41%</b>	<b>28%</b>	<b>98%</b>

Notes <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
Small: < 40,000 KWh or < 10,000 Therms  
Unknown: Insufficient data (<12 months)

<sup>b</sup> Regions are aggregates of Climate Zones (Z01 - Z16). There are 16 zones but not all are in PG&E's territory.  
Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, & Sonoma  
Central Valley includes: Z11 - Z13  
Coastal includes: Z01 - Z06 & Z09 (excludes Bay Area Counties)  
Mountain includes: Z14 - Z16

<sup>c</sup> "Unknown" size category included for completeness. Represents insufficient or partial-year data

<sup>d</sup> Column may not sum to 100% due to a small percentage of Unknowns not included

Figure C.1: Small Customer Data

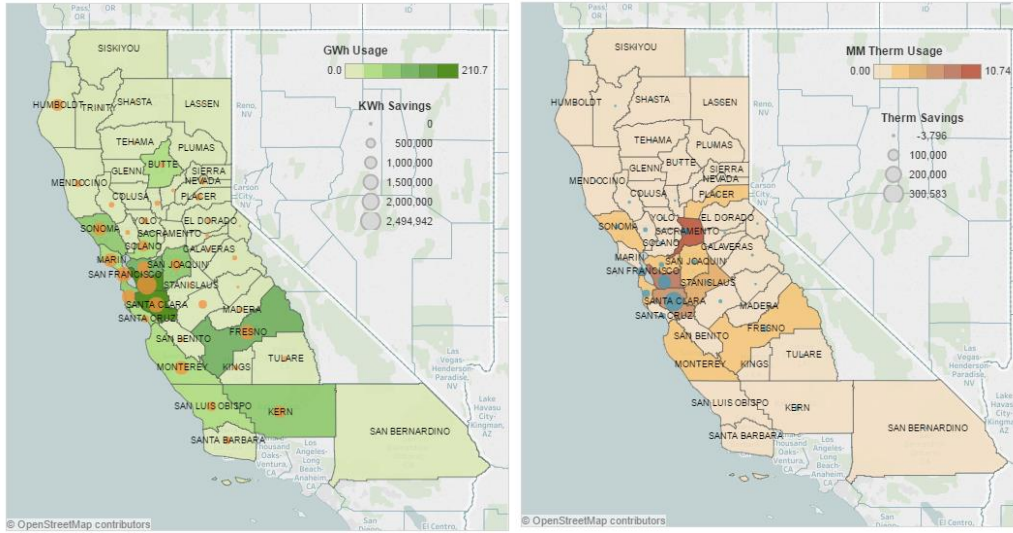


Figure C.2: Medium Customer Data

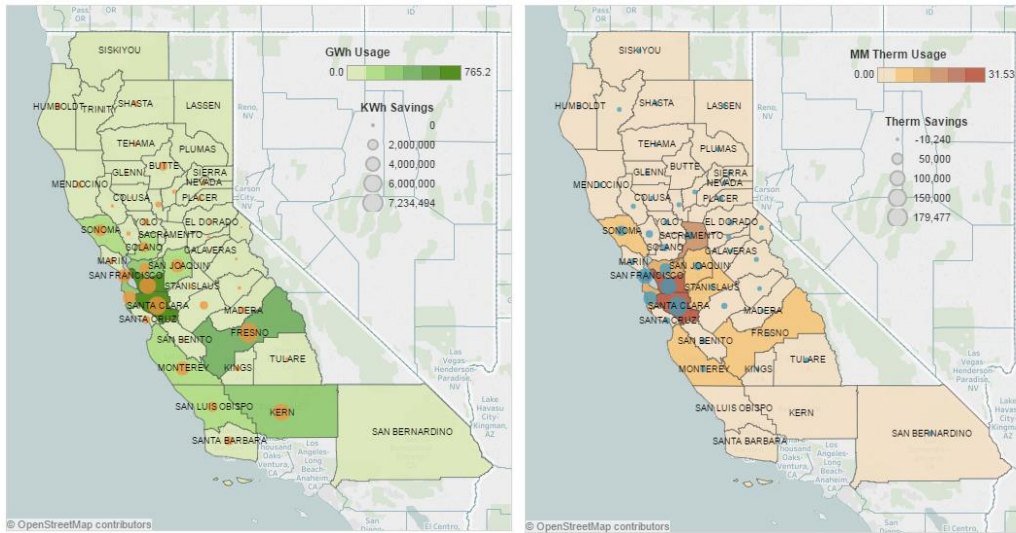




Figure C.3: Large Customer Data

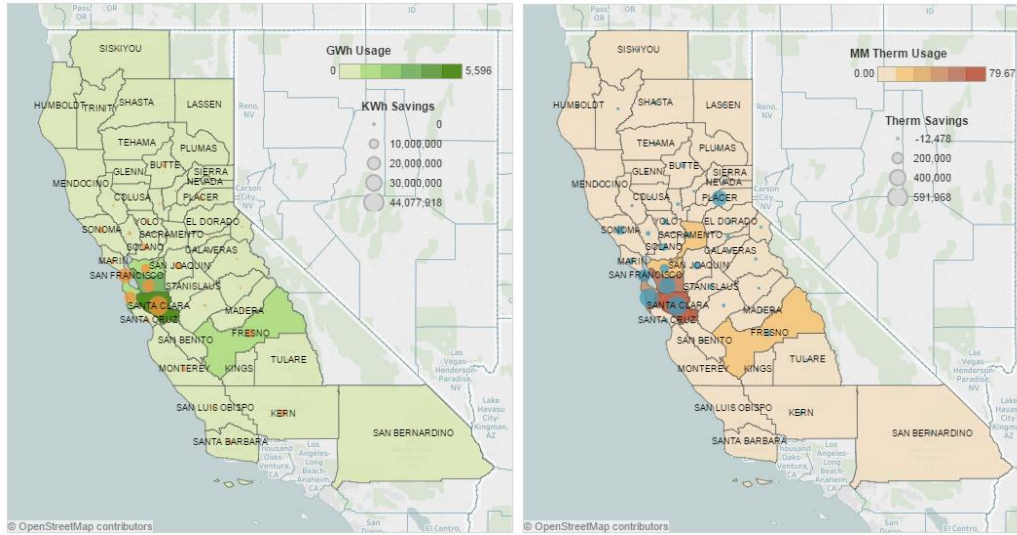


Table C.3: 2015 Electric Customers: Snapshot of Usage and Average Usage by Size

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Electricity Usage (GWh)</b>													
Retail	4,917.6	1,403.0	508.0	6.0	6,834.6	72.0%	20.5%	7.4%	100%	17.1%	4.9%	1.8%	23.7%
Offices	4,631.4	1,604.0	573.4	24.9	6,833.8	67.8%	23.5%	8.4%	100%	16.1%	5.6%	2.0%	23.7%
High Tech	6,098.6	176.5	24.9	1.1	6,301.1	96.8%	2.8%	0.4%	100%	21.2%	0.6%	0.1%	21.9%
Hospitality	2,451.2	1,815.7	196.7	9.1	4,472.7	54.8%	40.6%	4.4%	100%	8.5%	6.3%	0.7%	15.5%
Healthcare	2,196.9	359.2	189.8	0.7	2,746.6	80.0%	13.1%	6.9%	100%	7.6%	1.2%	0.7%	9.5%
Biotech	717.9	19.0	1.3	0.4	738.6	97.2%	2.6%	0.2%	100%	2.5%	0.1%	0.0%	2.6%
Other	127.9	457.4	250.3	7.0	842.6	15.2%	54.3%	29.7%	99%	0.4%	1.6%	0.9%	2.9%
<b>Total</b>	<b>21,141.5</b>	<b>5,834.7</b>	<b>1,744.5</b>	<b>49.22</b>	<b>28,770.0</b>	<b>73%</b>	<b>20%</b>	<b>6%</b>	<b>100%</b>	<b>73.5%</b>	<b>20.3%</b>	<b>6.1%</b>	<b>99.8%</b>
<b>Customers (Number of customers)</b>													
Retail	14,363	26,007	56,292	1,763	98,425	14.6%	26.4%	57.2%	98%	3.3%	5.9%	12.7%	21.9%
Offices	24,445	42,015	74,886	1,698	143,044	17.1%	29.4%	52.4%	99%	5.5%	9.5%	17.0%	32.0%
High Tech	37,907	4,268	2,819	83	45,077	84.1%	9.5%	6.3%	100%	8.6%	1.0%	0.6%	10.2%
Hospitality	10,322	27,727	14,550	898	53,497	19.3%	51.8%	27.2%	98%	2.3%	6.3%	3.3%	11.9%
Healthcare	5,437	7,622	19,222	329	32,610	16.7%	23.4%	58.9%	99%	1.2%	1.7%	4.4%	7.3%
Biotech	589	272	138	7	1,006	58.5%	27.0%	13.7%	99%	0.1%	0.1%	0.0%	0.2%
Other	1,907	9,489	53,136	3,325	67,857	2.8%	14.0%	78.3%	95%	0.4%	2.1%	12.0%	14.6%
<b>Total</b>	<b>94,970</b>	<b>117,400</b>	<b>221,043</b>	<b>8,103</b>	<b>441,516</b>	<b>22%</b>	<b>27%</b>	<b>50%</b>	<b>98%</b>	<b>21.5%</b>	<b>26.6%</b>	<b>50.1%</b>	<b>98.2%</b>
<b>Average Usage (kWh per customer)</b>													
Retail	342,380	53,948	9,024	3,398	69,439								
Offices	189,462	38,177	7,658	14,680	47,774								
High Tech	160,884	41,344	8,835	13,405	139,785								
Hospitality	237,472	65,484	13,521	10,116	83,606								
Healthcare	404,065	47,132	9,875	1,977	84,226								
Biotech	1,218,872	69,685	9,682	58,329	734,209								
Other	67,069	48,201	4,711	2,119	12,418								
<b>Average</b>	<b>222,613</b>	<b>49,699</b>	<b>7,892</b>	<b>6,074</b>	<b>65,162</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)

<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data

<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data

<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

Source: PG&E Internal Data

**Table C.4: 2015 Gas Customers: Snapshot of Usage and Average Usage by Size**

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Gas Usage (MM Therms)</b>													
Retail	51.0	32.2	14.3	0.2	97.6	52.2%	33.0%	14.6%	100%	7.7%	4.8%	2.1%	14.6%
Offices	66.6	35.6	18.1	0.6	120.8	55.1%	29.4%	15.0%	100%	10.0%	5.3%	2.7%	18.1%
High Tech	70.8	3.9	0.5	0.1	75.2	94.1%	5.1%	0.7%	100%	10.6%	0.6%	0.1%	11.3%
Hospitality	78.4	108.7	20.8	0.5	208.5	37.6%	52.2%	10.0%	100%	11.8%	16.3%	3.1%	31.2%
Healthcare	99.2	13.3	4.9	0.0	117.5	84.4%	11.3%	4.2%	100%	14.9%	2.0%	0.7%	17.7%
Biotech	24.3	0.3	0.1	0.0	24.7	98.3%	1.3%	0.2%	100%	3.7%	0.1%	0.0%	3.7%
Other	3.4	11.0	7.0	0.2	21.5	15.6%	51.2%	32.4%	99%	0.5%	1.6%	1.0%	3.2%
<b>Total</b>	<b>393.6</b>	<b>205.0</b>	<b>65.6</b>	<b>1.54</b>	<b>665.8</b>	<b>59%</b>	<b>31%</b>	<b>10%</b>	<b>100%</b>	<b>59.1%</b>	<b>30.8%</b>	<b>9.9%</b>	<b>99.8%</b>
<b>Customers (Number of customers)</b>													
Retail	8,197	10,454	26,546	858	46,055	17.8%	22.7%	57.6%	98%	4.4%	5.6%	14.2%	24.2%
Offices	9,162	15,936	34,413	625	60,136	15.2%	26.5%	57.2%	99%	4.9%	8.5%	18.4%	31.9%
High Tech	2,346	1,122	1,160	40	4,668	50.3%	24.0%	24.9%	99%	1.3%	0.6%	0.6%	2.5%
Hospitality	6,561	17,077	10,495	579	34,712	18.9%	49.2%	30.2%	98%	3.5%	9.2%	5.6%	18.3%
Healthcare	3,296	4,519	13,604	196	21,615	15.2%	20.9%	62.9%	99%	1.8%	2.4%	7.3%	11.5%
Biotech	370	139	94	9	612	60.5%	22.7%	15.4%	99%	0.2%	0.1%	0.1%	0.3%
Other	290	3,429	14,094	982	18,795	1.5%	18.2%	75.0%	95%	0.2%	1.8%	7.6%	9.5%
<b>Total</b>	<b>30,222</b>	<b>52,676</b>	<b>100,406</b>	<b>3,289</b>	<b>186,593</b>	<b>16%</b>	<b>28%</b>	<b>54%</b>	<b>98%</b>	<b>16.2%</b>	<b>28.2%</b>	<b>53.8%</b>	<b>98.2%</b>
<b>Average Usage (Therms per customer)</b>													
Retail	6,216	3,078	537	222	2,119								
Offices	7,264	2,231	526	880	2,008								
High Tech	30,161	3,441	473	1,287	16,114								
Hospitality	11,957	6,368	1,978	894	6,006								
Healthcare	30,110	2,952	362	213	5,438								
Biotech	65,706	2,399	598	2,386	40,396								
Other	11,564	3,201	493	175	1,141								
<b>Average</b>	<b>13,024</b>	<b>3,892</b>	<b>653</b>	<b>470</b>	<b>3,568</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

Source: PG&E Internal Data

**Table C.5: Retail Customer Data**

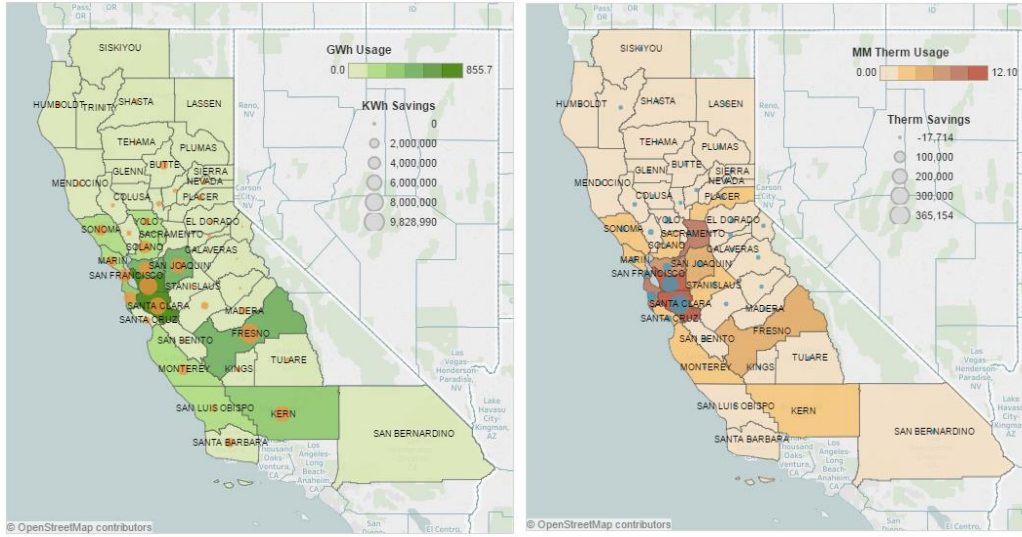
	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Retail</b>													
Electricity Usage (GWh)	4,917.6	1,403.0	508.0	6.0	6,834.6	72.0%	20.5%	7.4%	100%	17.1%	4.9%	1.8%	24%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	14,363	26,007	56,292	1,763	98,425	14.6%	26.4%	57.2%	98%	3.3%	5.9%	12.7%	22%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	342,380	53,948	9,024	3,398	69,439								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	45,658	27,045	10,455	607	83,765.1	54.5%	32.3%	12.5%	99%	18.2%	10.8%	4.2%	33%
Savings Trends (2011-2015)													
Participants (Number of Participants)	1,567	1,956	1,626	63	5,212	30.1%	37.5%	31.2%	99%	11.0%	13.7%	11.4%	36%
Participant (2011-2015)													
Average Savings (kWh per Participant)	29,137	13,827	6,430	9,637	16,072								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	10.9%	7.5%	2.9%	3.6%	5.3%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Retail</b>													
Gas Usage (MM Therms)	51.0	32.2	14.3	0.2	97.6	52.2%	33.0%	14.6%	100%	7.7%	4.8%	2.1%	14.6%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	8,197	10,454	26,546	858	46,055	17.8%	22.7%	57.6%	98%	4.4%	5.6%	14.2%	24.2%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	6,216	3,078	537	222	2,119								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	303,182	117,937	476,617	1,748	899,484.4	33.7%	13.1%	53.0%	100%	7.2%	2.8%	11.3%	21.2%
Savings Trends (2011-2015)													
Participants (Number of Participants)	848	1,626	1,569	43	4,086	20.8%	39.8%	38.4%	99%	7.4%	14.2%	13.7%	35.3%
Participant (2011-2015)													
Average Savings (Therms per Participant)	358	73	304	41	220								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	10.3%	15.6%	5.9%	5.0%	8.9%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.4: Retail Customer Data



**Table C.6: Offices Customer Data**

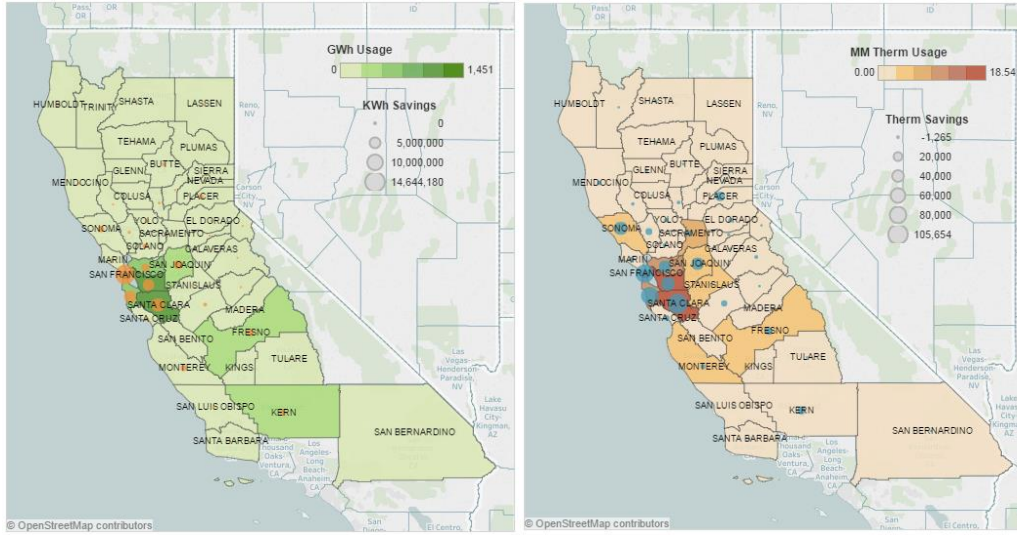
	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Total <sup>d</sup>	Percent of Sector <sup>e</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>		Large	Med	Small	Total
<b>Offices</b>														
Electricity Usage (GWh)	4,631.4	1,604.0	573.4	24.9	6,833.8	67.8%	23.5%	8.4%	100%	16.1%	5.6%	2.0%	24%	
Usage Trends (2011-2015) <sup>e</sup>														
Customers (Number of customers)	24,445	42,015	74,886	1,698	143,044	17.1%	29.4%	52.4%	99%	5.5%	9.5%	17.0%	32%	
Customer trends (2011-2015)														
Average Usage (kWh per customer)	189,462	38,177	7,658	14,680	47,774									
Usage Rate Trends (2011-2015)														
Electricity Savings (MWh)	32,355	11,938	4,775	507	49,575.8	65.3%	24.1%	9.6%	99%	12.9%	4.8%	1.9%	20%	
Savings Trends (2011-2015)														
Participants (Number of Participants)	1,296	947	887	50	3,180	40.8%	29.8%	27.9%	98%	9.1%	6.6%	6.2%	22%	
Participant (2011-2015)														
Average Savings (kWh per Participant)	24,966	12,606	5,383	10,140	15,590									
Savings Rate Trends (2011-2015)														
Participation Rates (% Participants per Cust.)	5.3%	2.3%	1.2%	2.9%	2.2%									
Participation Rate Trends (2011-2015)														

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Total <sup>d</sup>	Percent of Sector <sup>e</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>		Large	Med	Small	Total
<b>Offices</b>														
Gas Usage (MM Therms)	66.6	35.6	18.1	0.6	120.8	55.1%	29.4%	15.0%	100%	10.0%	5.3%	2.7%	18.1%	
Usage Trends (2011-2015) <sup>e</sup>														
Customers (Number of customers)	9,162	15,936	34,413	625	60,136	15.2%	26.5%	57.2%	99%	4.9%	8.5%	18.4%	31.9%	
Customer trends (2011-2015)														
Average Usage (Therms per customer)	7,264	2,231	526	880	2,008									
Usage Rate Trends (2011-2015)														
Gas Savings (Therms)	287,768	166,397	93,416	23,859	571,440.2	50.4%	29.1%	16.3%	96%	6.8%	3.9%	2.2%	12.9%	
Savings Trends (2011-2015)														
Participants (Number of Participants)	756	782	731	44	2,313	32.7%	33.8%	31.6%	98%	6.6%	6.8%	6.4%	19.8%	
Participant (2011-2015)														
Average Savings (Therms per Participant)	381	213	128	542	247									
Savings Rate Trends (2011-2015)														
Participation Rates (% Participants per Cust.)	8.3%	4.9%	2.1%	7.0%	3.8%									
Participation Rate Trends (2011-2015)														

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.5: Offices Customer Data



**Table C.7: High Tech Customer Data**

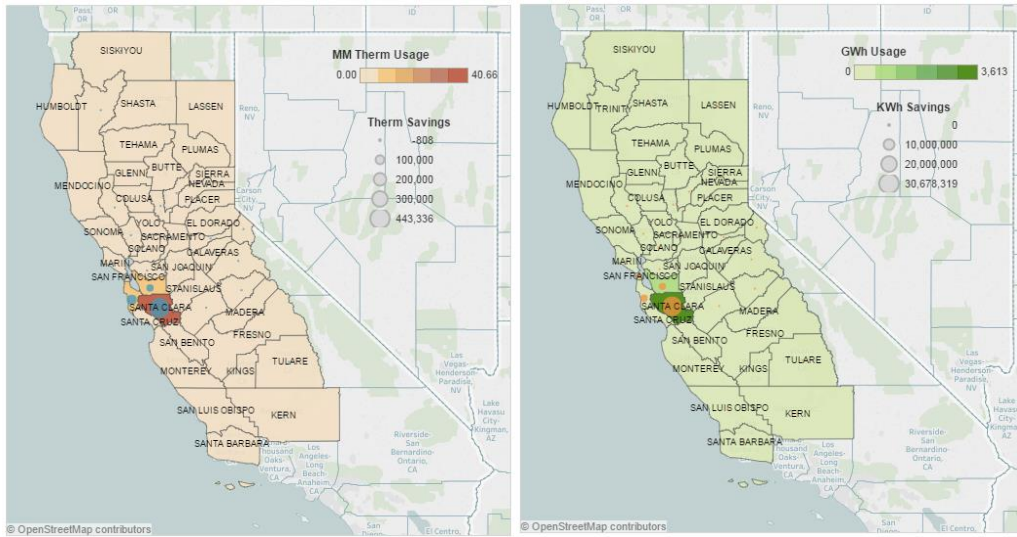
	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>High Tech</b>													
Electricity Usage (GWh)	6,098.6	176.5	24.9	1.1	6,301.1	96.8%	2.8%	0.4%	100%	21.2%	0.6%	0.1%	22%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	37,907	4,268	2,819	83	45,077	84.1%	9.5%	6.3%	100%	8.6%	1.0%	0.6%	10%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	160,884	41,344	8,835	13,405	139,785								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	41,727	699	40	793	43,258.7	96.5%	1.6%	0.1%	98%	16.7%	0.3%	0.0%	17%
Savings Trends (2011-2015)													
Participants (Number of Participants)	457	41	8	1	507	90.1%	8.1%	1.6%	100%	3.2%	0.3%	0.1%	4%
Participant (2011-2015)													
Average Savings (kWh per Participant)	91,306	17,051	4,953	792,942	85,323								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	1.2%	1.0%	0.3%	1.2%	1.1%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>High Tech</b>													
Gas Usage (MM Therms)	70.8	3.9	0.5	0.1	75.2	94.1%	5.1%	0.7%	100%	10.6%	0.6%	0.1%	11.3%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	2,346	1,122	1,160	40	4,668	50.3%	24.0%	24.9%	99%	1.3%	0.6%	0.6%	2.5%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	30,161	3,441	473	1,287	16,114								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	608,521	10,712	(147)	651	619,737.7	98.2%	1.7%	0.0%	100%	14.4%	0.3%	0.0%	14.6%
Savings Trends (2011-2015)													
Participants (Number of Participants)	214	23	7	1	245	87.3%	9.4%	2.9%	100%	1.9%	0.2%	0.1%	2.1%
Participant (2011-2015)													
Average Savings (Therms per Participant)	2,844	466	(21)	651	2,530								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	9.1%	2.0%	0.6%	2.5%	5.2%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.6: High Tech Customer Data





**Table C.8: Hospitality Customer Data**

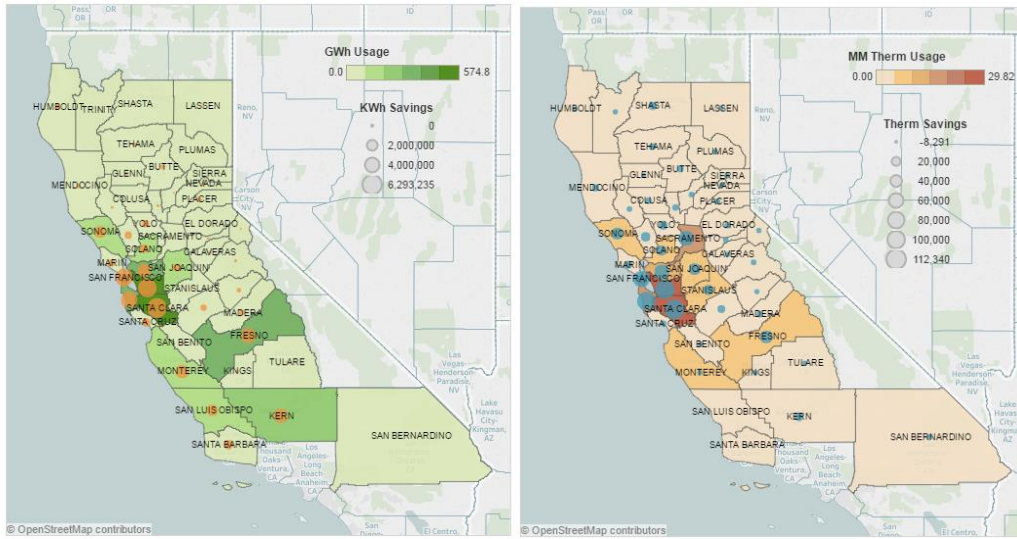
	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Total <sup>d</sup>	Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>		Large	Med	Small	Total
<b>Hospitality</b>														
Electricity Usage (GWh)	2,451.2	1,815.7	196.7	9.1	4,472.7	54.8%	40.6%	4.4%	100%	8.5%	6.3%	0.7%	16%	
Usage Trends (2011-2015) <sup>e</sup>														
Customers (Number of customers)	10,322	27,727	14,550	898	53,497	19.3%	51.8%	27.2%	98%	2.3%	6.3%	3.3%	12%	
Customer trends (2011-2015)														
Average Usage (kWh per customer)	237,472	65,484	13,521	10,116	83,606									
Usage Rate Trends (2011-2015)														
Electricity Savings (MWh)	26,854	19,311	2,753	778	49,695.8	54.0%	38.9%	5.5%	98%	10.7%	7.7%	1.1%	20%	
Savings Trends (2011-2015)														
Participants (Number of Participants)	1,477	2,074	446	48	4,045	36.5%	51.3%	11.0%	99%	10.3%	14.5%	3.1%	28%	
Participant (2011-2015)														
Average Savings (kWh per Participant)	18,182	9,311	6,172	16,202	12,286									
Savings Rate Trends (2011-2015)														
Participation Rates (% Participants per Cust.)	14.3%	7.5%	3.1%	5.3%	7.6%									
Participation Rate Trends (2011-2015)														

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Total <sup>d</sup>	Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>		Large	Med	Small	Total
<b>Hospitality</b>														
Gas Usage (MM Therms)	78.4	108.7	20.8	0.5	208.5	37.6%	52.2%	10.0%	100%	11.8%	16.3%	3.1%	31.2%	
Usage Trends (2011-2015) <sup>e</sup>														
Customers (Number of customers)	6,561	17,077	10,495	579	34,712	18.9%	49.2%	30.2%	98%	3.5%	9.2%	5.6%	18.3%	
Customer trends (2011-2015)														
Average Usage (Therms per customer)	11,957	6,368	1,978	894	6,006									
Usage Rate Trends (2011-2015)														
Gas Savings (Therms)	347,520	325,835	84,437	10,355	768,146.2	45.2%	42.4%	11.0%	99%	8.2%	7.7%	2.0%	17.9%	
Savings Trends (2011-2015)														
Participants (Number of Participants)	1,316	1,931	385	41	3,673	35.8%	52.6%	10.5%	99%	11.5%	16.9%	3.4%	31.7%	
Participant (2011-2015)														
Average Savings (Therms per Participant)	264	169	219	253	209									
Savings Rate Trends (2011-2015)														
Participation Rates (% Participants per Cust.)	20.1%	11.3%	3.7%	7.1%	10.6%									
Participation Rate Trends (2011-2015)														

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.7: Hospitality Customer Data



**Table C.9: Healthcare Customer Data**

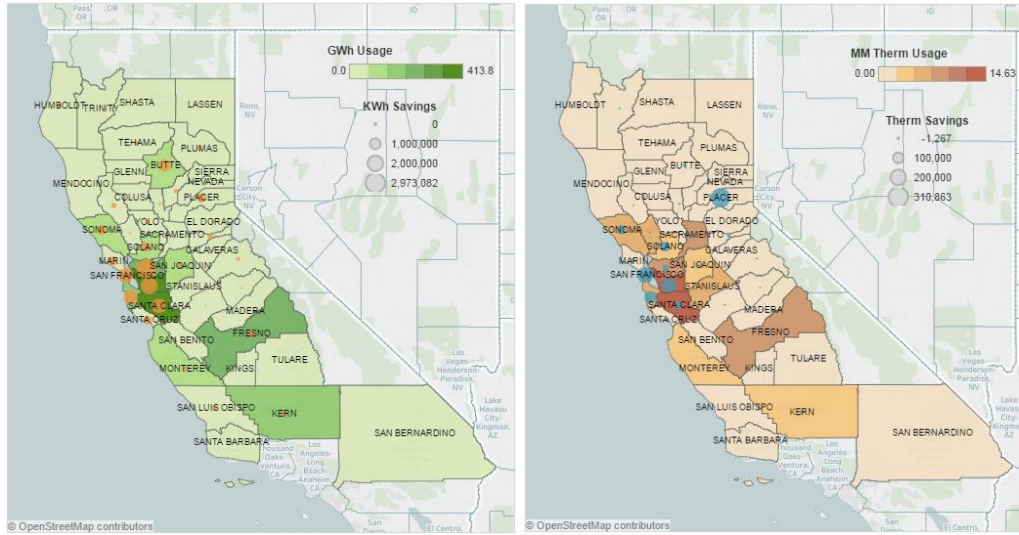
	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>e</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Healthcare</b>													
Electricity Usage (GWh)	2,196.9	359.2	189.8	0.7	2,746.6	80.0%	13.1%	6.9%	100%	7.6%	1.2%	0.7%	10%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	5,437	7,622	19,222	329	32,610	16.7%	23.4%	58.9%	99%	1.2%	1.7%	4.4%	7%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	404,065	47,132	9,875	1,977	84,226								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	14,440	1,493	613	15	16,560.1	87.2%	9.0%	3.7%	100%	5.8%	0.6%	0.2%	7%
Savings Trends (2011-2015)													
Participants (Number of Participants)	237	153	167	8	565	41.9%	27.1%	29.6%	99%	1.7%	1.1%	1.2%	4%
Participant (2011-2015)													
Average Savings (kWh per Participant)	60,926	9,757	3,672	1,834	29,310								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	4.4%	2.0%	0.9%	2.4%	1.7%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>e</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Healthcare</b>													
Gas Usage (MM Therms)	99.2	13.3	4.9	0.0	117.5	84.4%	11.3%	4.2%	100%	14.9%	2.0%	0.7%	17.7%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	3,296	4,519	13,604	196	21,615	15.2%	20.9%	62.9%	99%	1.8%	2.4%	7.3%	11.5%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	30,110	2,952	362	213	5,438								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	1,023,914	28,209	19,285	3,732	1,075,140.2	95.2%	2.6%	1.8%	100%	24.2%	0.7%	0.5%	25.3%
Savings Trends (2011-2015)													
Participants (Number of Participants)	185	141	157	9	492	37.6%	28.7%	31.9%	98%	1.6%	1.2%	1.4%	4.2%
Participant (2011-2015)													
Average Savings (Therms per Participant)	5,535	200	123	415	2,185								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	5.6%	3.1%	1.2%	4.6%	2.3%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.8: Healthcare Customer Data



**Table C.10: Biotech Customer Data**

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Biotech</b>													
Electricity Usage (GWh)	717.9	19.0	1.3	0.4	738.6	97.2%	2.6%	0.2%	100%	2.5%	0.1%	0.0%	3%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	589	272	138	7	1,006	58.5%	27.0%	13.7%	99%	0.1%	0.1%	0.0%	0%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	1,218,872	69,685	9,682	58,329	734,209								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	2,481	43	1	2	2,527.3	98.2%	1.7%	0.0%	100%	1.0%	0.0%	0.0%	1%
Savings Trends (2011-2015)													
Participants (Number of Participants)	50	5	1	1	57	87.7%	8.8%	1.8%	98%	0.3%	0.0%	0.0%	0%
Participant (2011-2015)													
Average Savings (kWh per Participant)	49,627	8,637	660	2,132	44,339								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	8.5%	1.8%	0.7%	14.3%	5.7%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Biotech</b>													
Gas Usage (MM Therms)	24.3	0.3	0.1	0.0	24.7	98.3%	1.3%	0.2%	100%	3.7%	0.1%	0.0%	3.7%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	370	139	94	9	612	60.5%	22.7%	15.4%	99%	0.2%	0.1%	0.1%	0.3%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	65,706	2,399	598	2,386	40,396								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	242,047	367	101	-	242,515.0	99.8%	0.2%	0.0%	100%	5.7%	0.0%	0.0%	5.7%
Savings Trends (2011-2015)													
Participants (Number of Participants)	45	4	1	-	50	90.0%	8.0%	2.0%	100%	0.4%	0.0%	0.0%	0.4%
Participant (2011-2015)													
Average Savings (Therms per Participant)	5,379	92	101	-	4,850								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	12.2%	2.9%	1.1%	0.0%	8.2%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively



## Appendix D: Commercial Up/Midstream Strategies and Codes & Standards Connections

### Commercial CSEEP Goals

- New Construction will increasingly embrace ZNE performance, reaching 100% penetration of new starts by 2030
- Support the increasing efficiency in existing buildings by simplification of T24 HVAC replacement procedures and Compliance Improve initiatives.
- Implement code driven, market transformation and customer demand for energy efficient products, and consumer demand flexibility controls to sculpt energy use to lower cost hours in response to Time-of-Use and peak demand rates.
- Support use of most efficient HVAC equipment in the replacement market with incentives and sales information.

Target end-use / measure	Long-term goal / target	C&S Strategy	Key C&S Timeline	Program strategy to support long-term goal
Electric Motors	New standards that took effect in 2016 apply to three-phase induction electric motors from 1 to 500 horsepower and are equivalent to the NEMA Premium (or IE3) efficiency levels. Updated efficiency levels, which would reduce energy losses by about 15%, can be met by more-efficient conventional induction motors as well as by advanced motor technologies including permanent magnet,	<b>Appliance Standards:</b> provide performance, cost, and market data to support federal standard levels for electric motors that are roughly equivalent to the Super Premium (or IE4) levels. <sup>2</sup>	<b>Appliance Standards:</b> <ul style="list-style-type: none"> <li>• 2018 to 2022: key period of influence</li> <li>• ~2022: next federal standard finalized</li> <li>• ~2025: next standard effective</li> </ul>	<b>Up/midstream:</b> Incentive program to expand market presence of super-efficient motors. <b>Downstream:</b> Explore enhanced early retirement program. <b>ETP:</b> Verify performance over a range of loads that can be expected to occur.

<sup>2</sup> DOE. (2014). Final Rule: Technical Support Documents. <https://www.regulations.gov/document?D=EERE-2010-BT-STD-0027-0108>

Target end-use / measure	Long-term goal / target	C&S Strategy	Key C&S Timeline	Program strategy to support long-term goal
Variable speed fans and variable speed condensing units for walk-in coolers/freezers	Future DOE standard for walk-ins requires variable refrigerant flow, on-cycle control of variable speed evaporator fans so that fan energy is minimized and evaporator and condenser surfaces are effectively oversized (low TD) for most hours of the year	<p><b>Appliance Standards:</b> Demonstrate VS technology on all sizes of walk-ins with various aggregated customer groups (chains) supermarkets, restaurants, schools etc. Provide performance, cost, and market data to support federal standard levels for walk-ins with VS vans and VRF refrigerant flow for condensing units.</p> <p><b>Building Codes:</b> Collect information on installation cost and energy savings of retrofitting variable speed evaporator fans</p>	<p><b>Appliance Standards:</b></p> <ul style="list-style-type: none"> <li>• 2021 to 2022: key period of influence</li> <li>• ~2022: next federal standard finalized</li> <li>• ~2025: next standard effective</li> </ul> <p><b>Building Codes:</b> Two years in advance of the Title 24 code cycle (either 2020 for 2022 T24 cycle or 2023 for 2025 T24 cycle)</p>	<p><b>Up/midstream:</b> Incentive program for systems meeting and exceeding the DOE standard in advance of the effective date.</p> <p><b>Downstream:</b> Develop programs for customer groups.</p> <p><b>ETP:</b> Validate performance of walk-ins controls that support long term efficient operation, fault detection and diagnosis.</p>

<sup>1</sup> Appliance Standards Awareness Project (ASAP). August 2016. *Next Generation Standards*. [http://www.appliance-standards.org/sites/default/files/Next%20Gen%20Report%20Final\\_1.pdf](http://www.appliance-standards.org/sites/default/files/Next%20Gen%20Report%20Final_1.pdf)



Target end-use / measure	Long-term goal / target	C&S Strategy	Key C&S Timeline	Program strategy to support long-term goal
Fans used in commercial building HVAC systems, commercial kitchen exhaust systems, and agricultural ventilation	DOE is currently conducting a rulemaking, scheduled for completion in 2016. The most-efficient fan designs available today and would achieve weighted-average savings of 8% relative to the assumed base case efficiency levels. <sup>3</sup>	<b>Appliance Standards:</b> Provide performance, cost, and market data to support federal standard levels that meet max tech levels.	<b>Appliance Standards:</b> <ul style="list-style-type: none"> <li>• 2022 to 2024: key period of influence</li> <li>• ~2024: next federal standard finalized</li> <li>• ~2029: next standard effective</li> </ul>	<b>Up/midstream:</b> Incentive program for fan systems meeting and exceeding the DOE standard in advance of the effective date.
Dedicated Outside Air Systems (DOAS)	DOAS systems are the code baseline system from small commercial buildings. DOAS systems typically are more robust (less likely to fail) and are well suited for the addition of heat recovery. The primary benefit for this	<b>Building Codes:</b> This product is not federally regulated and is impacted by building standards and retrofit programs. Collect performance, cost, and	<b>Building Codes:</b> Two years in advance of the Title 24 code cycle (either 2020 for 2022 Code Readiness projects focused on performance in California climates for various occupancies.	<b>Up/midstream:</b> Incentives for various high efficiency characteristics (fan efficiency, heat recovery, by-pass dampers, economizer capable etc.)

<sup>3</sup> Appliance Standards Awareness Project (ASAP). August 2016. *Next Generation Standards*. [http://www.appliance-standards.org/sites/default/files/Next%20Gen%20Report%20Final\\_1.pdf](http://www.appliance-standards.org/sites/default/files/Next%20Gen%20Report%20Final_1.pdf)

Target end-use / measure	Long-term goal / target	C&S Strategy	Key C&S Timeline	Program strategy to support long-term goal
	<p>technology is reduced fan energy as ventilation air is decoupled from supply air. This technology is used in IECC 2015 as one of the prescriptive “additional efficiency” paths.</p>	<p>market data to support T-24 CASE proposal.</p>	<p>Since this technology is often combined with VRF systems for providing cooling, research would center on predicting energy performance for both technologies when used together.</p>	<p><b>Downstream:</b> Small commercial building incentive program using pre-qualified equipment. <b>ETP:</b> Verify performance heat exchangers and variable speed, multiple mode DOAS units.</p>
<p>Distribution Transformers</p>	<p>Energy losses in transformers can be significantly reduced by using amorphous metal for the transformer steel core. We analyzed standards for distribution transformers based on the use of amorphous metal that would reduce energy losses by 40–70% relative to the current standards.<sup>4</sup></p>	<p><b>Appliance Standards:</b> Provide performance, cost, and market data to support federal standard levels based on the use of amorphous metal. <b>Building Codes:</b> Include transformer losses model in performance method simulation tool. This requires data on current loading of transformers.</p>	<p><b>Appliance Standards:</b></p> <ul style="list-style-type: none"> <li>• 2017 to 2019: key period of influence</li> <li>• ~2019: next federal standard finalized</li> <li>• ~2022: next standard effective</li> </ul>	<p><b>Up/midstream:</b> Procurement specification with IOUs, POUs etc. for procurement specification for transformers making use of amorphous steel (ideally US origin and ideally multiple suppliers) to stand up US industry to provide high efficiency transformers. Plan for trickle down to smaller size transformers over time. Utilities have the long planning times to support this type of investment. Work with CPUC to confirm this type of investment does not suffer from unintended policy</p>

<sup>4</sup> Appliance Standards Awareness Project (ASAP). August 2016. *Next Generation Standards*. [http://www.appliance-standards.org/sites/default/files/Next%20Gen%20Report%20Final\\_1.pdf](http://www.appliance-standards.org/sites/default/files/Next%20Gen%20Report%20Final_1.pdf)

Target end-use / measure	Long-term goal / target	C&S Strategy	Key C&S Timeline	Program strategy to support long-term goal
Compressors	DOE is currently conducting a rulemaking that would establish the first national efficiency standards for compressors. The most-efficient compressors available today would achieve weighted-average savings of 36% relative to the assumed base case efficiency levels. <sup>5</sup> Also, the current rulemaking excludes reciprocating compressors which comprise 97% of the compressor market. <sup>6</sup> Including reciprocating compressors at the max-tech level would realize an additional 2 quads over the	<b>Appliance Standards:</b> Provide performance, cost, and market data to support federal standard levels that meet max tech levels for both rotary and reciprocating compressors. <b>Building Codes:</b> Compressed air system efficiency highly dependent on the system installation. Title 24 will implement mandatory requirements in support of efficiency	<b>Appliance Standards:</b> <ul style="list-style-type: none"> <li>• 2022 to 2024: key period of influence</li> <li>• ~2024: next federal standard finalized</li> <li>• ~2029: next standard effective</li> </ul> <b>Building Codes:</b> Currently the 2019 version of Title 24 is being developed and will include consideration of compressor systems	<b>Up/midstream:</b> Incentive program to support early introduction into California of best compressors. <b>ETP:</b> Validation of the performance of a new generation of multiple stage or variable capacity compressors. Development of generic performance specifications.

<sup>5</sup> Appliance Standards Awareness Project (ASAP), August 2016, *Next Generation Standards*. [http://www.appliance-standards.org/sites/default/files/Next%20Gen%20Report%20Final\\_1.pdf](http://www.appliance-standards.org/sites/default/files/Next%20Gen%20Report%20Final_1.pdf)

<sup>6</sup> Department of Energy (DOE), May 2016, *2016-05-19 Energy Conservation Program: Energy Conservation Standards for Compressors; Notice of proposed rulemaking (NPR) and announcement of public meeting*. <https://www.regulations.gov/document?D=EERE-2013-BT-STD-0040-0038>

Target end-use / measure	Long-term goal / target	C&S Strategy	Key C&S Timeline	Program strategy to support long-term goal
	30-year period of analysis. This equates to roughly half of the energy savings possible at max-tech for all compressor types considered in the rulemaking. <sup>7</sup>			
ZNE Warehouses	New warehouses are constructed with satisfying the commercial ZNE goal before 2030. Heating loads reduced by radiant heating and attention to reducing infiltration. Capability to support DR or scheduling of forklift charging, capacity to not only be ZNE but also provide renewables expandability so there is flexibility to be a net generator if it is financially desirable. All systems well integrated so that provision for one system is not at detriment of other systems.	<b>Building Codes:</b> C&S program works to demonstrate ZNE warehouses that integrate efficiency, DR, storage and renewables. Collect performance, cost, and market data to support T-24 CASE proposal. Early adoption of ZNE for warehouses assists with administrative roll out of ZNE for other building types in succeeding code cycles.	<b>Building Codes:</b> Two years in advance of the Title 24 code cycle (2020 for 2022 T-24) Code Readiness projects to support development of repeatable prototypes for ZNE new and retrofit warehouses Radical design changes: forklift as demand response and energy storage system	<b>Up/midstream:</b> Incentives for PV/battery charger systems that are energy efficient and compatible with DR signaling systems and have sufficient capabilities. <b>Downstream:</b> SBD program for ZNE new warehouses that optimize energy efficiency prior to adding PV and DR capabilities. <b>ETP:</b> Verify performance of new controls.

<sup>7</sup> Department of Energy (DOE). May 2016. *Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Air Compressors*. <https://www.regulations.gov/document?D=EERE-2013-BT-STD-0040-0037>

Target end-use / measure	Long-term goal / target	C&S Strategy	Key C&S Timeline	Program strategy to support long-term goal
	Combined system designed for minimum life cycle cost to achieve an aggressive energy reduction goal.			
ZNE schools	New schools and new portable classrooms are ZNE while providing a high performance environment for learning and are a community center for arts and sports. For 9 month schools they are net importers and during the summer they are net generators of electricity. These schools are robust ZNE environments which require little site maintenance to retain ZNE status over the long term but which communicate to central management when equipment is not working. Occupancy is highly variable thus occupancy sensing is used to control lights, setpoints and ventilation in	<b>Building Codes:</b> C&S program works to demonstrate ZNE schools that integrate efficiency, DR, storage and renewables. Collect long term performance, cost, and market data to support T-24 CASE proposal.	<b>Building Codes:</b> Two years in advance of the Title 24 code cycle (2023 for 2025 T-24) Code Readiness projects in various climate zones to support development of repeatable prototypes. Demonstration projects of ZNE schools with focus on rugged equipment, low maintenance, and communication to central facilities management. HVAC that is quiet and occupancy controllable. Overlap with DOAS efforts	<b>Downstream:</b> SBD program for ZNE new schools and major remodels that optimize energy efficiency prior to adding PV and DR capabilities. Also smart controls that tie into central energy management. Training interpreting smart control fault signals and repair. <b>ETP:</b> Verify performance of new controls.

Target end-use / measure	Long-term goal / target	C&S Strategy	Key C&S Timeline	Program strategy to support long-term goal
Unitary Package Heating and Cooling Equipment	For both commercial and residential equipment DOE has adopted new standards which are scheduled to take effect in 2022 and 2023. California is preempted from having a higher standard. But, using voluntary methods of test and performance metrics along with Title 24 application requirements real world efficiency is improved. Of note is performance during heat storm weather.	<b>Appliance Standards:</b> Develop, in consort with other stakeholders, voluntary test standards and performance metrics that give customers a correct understanding of relative performance of both fixed capacity and variable capacity heat pumps and air conditioners. Support California Air Resources Board in regulations controlling high GHG refrigerants. <b>Building Codes:</b> Develop application criteria which support system performance. These will be mandatory, prescriptive, and alternative criteria.	<b>Appliance Standards:</b> <ul style="list-style-type: none"> <li>• 2017 to 2030: key period of influence to keep standards, develop load based/dynamic testing,</li> <li>• ~2030: next federal standard finalized if new standards are kept on track</li> <li>• ~2023: next standard effective</li> </ul> <b>Building Codes:</b> In each cycle implement mandatory and prescriptive measures that make application of unitary systems work efficiently at startup and over the long term. Use results of voluntary dynamic testing and performance metrics in compliance simulation software to give appropriate performance credit. Execute code readiness projects that support future application criteria.	<b>Up/midstream:</b> Incentive programs based on efficiency metrics from voluntary test standards in addition to DOE metric all designed to introduce at an early date equipment that will be required in the 2020s. Low GHG refrigerants will be supported. <b>ETP:</b> Verification of controls, both OEM and 3 <sup>rd</sup> party, that ensure initial and long term efficient operation.



# PUBLIC

## CHAPTER 04

# MARKET CHARACTERIZATION & APPROACH

## PUBLIC

### SETTING THE STAGE



USAGE:

**7.4% OF ELECTRIC**  
**5.4% OF GAS**

**Nearly 90,000** customers  
(including local, state, federal,  
K-12, higher ed)



### KEY APPROACH & STRATEGIES



**Expand** the successful partnership model with local governments, the state and educational institutions

**Improve** data access processes to empower customers to complete projects with greater savings more quickly



**Refine** financing offerings to better meet the unique needs of Public sector customers

### TRENDS



Local governments increasingly need to link energy savings to greenhouse gas emissions reductions to align with Climate Action Plans

Executive Order B-18-12 sets ambitious energy efficiency goals and ZNE targets for state agencies

Significant energy savings potential in older facilities, particularly in K-12

University of California Carbon Neutrality Initiative commits the University to zero greenhouse gas emissions by 2025

Executive Order 13693 requires federal buildings to reduce energy usage by 2.5% annually between 2015-2025



## A. PG&E's Public Sector Vision

PG&E's long-term vision for the public sector is to empower customers with the expertise and tools they need to efficiently manage their energy use.

Working with public sector customers will be crucial to meeting California's ambitious energy goals. Not only can the public sector achieve significant energy savings through its own facilities and infrastructure, but these public sector customers are also leaders and influencers in their communities. PG&E has observed residential, commercial, industrial, and agricultural customers look to their local governments and educational institutions to lead the way.<sup>1</sup> By providing relevant leadership in their communities, public sector customers can drive enhanced energy efficiency adoption on the path to institutionalizing it as a normal practice.

PG&E characterizes the public sector in five segments:

- **Local Governments:** City and county government buildings, infrastructure, and wastewater treatment facilities
- **State Government:** California state government buildings and infrastructure
- **Federal Government:** Military bases, federal offices, Native American reservations, and related infrastructure
- **Kindergarten (K) - Grade 12:** K-12 public school campuses and offices
- **Higher Education:** University of California (UC), California State University (CSU), and California Community College (CCC) systems

<sup>1</sup> Cooper, Rachel. 2013. E Source Market Research: Government and Public Administration Sector Profile and Survey.



### Table 4.1 Customers by the Numbers<sup>a</sup>

Source: PG&E program and customer data.

	2011-2015 Average	Trend <sup>b</sup>	2015 Total
<b>Customer Counts (Number of customers)<sup>c</sup></b>			
Electric	75,786		76,751
Gas	17,204		17,042
<b>Total</b>	<b>88,628</b>		<b>89,394</b>
<b>Annual Sales (GWh, MM Therms)</b>			
Electric	6,502.7		6,357.8
Gas	436.0		441.1
<b>Energy Savings (GWh, MW, MM Therms)</b>			
Electric	103		75.5
Demand	14		7.8
Gas	3.6		2.0
<b>Program Participation (% of total)</b>			
Electric	3.3%		2.5%
Demand	2.4%		1.7%
Gas	9.1%		6.7%
<b>Segment Program Participation (% of segment)</b>			
<b>Electric (GWh) Savings participants</b>			
Local Government	2.4%		2.0%
Federal Government	2.3%		1.6%
State Government	0.5%		0.4%
Wastewater & Treatment	2.0%		0.8%
K-12 Schools	11.8%		8.0%
Higher Education	9.9%		7.8%
Other Education <sup>d</sup>	2.4%		1.2%
<b>Gas (Therms) Savings participants</b>			
Local Government	7.6%		6.1%
Federal Government	4.7%		2.8%
State Government	3.8%		4.1%
Wastewater & Treatment	13.2%		3.6%
K-12 Schools	14.5%		10.3%
Higher Education	9.8%		6.5%
Other Education <sup>d</sup>	3.6%		2.1%

<sup>a</sup> Though not a stand-alone segment, wastewater facility data is split from local government, as the energy use profile of these customers will differ greatly from the typical administrative office found in local government facilities, necessitating a different approach.

<sup>b</sup> Sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively.

<sup>c</sup> Customer count by unique combination of Account ID and Premise ID.

<sup>d</sup> Other Education is a broad category which includes schools for technical and trade, cosmetology, fine art, and language; and training facilities for management, driver education, flight, sports training, exam preparation.

## PUBLIC SECTOR AND THE CALIFORNIA ENERGY EFFICIENCY STRATEGIC PLAN

The California Energy Efficiency Strategic Plan defines a vision for Local Governments rather than the Public sector as a whole.

**CEESP Vision:** By 2020, California’s local governments will be leaders in using energy efficiency to reduce energy use and global warming emissions both in their own facilities and throughout their communities.

The Strategic Plan identifies three strategies to achieve this vision. These are linked to PG&E’s Intervention Strategies below:

**Tap Local Government Authority:** Technical Assistance and Tools supports reach codes at the local government level, pushing communities further in energy efficiency.

**Lead by Example:** Strategic Partnerships and Outreach and Education both highlight local government activity in energy efficiency, positioning local governments as models for their local communities.

**Community Leadership:** Data Analytics, Data Access and Financial Solutions allow local governments to identify energy efficiency opportunities and find the financial resources to push those opportunities forward.

Despite its diversity, all of these public sector segments can be characterized by:

- Providing basic governmental services;
- Having formal policy drivers that prioritize energy investments;
- Experiencing complex decision-making processes;
- Being bound by multiple bureaucratic hierarchies; and
- Commitment to serving the common good.<sup>2</sup>

Despite their commonalities, public sector segments are diverse in structure and organization. Each segment has a distinct management structure, varied building profiles, and inconsistencies in available resources (e.g., project planning and management support). These differences inform PG&E’s approach to serving the public sector.

PG&E also acknowledges the importance of ensuring program cost effectiveness, which requires prioritizing persistent, long-term savings and market transformation over short-term savings. For example, while local government buildings account for the majority of public sector energy consumption, only 6% of meters currently register participation in an energy efficiency program. Driving increased participation among the remaining 94% constitutes a major goal of this business plan and represents an opportunity to achieve long-term savings.

### The Public sector has three goals with the primary goal being to save energy:

- Save 511 GWh, 72 MW, 28.8 MM therms by 2025 – while focusing on five key public sector segments, and serving rural communities. To help understand how to reach this goal, PG&E intends to track:
- Increase in customers’ ability to manage energy by helping public sector customers benchmark their buildings and obtain the energy consumption data that they need to plan projects
- Increase in operational efficiency (i.e., reduce \$/kWh and \$/therm) by targeting with data analytics, using strategic partnerships and increasing scalable programs such as loans

<sup>2</sup> “Distinctive Characteristics of Public Sector Organisations and Implications for Leadership,” Northern Leadership Academy, Julian Pratt, Diane Plamping, Pat Gordon, February 2007, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.545.123&rep=rep1&type=pdf>.

See **Table 4.2** for a goal to intervention strategy map. Greater detail on the intervention strategies supporting these goals can be found in *Section F: PG&E’s Approach to Achieving Goals*.

Detail on the Metrics supporting these goals can be found in *Section M: Metrics and EM&V Considerations*.

**Table 4.2**  
Goal to Intervention Strategy Map

Goal	Strategic Partnerships	Data Access	Data Analytics	Technical Assistance and Tools	Loans, Rebates, and Incentives	Education and Outreach
Save energy and reduce demand	X	X	X	X	X	X
Increase customers’ ability to manage energy	X	X	X	X	X	X
Increase operational efficiency (i.e., reduce \$/kWh)	X	X	X	X		

## B. PG&E’s Public Sector Proposal Compared to Prior Program Cycles

While the public sector constitutes a relatively new concept relative to how program administrators have traditionally organized energy efficiency portfolios, PG&E has a long history of serving public sector customers through various partnerships (e.g., local government partnerships, University of California and California State Universities, and the State of California), third-party programs (e.g., K-12 schools), and self-directed options of which federal government customers typically avail themselves (e.g., statewide custom and deemed offerings). Institutionalizing the public sector in the energy efficiency portfolio creates an opportunity to work with all of these segments holistically.

To meet the goals defined in its vision, PG&E has identified the following intervention strategies that build upon and strengthen PG&E’s existing partnerships with public sector customers. These strategies promote investment in energy efficiency through comprehensive resource support and internal capacity-building, while also encouraging

the development of ideal conditions that make energy efficiency possible. Each strategy is briefly explained in the context of PG&E’s existing offerings, with additional focus on where they depart from past practice. Further details can be found in *Section F: PG&E’s Approach to Achieving Goals*.

- **Strategic partnerships:** PG&E’s local government partnerships (LGPs) and institutional partnerships (IPs) comprise its primary channel for serving public sector customers. PG&E will reinforce these partnerships and expand their benefits to further engage public customers by promoting the value of energy efficiency, sharing tailored solutions for customers’ needs, and leveraging cross-agency resources to maximize impact. For additional information specific to LGPs, see *Appendix D: Local Government Partnerships Overview*. Notable differences from past program cycles include:
  - Partnering with select statewide agencies to better align energy efficiency offerings with grant or permit approval guidelines

- Renewing collaboration among investor-owned utilities (IOUs) to ensure statewide consistency across LGP and IPs (See *Appendix D: Local Government Statewide Consistency* for further detail.)
- **Data access:** Accurate and timely data access is a prerequisite for customers seeking to implement energy efficiency projects, particularly public sector customers facing unique decision-making challenges and regulatory timelines. In the past, PG&E has faced challenges working with local and state governments, community colleges and other public sector customers to ensure access to energy usage data for their specific needs. Improving customer data accessibility is a key component of PG&E's long-term public sector strategy. Changes from past practice include, but are not limited to:
  - Working with stakeholders and the CPUC to improve data access protocols
  - Promoting accessible data platforms that improve public customers' understanding of usage, savings, and potential
  - Facilitating solutions for public sector customers with campus-style portfolios to easily view and manage their usage data
- **Data analytics:** Advanced Metering Infrastructure (AMI) data presents an opportunity for strategically targeting high-opportunity projects and providing targeted value propositions on energy efficiency opportunities in the public sector. Exploring opportunities for implementers to target public sector customers with AMI data will be a major component of PG&E's future strategy.
- **Technical assistance and tools:** Technical assistance and tools have been a key component of PG&E's public sector programs. New and modified technical assistance and tools to better serve the public sector include:
  - A Job-Order Contracting (JOC) initiative to address the public sector's procurement challenges
  - Extended Regional Direct-Install (DI) to serve small and medium public sector facilities, with expanded offerings to create a more comprehensive mix of measures
  - Extended energy audit offerings that identify projects integrating behavioral and operational opportunities
- Expanded work with fellowship programs (e.g., Civic Spark, Environmental Defense Fund (EDF) Climate Corps) to build long-term internal organizational capacity in energy efficiency
- **Loans, Rebates and Incentives:** Rebates, incentives and loans are an important part of offsetting upfront customer costs and payback requirements. Offerings such as On-Bill Financing (OBF) have been central to providing the resources necessary to complete energy efficiency projects in the face of constrained public sector resources. However, many public sector projects involve multiple buildings, and OBF loan caps have presented a barrier to completing these large scale projects. Changes from past practice in this proposal include:
  - Transitioning from deemed and calculated incentives to meter-based savings and/or pay for performance models, as appropriate
  - Evaluating the eligibility criteria of OBF to encourage more comprehensive projects
  - Offering tailored finance bundles, moving away from traditional incentive models, and towards loans as the primary means to finance projects
- **Outreach and education to drive energy efficiency projects:** PG&E has worked with many local partners in the past to co-brand outreach and educational materials. Continuing and expanding those initiatives can further engagement within communities outside of traditional partnerships. Changes from past practice involve:
  - Ongoing collaboration with the Statewide Local Government Energy Efficiency Best Practices Coordinator (the Statewide Best Practices Coordinator)
  - Encouraging community participation in demand-side management (DSM) activities by co-branding outreach

These intervention strategies will be deployed in three stages, over the short, mid and long-term.

Below is a brief outline of key time horizons<sup>3</sup>:

- **In the short-term (1-3 years)** PG&E will continue and expand existing public sector programs, such as fellowship programs like CivicSpark and EDF Climate Corps, the role of the Statewide Best Practices Coordinator,<sup>4</sup> and existing project development offerings. Process improvement opportunities, such as data access protocols and benchmarking services, are other short-term opportunities. Outreach and education efforts are also short-term opportunities for improvement, especially helping local governments and other public sector partners work with residential and commercial customers in their local communities.
- **In the mid-term (4-7 years)** PG&E will continue to integrate changes into existing partnerships, and establish new ones. Data offerings, and energy efficiency project review timelines will better align with customer timelines and better meet customer needs. PG&E will work to meet the specific needs of each segment through a range of offerings, from turnkey direct install offerings to comprehensive, long-term project design planning, to meter-based savings approaches and pay-for-performance models.
- **In the long-term (8-10 years)** Public sector customers will interact seamlessly with PG&E's energy efficiency offerings. Data that identifies energy efficiency opportunities and quantifies energy savings will be easily available. Higher education and K-12 schools will have a broad base of information from Proposition 39 (Prop 39) pilots to scale Zero Net Energy (ZNE) across the service territory. All public sector customers will

have access to a range of offerings to support a transition to ZNE. PG&E will continue to support advanced energy management technologies, meter-based savings, pay-for-performance, and other models to advance progress towards doubling energy efficiency savings by 2030.

## Key Learnings from Recent EM&V Reports of California's Public Sector Energy Efficiency Programs

Since the public sector was originally characterized as a part of the commercial and industrial sector, no evaluation studies or recommendations exist for this sector as a whole. However, evaluations do exist for LGPs and Institutional Partnerships. Since their inception in the 2004-2005 program cycle, LGPs have aimed to generate energy and demand savings in new and existing municipal facilities, support municipal actions that meet the California Long Term Energy Efficiency Strategic Plan (CEESP) objectives, and provide demand-side management outreach and program implementation in their communities.<sup>5</sup> This discussion is based on separate EM&V studies for LGPs<sup>6</sup> and Institutional<sup>7</sup> Partners within the public sector.

<sup>3</sup> Email communication from Administrative Law Judge Julie Fitch, on November 15, 2016 clarified program administrators' Business Plan timeline. "Because D.14-10-046 only authorizes funding through the end of 2025, it is my expectation that this would be the timeframe for the Business Plans as well, covering calendar years 2018-2025." However, PG&E has built its Business Plan around a ten-year vision, and has identified short (1-3 years), medium (4-7 years) and long-term (8-10 years) time periods used to indicate when strategies and tactics will be deployed, and targets will be met. PG&E believes this structure is in line with the intent of the rolling portfolio concept.

<sup>4</sup> The Statewide Best Practices Coordinator position was created by the CPUC D.08-07-021 and the position is jointly funded by the four California IOUs. The Statewide Best Practices Coordinator is tasked with developing EE best practice case studies, sharing resources to promote best practice adoption among LGs and track progress towards the LG chapter of the California Long-term Energy Efficiency Strategic Plan.

<sup>5</sup> R.09-11-014. Energy Efficiency Policy Manual V5. July 2013. [http://www.cpuc.ca.gov/NR/rdonlyres/7E3A4773-6D35-4D21-A7A2-9895C1E04A01/0/energy efficiencyPolicyManualV5forPDF.pdf](http://www.cpuc.ca.gov/NR/rdonlyres/7E3A4773-6D35-4D21-A7A2-9895C1E04A01/0/energy%20efficiencyPolicyManualV5forPDF.pdf), Page 7.

<sup>6</sup> PA Consulting Group, Pacific Gas and Electric Company (PG&E), Summary Report: Process Evaluation of the 2006-2008 Statewide Partnership Programs, July 31, 2009.

<sup>7</sup> Navigant Consulting, for The California Public Utilities Commission, California Investor-Owned Utilities, and Itron, Program Assessments Study: Statewide Institutional IOU Energy Efficiency Partnership Programs – W0012, Draft Report, October 9, 2012.

Below are key learnings from recent EM&V studies that provide and understanding of public customers.

- **Statewide IPs are fairly unique in that they manage large and diverse portfolios of buildings and are usually mandated to provide services that require various long-term planning efforts.**<sup>8</sup> Planning activities that could benefit from alignment with EE incentive funding include system-wide and campus-level master plans and unique initiatives, such as the Governor’s Green Building initiative that requires specific EE actions by 2018.
- **The misalignment between program funding cycles and project timelines has been problematic for IPs.** IPs have operated on a schedule where projects receiving incentives need to be completed by the end of the program funding cycle in order to receive full payment.<sup>9</sup>
- **More complex projects with design, build, and verification requirements that are more rigorous than the simpler types such as lighting retrofits are riskier.**<sup>10</sup> As project complexity increases, there is a growing risk that these projects will not be completed within a strictly defined portfolio cycle.
- **LGPs are diverse, making it difficult to evaluate one against the other.** Diversity includes type (one city, multiple cities, county, regional), longevity (new or longer-established), setting (urban or rural), program element (resource, non-resource), and number of IOU partners (one, two, or three IOU partners).<sup>11</sup> The diversity creates challenges in comparing and sharing results, and creates the need to evaluate each LGP against their own goals.

- **Project completion by LGPs can be supported through improved communication.**<sup>12</sup> The technical assistance provided by IOUs is helpful in mitigating barriers.<sup>13</sup> Assistance needs to also include clear guidance and information on the funding process and data requirements.<sup>14</sup>
- **Financial barriers to completing projects can be addressed with financing options.**<sup>15</sup> IOUs can facilitate the use of instruments such as OBF by educating local governments in their workings and by supporting local governments in presenting financing options to decision makers.

To achieve its vision, PG&E anticipates meeting the following energy savings goals for the following investment, as shown in *Sections C* and *D*.

## C. Goals, Budget and Cost-Effectiveness

As Business Plans were envisioned as “a comprehensive vision outlining long-term strategic initiatives and intervention strategies,”<sup>16</sup> PG&E provides energy and demand savings goals, budgets, and cost-effectiveness forecasts that represent its best estimates to realize its portfolio vision, while retaining flexibility to accommodate potential market or regulatory changes. Each year, PG&E will file a Tier 2 advice letter (AL) that provides detailed goals, budgets and cost-effectiveness for the Commission’s review and approval.<sup>17</sup>

<sup>8</sup> Navigant Consulting, for The California Public Utilities Commission, California Investor-Owned Utilities, and Itron, Program Assessments Study: Statewide Institutional IOU Energy Efficiency Partnership Programs – W0012, Draft Report, October 9, 2012.

<sup>9</sup> Navigant Consulting, for The California Public Utilities Commission, California Investor-Owned Utilities, and Itron, Program Assessments Study: Statewide Institutional IOU Energy Efficiency Partnership Programs – W0012, Draft Report, October 9, 2012., p. 7-1.

<sup>10</sup> Navigant Consulting, for The California Public Utilities Commission, California Investor-Owned Utilities, and Itron, Program Assessments Study: Statewide Institutional IOU Energy Efficiency Partnership Programs – W0012, Draft Report, October 9, 2012., p. 7-1.

<sup>11</sup> Evergreen Economics and Navigant Consulting, Program Assessment Study: Local Government Partnership Programs – Final Report, for Itron, the California Public Utilities Commission and the California Investor-Owned Utilities, July 26, 2013, p. 18.

<sup>12</sup> Opinion Dynamics Corporation for the California Public Utilities Commission, PY 2013-14 Local Government Partnerships, Value and Effectiveness Study Final Report, January 29, 2016, pp. 2-4.

<sup>13</sup> Research Into Action for the California Public Utilities with Oversight by the California Public Utilities Commission, Draft Report, Targeted Process Evaluation of the Local Government Partnership Program, September 30, 2016, pp. I-VII.

<sup>14</sup> Research Into Action for the California Public Utilities with Oversight by the California Public Utilities Commission, Draft Report, Targeted Process Evaluation of the Local Government Partnership Program, September 30, 2016, pp. I-VII.

<sup>15</sup> Research Into Action for the California Public Utilities with Oversight by the California Public Utilities Commission, Draft Report, Targeted Process Evaluation of the Local Government Partnership Program, September 30, 2016, pp. I-VII.

<sup>16</sup> D.15-10-028 p.48.

<sup>17</sup> D.15-10-028 OP 4.

## Annual Net Market Potential

PG&E's primary goal is to save energy. PG&E has used the energy and demand savings targets provided in the "Energy Efficiency Potential and Goals Study for 2015 and Beyond," approved in D.15-10-028, as the foundation for its projected energy savings goals for 2018-2025. Energy and demand savings goals are shown as net annual goals, per D.16-08-019. **Table 4.3** shows energy savings goals by sector.

**Table 4.3**  
Public Sector Annual Net Market Potential

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
<b>GWh</b>	28	29	27	28	29	29	29	30	30	30
<b>MW</b>	2.6	2.8	2.8	3.0	3.3	3.9	4.4	4.9	5.2	5.2
<b>MM therms</b>	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6

PG&E's net annual energy and demand savings goals are directional in nature, and meant to reflect our best estimates of energy and demand savings potential, based on the 2015 Potential Study. As the 2015 Potential Study does not include Public sector goals, PG&E requests flexibility to adjust savings as more information is learned, and to accommodate potential market or regulatory changes. PG&E will file an annual Tier 2 AL that provides detailed sector-level energy and demand goals.

PG&E recognizes energy and demand savings goals will be updated to meet the SB 350 energy efficiency targets set by the Energy Commission no later than November 1, 2017,<sup>18</sup> and the net goals framework adopted in D.16-08-019.<sup>19</sup> PG&E will update its energy savings forecasts once the Commission approves new energy and demand savings targets.

## Sector Budget

PG&E's Business Plan budget provides general information on the expected levels of annual spending for 2018-2025, along with 2016 and 2017 approved budgets for reference. As provided in D.15-10-028, PG&E's Business Plan budget represents its best estimates of spending for the life of the Business Plan.<sup>20</sup> See **Table 4.4**. The intent is to allow program administrators flexibility to adjust spending during the life of the Business Plan.<sup>21</sup> Note that PG&E's current public sector budget estimates represent energy efficiency activities that occur through its LGPs and Institutional Partnerships. In future, the budget will activities directed toward K-12 and federal customers, which were previously captured in PG&E's commercial sector. As the public sector is new, this budget reflects PG&E's best estimates. PG&E will file Tier 2 AL annually, containing a detailed budget for the next calendar year's energy efficiency portfolio.<sup>22</sup> The Tier 2 AL budgets will include detailed budgets for cost recovery, transfer, and contracting purposes.<sup>23</sup>

<sup>18</sup> SB 350 requires the Energy Commission to develop and establish statewide targets that lead to a cumulative doubling of energy efficiency savings from all retail electric and natural gas end-users by 2030. <http://www.energy.ca.gov/sb350/timeline.pdf>.

<sup>19</sup> "Commission staff should work with its consultants to prepare a net goals framework in time for the start of 2018, if not sooner." D.16-08-019 p.20.

<sup>20</sup> D.15-10-028 "It [the budget] will establish a "ballpark" figure for spending for the life of the business plan." p. 55.

<sup>21</sup> D.15-10-028 p.56.

<sup>22</sup> D.15-10-028 OP 4.

<sup>23</sup> D.15-10-028 p.56.

## Table 4.4

### PG&E Public Sector Budget Summary

Cost Category	2016	2017	2018	2019	2020-2025 Annual Budget <sup>a</sup>
<b>Administration</b>	\$12,628,378	\$9,235,712	\$8,039,984	\$6,844,256	\$6,108,761
<b>Marketing</b>	\$5,767,586	\$2,155,604	\$1,739,416	\$1,623,227	\$1,507,039
<b>Implementation</b>	\$26,190,458	\$35,378,807	\$35,112,764	\$34,846,721	\$34,580,678
<b>Incentive</b>	\$27,735,492	\$28,515,776	\$27,615,776	\$27,615,776	\$27,615,776
<b>Total</b>	<b>\$72,321,914</b>	<b>\$75,285,899</b>	<b>\$72,507,940</b>	<b>\$70,929,980</b>	<b>\$69,812,255</b>

<sup>a</sup> The Annual Budget from 2020 through 2025 will remain the same.

For more discussion on PG&E portfolio and sector-level budgets, please see the *Portfolio Overview* chapter.

### Cost-Effectiveness

PG&E presents its sector-level cost-effectiveness for its 2018-2025 Business Plan. See **Table 4.5** for public projected cost-effectiveness results 2018-2020, **Table 4.6** for public projected net annual savings impact from cost-effectiveness scenario 2018-2020, and **Table 4.7** for public projected emissions reductions from cost-effectiveness scenario 2018-2020.

### Table 4.5 Public Cost-Effectiveness Results

	Result
<b>TRC</b>	.84
<b>PAC</b>	.94

Note: Does not include Market Effects

### Table 4.6

#### Public Projected Net Annual Savings Impact from Cost-Effectiveness Scenario 2018-2020

	PG&E Target	PGS Goal
<b>Energy Savings (Net GWh/yr)</b>	76.45	29
<b>Demand Reduction (Net MW)</b>	11.19	3.30
<b>Gas Savings (Net MMTh/yr)</b>	.44	.4

Note: Does not include Market Effects

### Table 4.7

#### Public Emission Reductions

	Reduction
<b>Annual tons of CO<sub>2</sub> avoided</b>	20,719
<b>Lifecycle tons of CO<sub>2</sub> avoided</b>	281,342
<b>Annual tons of NO<sub>x</sub> avoided</b>	23,889
<b>Lifecycle tons of NO<sub>x</sub> avoided</b>	342,827
<b>Annual tons of SO<sub>x</sub> avoided</b>	—
<b>Lifecycle tons of SO<sub>x</sub> avoided</b>	—
<b>Annual tons of PM<sub>10</sub> avoided</b>	8,926
<b>Lifecycle tons of PM<sub>10</sub> avoided</b>	103,561





## LOCAL GOVERNMENTS AT A GLANCE

Local governments are 60% of PG&E's public customers and consume 40% of the energy in the public sector. PG&E's service territory includes more than 1,800 local government customers across 49 counties and 242 cities.

LGPs are the primary delivery channel supporting cities, counties, and other local governments seeking energy savings and greenhouse gas emission reductions on the community-scale. LGPs build on the unique role of local governments to achieve deeper energy savings in municipal facilities and community-wide.

For more information, see *Appendix D: Local Government Partnerships Overview*.

PG&E conducted a cost-effectiveness analysis of its proposed portfolio in compliance with D.15-10-028, and with the California Standard Practice Manual.<sup>24</sup> PG&E used the 2017 updated avoided costs and cost-effectiveness inputs approved in Resolution E-4801.

PG&E's cost effectiveness calculation represents the near-term years of its Business Plans (2018-2020), and is directional in nature. Meaning, PG&E will strive to meet the cost-effectiveness projections set forth for the sector. However, PG&E requests flexibility to accommodate potential market or regulatory changes. Through the annual Tier 2 ALs, PG&E will provide the Commission updated cost-effectiveness forecasts for each year of Business Plan implementation.

Through implementation of its Business Plan, PG&E seeks to make significant impact in reducing energy waste cost-effectively and maximizing the value of energy efficiency for customers, the grid, and the state. To do that, PG&E recognizes the need to take "a more integrated, cost-effective approach"<sup>25</sup> to scale energy savings. For more discussion on PG&E's key strategies to scale energy efficiency and continue to deliver cost-effective energy efficiency portfolios, please see the *Portfolio Overview* chapter.

<sup>24</sup> California Standard Practice Manual: Economic Analysis of Demand Side Management Programs and Projects, 2002. [http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf).

<sup>25</sup> Mitchell, Cynthia 2014. "A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach." p. 1, TURN May 15, 2015 iDSM comments in R.14-10-003, page 9.

## D. Sector Overview

The public sector is diverse, encompassing rural school districts and statewide university systems, federal military bases and major cities.

Resources and expertise available within each of the segments identified vary considerably. In higher education, the University of California (UC) places a dedicated energy manager on each campus and has a comprehensive system-wide set of energy efficiency resources available, while the California State University (CSU) system has fewer system-wide resources and on-campus expertise varies from campus to campus.

Priorities also vary within segments. For example, while state government buildings are mandated to achieve certain energy efficiency targets, many local governments place a lower priority on energy efficiency.

All of these factors add to the complexity of serving public sector customers.

## Target Audience

Public sector customers are diverse and demand a comprehensive suite of interventions to drive energy efficiency. For example, a local government with a small administrative building has a different usage profile than a university campus with several research and development labs. Segmenting the public sector is also challenging because it has historically been embedded within the commercial and industrial sectors, making it difficult to identify trends impacting public customers in particular.<sup>26</sup>

PG&E characterizes its public sector customers in terms of segment, size (and past participation) and geography.

**Segment Overview:** Segments included within the public sector consist of local governments, state governments, federal governments, K-12 schools, higher education and other education.<sup>27</sup>

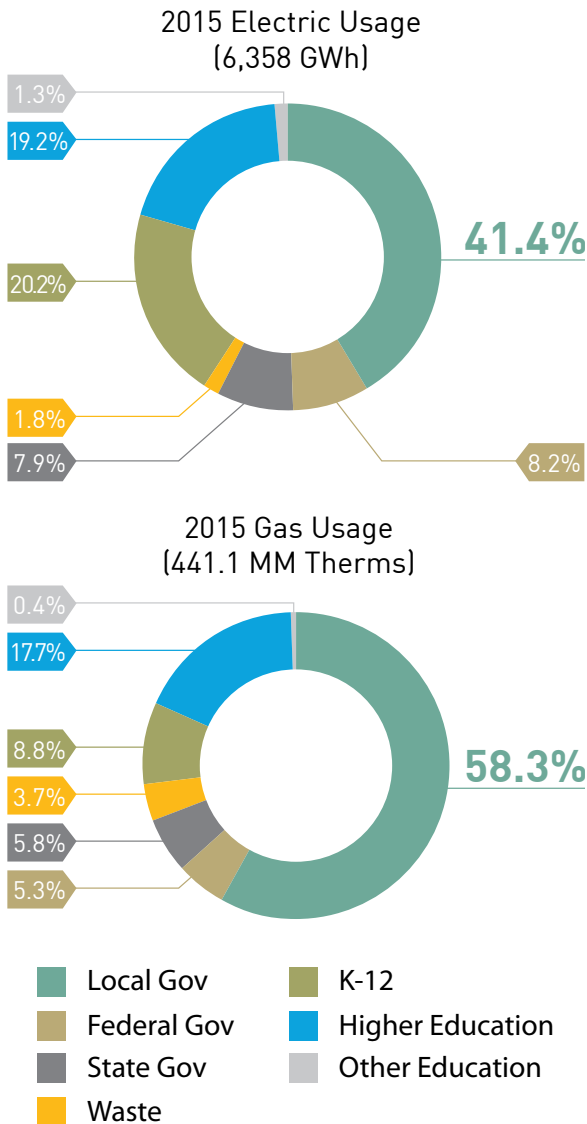
The largest consumers of electricity in the public sector are local governments (42%), K-12 schools (21%) and higher education (20%). The largest consumers of gas are local governments (61%), higher education (18%) and K-12 schools (9%). Wastewater (1.8% of usage) and Other Ed (1.3% of usage) account for the smallest users. Energy usage and savings for each segment are identified in greater detail in *Appendix C: Customer Data*. **Figure 4.1** shows 2015 energy usage by customer segment.

<sup>26</sup> The 2016 California State Building Decision Maker Study is an ongoing effort initiated by the California Public Utilities Commission that aims to profile energy usage and performance of state buildings to identify candidates for ZNE retrofits. For more information, see "PY 2016 California ZNE State Buildings Decision Maker Study, Draft Work Plan, February 29, 2016.

<sup>27</sup> Other education is a broad category which includes schools for technical and trade, cosmetology, fine art, and language, as well as training facilities for management, driver education, flight, sports training, and exam preparation.

## Figure 4.1 2015 Energy Usage by Public Customer Segment<sup>a</sup>

Source: PG&E Customer Usage Data.



<sup>a</sup> Though not a stand-alone segment, wastewater facility data is split from local government as the energy use profile of these customers will differ greatly from the typical administrative office found in local government facilities, necessitating a different approach.

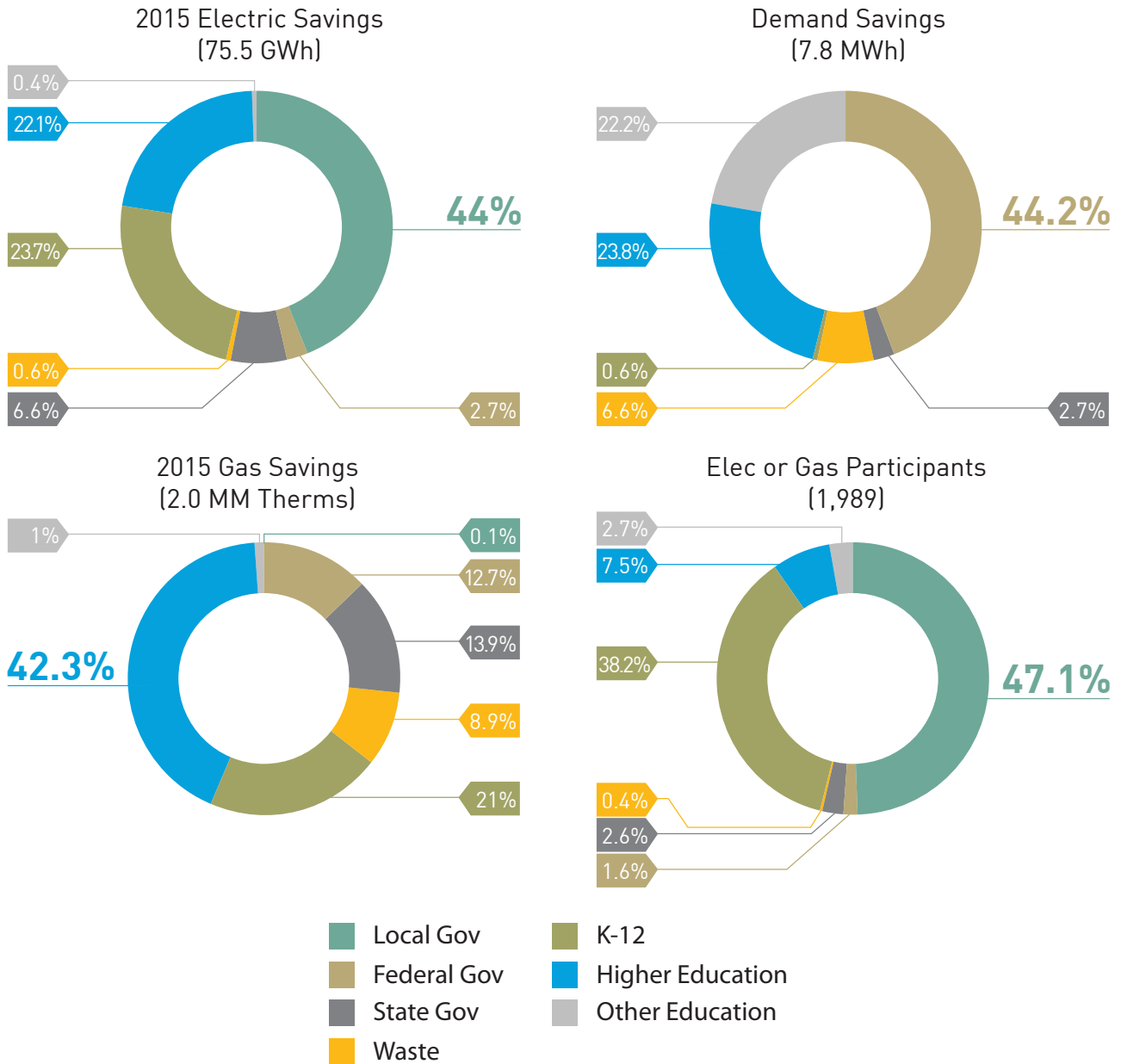
PG&E defines customer size based on energy usage. Defining customers based on energy usage enables PG&E to tailor solutions based on a customer's resources and needs.

While the data shows that large customers' accounts (> 500,000 KWh or 250,000 Therms) comprise nearly 90% of the participants in public sector energy efficiency programs and account for more than 95% of the sector's electric and gas savings, it is important to note that data at the "account" level represents multiple meters and premises. The data suggests that campus-style accounts are common in the public sector. **Figure 4.2** shows 2015 customer savings and participation by sector. **Figure 4.3** shows 2015 customer participation and savings by customer size.

**Figure 4.2**

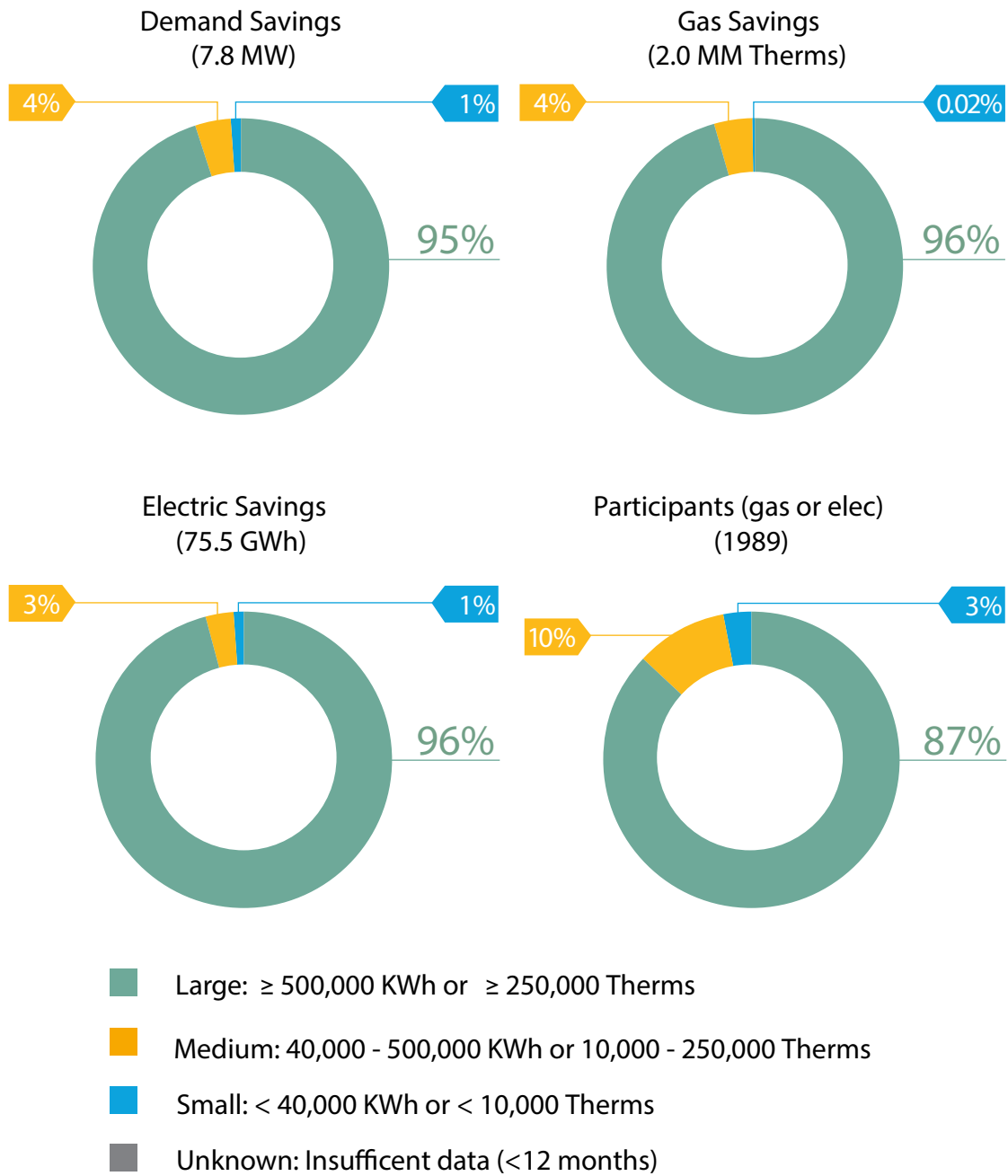
Public Sector 2015 Energy Efficiency Program Participation and Savings by Segment

Source: PG&E program and customer data.



**Figure 4.3**

Public Sector 2015 Energy Efficiency Program Participation and Savings by Size



## PROPOSITION 39

In 2012, the California Clean Energy Jobs Act (Prop 39) changed the corporate income tax code and allocates projected revenue to California's General Fund and the Clean Energy Job Creation Fund. Up to \$550 million annually is available for appropriation by the Legislature for eligible projects to improve energy efficiency and expand clean energy generation in educational agencies. Eligible local educational agencies include county offices of education, school districts, charter schools and state special schools.

The IOUs launched a "Prop 39 ZNE Schools Pilot" to assist schools in retrofitting existing facilities to ZNE by leveraging Prop 39 funding. The Pilot will establish "proof of concept" that ZNE retrofits of schools is feasible across California. PG&E is moving forward with seven pilot projects across its service territory. Additionally, PG&E and other IOUs will disseminate learnings, processes and materials germane to ZNE to the many stakeholders in the California schools community. These efforts would involve training classes and webinars, publications, design guides and recognition events.

The pilots will examine the feasibility of a larger-scale program for future years, addressing ZNE needs in schools.

## Snapshot of Usage

**Table 4.8** and **Table 4.9** examine public electricity and gas customers in 2015 by size, usage, number of customers and average usage. Data at the "customer account" level often captures numerous smaller facilities and can mask the true profile of these customer portfolios. Many local government accounts contain multiple small premises with energy efficiency opportunities of their own.

**Table 4.8**  
2015 Electric Usage and Savings by Size

	Customer By Size <sup>a</sup>				Total	Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>
<b>Whole Sector</b>									
Electricity Usage (GWh)	6,101	216	40	(0.2)	6,358	96%	3%	1%	100%
Usage Trends (2011-2015) <sup>e</sup>									
Customers (Number of customers)	64,383	6,251	6,001	116	76,751	84%	8%	8%	100%
Customer trends (2011-2015)									
Average Usage (kWh per customer)	94,765	34,625	6,722	(1,778)	82,837				
Usage Rate Trends (2011-2015)									
Electricity Savings (MWh)	72,695	2,430	302	23	75,450	96%	3%	0.4%	100%
Savings Trends (2011-2015)									
Participants (Number of Participants)	1,648	181	55	3	1,887	87%	10%	3%	100%
Participant (2011-2015)									
Average Savings (kWh per Participant)	44,111	13,425	5,496	7,600	39,984				
Savings Rate Trends (2011-2015)									
Participation Rates (% Participants per Cust.)	3%	3%	1%	3%	2%				
Participation Rate Trends (2011-2015)									

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table 4.9**  
2015 Gas Usage and Savings by Size

	Customer By Size <sup>a</sup>				Total	Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>
<b>Whole Sector</b>									
Gas Usage (MM Therms)	428	11	2	0.01	441	97%	3%	0.4%	100%
Usage Trends (2011-2015) <sup>e</sup>									
Customers (Number of customers)	11,785	2,419	2,798	40	17,042	69%	14%	16%	100%
Customer trends (2011-2015)									
Average Usage (Therms per customer)	36,345	4,581	621	127	25,886				
Usage Rate Trends (2011-2015)									
Gas Savings (Therms)	1,953,722	72,402	424	1	2,026,550	96%	4%	0.02%	100%
Savings Trends (2011-2015)									
Participants (Number of Participants)	936	152	50	1	1,139	82%	13%	4%	100%
Participant (2011-2015)									
Average Savings (Therms per Participant)	2,087	476	8	1	1,779				
Savings Rate Trends (2011-2015)									
Participation Rates (% Participants per Cust.)	8%	6%	2%	3%	7%				
Participation Rate Trends (2011-2015)									

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

With that, large local government customer accounts comprise 54% of the entire public sector, while large state government accounts represent 16% of the public sector. Only 8% of all public sector customer accounts are small, and nearly half of these accounts are segmented in “other education,” a reflection of the fact that this segment includes customers with smaller facilities, such as technical trade schools and exam preparation centers.

While higher education and federal government customers comprise less than 5% of the public sector, they used more electricity than any other segment on a kWh per customer and therms per customer basis. For example, whereas average usage across all public segments was 82,000 kWh and 25,000 therms per customer, higher education customers used more than 700,000 kWh and 56,000 therms per customer. Federal government customers used nearly 300,000 kWh and 37,000 therms per customer. These trends largely reflect the fact that higher education and federal government customers operate across larger building complexes relative to local and state governments.

Higher education customers also operate as “self-sufficient towns” with facilities such as office buildings, restaurants, retail, multi-family dwellings, sports facilities, entertainment complexes, and classrooms that supports upwards of 30,000 students.<sup>28</sup> Some of these facilities also operate beyond normal business hours, resulting in longer periods of electricity usage compared to the other segments.

### Segment Participation

**Figure 4.2** displays participation, energy savings, and demand reduction in 2015 public sector energy efficiency programs by segment. Local governments account for the majority of participants at 47%, and deliver 44% of the electric savings. While federal government customers’ participation was fairly low, at close to 2%, these customers accounted for the bulk of demand reductions at 44%. 38% of K-12 customers participated in our energy efficiency programs in 2015, and delivered close to 24% of the electric savings and 21% of the gas savings.

Prop 39 is a key driver of higher participation rates in energy efficiency programs for K-12 and California Community Colleges. Higher education customers are also more likely to participate in energy efficiency programs due to their leadership in achieving climate goals, such as the UC Carbon Neutrality Initiative, which commits UCs to net zero greenhouse gases emissions from its buildings and vehicle fleet by 2025.<sup>29</sup>

**Geography:** More than half of the 2015 participants in public sector energy efficiency programs were located in the Bay Area, with significant shares also in the Central Valley (30% electric and 25% gas) and Coastal (17% electric and 20% gas) regions. Savings achievement in 2015 largely reflect trends in energy efficiency program participation. For example, 51% of electric savings and 71% of gas savings were achieved by customers in the Bay Area.

<sup>28</sup> “Leading Techniques for Energy Savings in Colleges and Universities,” Schneider Electric, January 2007, p. 5 [http://www2.schneider-electric.com/documents/buildings/leading\\_techniques\\_for\\_energy\\_savings\\_in\\_colleges\\_and\\_universities.pdf](http://www2.schneider-electric.com/documents/buildings/leading_techniques_for_energy_savings_in_colleges_and_universities.pdf).

<sup>29</sup> <http://www.ucop.edu/initiatives/carbon-neutrality-initiative.html>.



**Figure 4.5** provides a detailed breakdown of energy efficiency program participants and savings by geographical region in 2015.

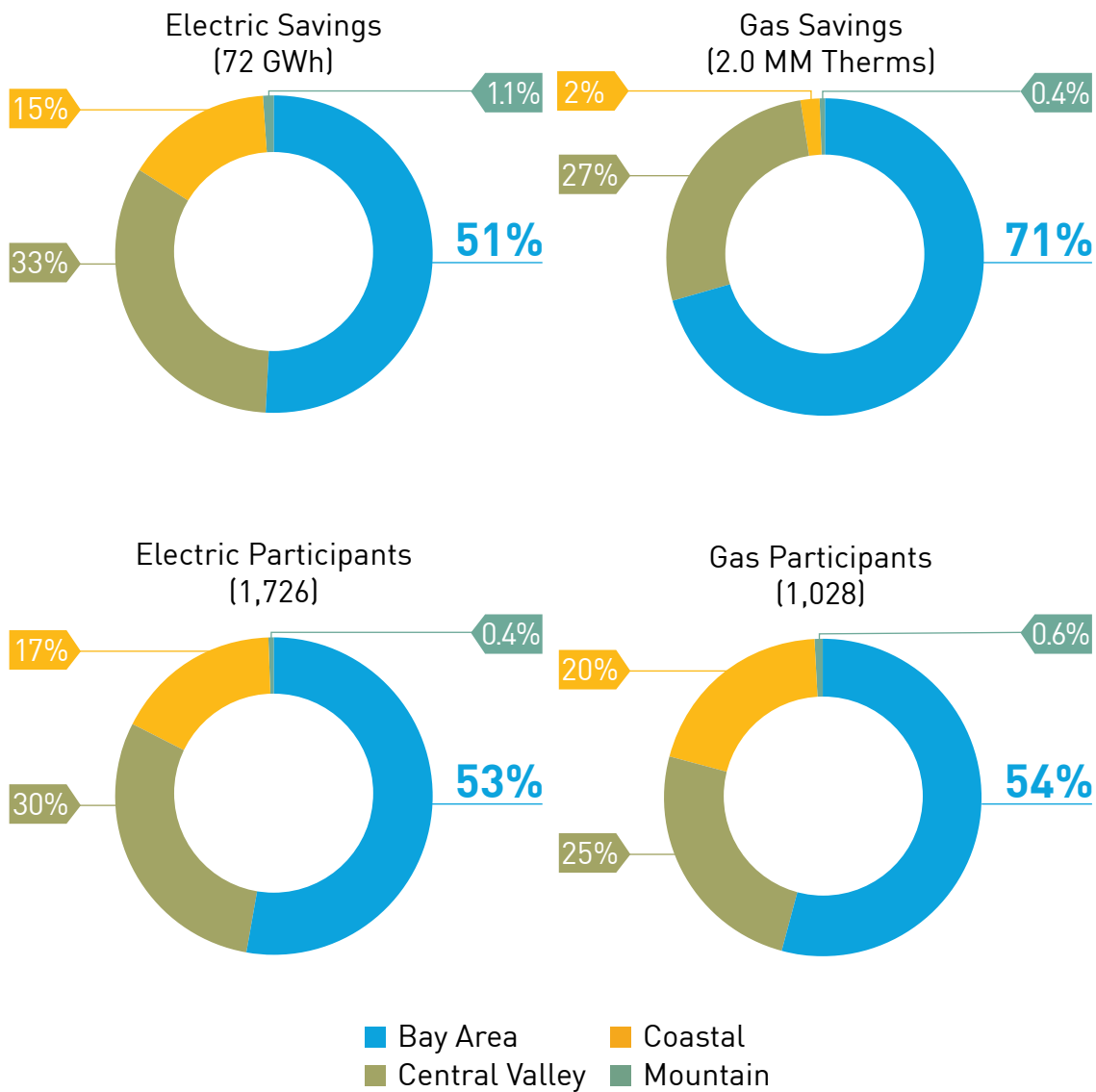
In addition to analyzing energy usage at the climate zone level, PG&E uses data analytics to identify which

counties consume and save the most energy. **Figure 4.6** provides an overview of electric and gas usage and savings in 2015 at the county level. Please see *Appendix C: Customer Data* for more detailed maps that display usage and savings by segment.

**Figure 4.5**  
Customer Savings and Program Participation by Climate Region

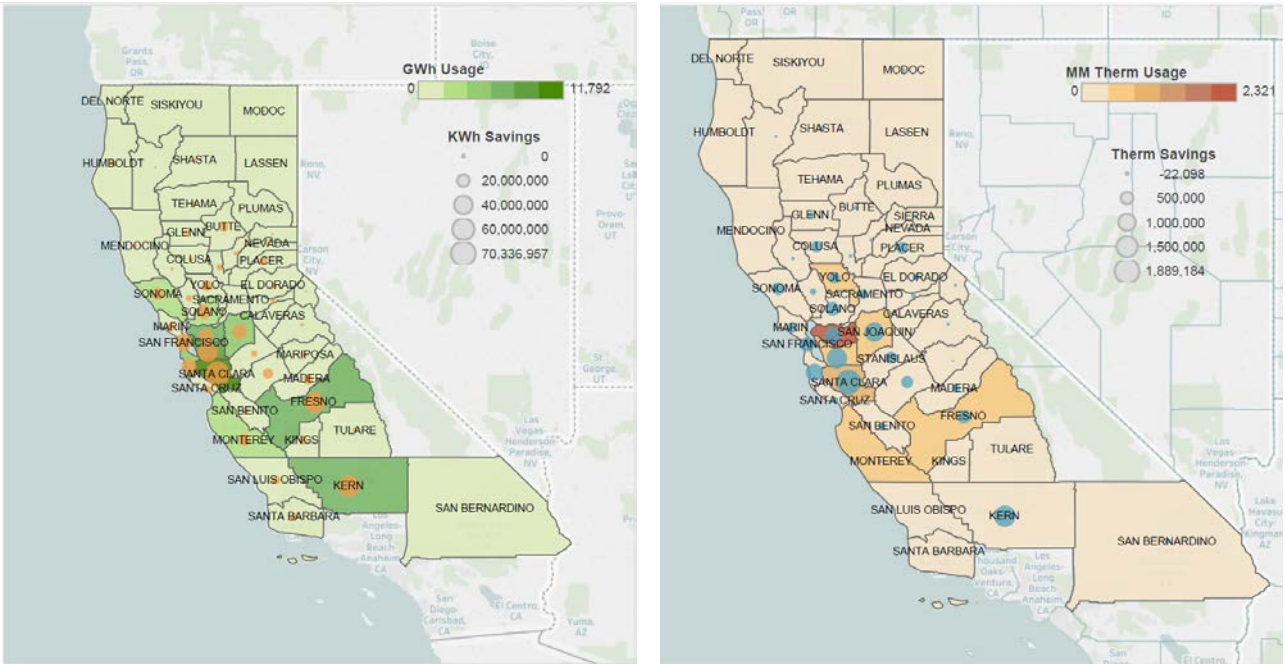
Note: Regions are aggregates of Climate Zones (Z01-Z16). There are 16 zones but not all are in PG&E's territory:

- Central Valley includes: Z11-Z13
- Coastal includes: Z01-Z06 and Z09 (excludes Bay Area Counties)
- Mountain includes Z14-Z16
- Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma



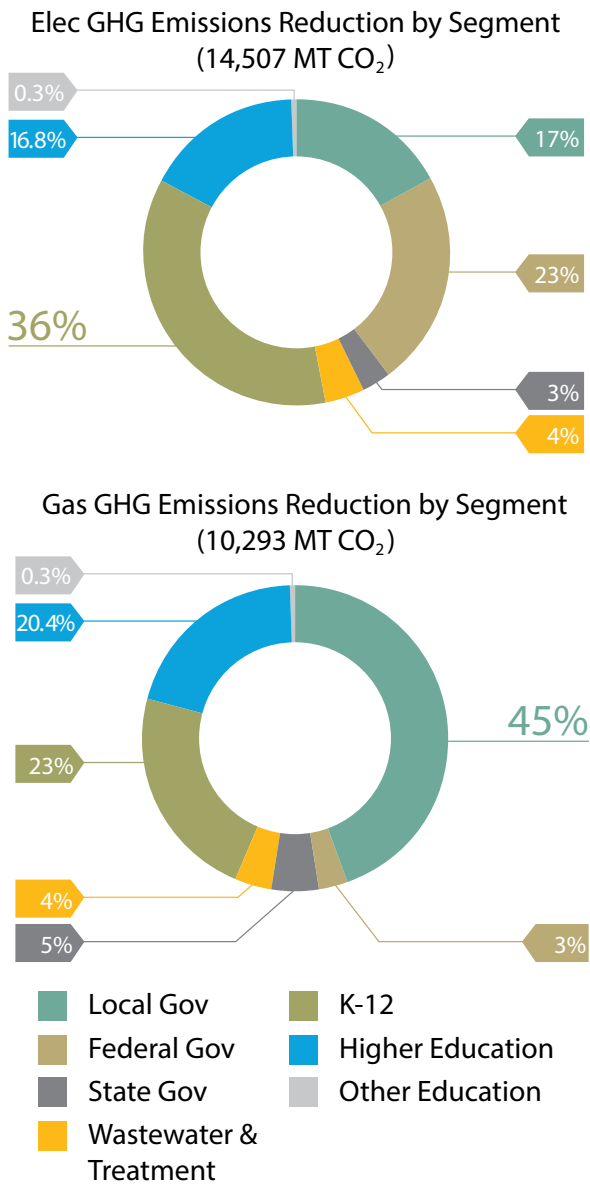
**Figure 4.6**

2015 Public Sector Energy Consumption and Savings by County



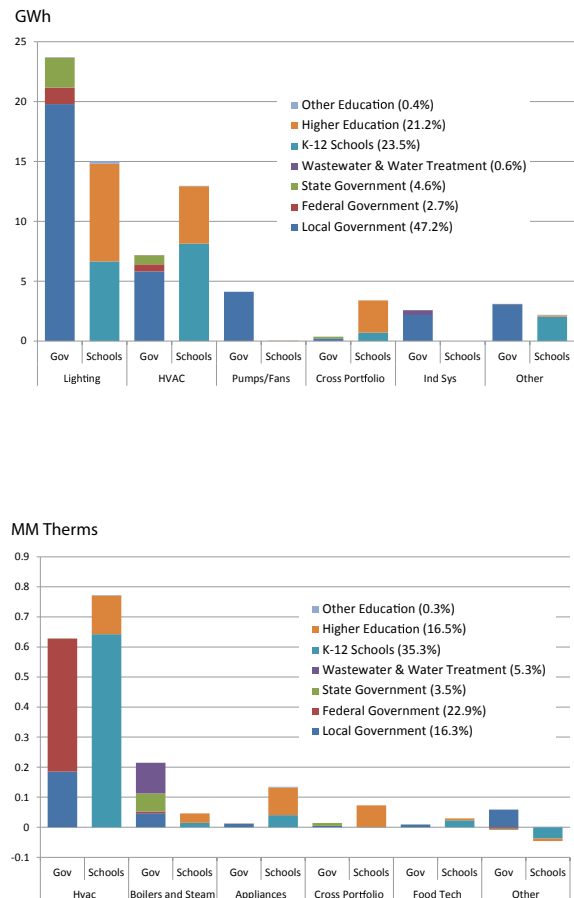
Electricity usage by county was dominated by Santa Clara, Alameda and Fresno counties in 2015. This is reflected in the level of savings for each of those counties, with Santa Clara and Alameda reflecting a higher level of energy savings. Gas usage was led by Santa Clara County, which also achieved the highest level of savings. Greenhouse gas (GHG) savings were led by local government on the electric side and K-12 schools on the gas side. **Figure 4.7** shows 2015 GHG savings by segment.

**Figure 4.7**  
2015 GHG Emissions Reductions  
by Segment



**Figure 4.8** identifies 2013-2015 energy savings by end use technology. Overall, nearly 60% of electric savings were achieved in the government segment, compared to 40% in the education segment. The end uses with the greatest electric savings during this period were lighting (50% of total electric savings) and HVAC (29% of total electric savings). Within lighting, government customers achieved more than double the electric savings compared to education customers.

**Figure 4.8**  
Public Sector Energy Savings by Segment and End Use, 2013-2015



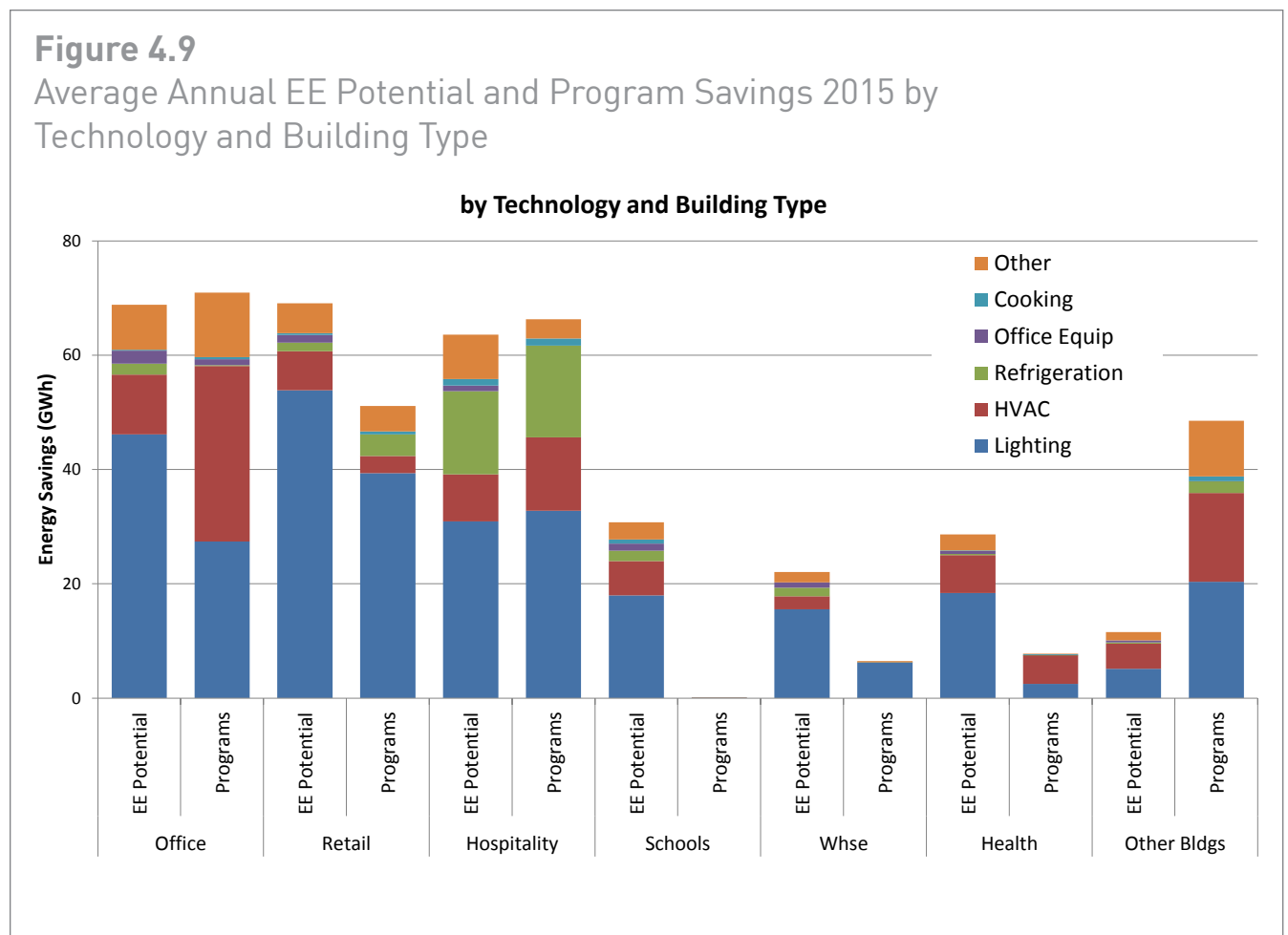
Nearly 60% of gas savings were in schools, compared to 40% in government. The end uses with the greatest savings for both segments were lighting (48%) and boilers & steam (26%). In addition, school appliances comprised more than 10% of total gas savings.

## Energy Efficiency Potential

The *Energy Efficiency Potential and Goals Study for 2015 and Beyond* study by Navigant provided data on energy efficiency market potential by utility, sector, and end-use. Because a comparable study has never been conducted for the public sector, the commercial sector's potential study serves as the best available representation of public sector market potential at this time. Offices and schools are the commercial sector segments most applicable to the public sector (see **Figure 4.9**). Once a potential study with public sector specific data is available, a more detailed analysis will be possible.

**Figure 4.9**

Average Annual EE Potential and Program Savings 2015 by Technology and Building Type



## E. Public Market Trends and Challenges

PG&E's public sector Business Plan is shaped by a number of market trends and challenges, as discussed below.

### Local Government

- Mayors believe energy efficiency plays a leading role in saving taxpayer money, reducing emissions, and developing their economies. Three in ten mayors surveyed at the 2014 U.S. Conference of Mayors identified light emitting diodes (LEDs) and other energy-efficient lighting measures as the energy technology receiving top priority within the next two years.<sup>30</sup> 86% recognized retrofitting city-owned buildings as the top priority for improving the efficiency of buildings in their cities.
- Local governments believe implementing energy efficiency measures in their buildings and operations demonstrates leadership within their communities. For example, improving the efficiency of taxpayer-funded facilities such as city halls and public libraries both reassures residents their tax dollars are being utilized wisely and showcases the application of energy efficiency technologies.<sup>31</sup>
  - California's Existing Buildings Energy Efficiency Action Plan reinforces the leadership role played by local governments due to the fact that local governments may "facilitate more energy efficiency upgrades, demonstrate leadership by accomplishing deep energy retrofits in government buildings, and become the resource for businesses, home owners, property managers, and other decision makers looking for energy and water efficiency solutions."<sup>32</sup>

<sup>30</sup> "Energy Efficiency and Technology in America's Cities," Mayors Climate Protection Center, January 2014, p. 1,3, 8. <http://usmayors.org/pressreleases/uploads/2014/0122-report-energyefficiency.pdf>.

<sup>31</sup> "Energy Efficiency in Local Government Operations," Environmental Protection Agency, 2011, p. 2. [https://www.epa.gov/sites/production/files/2015-08/documents/ee\\_municipal\\_operations.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/ee_municipal_operations.pdf).

<sup>32</sup> "California Existing Buildings Energy Efficiency Action Plan," California Energy Commission, p. 19. <http://www.energy.ca.gov/2015publications/CEC-400-2015-013/CEC-400-2015-013-D.pdf>.

- California government and education sector customers have developed Climate Action Plans that set greenhouse gas reduction targets and include strategies, many of which include energy efficiency, demand reduction and other distributed energy resource investments.<sup>33</sup>
- Rural local governments in particular face challenges around access to data, cost effectiveness and lack of resources to devote to energy efficiency.

### State Government

- California's Executive Order B-18-12<sup>34</sup> establishes ambitious energy goals that "serve to lead the nation and the world in climate change mitigation."<sup>35</sup> This includes:
  - Reducing grid-based electricity purchases for state-owned buildings by 20% by 2018
  - 50% of new state buildings designed after 2020 will be constructed as ZNE
  - All new state buildings designed after 2025 will be constructed as ZNE
  - 50% of existing state-owned buildings will be ZNE by 2025
- The California Department of General Services (DGS) is the contracting arm for approximately 200 departments across 32 state agencies. However, there are at least 10 agencies, such as the Judicial Council of California, that have their own contracting authority, resulting in missed opportunities with those agency buildings.<sup>36</sup>

<sup>33</sup> "California Existing Buildings Energy Efficiency Action Plan," California Energy Commission, p. 19. <http://www.energy.ca.gov/2015publications/CEC-400-2015-013/CEC-400-2015-013-D.pdf>.

<sup>34</sup> "Executive Order B-18-12," Office Of Governor Edmund G. Brown Jr., April 25, 2012, <https://www.gov.ca.gov/news.php?id=17508>.

<sup>35</sup> Business Plan Comments, September 27, 2016 "State of California Partnership With IOUs." p.1.

<sup>36</sup> Navigant. Analysis to Update Energy Efficiency Potential, Goals and Targets for 2013 and Beyond. Prepared for the California Public Utilities Commission.

- The DGS is spearheading efficiency improvements in state buildings. Nearly 18 million square feet and 142 state buildings were LEED certified as of 2015, equal to approximately 14% of the entire state building portfolio.<sup>37</sup>
- State agencies are saddled with funding and resource challenges, as well as a lengthy and comprehensive public accountability process. State agencies require diverse finance options to facilitate energy efficiency project execution.<sup>38</sup>

## Federal Government

- The Energy Policy Act of 2005 (EPACT) and Executive Order 13423 require federal agencies to reduce their energy consumption by 30% by 2015 based on a 2003 baseline.<sup>39</sup> These policies also establish additional goals for water conservation, energy management, and renewable energy use. According to the US Department of Energy (DOE), the federal sector will need to invest at least \$4 billion in public and private funds to achieve these ambitious goals. Like many others in the public sector, the federal government continues to face budget constraints, and at the same time seeks to meet requirements to reduce energy and water consumption.<sup>40</sup>
- President Obama signed Executive Order 13693 in March 2015, which requires federal buildings to reduce energy usage by 2.5% annually between 2015 and 2025.<sup>41</sup> The executive order directs implementation of specific efficiency measures such as using remote building energy performance assessment auditing technology, incorporating Green Button data access into reporting and data analytics processes, and targeting energy efficiency at federal data centers.
- Section 433 of the Energy Independence and Security Act of 2007 requires new federal buildings to be carbon neutral by 2030.<sup>42</sup> However, implementation of this legislation has lagged due to concerns over the feasibility of implementation.<sup>43</sup>

<sup>37</sup> Burgoyne, Dan “State of California Buildings Focus on Water, Energy, Environment, Performance,” Green Building Information Gateway, <http://insight.gbgi.org/state-of-california-buildings-focus-on-water-energy-environment-performance/>.

<sup>38</sup> Business Plan Comments, September 27, 2016 “State of California Partnership With IOUs.” p.1.

<sup>39</sup> “Executive Order 13423—Strengthening Federal Environmental, Energy, and Transportation Management,” United States Government Publishing Office, January 26, 2007, p. 3919, <https://www.gpo.gov/fdsys/pkg/FR-2007-01-26/pdf/07-374.pdf>.

<sup>40</sup> Federal Energy Management Program (FEMP) Fact Sheet. p.1. <http://www.nrel.gov/docs/fy07osti/41916.pdf>.

<sup>41</sup> “Executive Order—Planning for Federal Sustainability in the Next Decade,” The White House, March 19, 2015, <https://www.whitehouse.gov/the-press-office/2015/03/19/executive-order-planning-federal-sustainability-next-decade>.

<sup>42</sup> “Energy Independence and Security Act of 2007,” United States Government Publishing Office, January 4, 2007, Section 433, p. 121. <https://www.gpo.gov/fdsys/pkg/BILLS-110hr6enr/pdf/BILLS-110hr6enr.pdf>.

<sup>43</sup> Dotson, Greg and Erin Auel, “The Buildings of Tomorrow Are Here Today,” Center for American Progress, April 30, 2015 <https://www.americanprogress.org/issues/green/report/2015/04/30/112212/the-buildings-of-tomorrow-are-here-today/>.

## K-12

- Among the competing priorities for the public sector is the need to retrofit and modernize the existing building stock. For example, over two-thirds of public school buildings were built over 25 years ago.<sup>44</sup>
- The fiscal year (FY) 2016-2017 state budget appropriates \$398.8 million in Prop 39 funds for local educational agencies to improve energy efficiency and spur clean job creation.<sup>45</sup> This represents more than a 25% increase from the 2015-2016 budget.
  - As of October 2016, the estimated annual energy cost savings from Prop 39 projects is nearly \$60 million. This is equivalent to over 200 million pounds of carbon dioxide emissions avoided annually.<sup>46</sup>
  - The most popular energy efficiency measures funded by Prop 39 as of October 2016 are lighting (48%), HVAC (16%), lighting controls (11%), and HVAC controls (10%).<sup>47</sup>
  - The number of measures approved as part of Prop 39 increased from 2,250 in FY 2013-2014 to 5,560 in FY 2014-2015 and 5,922 in FY 2015-2016.<sup>48</sup>
  - However, staff bandwidth constraints and limited planning and implementation support inhibit even greater project implementation.<sup>49</sup>

<sup>44</sup> Ed-Data. 2014. School Facilities in California. Retrieved from <https://www.ed-data.k12.ca.us/Pages/School-Facilities-in-California.aspx>.

<sup>45</sup> "Proposition 39 – California Clean Energy Jobs Act," California Department of Education, <http://www.cde.ca.gov/fg/fo/profile.asp?id=3898>.

<sup>46</sup> "Proposition 39 K-12 Snapshot," California Energy Commission, Accessed October 5, 2016, <http://www.energy.ca.gov/efficiency/proposition39/>.

<sup>47</sup> "Proposition 39 K-12 Snapshot," California Energy Commission, Accessed October 5, 2016, <http://www.energy.ca.gov/efficiency/proposition39/>.

<sup>48</sup> "Proposition 39 K-12 Snapshot," California Energy Commission, Accessed October 5, 2016, <http://www.energy.ca.gov/efficiency/proposition39/>.

<sup>49</sup> Flanigan, Ted "Proposition 39 is Succeeding...Just Wait and See," Climate Resolve, September 8, 2015, <http://climateresolve.org/proposition-39-is-succeeding-just-wait-and-see/>

## Higher Education

- The University of California's (UC) revenue has not kept pace with enrollment growth and other rising costs, spending less per student than it did twelve years ago.<sup>50</sup> Amidst budget constraints, UC announced the Carbon Neutrality Initiative in 2013, which commits UC to emitting net zero greenhouse gases from its buildings and vehicle fleet by 2025.<sup>51</sup>
- California State University (CSU) is the largest public university system in the state. CSU looks continuously for ways to reduce costs and find efficiencies.<sup>52</sup> In fact, CSU energy efficiency projects have avoided \$16 million in annual costs, and the University continues to pursue high-efficiency energy projects.<sup>53</sup> Many CSU campuses are experiencing record levels of enrollments, so energy efficiency will continue to play a key role in operating cost effectively.<sup>54</sup> CSU also has a backlog of urgent facilities maintenance and utilities infrastructure needs.<sup>55</sup>
- The California Community College System (CCC) is the largest higher education system in the United States with more than 2.1 million students across 113 campuses.<sup>56</sup>

Driven largely by these trends, public customers face five key barriers to participation in energy efficiency programs. PG&E's six intervention strategies seek to overcome these barriers for the public sector, as shown in **Table 4.10** and explained in greater detail in *Section F: PG&E's Approach to Achieving Goals*.

<sup>50</sup> <http://universityofcalifornia.edu/infocenter/uc-revenue-and-enrollment-trends>

<sup>51</sup> <http://universityofcalifornia.edu/initiative/carbon-neutrality-initiative/our-commitment>

<sup>52</sup> The California State University 2016-2017 Support Budget, p.3.

<sup>53</sup> The California State University 2016-2017 Support Budget, p.3.

<sup>54</sup> The California State University 2016-2017 Support Budget, p.12

<sup>55</sup> The California State University 2016-2017 Support Budget, p.21

<sup>56</sup> "California Community Colleges Key Facts," California Community Colleges Chancellor's Office, <http://californiacommunitycolleges.cccco.edu/PolicyInAction/KeyFacts.aspx>

**Table 4.10**

## Public Sector Barriers to Energy Efficiency Program Participation

Public Sector Intervention Strategies	Barriers for the Public Sector
<b>Strategic Partnerships</b>	<ul style="list-style-type: none"> <li>• Energy savings are misaligned with most public customers’ motivations and processes</li> <li>• Customers lack the internal expertise to meet climate planning targets and State policy goals</li> <li>• Lack of understanding of the value of energy efficiency to take action</li> </ul>
<b>Data Access</b>	<ul style="list-style-type: none"> <li>• Energy savings are misaligned with most public customers’ motivations and processes</li> <li>• Customers lack access to data to identify energy savings potential and track progress towards goals<sup>a</sup></li> </ul>
<b>Data Analytics</b>	<ul style="list-style-type: none"> <li>• Energy savings are misaligned with most public customers’ motivations and processes</li> <li>• AMI data unexplored opportunity for targeting of energy efficiency projects</li> </ul>
<b>Technical Assistance and Tools</b>	<ul style="list-style-type: none"> <li>• Customers sometimes lack the internal expertise to meet climate planning targets and State policy goals</li> </ul>
<b>Loans, Rebates and Incentives</b>	<ul style="list-style-type: none"> <li>• Customers have limited financial resources to devote to energy efficiency projects<sup>b</sup></li> </ul>
<b>Outreach and Education</b>	<ul style="list-style-type: none"> <li>• Energy savings are misaligned with most public customers’ motivations and processes</li> <li>• Lack of understanding of the value of energy efficiency to take action</li> </ul>

<sup>a</sup> Integrated Energy Policy Report, pp. 21-22.

<sup>b</sup> Integrated Energy Policy Report, p. 21.

## F. PG&E’s Approach to Achieving Goals

### Strategic Interventions: Overview

As California’s public sector changes and the energy efficiency technological and policy landscape evolves, PG&E has identified six strategic interventions based on past strategies.

These intervention strategies are:

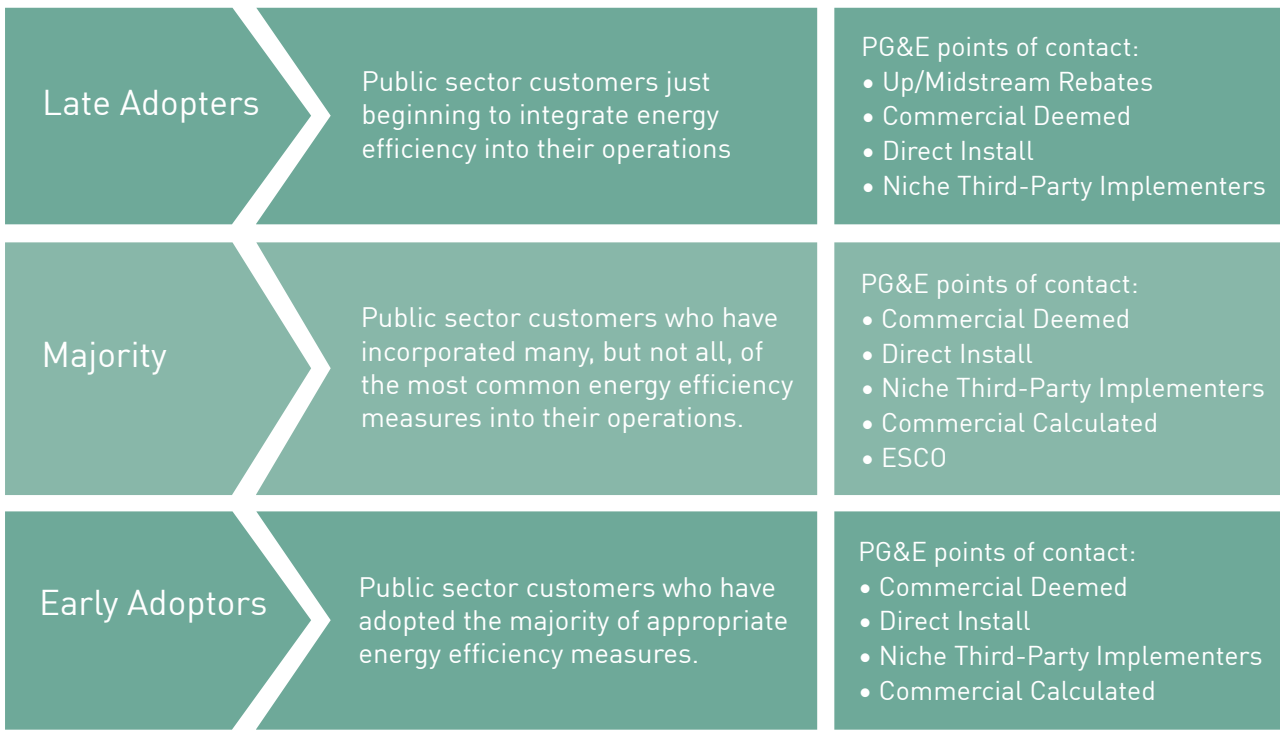
- **Strategic Partnerships** engage public customers through LGPs and institutional partnerships to maximize outreach, share technical expertise, and leverage cross-agency resources to broaden impact.
- **Data Access** emphasizes the need to ensure customers have access to data and can understand their data. As important is the ability to share data with implementers and have access to community-wide data to meet their climate planning goals.
- **Data Analytics** allows PG&E to use data to support energy efficiency efforts and maximize the savings from each project.
- **Technical Assistance and Tools** provide public sector customers with the assistance they need in the short-term to take action. Connecting customers with bundled solutions that make economic sense for their segment, helping them navigate the complexity of regulations, and integrating energy efficiency offerings into day-to-day operations are all important components of this intervention strategy.



**Figure 4.10**

## Public Sector Customer Journey

Public sector customers fall into three categories identifying the level to which they have integrated energy efficiency measures into their operations.



- **Loans, Rebates and Incentives** allow more customers to take energy efficiency actions and have access to viable financing.
- **Outreach and Education** promotes greater market awareness about the value of energy efficiency and engagement of communities in energy efficiency outside of traditional programs.

The next section provides further detail on the selected intervention strategies and exploratory tactics. Before proceeding with implementation, PG&E will expose each tactic described to a rigorous internal development process to assess its relative viability and cost effectiveness. New tactics represent targeted or innovative steps forward to address a specific need while modified tactics are those where deficiencies or gaps in service have been identified and thus are being modified to ensure relevance and achieve better results.

## Intervention 1 – Strategic Partnerships to provide tailored solutions and leverage cross-agency resources

Strategic partnerships play a critical role in maximizing outreach to promote the benefits of energy efficiency, sharing technical expertise to provide tailored solutions for a customer’s needs and leveraging cross-agency resources to maximize impact. To date, LGPs and IPs have provided the best examples of highly effective strategic partnerships. Another example is Prop 39 implementation, which is founded on close coordination among IOUs, state agencies, educational customers, and other public sector stakeholders.

Partnerships support project development within the public sector by acting as an extension of PG&E’s customer service representatives, field engineers and marketing. Partnerships have in-depth knowledge of PG&E’s offerings, as well as connections and knowledge of the communities they serve. Partnerships act as liaisons between public sector decision-makers and energy efficiency program implementers.

PG&E will continue to support existing strategic partnerships in the short-term to promote energy efficiency among its public customers. In the mid-term, PG&E will explore expanding existing and creating new strategic partnerships to achieve greater participation in energy efficiency programs and drive deeper savings. Ultimately, engaging public customers through strategic partnerships enables them to take action while demonstrating leadership that inspires their constituents to pursue their own energy efficiency projects.<sup>57</sup>

Success in this strategy can be primarily measured by an increase in energy saving actions, both inside and outside of traditional program models.

**Table 4.11** summarizes *Intervention 1: Strategic Partnerships*.

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<sup>57</sup> Integrated Energy Policy Report, p. 21.

**Table 4.11**

Intervention 1: Strategic Partnerships to Provide Tailored Solutions and Leverage Cross-Agency Resources

GOALS:				
<ul style="list-style-type: none"> <li>• Save energy and reduce demand</li> <li>• Increase customers' ability to manage energy</li> <li>• Increase operational efficiency</li> </ul>				
Intervention Strategy	Barriers	Example Tactics	Existing, Modified, or New	Short, Mid, Long-term
<b>Strategic Partnerships to provide tailored solutions and leverage cross-agency resources</b>	Energy savings are misaligned with most public customers' motivations and processes <ul style="list-style-type: none"> <li>• Lack of community champions and advocates</li> <li>• Lack of hyper-local community knowledge</li> </ul>	Continue coordinating Prop 39 activities across state agencies and other IOUs <sup>a</sup>	E	S
		Continue cooperation with CCAs implementing energy efficiency programs	M	S
		Partner with statewide agencies to align energy efficiency offerings with grant or permit approval guidelines	N	M
		Ensure flexible approaches for LGPs to respond to local issues and conditions, particularly for rural LGPs	E	S
		Expand existing partnerships to include new strategic partners (e.g., Judicial Council of California) and create new partnerships as needed to realize savings potential in public sector buildings	N	M

**Partners:** All Public Sector Customers, ACEEE, BayREN, Marin Clean Energy, Statewide Energy Efficiency Collaborative (SEEC)

<sup>a</sup> Zuckerman, Julia, Jeff Deason, and Elinor Benami, "Targeting Proposition 39 to Help California's Schools Save Energy and Money," Climate Policy Initiative, p. 3, <http://climatepolicyinitiative.org/wp-content/uploads/2013/05/Targeting-Proposition-39-to-Help-California%E2%80%99s-Schools-Save-Energy-and-Money.pdf>.

A recent draft evaluation report finds LGPs benefit from cross-partnership collaboration.<sup>58</sup> As a result, the report recommends the IOUs and the CPUC facilitate integrating non-collaborating local partners into existing collaborations. It is possible that the IOUs and CPUC have a view of partnership needs and activities that would allow recognition and communication of opportunities. The report also recommends IOU program managers encourage increased partnering and establish the necessary connections among local partners, with the local partners being allowed to decide which networks to participate in so as to select the most pertinent one.

## Intervention 2 – Data Access to Increase Customer Awareness of Energy Use and Target High Potential Opportunities

A 2015 needs assessment conducted by PG&E identified “PG&E has an opportunity to increase communication regarding available data” and that “more training is needed for local governments to know how to request customized data.”<sup>59</sup> Improving access to customer data will enable customers to better understand their usage patterns, identify the need for savings opportunities, and enable implementers to provide the right solution at the right time.

In the short-term, PG&E will continue to work with stakeholders and the CPUC to streamline data access protocols to ensure public customers are able to analyze their usage in a straightforward and timely manner. PG&E will also continue to use its marketing, education, and outreach (ME&O) resources to drive customers to existing data sharing platforms such as Share My Data to provide them with tailored energy solutions.

In the mid-term, PG&E will assist public customers’ climate planning by incorporating avoided GHG emissions as a result of energy efficiency measures into data reporting. In addition, PG&E will use improved benchmarking and data disclosure practices to aggregate usage across multiple meters and report to public customers in a single dashboard, per AB 802. Data aggregation will enable public customers to track energy usage at a systems level to quantify how individual energy efficiency measures generate impact across their entire community or campus.<sup>60</sup>

Success in this strategy can be measured by whether all public sector customers have access and can share data with a third party, and by whether all public sector customers have the ability to access community-wide data to meet their climate planning goals. **Table 4.12** summarizes *Intervention 2: Data Access*.

<sup>58</sup> “Draft Targeted Process Evaluation of the Local Government Partnership Program,” Research into Action, September 13, 2016, p. 2.

<sup>59</sup> “Local Government Energy Data Needs Assessment PG&E Government and Community Partnerships,” [https://www.pge.com/includes/docs/pdfs/mybusiness/environment/whatyoucando/greencommunities/LocalGovt\\_EnergyDataNeedsAssessment.pdf](https://www.pge.com/includes/docs/pdfs/mybusiness/environment/whatyoucando/greencommunities/LocalGovt_EnergyDataNeedsAssessment.pdf)

<sup>60</sup> “Local Government-Utility Partnerships for Facilitating Access to Community Energy Usage Data,” American Council for an Energy-Efficient Economy, <http://aceee.org/local-government-utility-partnerships-facilitating>

**Table 4.12**

Intervention 2: Data Access to Increase Customer Awareness of Energy Use and Target High Potential Opportunities

GOALS:				
<ul style="list-style-type: none"> <li>• Save energy and reduce demand</li> <li>• Increase customers' ability to manage energy</li> <li>• Increase operational efficiency</li> </ul>				
Intervention Strategy	Barriers	Example Tactics	Existing, Modified, or New	Short, Mid, Long-term
<b>Data access to increase customer awareness of energy use, and target high-potential opportunities</b>	Customers lack access to data to identify energy savings potential and track progress towards goals	Continue to work with stakeholders and the CPUC to improve data access protocols <sup>a</sup>	E	S
		Promote accessible data platforms that improve public customers' understanding of usage, savings and potential	E	S
		Support energy efficiency proposals and completed projects with data-focused EM&V accessible to decision-makers	M	S
		Use analytics to support role of energy savings in GHG emissions and other public sector goals	N	M
		Create a comprehensive energy management dashboard incorporating data from multiple accounts within a single municipal/campus operation	N	M

**Partners:** Energy Data Access Committee (EDAC), Third Party Implementers, all Public Sector Customers

<sup>a</sup> This tactic is based on the California Existing "California's Existing Buildings Energy Efficiency Action Plan," p. x

The California Energy Efficiency Strategic Plan (CEESP) established a goal for local governments to take the lead in using energy efficiency to reduce energy use in their own facilities and throughout their communities by 2020.<sup>61</sup> A 2014 evaluation by Opinion Dynamics finds that projects implemented to achieve the CEESP's goal for local governments

encountered issues when it took months for IOUs to provide access to energy data. These delays reduced the amount of time available to complete projects and made it difficult for LGP implementers to provide their consultants with critical information about project cycles, funding, contracts and requested

<sup>61</sup> "California Energy Efficiency Strategic Plan," *California Public Utilities Commission and California Energy Commission*, January 2011, p. 85.

data.<sup>62</sup> This case highlights the need for PG&E to streamline data access processes so customers are able to analyze their data in a timely and straightforward fashion.

The recent process evaluation draft report concludes that local partners' needs may not have been fully met through the established data access procedures, thereby limiting partnership planning and action. The evaluation recommends IOU program managers investigate any limitations a local partner may have in accessing and using its energy data and work on removing those limitations.

### Intervention 3 – Data Analytics to Identify Energy Efficiency Opportunities

Advanced Metering Infrastructure (AMI) data presents a major opportunity for providing value propositions for high-opportunity projects in the public sector. Offering opportunities for implementers to target public sector customers with AMI data will be a major component of PG&E's future strategy. **Table 4.13** summarizes *Intervention 3: Data Analytics*.

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<sup>62</sup>Opinion Dynamics Corporation. 2016a. PY 2013-2014 *Local Government Partnerships Value And Effectiveness Study Final Report*. CPUC. 46 Research Into Action, Draft Report, Targeted Process Evaluation of the Local Government Partnership Program, September 13, 2016, p. IV.

**Table 4.13**

Intervention 3: Data Analytics to Identify Energy Efficiency Opportunities

GOALS:				
<ul style="list-style-type: none"> <li>• Save energy and reduce demand</li> <li>• Increase customers’ ability to manage energy</li> <li>• Increase operational efficiency</li> </ul>				
Intervention Strategy	Barriers	Example Tactics	Existing, Modified, or New	Short, Mid, Long-term
<b>Data analytics to identify energy efficiency opportunities</b>	AMI data unexplored opportunity for targeting of energy efficiency projects	Explore opportunities for implementers to target public sector customers with AMI data	E	S
		Share insights into areas of high savings opportunities with LGPs and other stakeholders to support innovative programs to meet customer needs	E	S

**Partners:** All Public Sector Customers, Third-Party Implementers

Data analytics will play a critical role in allowing PG&E to scale energy efficiency offerings, as they enable a more accurate deployment of resources for the largest impacts. In this way, insights into customer trends not only enhance targeting efforts, but also inform strategies to promote data access and the design of technical assistance, tools, and financial incentives to get energy efficiency measures off the ground.

## Intervention 4 – Technical Assistance and Tools to Build Energy Efficiency Capacity and Knowledge

While the public sector may have clear state policy mandates for reducing energy use, the Existing Buildings Energy Efficiency Action Plan finds public customers have “a lack of technical knowledge, staff and resources to make energy efficiency management operational and effective, particularly at the local level and in smaller municipalities.”<sup>63</sup>

In response to these barriers, PG&E will continue to build the capacity and knowledge base of public customers through fellowship programs, like Civic Spark and EDF Climate Corps. Furthermore, PG&E is committed to modifying its suite of technical assistance and tools that are targeted to overcome the resource constraints that impede public customers from pursuing energy efficiency projects.

In support of the Governor’s Executive Order B-18-12<sup>64</sup> requiring State of California-owned facilities to reduce energy usage by 20% by 2018, IOUs will continue to engage and provide necessary technical support to agencies that are poised to deliver significant energy savings, such as California Department of Corrections and Rehabilitation, Department of General Services, and Judicial Council of California (formerly known as the Administrative Office of the Courts).

In the short-term, PG&E will offer comprehensive audits that integrate energy efficiency solutions with distributed energy resources such as distributed generation, demand response, and storage. As public customers increasingly pursue integrated demand-side management (IDSMS) solutions, PG&E will act as a trusted energy adviser to provide technical expertise tailored to individual customer needs.<sup>65</sup>

In the mid-term, PG&E will bundle improved benchmarking data (AB 802) with project development assistance to guide public customers on their energy journeys. In particular, PG&E will identify the need for energy efficiency through benchmarking and help customers select and install the appropriate suite of measures. PG&E will expand both its direct install program and HVAC measures to target an end use with high savings potential.

Additionally, PG&E will implement Job-Order Contracting (JOC) and explore other energy services contracting models to ease procurement challenges and increase project throughput.

Success in this strategy can be measured based on whether public sector customers have the assistance they need in the short-term to take action in identifying energy efficiency opportunities, moving energy efficiency projects forward, or otherwise completing an energy efficiency activity. **Table 4.14** summarizes *Intervention 4: Technical Assistance and Tools*.

<sup>63</sup> “California’s Existing Buildings Energy Efficiency Action Plan,” p. 20.

<sup>64</sup> <https://www.gov.ca.gov/news.php?id=17508>

<sup>65</sup> Accenture Research, 2015. The New Energy Consumer: “Unleashing Business Value in a Digital World”. p. 16



**Table 4.14**

Intervention 4: Technical Assistance and Tools to Build Energy Efficiency Capacity and Knowledge

GOALS:				
<ul style="list-style-type: none"> <li>• Save energy and reduce demand</li> <li>• Increase customers’ ability to manage energy</li> <li>• Increase operational efficiency</li> </ul>				
Intervention Strategy	Barriers	Example Tactics	Existing, Modified, or New	Short, Mid, Long-term
<b>Technical assistance and tools to build energy efficiency capacity and knowledge</b>	Customers lack the internal expertise to meet climate planning targets and State policy goals <ul style="list-style-type: none"> <li>• Navigating complex energy efficiency offerings</li> <li>• Increasingly complex energy management challenges (DER)</li> <li>• Understanding how to design projects with an effective bundling of energy and cost savings</li> <li>• “Selling” projects to decision-makers</li> <li>• Lack of internal capacity</li> </ul>	Promote and expand audit programs to identify comprehensive solutions; remarket solutions where projects are not initiated <sup>a</sup>	E	S
		Provide project development assistance to scope and design projects to maximize energy savings opportunities	E	S
		Engage select customers in demonstration projects/pilots such as targeted demand-side management (TDSM) or ZNE	E	S
		Work with fellowship programs (e.g. Civic Spark, EDF Climate Corps) to build internal organizational capacity	E	S
		Offer in-depth audits focused on integrating energy efficiency with DERs	M	S
		Offer benchmarking services, paired with project development support (advanced benchmarking)	M	S
		Expand on successful direct install program model to serve small/medium buildings throughout the public sector	M	M
		Implementing solutions for master-metered customers	N	M
		Support JOC and explore other energy services contracting models to ease procurement challenges and increase project throughput	N	M

**Partners:** PG&E account representatives, PG&E Government Relations, Third Party Implementers, Community-Based Organizations, Social Scientists

<sup>a</sup> “A Guide to Energy Audits,” U.S. Department of Energy, [http://www.pnnl.gov/main/publications/external/technical\\_reports/pnnl-20956.pdf](http://www.pnnl.gov/main/publications/external/technical_reports/pnnl-20956.pdf).

Lack of energy efficiency subject matter expertise and lack of technical support have been identified as the largest barrier to project completion in the public sector.<sup>66</sup> This is exacerbated by the diversity of the public sector, with large disparities in expertise between customers. For example, the University of California supports dedicated energy managers at each campus, while California State Universities lack resources for this role, leading to much greater rates of implementation on the part of UC.<sup>67</sup> The California Department of Corrections and Rehabilitation (CDCR), whose prisons reportedly depend on energy service companies (ESCOs) and utilities to provide project proposals, face a particular shortage of expertise.<sup>68</sup>

Local governments also face a steep learning curve. An evaluation of LGP programs finds “individuals new to the program must invest substantial effort to understand the requirements and details of the program.” The evaluation also mentions details of the program are difficult to explain by both local partners and IOU program staff to new local government staff.<sup>69</sup>

As part of the Governor’s Green Building Initiative, state buildings have been benchmarked through ENERGY STAR Portfolio Manager. Additionally, thirty-three state agencies reported energy data as part of the 2014 benchmarking report<sup>70</sup>, and 80% of facility meters are automatically uploading data through Portfolio Manager.<sup>71</sup> Benchmarking data will play a key role in moving projects forward.

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<sup>66</sup> Opinion Dynamics, 2016a/RTR sheet

<sup>67</sup> Statewide Institutional IOU Energy Efficiency Partnership Study, Navigant, 2013, page 8

<sup>68</sup> Navigant. Analysis to Update Energy Efficiency Potential, Goals and Targets for 2013 and Beyond. Prepared for the California Public Utilities Commission.

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<sup>69</sup> Research Into Action, Draft Report, Targeted Process Evaluation of the Local Government Partnership Program, September 13, 2016, p. IV.

<sup>70</sup> Department of General Services Office of Sustainability. 2014. 2014 California State Facility Water and Energy Benchmarking Report.

<sup>71</sup> Opinion Dynamics, 2016b

## Intervention 5 – Loans, Rebates and Incentives to Overcome Constrained Budgets and First Cost Barriers

Due to constrained budgets, education customers often pursue energy projects that generate immediate energy savings and result in short payback periods.<sup>72</sup> The same trend is evident in government organizations where these customers prioritize energy efficiency opportunities based on payback and cost, available rebates, and minimum hassle and financing.<sup>73</sup> In some cases, this approach will result in a customer forgoing a project with higher upfront costs but greater long-term savings.<sup>74</sup> In addition, many public customers also lack awareness and expertise on the nuances of funding options available for energy efficiency projects.<sup>75</sup>

As a result, loans, rebates, and incentives play a critical role in getting energy efficiency measures off the ground. In the short-term, PG&E will continue to provide customers with financing options as well as rebates and incentives for eligible energy efficiency measures. PG&E will also explore new and expanded financing models to empower public sector customers to take action, such as the “Green Bond” pilot program, and revolving loans, which have already demonstrated effectiveness in community college campuses.<sup>76</sup> In the mid and long-term, PG&E aims to provide tailored financing solutions to make projects feasible, whether it be a combination of rebates and loans or a no-cost/low-cost loan. PG&E intends to launch new program models that move away from the traditional incentive, promote energy management technologies, capture stranded energy savings potential and drive ZNE development.

Public sector customers will benefit from meter-based savings program models in accordance with AB 802. As new program models emerge, the public sector will yield significant energy savings calculated at the meter due to aging and below-code facilities across all segments.<sup>77</sup>

In addition, PG&E will collect proof of permit closure before paying rebates or incentives for all downstream central air conditioning or heat pumps and their related fans, in accordance with SB 1414.<sup>78</sup>

Success in this strategy can be measured by whether more customers take energy efficiency actions and have access to financing that meets their requirements. **Table 4.15** summarizes Intervention 5: Loans, Rebates and Incentives.

<sup>72</sup> Zuckerman, Julia et al. 2013. Targeting Proposition 39 to Help California Schools Save Energy and Money. Climate Policy Initiative Brief. Retrieved from <http://climatepolicyinitiative.org/wp-content/uploads/2013/05/Targeting-Proposition-39-to-Help-California%E2%80%99s-Schools-Save-Energy-and-Money.pdf>

<sup>73</sup> Cooper, Rachel. 2013. E Source Market Research: Government and Public Administration Sector Profile and Survey.

<sup>74</sup> Cooper, Rachel. 2013. E Source Market Research: Government and Public Administration Sector Profile and Survey.

<sup>75</sup> “Energy Efficiency Financing in California: Needs and Gaps,” p. 37.

<sup>76</sup> Two community college campuses have continued implementing energy efficiency projects by setting up revolving energy efficiency funding policies: Mt. San Antonio and San Mateo (Navigant Consulting, Inc. 2012. Program Assessment Study: Statewide Institutional IOU Energy Efficiency Partnership Programs – W0012. October 9, 2012.)

<sup>77</sup> “California Existing Buildings Energy Efficiency Action Plan,” p. 3.

<sup>78</sup> For more information, see “Senate Bill No. 1414,” California Legislative Information, [https://leginfo.ca.gov/faces/billTextClient.xhtml?bill\\_id=201520160SB1414](https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB1414)

**Table 4.15**

Intervention 5: Loans, Rebates and Incentives to Overcome Constrained Budgets and First Cost Barriers

GOALS:				
<ul style="list-style-type: none"> <li>• Save energy and reduce demand</li> <li>• Increase customers' ability to manage energy</li> <li>• Increase operational efficiency</li> </ul>				
Intervention Strategy	Barriers	Example Tactics	Existing, Modified, or New	Short, Mid, Long-term
<b>Loans, rebates, and incentives to overcome constrained budgets and first-cost barriers</b>	Customers have limited financial resources to devote to energy efficiency projects <ul style="list-style-type: none"> <li>• Without additional funding sources, many projects are unable to get off the ground</li> <li>• Participation process misaligned with customer needs</li> </ul>	Ensure energy efficiency rebates are appropriately set to sufficiently incent customers to proceed with implementation	E	S
		Support creation of energy efficiency revolving funds to ensure continuity of energy efficiency dedicated resources	E	S
		Continue existing energy efficiency program offerings and measures, such as downstream calculated incentives, while also seeking nuanced, innovative means to incentivize efficiency-driven market transformation	E	S
		Launch programs that measure energy savings at the meter (e.g., Pay for Performance) <sup>a</sup>	N	S
		Launch new finance offerings (e.g. "Green Bond" program) <sup>b</sup>	N	M

**Partners:** Customer financing and accounting staff

<sup>a</sup> Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, 2016. "Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings." p.2.

<sup>b</sup> The Green Bond program is a pilot financing offering which will be offered in 2017.

Current OBF loan amounts are often insufficient for customers with multiple buildings per facility and have been cited as a frequent barrier to public sector customers. PG&E seeks to address this need by raising OBF loan caps. According to a 2009 study by P.A. Consulting, "The incentive cap of \$1 million per facility caused problems in facilities where there was more than one building. ESCOs performing the retrofits needed to make decisions to perform low-level projects across all buildings or perform deeper retrofits at a few buildings. The requirement for a five-year payback meant that some more expensive projects, but ones that could save significant energy

over time, did not receive funding."<sup>79</sup>

The Existing Buildings Energy Efficiency Action plan finds public customers are often not motivated to pursue energy efficiency due to the difficulty of obtaining consistent funding for these projects.<sup>80</sup> In particular, energy costs are paid from funds allocated

<sup>79</sup> P.A. Consulting 2009 studies about program design for the CDCR per ODC draft work plan, 2/29/16, p. 23.

<sup>80</sup> "California's Existing Buildings Energy Efficiency Action Plan," p. 54.

during annual budgeting.<sup>81</sup> As a result, it is frequently less controversial for a public customer to pay their energy bills from these allocated funds than to request new funding for capital investments in energy efficiency projects.<sup>82</sup>

The draft “Targeted Process Evaluation” of the LGP program<sup>83</sup> states OBF helps local governments overcome financial barriers to municipal retrofits. It recommends that IOUs facilitate the use of OBF by educating partners that are not currently using the financing option. An example of facilitating is peer-to-peer sharing of “case studies” that illustrate how OBF can be used to fund large-scale municipal retrofit projects. PG&E is seeking to address this issue by connecting public sector customers to, and raising awareness of, enhanced OBF offerings.

## Intervention 6 – Outreach and Education to Reach Public Sector Customer Constituencies with the Value of Energy Efficiency

Public sector customers are uniquely accountable not only for their own energy-usage portfolios, but also for reducing overall community-wide greenhouse gas emission levels, per AB 32. As a result, PG&E and the LGP and Institutional Partnership partners play a crucial role in providing information about the value of energy efficiency through coordinated outreach with public sector customers for their larger constituencies.

In the short-term, PG&E will continue co-branding with public sector customers to promote simple energy savings opportunities that can serve as an entry point for a customer’s energy journey. This includes partnering with community-based organizations to raise awareness of energy efficiency opportunities in their homes and places of businesses.

By promoting greater awareness throughout communities, municipalities, and regions, PG&E aims for all residents within its service territory to understand the value of energy efficiency. With this knowledge in hand, these individuals may be more likely to take action upon learning of a specific offering that may save them energy and money.<sup>84</sup>

Success in this strategy can be measured based on increased engagement of communities in energy efficiency outside of traditional programs. **Table 4.16** summarizes *Intervention 6: Outreach and Education*.

<sup>81</sup> “Energy Efficiency Financing in California: Needs and Gaps,” Harcourt Brown & Carey, Inc., July 8, 2011, p. 34, [http://www.harcourtbrown.com/wp-content/uploads/CPUC\\_FinancingReport\\_HBC\\_Jul8v2.pdf](http://www.harcourtbrown.com/wp-content/uploads/CPUC_FinancingReport_HBC_Jul8v2.pdf).

<sup>82</sup> “Energy Efficiency Financing in California: Needs and Gaps,” Harcourt Brown & Carey, Inc., July 8, 2011, p. 34, [http://www.harcourtbrown.com/wp-content/uploads/CPUC\\_FinancingReport\\_HBC\\_Jul8v2.pdf](http://www.harcourtbrown.com/wp-content/uploads/CPUC_FinancingReport_HBC_Jul8v2.pdf).

<sup>83</sup> Research Into Action, Draft Report, Targeted Process Evaluation of the Local Government Partnership Program, September 13, 2016, p. VI.

<sup>84</sup> Statewide ME&O Verification and Integrated Effectiveness Study <http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=10834>.

**Table 4.16**

Intervention 6: Outreach and Education to Reach Public Sector Customer Constituencies with the Value of Energy Efficiency

GOALS:				
<ul style="list-style-type: none"> <li>• Save energy and reduce demand</li> <li>• Increase customers' ability to manage energy</li> </ul>				
Intervention Strategy	Barriers	Example Tactics	Existing, Modified, or New	Short, Mid, Long-term
Outreach and education to reach public sector customer constituencies with the value of energy efficiency	Lack of understanding the value of energy efficiency to take action	Co-brand opportunities (flyers, events) with local governments, water agencies/districts, and schools to increase credibility and reach	E	S
	<ul style="list-style-type: none"> <li>• Lack of awareness of the co-benefits of an energy efficient facility</li> </ul>	Support the Statewide Energy Efficiency Council and Best Practices Coordinator to provide critical energy efficiency resources to local governments and the public sector as a whole	E	S
	<ul style="list-style-type: none"> <li>• Meet the goals of AB 32 for community-wide greenhouse gas emission reductions</li> </ul>	Create engaging materials and tools to encourage residential and business community members to see the benefits of participation in energy efficiency programs, and supporting energy efficiency at the local government level	M	S
		Work with partners to drive customers to actively manage their energy usage, and inform customers of AB793 related offerings	N	S

**Partners:** Associations of Governments/Joint Power Authorities, Community-based Organizations, K-12 Schools, Community Colleges, State Universities, Statewide Energy Efficiency Collaborative (SEEC), Regional Water Agencies, Third-Party Implementers

A recent recommendation<sup>85</sup> to enhance the effectiveness of IOU administration is to improve communication with LGP partners around broad topics. Suggestions include creating mechanisms (such as an e-mail blast) to provide information, and documenting best practices that a LGP can share with other local governments. Local governments appear to need reminders of the support provided by the Statewide Best Practices Coordinator.

PG&E embraced this recommendation by improving outreach to LGP partners and other community partners around strategic planning and other energy efficiency-related activities.

<sup>85</sup> Research Into Action, Draft Report, Targeted Process Evaluation of the Local Government Partnership Program, September 13, 2016, p. 4.

## Pilots and Workforce Standard Requirements

PG&E will describe any unique and innovative aspects of each program, as well as any pilots contemplated or underway, within its program-level implementation plans.

Additionally, PG&E will consider the appropriate workforce standard requirements, such as any required certifications, minimum performance standards, or pre-qualification process for specific programs in support of its energy efficiency portfolio. As applicable, PG&E will detail workforce standard requirements in each Implementation Plan.

## G. Leveraging Cross-cutting Resources

PG&E's cross-cutting sectors will play a pivotal role in advancing energy efficiency in the public sector. Here, PG&E provides a brief review of how cross-cutting initiatives fit into its public sector strategy.

**Finance:** Finance offerings will play a critical role in increasing energy efficiency opportunities through a diversified mix of loans, rebates, and incentives. Expanding existing low-risk financing, such as OBF (e.g., lifting caps, improving measure eligibility, and higher up-front payments) will play a role in improving energy savings in the public sector. In addition, the public sector will be targeted by innovative financing pilots, such as the Green Bond pilot offering. Financing primarily supports *Intervention Strategy 5: Loans, Rebates and Incentives*.

**Emerging Technologies (ET):** ET plays an important role in screening technologies to determine which best meet the needs of public sector customers. ET is also partnering with state agencies to study the potential of a portable classroom retrofit package, which offers a short payback for older portable units. ET plays a major role in *Intervention Strategy 4: Technical Assistance and Tools*.

**Workforce Education & Training (WE&T):** PG&E will provide resources and expertise to develop the necessary skills and knowledge to effectively implement energy efficiency projects. WE&T will provide technical training in energy efficiency both on-site and at energy centers. These might include Building Operator Certification (BOC) training, lighting design and maintenance and others. WE&T supplements efforts to build internal organizational capacity, as detailed in *Intervention Strategy 4: Technical Assistance and Tools*.

**Marketing:** Marketing will continue to play a major role in direct marketing of energy efficiency offerings to raise awareness of new tools and offerings, as well as building integration with Distributed Energy Resources (DER). Targeted marketing and outreach can support community energy efficiency initiatives through local governments, as well as creating channels to reach public sector entities such as hospitals, smaller educational institutions and others. Marketing will play a key role in *Intervention Strategy 1: Strategic Partnerships*, as well as building awareness of the offerings available through *Strategy 5: Loans, Rebates and Incentives*, and *Strategy 6: Outreach and Education*.

**Codes and Standards:** Codes and standards will continue to play a prominent role in supporting local governments interested in adopting ordinances that exceed the state building energy codes: Title 24, Part 6 (also known as "reach codes"). The reach codes program will expand to include support for ordinances requiring measures beyond traditional energy efficiency measures including zero net energy, voluntary standards, renewable energy, alternative fuels vehicle infrastructure, energy storage, demand response, and water saving measures. Codes and Standards will play a major role in supporting *Intervention Strategy 4: Technical Assistance and Tools*.

## H. Integrated Demand Side Management (IDSMS)

PG&E's role is to help its public sector customers think about energy efficiency within the context of all of the demand side management (DSM) offerings available to them. PG&E seeks an integrated approach, breaking down barriers to DSM integration. As outlined in the 2015 Integrated Energy Policy Report, a "more siloed approach to energy planning in which renewable energy goals are considered separately from energy efficiency or demand response or storage goals, for example, does not generate the best results. Each area progresses towards the respective goals but is not integrated and not necessarily part of an effective strategy to meet climate goals. A more integrated approach aimed at GHG reductions is needed."<sup>86</sup> Below, PG&E provides an overview of opportunities for integration.

### Targeted Demand Side Management

TDSM is a pilot program which targets energy efficiency, demand response, distributed generation, and other DSM activities around specific substations where load growth is projected to require significant upgrades. By reducing overall load through DSM, infrastructure upgrades can be deferred.

Public sector facilities, including schools, are outreach targets in terms of reducing the non-residential load. TDSM around the Linden (East Stockton) and Sycamore / Notre Dame (Chico) substations includes a total of 29 schools. In addition, outreach around the Sycamore / Notre Dame substation includes outreach to church organizations, incorporating community organizations into outreach. Savings achieved through the LGP and institutional partnership program are also an integral part of achieving PG&E's goals for each substation. LGPs are continuing to expand their role in TDSM initiatives moving forward.

### Time-of-Use Rate Changes and Electric Vehicles

PG&E may be moving the peak period rates for non-residential customers from mid-day to later in the evening beginning based on the 2017 General Rate Case (GRC) 2 proposal. The proposed mandatory TOU change would move peak rates from 12 PM-6 PM to 5-10 PM. Due to the diversity of the commercial customer base, certain customers may be impacted more than others.

If the change is implemented, PG&E will work with its account representatives to ensure commercial customers understand the implications of the change for their business operations. This conversation will also create an entry point to discuss available energy efficiency offerings. If a customer experiences an increase in energy costs due to the change, energy efficiency can be pitched as an opportunity to mitigate the negative cost impact. Alternately, if a customer experiences a decrease in energy costs due to the change, energy efficiency can be positioned as an opportunity to achieve even greater savings.

Most public sector customers reduce operations after 5 PM. However, this shift in rates will push greater workplace charging of electric vehicles (EVs) as this creates advantageous pricing in the middle of the day. PG&E is supporting the proposed build out of 7,500 EV charging stations at workplaces, multi-unit dwellings and other public sites. Public customers will likely be leading adopters of charging stations.

## I. PG&E Helping to Meet State Policy Goals

**Table 4.17** provides a summary of how PG&E's approach with the public sector will address key state policies.

<sup>86</sup> California Energy Commission. 2015. 2015 Integrated Energy Policy Report. Publication Number: CEC-100-2015-001-CMF. Retrieved from [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN210279\\_20160211T152803\\_2015\\_Integrated\\_Energy\\_Policy\\_Report\\_\\_Small\\_Size\\_File.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN210279_20160211T152803_2015_Integrated_Energy_Policy_Report__Small_Size_File.pdf).



**Table 4.17**

Summary of Relevant Energy Efficiency Policies, Guidance, and PG&E Support

Policy Drivers	Guidance Given	PG&E’s Policy Support
<b>SB350</b>	<ul style="list-style-type: none"> <li>• Doubling energy efficiency savings by 2030, where cost-effective and feasible</li> <li>• Address barriers for low-income customers to energy efficiency and weatherization investments, including those in disadvantaged communities, as well as recommendations on how to increase access to energy efficiency and weatherization investments to low-income customers</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Technical Assistance and Tools:</b> Technical support will be crucial in maximizing the energy savings achieved for measures that programs implement</li> <li>• <b>Loans, Rebates and Incentives:</b> Financial support will help energy efficiency projects and measures move forward in the complex funding environment the public sector faces</li> <li>• <b>Outreach and Education:</b> Public outreach and education around energy efficiency will ensure community support for energy efficiency measures, sustaining long-term savings. Coordinate with public agencies on targeting opportunities for public housing, such as directing qualifying customers to Energy Savings Assistance and CARE programs</li> </ul>
<b>SB 32</b>	Reduce statewide greenhouse gas emissions to 40% below the 1990 level by 2030	PG&E’s support for SB 32 mirrors its approach to SB 350’s goals, as described above
<b>AB 793</b>	<ul style="list-style-type: none"> <li>• Provide education on energy management technologies</li> <li>• Provide incentives for energy management technology</li> </ul>	<b>Outreach and Education:</b> In partnership with local governments, schools and industry leaders, PG&E will work to drive customers to actively manage their energy usage, and inform customers of AB-793 related offerings
<b>AB 802</b>	<ul style="list-style-type: none"> <li>• Disclosure of aggregated whole building energy data</li> <li>• Benchmarking</li> <li>• Provide financial incentives based on all estimated energy savings and considering the overall reduction in normalized metered energy consumption as a measure of energy savings</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Data Access:</b> Quick and easily useable customer data will be critical for customers implementing programs under AB-802</li> <li>• <b>Technical Assistance and Tools:</b> Technical support will be essential as customers adopt new programs and incentives allowable under AB-802</li> <li>• <b>Loans, Rebates and Incentives:</b> New incentives rolled out under the provisions of AB-802 will provide new avenues to achieve savings in existing buildings</li> </ul>
<b>AB 758</b>	<p>Established requirements for program administrators to offer a full range of energy and complementary services, including:</p> <ul style="list-style-type: none"> <li>• Energy assessments</li> <li>• Building benchmarking</li> <li>• Energy rating</li> <li>• Cost-effective energy efficiency improvements</li> <li>• Financing options</li> <li>• Public outreach and education</li> <li>• Green workforce training efforts</li> </ul>	All of PG&E’s public sector interventions are fundamentally based in the provisions of AB-758, and specifically the requirements outlined in the California Energy Efficiency Strategic Plan created by the CPUC in response to the bill

Table continued on next page

**Table 4.17** (continued)

Summary of Relevant Energy Efficiency Policies, Guidance, and PG&E Support

Policy Drivers	Guidance Given	PG&E’s Policy Support
<b>Executive Order B-18-12</b>	Requires state buildings to: <ul style="list-style-type: none"> <li>• State buildings to reduce grid-based electricity purchases for state-owned buildings by 20% by 2018</li> <li>• 50% of new state buildings designed after 2020 will be constructed as ZNE</li> <li>• All new state buildings designed after 2025 will be constructed as ZNE</li> <li>• 50% of existing state-owned buildings will be ZNE by 2025</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Data Access:</b> State agencies should have quick access to their usage data in order to implement measures to fulfill the requirements of B-18-12</li> <li>• <b>Technical Assistance and Tools:</b> Technical assistance will be crucial as state buildings implement energy efficiency measures</li> <li>• <b>Loans, Rebates and Incentives:</b> Incentives and rebates will make additional energy efficiency measures possible for state buildings</li> <li>• In alignment with Codes &amp; Standards, PG&amp;E has created ZNE indicators by building type to track the progress of ZNE adoption. For more information, please refer to the Commercial chapter and the Codes and Standards chapter.</li> </ul>
<b>California Energy Efficiency Strategic Plan (CEESP)</b>	The California Energy Efficiency Strategic Plan spoke specifically to the local government partnerships, identifying six major goals: <ul style="list-style-type: none"> <li>• Lead adoption of higher energy efficiency standards or “reach codes”</li> <li>• Lead energy code compliance enforcement</li> <li>• Lead by example</li> <li>• Lead their communities with innovative energy efficiency programs</li> <li>• Provide expertise in their communities, and</li> <li>• LG energy efficiency expertise becomes widespread</li> </ul>	All of PG&E’s public sector interventions are fundamentally based in the provisions of AB-758, and specifically the requirements outlined in the California Energy Efficiency Strategic Plan created by the CPUC in response to the bill
<b>SB 1414</b>	Proof of permit closure for all downstream central air conditioning or heat pumps	<ul style="list-style-type: none"> <li>• Large portions of the public sector (UCs, CSUs, and others) are exempted from the requirements of SB 1414. Other portions of the public sector are subject to the same requirements as Commercial customers</li> <li>• As required, PG&amp;E will collect proof of permit closure before paying rebates or incentives for all downstream central air conditioning or heat pumps and their related fans, in accordance with SB 1414</li> </ul>
<b>AB 1109</b>	California must reduce its lighting energy use between 2007 and 2018 by 50% for residential interior lighting and by 25% for commercial interior and outdoor lighting	PG&E has strongly supported the intent of AB 1109’s lighting energy use reductions through codes and standards programs and through upstream and downstream energy efficiency incentive programs. PG&E will continue to support AB1109’s objectives with guidance from the Energy Commission and CPUC. As envisioned by the AB 1109, this effort will continue beyond 2018

## J. PG&E's Partners and Commitment to Coordination

The public sector exists within the context of a tight network of inter-related stakeholders, ranging from public sector customers themselves to community organizations, other utilities, realtors and developers and many others. Working with others in this space will be key to achieving greater public sector energy savings.

### San Francisco Bay Area Regional Energy Network (BayREN)

Both BayREN and PG&E work closely with local governments to deliver energy efficiency programs. While PG&E provides funding to BayREN, PG&E does not have oversight over BayREN's activities, and it will be important to ensure cooperation between the two program administrators to create a positive experience for the customer and maximize energy savings for both parties. Past examples of collaboration include the CSI-Solar Thermal rebate program, offered through the BayREN's multifamily energy efficiency program. PG&E will continue to support collaboration as BayREN continues to grow and develop its services.

### Community Choice Aggregators (CCAs)

Community Choice Aggregators (CCAs) are a new and growing element in California's energy efficiency ecosystem. Currently Marin Clean Energy (MCE) is the only CCA implementing energy efficiency programs in PG&E's service territory, but more and more counties and regions are setting up their own CCA programs. Cooperation with the CCAs will be critical in ensuring that customers continue to receive the best possible service.

### Local Governments

LGPs have been and will continue to be one of the primary delivery mechanisms of energy savings through the public sector. Local governments account for the majority of usage within the sector and play a role as community leaders in energy efficiency. For more information, please see *Appendix D: Local Government Partnerships Overview*.

### Program Administrators

PG&E will collaborate with program administrators and publicly-owned utilities (POUs) to share best practices and lessons learned, ensure consistent messaging and program delivery, minimize gaps and program overlap, and coordinate implementation of statewide offerings, and local offerings that cut across multiple service territories. For example, customers within a county served by multiple IOUs should have access to the same program offerings.

In addition, in the new statewide administration model, PG&E will work closely with statewide administrators leading the public sector statewide programs such as the UC/CSU partnership. Please refer to PG&E Statewide Administration Business Plan chapter for more information on statewide programs.

### Community Organizations

Community organizations like regional non-profits, churches, clubs, and others will play a key role in facilitating acceptance of energy efficiency. Community organizations can also play a role in encouraging participation among commercial and residential entities.

### Regional Government Agencies

Examples of these might include regional water agencies, associations of governments, or others. By working closely with these agencies around their areas of expertise, PG&E can better disseminate energy efficiency programs to customers and find synergies between energy efficiency and other areas of concern, such as water savings.

### Third-Party Implementers

In the rolling portfolio structure, IOUs turn to third party implementers to propose, design, and deliver the bulk of energy efficiency programs. D. 16-08-019 sets a minimum target of 60% of the utility's total portfolio budget to be devoted to third party programs by the end of 2020.<sup>87</sup> As such, by 2020, PG&E will have transitioned at least 60% of its program design and delivery to third parties. This transition allows PG&E to engage third parties to offer a more diverse and innovative portfolio of programs to help customers use energy more efficiently. PG&E will evolve its energy efficiency

<sup>87</sup> D. 16-08-019, p. 111.

portfolio to maximize energy savings in support of California’s goal to double energy efficiency by 2030, and achieve cost-effectiveness by offering programs that drive value and innovation for customers, cultivate relationships with new partners, and use its knowledge of customers to more efficiently and effectively deliver energy efficiency programs.

## K. Statewide Administration and Transition Timeline

D.16-08-019 modifies the program administration structure for all upstream and midstream programs, market transformation efforts, and select downstream programs, such that these programs become “statewide.” D.16-08-019 defines statewide programs as being delivered uniformly throughout the IOU service territories and overseen by a single lead program administrator.<sup>88</sup> Statewide efforts are required to comprise at least 25% of each IOU’s portfolio budget.<sup>89</sup>

Please refer to the *Statewide Administration* chapter for program administrators’ proposals for statewide programs and/or subprograms.

## L. Solicitation Strategies

D.16-08-019 sets a minimum target of 60% of the utility’s total portfolio budget, including administrative costs and EM&V, to be proposed, designed, and delivered by third parties by the end of 2020.<sup>90</sup> Please refer to the *Portfolio Overview* chapter for PG&E’s complete solicitation strategy and transition timeline, by sector.

## M. Metrics

PG&E and the other PAs understand the importance of ensuring that all metrics provide value to the CPUC, program administrators, or other stakeholders, and recognizes that listed metrics can have powerful and unintended effects.<sup>91</sup>

All of the metrics proposed are consistent with the agreed-upon statewide guiding principles for the metrics shared with the Energy Division on Aug 16, 2016.

Metrics should...
Be used and useful by PAs to manage portfolio
Be timely
Rely on data used in program implementation
Be simple to understand and clear of any subjectivity
Have longevity

The guiding principles also indicate that metrics are not a replacement for EM&V.

Additionally, not all metrics have a readily interpretable meaning, so context is needed. As such, we provide context on the metrics in the notes section of **Table 4.18**.

<sup>88</sup> D.16-08-019, pg. 51.

<sup>89</sup> D.16-08-019, p. 65.

<sup>90</sup> D.16-08-019, p.74.

<sup>91</sup> Perrin, in an article in the American Journal of Evaluation, discussed certain known limitations of performance metrics. Among these limitations, he described varying interpretation of the “same” term and concepts, goal displacement, use of meaningless and irrelevant measures, and cost-savings vs. cost-shifting. (Perrin, Burt. 1998. *Effective Use and Misuse of Performance Measurement*. American Journal of Evaluation 1998:19;367.)

Note that in the Business Plans, PG&E is proposing to track metrics and indicators that can be frequently updated to allow PG&E staff, implementers, the CPUC, and other stakeholders understand and manage the sector. While we recognize that there are longer-term outcome and satisfaction/quality metrics and indicators that are important to track through research studies, we are not proposing study-based metrics at the Business Plan level as they are measured less frequently, and require EM&V dollars that may or may not be available. These studies will be needed to support the program; however, we recommend that these be determined through a different process (i.e., EM&V Roadmap) once the programs are finalized.

## Metrics Measuring Public Goals

The draft metrics proposed are aligned with the overall program goals. Specifically, within the next-10-year period, PG&E's primary goal for the public sector is to:

- Save 511 GWh, 72 MW, 28.8 MM therms by 2025 – while focusing on five key public sector segments, and serving rural communities. These goals are based on past PG&E performance relative to Potential Study targets.

Secondary goals include:

- Increase customers' ability to manage energy by helping public sector customers benchmark their buildings and obtain the energy consumption data that they need to plan projects.
- Increase operational efficiency (i.e., reduce \$/kWh) by targeting with data analytics, using strategic partnerships and increasing scalable programs such as loans.

**Table 4.18** summarizes the metrics and indicators for the Public sector.

**Table 4.18**  
Public Metrics and Indicators

GOAL: Save 511 GWh, 72 MW, 28.8 MM therms by 2025						
Intervention Strategies	Metrics	Baseline (or Benchmark)	Metric Source	Short-Term Targets (1-3 years)	Mid-Term Targets (4-6 years)	Long-Term Targets (7-8+ years)
All	Electricity Savings (Net First Year)	Average of 103 Gross GWh/year across 2011-2015	Net Ex Ante savings from program databases	62 net GWh/yr (77 gross GWh/yr)	65 net GWh/yr (81 gross GWh/yr)	66 net GWh/yr (83 gross GWh/yr)
	Demand Savings (Net First Year)	Average of 14 Gross MW / year across 2011-2015		7 net MW/yr (9 gross MW/yr)	10 net MW/yr (13 gross MW/yr)	11 net MW/yr (15 gross MW/yr)
	MM Therm Savings (Net First Year)	Average of 3.6 Gross MM Therms/year across 2011-2015		2.9 net MM Therms/yr (3.7 gross MM Therms/yr)	3.8 net MM Therms/yr (4.8 gross MM Therms/yr)	4.3 net MM Therms/yr (5.5 gross MM Therms/yr)
<b>Indicators</b>						
<ul style="list-style-type: none"> <li>• Lifetime GWh and MM Therm energy savings<sup>a</sup></li> <li>• Energy savings by five key segments (local governments, state governments, federal government, K-12, higher education)</li> <li>• Participation: Annual number and proportion of all customers participating in energy efficiency programs (overall and by five key segments)<sup>b</sup></li> <li>• Participation in rural communities (by zip code)</li> <li>• Depth of savings metric of kWh/participant (by size or segment TBD based on needs)</li> <li>• Reduction of GHG emissions<sup>c</sup></li> </ul>						
<b>Notes</b>						
<p><sup>a</sup> Goals are set on first year net energy savings, but lifetime savings will also be tracked.</p> <p><sup>b</sup> Participation may go up or down depending on the programs proposed by third parties. The combination of participation and depth of savings indicators will provide insights on overall savings numbers.</p> <p><sup>c</sup> GHG emission reductions will be tracked because it is of interest to Public Sector customers. Similar to the approach for C&amp;S, this will be calculated based on emission factors for electricity and nature gas energy savings provided in the California Energy Commission 2016 Title 24 Part 6 Impact Analysis.</p>						

Note: **Metrics** have baselines and targets, will be tracked, and when updated will compare the current value to the baseline and target. **Indicators** will be tracked but have no targets and may or may not have baselines. Indicators provide useful context for the metric.

Table continued on next page

**Table 4.18** (continued)  
Public Metrics and Indicators

GOAL: Increase customers' ability to manage energy						
Intervention Strategies	Metrics	Baseline (or Benchmark)	Metric Source	Short-Term Targets (1-3 years)	Mid-Term Targets (4-7 years)	Long-Term Targets (8-10+ years)
<ul style="list-style-type: none"> <li>Data Access</li> <li>Technical assistance and Tools</li> </ul>	Increase the number of buildings benchmarked through Energy Star Portfolio or other benchmarking tools	TBD by the end of year two	Number of Public Sector buildings requesting PG&E to enter data in benchmarking tools	Determine baseline	TBD (# Public Buildings using benchmarking tools)	TBD (# Public Buildings using benchmarking tools)
<b>Indicators</b>						
None						
<b>Notes</b>						
Targets will be set after baseline is finalized.						
GOAL: Increase operational efficiency (i.e., reduce \$/kWh and \$/therm)						
All Interventions	Annual levelized cost of energy (kWh)	\$0.074/kWh <sup>a</sup>	Customer Data	Same as baseline <sup>b</sup>	10% lower than baseline	TBD <sup>c</sup>
	Annual levelized cost of energy (Therm)	\$0.497/Therm <sup>a</sup>	Customer Data	Same as baseline <sup>b</sup>	10% lower than baseline	TBD <sup>c</sup>
<b>Indicators</b>						
Operational efficiency for third party implementers and other implementers						
<b>Notes</b>						
Levelized cost represents discounted lifecycle net savings using Program Administrator Costs.						
<sup>a</sup> As the Public sector is new, PG&E used its best estimates based on current program data to determine the baseline. In 2018, data will be tracked for the Public sector.						
<sup>b</sup> PG&E will strive to keep levelized costs flat from baseline. However, due to new program administration and implementation structures, and other portfolio/program changes, flexibility is required to adapt to the new paradigm.						
<sup>c</sup> PG&E will update its long term targets once more data is gathered on the new administration and implementation structures.						

Note: **Metrics** have baselines and targets, will be tracked, and when updated will compare the current value to the baseline and target. **Indicators** will be tracked but have no targets and may or may not have baselines. Indicators provide useful context for the metric.

## N. EM&V Research Needs

Evaluation, Measurement and Verification (EM&V) conducts research studies with the guidance of the CPUC Framework and Protocols. The main source of planned research will be the annual EM&V Research Plan put together jointly by the CPUC and the PAs. This ongoing process enables stakeholders to understand and comment on research at PG&E. The PG&E-led research for this sector will be contingent upon the needs of the portfolio as a whole and the annual sector-specific research budget.

Past EM&V has not looked at the public sector as a whole, but future EM&V must consider this a separate sector since it has been called out separately by the CPUC. For example, the 2013 California Market Potential Study by Navigant does not consider public facilities as a part of a unique sector in its energy efficiency market potential analysis. To further illustrate how public sector has been lumped in with C&I in the past, the PG&E public sector projects (specifically higher education) were included in a 2015 evaluation that bundled these customers into a single stratum with oil, food/agriculture, and data center projects. In this evaluation the results were presented at the stratum level, and as such did not provide information specific to public sector customers, reiterating the need for additional public sector specific impact evaluations.

Future research (both market studies, public sector baselines, and detailed information in the potential study) is needed in this area. Once a potential study with public sector specific data is available, a more detailed understanding of the potential in this sector will be possible. Until that time, the joint IOUs have agreed to a methodology for breaking out the public sector from the prevailing potential goals study, taking savings primarily from the commercial sector and to a lesser extent the industrial sector (e.g., wastewater facilities).

Moving forward within the rolling portfolio structure, PG&E will clarify and target the public sector as a whole. Commensurate with this approach, EM&V will by necessity expand its scope beyond current LGP assessments to include other public sector customer types (e.g., K-12, college, etc.) historically not evaluated.

The bullets below show currently known information needs that may or may not be detailed in the most recent EM&V Evaluation Plan. For those study types under PG&E's purview, PG&E plans to conduct this research as much as practical given annual EM&V budgets, although the specifics may change over time. Specific research needs for this sector, by study category, include:

- Market and baseline studies to understand program gaps, needs, and inform design and metrics

Specific research needs include:

- Updating CEUS with public called out separately
- Baseline information for the public sector (and related five key public sector segments)

- Process studies to understand how to improve current or new programs

Specific research needs include:

- LGP studies over time that are comprehensive process evaluations on a subset of individual partnerships each year, rotating across all LGPs in their service territory so that each LGP within a utility will receive a comprehensive process evaluation every four or five years. The IOUs propose that a common core scope of work be used for all individual process evaluations of partnerships so that findings can be compared year after year. The first set of comprehensive process evaluations is currently in progress and due to be completed during the first quarter of 2017
- Process studies of other public sector program components to see if the program designs are able to meet customer needs

- Energy impact studies that are specific to measures, end uses, or sectors

Specific research needs include:

- Energy impacts that are specific to public



- Monitoring studies to inform PG&E and stakeholders about accomplishments to date, sector needs, and remaining potential

Specific research needs include:

- Setting up studies to enable tracking of business and implementation plan metrics
- An updated Potential & Goals Study to inform PG&E goals and indicate potential savings by end use. PG&E looks forward to the updated Potential Study in 2017 to inform the design of future public offerings and hopes that the public sector will have specific values.

Notably, for future process work in this sector, PG&E, along with the other California IOUs, plans to conduct a comprehensive process evaluation for each of the LGPs as recommended by the California Evaluation Framework (CEF). A “comprehensive” evaluation documents and examines all the activities of each LGP, rather than a “targeted” evaluation that focuses only on a subset of a LGP’s activities.

To accommodate evaluations for each LGP within a limited budget, the IOUs propose to conduct comprehensive process evaluations on a subset of individual partnerships each year, rotating across all LGPs in their service territory so that each LGP within a utility will receive a comprehensive process evaluation every four or five years. The IOUs propose that a common core scope of work be used for all individual process evaluations of partnerships so that findings can be compared year after year. The first set of comprehensive process evaluations is currently in progress and due to be completed during the first quarter of 2017.

After all LGPs have been evaluated, at the end of a four to five year period, the cycle will begin again. This will allow evaluators to provide customized and specific recommendations to each LGP being evaluated.

Note that the ability to conduct these evaluations for this sector will be weighed within the need to understand the other public segments and EM&V needs for other sectors.

As the EM&V environment changes, PG&E is preparing to address the associated EM&V needs. PG&E will identify specific data collection strategies early in a program’s history to support internal performance analysis and program evaluations, and will embed data collection and evaluation into the program designs whenever possible to reduce evaluation costs and increase feedback to the programs. Additionally, PG&E will ask third-party program designers to include an EM&V plan demonstrating their program evaluability, documenting what data will be collected through the program, and to propose a method for assessing impacts.

The specifics on data collection and reporting will be provided in as much detail as possible in PG&E’s Implementation Plans (IPs). Ultimately, both PG&E-led and third-party programs, PG&E will collaborate with CPUC staff and their evaluation consultants to ensure that appropriate data collection and reporting capabilities are in place to facilitate accurate evaluation.

# WHAT PG&E IS DOING TO SUPPORT: **HARD-TO-REACH CUSTOMERS**

## PG&E works with Local Government Partnerships to identify and support Hard-to-Reach (HTR) customers and provide them with:



- Implementers work directly with customers to determine the best combination of measures that fits their needs, and connect those customers to resources
- Reports with available incentives, recommendations, and a financial summary
- Start to finish project management
- Assistance with 0%-interest project financing on your utility bill
- Incentives paid directly to participating contractors
- Negotiated discounts with qualified contractors and distributors

## WHAT DEFINES A HTR CUSTOMER?

Customers are considered hard-to-reach based on business size, primary language, geographic location, energy usage and renter/owner status.

In 2016, over 80% of the projects completed by PG&E's I Direct Install programs were for HTR customers.

## LOCAL GOVERNMENT PARTNERSHIP SPOTLIGHT



Redwood Coast Energy Watch (RCEW), which offers comprehensive locally-based energy efficiency services to traditionally hard-to-reach market sectors in Humboldt County. RCEW worked in partnership with local organizations, such as Humboldt State University, to implement a comprehensive energy efficiency upgrade for Blue Lake Rancheria, a federally recognized Native American Tribe, and the town of Blue Lake.

“Energy interconnects with every aspect of development,” said Jana Ganion, Energy Director for the Tribe, pointing to the energy efficient hotel the Tribe built in 2009.

As a result of the Tribe's commitment to energy use reductions, they were one of 16 communities selected as a 2015-106 Climate Action Champion by the Obama Administration.

## STATE VISION: California Energy Efficiency Strategic Plan



Hard-to-reach customers can be found in the public and commercial sectors, as small and medium businesses share many of the barriers to adopting energy efficiency as governments and schools. The CEESP targets HTR customers in a number of ways, here are some examples:

### GOAL 1. INCREASED GOVERNMENT LEADERSHIP IN ENERGY EFFICIENCY

The new Local Government Challenge program will promote performance-based efficiency improvements with grant payment amounts tied to actual energy savings achieved, thus overcoming a primary barrier to pursuing existing building upgrades for many HTR customers.

### GOAL 3. INCREASED BUILDING INDUSTRY INNOVATION AND PERFORMANCE

Direct install (DI) programs are designed to provide HTR customers with enhanced technical assistance and project design services to reduce operating costs and energy use.

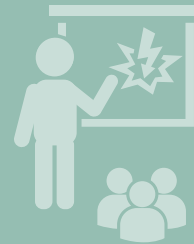


# WHAT PG&E IS DOING TO SUPPORT: K-12 SCHOOLS

## Through Local Government Partnerships (LPGs) and other energy efficiency programs, PG&E...

- Conducts energy audits of K-12 facilities
- Supports creation of Prop 39 energy plans
- Connects K-12 staff with energy efficiency training through Workforce Education & Training
- Offers a variety of energy efficiency incentives and financing solutions, such as on-bill financing (OBF)
- Supports direct installation of energy efficiency measures

## To support education of students around energy efficiency, PG&E...



- Provides basic energy education and energy career awareness resources for teachers with focus on energy efficiency concepts and awareness about energy-related jobs
- Prioritizes school districts with a structure in place for energy or environmental teaching and career awareness resources for energy efficiency

## STATE VISION: The State of California's vision for K-12 schools consists of ...



### California Energy Efficiency Strategic Plan:

- Support energy efficiency and sustainability curricula
- Develop linkages between K-12 and visible career paths in energy efficiency

### Prop 39:

- Support eligible projects to improve energy efficiency and expand clean energy generation in schools
- Eligible schools request funding by submitting an energy expenditure plan application to the California Energy Commission

## LGP SPOTLIGHT: Association of Monterey Bay Area Governments (AMBAG)



PG&E's partnership with AMBAG, the AMBAG Energy Watch, actively assisted local school districts with \$23.3 million of the total Prop 39 funding allocated to the school districts in the AMBAG region. (73% of the total Prop 39 funding in the region)

"AMBAG was instrumental in getting our expenditure plan approved. AMBAG conducted audits, participated in planning, and communicated directly with CEC auditors. MPUSD's Prop 39 plan would have been a daunting task without AMBAG's partnership."

— David Chandler, Energy Conservation Coordinator, Monterey Peninsula USD

## 2015 STATISTICS

9,027 K-12 ELECTRIC customers

and 5,413 K-12 GAS customers in PG&E's Territory

### OF THOSE:

718 ELECTRIC (8% of total) and

555 GAS ACCOUNTS (10.3% of total) participated in PG&E's EE programs

### USAGE:

ELECTRIC USAGE: 1,281.8 GWh

GAS USAGE: 38.7 MM Therms

### SAVINGS:

ELECTRIC SAVINGS: 17,893 MWh

GAS SAVINGS: 790,573 Therms

AVERAGE SAVINGS PER PARTICIPANT:

24,922 kWh

*On average, participating schools saved 24,922 kWh of electricity and 1,424 Therms in 2015*



# Public Appendices

## Appendix A: Compliance Checklist

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
<b>Portfolio Summary</b>		
0	<b>Executive Summary</b>	
	<i>Company description</i>	Executive Summary p. A
	<i>Definition of market</i>	Executive Summary p. A
	<i>Mission Statement</i>	Executive Summary p. A
	<i>Purpose of Business Plan</i>	Executive Summary p. A
I.A.1, II.D.2	<b>Overview</b>	
	<i>About EE/DSM</i>	Energy Efficiency and It's Role in Helping PG&E Meet Its Energy Needs, pp. 11-16
	<i>CA Energy Needs</i>	California's Evolving Energy Efficiency Landscape, pp. 21-26
	<i>Regulatory Requirements</i>	California's Evolving Energy Efficiency Landscape, pp. 22-23
	<i>Strategic Plan</i>	California's Evolving Energy Efficiency Landscape, pp. 20-21
	<i>Legislation (e.g., AB 758, SB 350, AB 802, AB 793)</i>	California's Evolving Energy Efficiency Landscape, pp.

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		22-23
	<i>IOUs/PAs/CPUC/etc. overall role</i>	Roles in the Changing Landscape, pp. 8-9
I.A.2	<i>Broad socioeconomic and utility industry trends relevant to PA's EE programs (population, economics and markets, technology, environment/climate)</i>	California's Evolving Energy Efficiency Landscape pp. 23-26
I.B.1	<i>Vision (e.g., How PA thinks about and uses EE over next 10 years)</i>	PG&E's Vision, p. 1
I.5	<i>Compare/contrast to past cycles</i>	PG&E's Portfolio Evolution: Comparison to Past Cycles, pp. 9-11
I.B.2	<b>Goals &amp; Budget</b>	
I.B.2 & I.C.2.a	<i>Energy Saving Goals</i>	Goals, Budget and Cost-Effectiveness, pp. 27-28
I.C.2.a	<i>Portfolio Budget (sector and portfolio level per xls checklist)</i>	Goals, Budget and Cost-Effectiveness, pp. 28-30
I.C.2.a, I.C.2.d	<i>Cost-effectiveness (sector and portfolio level per xls checklist)</i>	Goals, Budget and Cost-Effectiveness, pp. 30-34
I.C.2.b	<i>Explanation of Admin Budgets (e.g., Direct/Indirect Labor, Professional/Admin personnel)</i>	Goals, Budget and Cost-Effectiveness, pp. 28-29
I.C.2.c	<i>Explanation of accounting practices</i>	Goals, Budget and Cost-

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		Effectiveness, p. 30
I.C.3 and I.C.4	<b>Intervention strategies (high level)</b>	
	<i>Overall issues/challenges/barriers</i>	PG&E's Portfolio Plan, pp. 4-7
	<i>High level summary of strategies and tools (e.g., AMI data, AB 802, procurement model, up/mid/downstream, etc.)</i>	PG&E's Portfolio Plan, pp. 4-7
I.C.4; I.D	<b>Solicitation plan</b>	
I.C.4	<i>Solicitation strategies/areas that could be SW</i>	Solicitation Strategy and Transition Timeline, pp. 35-42
I.D; II.F	<i>Proposal for transitioning the majority of portfolios to be outsourced by the end of 2020.</i>	Solicitation Strategy and Transition Timeline, pp. 35-42
<b>Sector Chapter (commercial, residential, public, agricultural, industrial, x-cutting)</b>		
II.A	<b>Summary tables</b>	
II.A	<i>Table with CE, TRC, PAC, emissions, savings, budget</i>	Budget, Savings and Cost-Effectiveness, p. 8-9
I.C.7; II.E.1.b	<i>Metrics for sector</i>	Metrics, pp. 44-47
II.D	<b>Market characterization (overview and market/gap and other analysis)</b>	
II.D.1	<i>Electricity/NG</i>	Sector Overview, pp. 11-20
II.D.2	<i>State goals include acknowledgement of goals set by Strategic Plan, SB 350, AB758, guidance as appropriate)</i>	PG&E Helping to Meet State Policy Goals,

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		pp. 40-42
II.D.3	<i>EE potential and goals</i>	Budget, Savings and Cost-Effectiveness, p. 8-9
II.D.5	<i>Customer landscape (e.g., segments/subsegments, major end uses, participation rates, etc.)</i>	Sector Overview, pp. 11-20
II.D.6	<i>Major future trends that are key for the PA and its customers</i>	Public Market Trends and Challenges, pp. 20-24
II.D.7	<i>Barriers to EE and other challenges to heightened EE (e.g., regulatory, market, data)</i>	Public Market Trends and Challenges, pp. 20-24
II.2.a	<b>Description of overarching approach to the sector</b>	
	<i>Goals/strategies/approaches</i>	Public Sector Vision, pp. 1-4
I.C.6; I.D	<i>How portfolio meets Commission guidance</i>	PG&E Helping to Meet State Policy Goals, pp. 40-42
II.C	<i>Description of how this chapter addresses the performance challenges/barriers</i>	PG&E's Approach to Achieving Goals, pp. 24-39
I.C.4 a-c	<b>Intervention strategies (detailed)</b>	
II.D.2.a; II.E.3	<i>What specific strategies are being pursued (e.g., near, mid, long AND existing, modified, new)</i>	PG&E's Approach to Achieving Goals, pp. 24-39
I [cmt with excerpt]	<i>Why specific strategies were chosen (e.g., ID current weaknesses, best practices, or other rationale to support choice)</i>	PG&E's Approach to Achieving Goals, pp. 24-39
II.E.1.a; II.E.4	<i>How approaches advance goals discussed above</i>	PG&E's Approach to Achieving Goals, pp. 24-

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		39
I.C.4; I.E; II.D.4	<i>How strategies use lessons learned from past cycles and EM&amp;V</i>	PG&E's Approach to Achieving Goals, pp. 24-39
I	<i>How will interventions support/augment current approaches or solve challenges</i>	PG&E's Approach to Achieving Goals, pp. 24-39
II.D.2	<i>Explanation for how these strategies address legislative mandates from AB 802, SB350, and AB 793, as well as other Commission directives for this sector, including strategic plan.</i>	PG&E Helping to Meet State Policy Goals, pp. 40-42
I.C.4	<i>Future expectations for intervention strategies</i>	PG&E's Approach to Achieving Goals, pp. 24-39
I.C.1; II.E.6	<i>Description of pilots</i>	PG&E's Approach to Achieving Goals, p. 39
II.F	<i>Key Partners</i>	PG&E's Approach to Achieving Goals, pp. 24-39
I.C.5; I.D; II.B; II.C	<b>Compare/contrast to past cycles</b>	
	<i>Budget changes as appropriate</i>	Budget, Savings and Cost-Effectiveness, p. 8-9
	<i>Modification to sector strategies</i>	PG&E's Public Sector Proposal Compared to Prior Program Cycles, pp. 4-7
	<b>Cross-cutting (sector chapters and ME&amp;O)</b>	



Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
II.E.2; II.H, II.K	<i>Program Administrator marketing and integration with SW MEO as applicable</i>	Leveraging Cross-Cutting Resources, p. 39
II.E.5; II.H	<i>Workforce, education, and training</i>	Leveraging Cross-Cutting Resources, p. 39
II.H	<i>Emerging Technologies</i>	Leveraging Cross-Cutting Resources, p. 39
II.H	<i>Codes &amp; Standards</i>	Leveraging Cross-Cutting Resources, p. 39
II.G	<b>Cross PA and Offering Coordination</b>	
II.G	<i>How strategies are coordination among regional PAs</i>	PG&E's Partners and Commitment to Coordination, pp. 43-44
II.G	<i>Proposal of statewide program administrator/approaches for this sector</i>	See Statewide Administration Chapter
II.G	<i>How the sector strategies are coordinated with statewide program activities</i>	See Statewide Administration Chapter
II.G	<i>How are strategies coordinated with other state agencies and initiatives (e.g., AB 758)</i>	PG&E's Partners and Commitment to Coordination, pp. 43-44
II.I	<b>EM&amp;V Considerations (statement of needs)</b>	
II.I	<i>Data collection needs</i>	EM&V Research Needs, pp. 48-49
II.I	<i>Anticipated study needs</i>	EM&V Research Needs, pp. 48-49
II.J	<b>Demand Response</b>	
ED Guidance	<i>How EE measures use up-to-date DR enabling technologies to be "DR ready"</i>	Integrated

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
(p.8)		Demand Side Management, p. 40
ED Guidance (p.8)	<i>How duplication of costs for ME&amp;O, site visits, etc. is avoided for dual-purpose technologies</i>	Integrated Demand Side Management, p. 40
ED Guidance (p.9)	<i>How strategies facilitate customer understanding of peak load, cost, and opportunities to reduce</i>	Integrated Demand Side Management, p. 40
II.K	<b>Residential Rate Reform</b>	
ED Guidance (p.9)	<i>How BPs will help reduce load during TOU periods</i>	NA
ED Guidance (p.9)	<i>How BP will diminish barriers to load reduction during TOU periods</i>	NA
ED Guidance (p.9)	<i>How strategies will provide info to customers and/or provide a tool to show how program may impact customer energy usage during different TOU periods</i>	NA
ED Guidance (p.9)	<i>How strategies will analyze whether a customer may experience greater savings by switching to a different, opt-in TOU rate</i>	NA
ED guidance (p.9)	<i>ME&amp;O re: rate reform</i>	NA
II.L	<b>Integrated Demand Side Resources</b>	
II.M	<b>Zero-Emission Vehicles (EVs)</b>	Integrated Demand Side Management, p. 40
II.N	<b>Energy Savings Assistance (Multi-family Focused)</b>	NA
	<b>Appendices</b>	
	<i>Additional Customer Data</i>	Appendix C
	<i>Cited research</i>	Appendix B
	<i>CAEECC stakeholder input resolution</i>	See Input Tracker

## Appendix B: References

Accenture Research. 2015. The New Energy Consumer: “Unleashing Business Value in a Digital World”.  
The New Energy Consumer: “Unleashing Business Value in a Digital World”

[https://www.accenture.com/\\_acnmedia/Accenture/next-gen/insight-unlocking-value-of-digital-consumer/PDF/Accenture-New-Energy-Consumer-Final.pdf](https://www.accenture.com/_acnmedia/Accenture/next-gen/insight-unlocking-value-of-digital-consumer/PDF/Accenture-New-Energy-Consumer-Final.pdf)

American Council for an Energy Efficiency Economy. “Local Government-Utility Partnerships for Facilitating Access to Community Energy Usage Data,” Accessed October 5, 2016. <http://aceee.org/local-government-utility-partnerships-facilitating>

Assembly Bill 802. October 8, 2015.

[https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill\\_id=201520160AB802](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB802)

Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA. 2016. “Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings.” <http://scholarship.law.berkeley.edu/cleepubs/4/>

Burgoyne, Dan “State of California Buildings Focus on Water, Energy, Environment, Performance,” *Green Building Information Gateway*, <http://insight.gbig.org/state-of-california-buildings-focus-on-water-energy-environment-performance/>

California Community Colleges Chancellor’s Office. “California Community Colleges Key Facts,” Accessed October 5, 2016. <http://californiacommunitycolleges.cccco.edu/PolicyInAction/KeyFacts.aspx>

California Department of Education, “Proposition 39 – California Clean Energy Jobs Act,” Accessed October 5, 2016. <http://www.cde.ca.gov/fg/fo/profile.asp?id=3898>

California Energy Commission. “Proposition 39 K-12 Snapshot,” Accessed October 5, 2016, <http://www.energy.ca.gov/efficiency/proposition39/>

California Energy Commission. August 2012. Comprehensive Energy Efficiency Program for Existing Buildings. Scoping Report. <http://www.energy.ca.gov/2012publications/CEC-400-2012-015/CEC-400-2012-015.pdf>

California Energy Commission. 2015. *Existing Buildings Energy Efficiency Action Plan*. CEC-400-2015-013-F. September 2015. <http://www.energy.ca.gov/2015publications/CEC-400-2015-013/CEC-400-2015-013-D.pdf>

California Energy Commission. 2015. 2015 Integrated Energy Policy Report. Publication Number: CEC-100-2015-001-CMF. Retrieved from [http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN210279\\_20160211T152803\\_2015\\_Integrated\\_Energy\\_Policy\\_Report\\_Small\\_Size\\_File.pdf](http://docketpublic.energy.ca.gov/PublicDocuments/15-IEPR-01/TN210279_20160211T152803_2015_Integrated_Energy_Policy_Report_Small_Size_File.pdf)

California Public Utilities Commission. July 2013. *Energy Efficiency Policy Manual v5*. [http://www.cpuc.ca.gov/NR/rdonlyres/7E3A4773-6D35-4D21-A7A2-9895C1E04A01/0/energy\\_efficiencyPolicyManualV5forPDF.pdf](http://www.cpuc.ca.gov/NR/rdonlyres/7E3A4773-6D35-4D21-A7A2-9895C1E04A01/0/energy_efficiencyPolicyManualV5forPDF.pdf)

California Public Utilities Commission. January 2011. *California Energy Efficiency Strategic Plan*. <http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5303>

California Standard Practice Manual: Economic Analysis of Demand Side Management Programs and Projects, 2002. [http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf)

Cooper, Rachel. 2013. E Source Market Research: Government and Public Administration Sector Profile and Survey.

Department of General Services Office of Sustainability. 2014. 2014 California State Facility Water and Energy Benchmarking Report. <https://www.documents.dgs.ca.gov/dgs/pio/benchmarking15.pdf>

DNV-GL. July 24, 2015. *Draft Report IALC4 NRNC Whole Building Impact Evaluation Report*. [http://www.calmac.org/publications/2013\\_NRNC\\_Eval\\_Final\\_Report.pdf](http://www.calmac.org/publications/2013_NRNC_Eval_Final_Report.pdf)

Dotson, Greg and Erin Auel, April 30, 2015. "The Buildings of Tomorrow Are Here Today," *Center for American Progress*, <https://www.americanprogress.org/issues/green/report/2015/04/30/112212/the-buildings-of-tomorrow-are-here-today/>

Ed-Data. 2014. School Facilities in California. Retrieved from <https://www.ed-data.k12.ca.us/Pages/School-Facilities-in-California.aspx>

*Environmental Protection Agency*, 2011, "Energy Efficiency in Local Government Operations," [https://www.epa.gov/sites/production/files/2015-08/documents/ee\\_municipal\\_operations.pdf](https://www.epa.gov/sites/production/files/2015-08/documents/ee_municipal_operations.pdf)

Evergreen Economics and Navigant Consulting. July 26, 2013. Program Assessment Study: Local Government Partnership Programs – Final Report. CPUC. [http://www.calmac.org/publications/LGP\\_Program\\_Assessment\\_Report\\_-\\_final.pdf](http://www.calmac.org/publications/LGP_Program_Assessment_Report_-_final.pdf)

Flanigan, Ted "Proposition 39 is Succeeding...Just Wait and See," *Climate Resolve*, September 8, 2015, <http://climateresolve.org/proposition-39-is-succeeding-just-wait-and-see/>

Freeman, Sullivan & Co. 2013a. April 1, 2013. *2012 Load Impact Evaluation of California's Statewide Base Interruptible Program*. [http://www.calmac.org/publications/2013\\_Statewide\\_BIP\\_Evaluation\\_-\\_FINAL.pdf](http://www.calmac.org/publications/2013_Statewide_BIP_Evaluation_-_FINAL.pdf)

Freeman, Sullivan & Co. 2013b. *2012 California Statewide Non-residential Critical Peak Pricing Evaluation*. April 1, 2013. [http://www.calmac.org/publications/2012\\_non-res\\_cpp\\_statewide\\_evaluation\\_-\\_final.pdf](http://www.calmac.org/publications/2012_non-res_cpp_statewide_evaluation_-_final.pdf)

Green Building Action Plan – For Implementation of Executive Order B-18-12. [http://www.climatechange.ca.gov/climate\\_action\\_team/documents/Green\\_Building\\_Action\\_Plan.pdf](http://www.climatechange.ca.gov/climate_action_team/documents/Green_Building_Action_Plan.pdf)

Harcourt Brown & Carey, Inc. July 8, 2011. "Energy Efficiency Financing in California: Needs and Gaps," [http://www.harcourtbrown.com/wp-content/uploads/CPUC\\_FinancingReport\\_HBC\\_Jul8v2.pdf](http://www.harcourtbrown.com/wp-content/uploads/CPUC_FinancingReport_HBC_Jul8v2.pdf)

Itron. 2014a. 2010-2012 CPUC Nonresidential (Non-Core) Audit Evaluability Assessment. Final Report. Local Government Partnership, Institutional Partnership, and Third Party Programs. June 24, 2014. [http://www.calmac.org/publications/LGP3P\\_EvaluabilityAssessment\\_FinalReport\\_20140911ES.pdf](http://www.calmac.org/publications/LGP3P_EvaluabilityAssessment_FinalReport_20140911ES.pdf)

Itron. 2014b. Commercial Saturation and Commercial Market Share Tracking Study Telephone Survey Findings. September 22, 2014. [http://www.calmac.org/publications/California\\_CSS\\_CMST\\_Phone\\_Survey\\_Report\\_updated.pdf](http://www.calmac.org/publications/California_CSS_CMST_Phone_Survey_Report_updated.pdf)

Itron. 2014c. Commercial Saturation and Commercial Market Share Tracking Study Telephone Survey Findings. Appendices. September 4, 2014. [http://www.calmac.org/publications/California\\_CSS\\_CMST\\_Phone\\_Survey\\_AppendicesES.pdf](http://www.calmac.org/publications/California_CSS_CMST_Phone_Survey_AppendicesES.pdf)

Itron. 2014d. 2010-12 WO33 Custom Net-to-Gross. Final Report. September 24, 2014. <http://www.energydataweb.com/cpucFiles/pdaDocs/1180/2010-12%20WO033%20Custom%20Net-to-Gross%20Report%20-%20Final.pdf>

Itron. 2015a. 2013 Custom Impact Evaluation Industrial, Agricultural, and Large Commercial. Final Report. CALMAC Study ID CPU0107.01. July 17, 2015. [http://www.calmac.org/publications/IALC\\_2013\\_Report\\_Final\\_071715.pdf](http://www.calmac.org/publications/IALC_2013_Report_Final_071715.pdf)

Itron. 2015b. 2013 Custom Impact Evaluation Industrial, Agricultural, and Large Commercial. Final Appendices. CALMAC Study ID CPU0107.02 [http://www.calmac.org/publications/IALC\\_2013\\_Report\\_Final\\_071715.pdf](http://www.calmac.org/publications/IALC_2013_Report_Final_071715.pdf)

Mayors Climate Protection Center, January 2014 "Energy Efficiency and Technology in America's Cities," <http://usmayors.org/pressreleases/uploads/2014/0122-report-energyefficiency.pdf>

Mitchell, Cynthia 2014. "A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach.", TURN May 15, 2015

<https://www.electricitypolicy.com/images/2014/11/16Nov2014/Mitchell/Mitchell16Nov2014.pdf>

Moezzi, Mithra, Christine Hammer, John Goins, and Alan Meir. February 2014. Behavioral strategies to bridge the gap between potential and actual savings in commercial buildings. Contract Number: 09-327. California Air Resources Board. <https://eec.ucdavis.edu/files/04-11-2014-09-327-final-21feb2014.pdf>

Navigant Consulting, Inc. 2012. *Analysis to Update Energy Efficiency Potential, Goals and Targets for 2013 and Beyond*.

Navigant Consulting, Inc. 2012. Program Assessment Study: Statewide Institutional IOU Energy Efficiency Partnership Programs – WO012. October 9, 2012.

Navigant Consulting, Inc. 2014. 2013 California Energy Efficiency Potential and Goals Study. Final Report. February 14, 2014. [www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=4024](http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=4024)

Office Of Governor Edmund G. Brown Jr., April 25, 2012. "Executive Order B-18-12,"

<https://www.gov.ca.gov/news.php?id=17508>

Opinion Dynamics Corporation. 2016a. PY 2013-2014 LOCAL GOVERNMENT PARTNERSHIPS VALUE AND EFFECTIVENESS STUDY FINAL REPORT. CPUC.

Opinion Dynamics Corporation. 2016b. PY2016 California ZNE State Buildings Decision Maker Study Draft Work Plan Updated February 29, 2016. CPUC. (Study is in progress.)

[http://www.energydataweb.com/cpucFiles/pdaDocs/1524/PY2015%20State%20Building%20Decision%20Maker%20Study%20Scope%20of%20Work\\_February%2029%202016.docx](http://www.energydataweb.com/cpucFiles/pdaDocs/1524/PY2015%20State%20Building%20Decision%20Maker%20Study%20Scope%20of%20Work_February%2029%202016.docx).

Opinion Dynamics, April 2016, Statewide ME&O Verification and Integrated Effectiveness Study. CPUC.

<http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=10834>

Pacific Gas and Electric. November 2015. "Local Government Energy Data Needs Assessment PG&E Government and Community Partnerships,"

[https://www.pge.com/includes/docs/pdfs/mybusiness/environment/whatyoucando/greencommunities/LocalGovt\\_EnergyDataNeedsAssessment.pdf](https://www.pge.com/includes/docs/pdfs/mybusiness/environment/whatyoucando/greencommunities/LocalGovt_EnergyDataNeedsAssessment.pdf)

PA Consulting Group. 2009a. Southern California Gas Company. Final Summary Report: Process Evaluation of the 2006-2008 Local Government and Institutional Partnership Programs. January 2, 2009.

PA Consulting Group. 2009b. San Diego Gas & Electric. Final Summary Report: Process Evaluation of the 2006-2008 Local Government and Institutional Partnership Programs. January 5, 2009.

## Appendix C: Customer Data

### Table C.1: 2015 Electric Customers: Snapshot of Usage and Average Usage by Size

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Electricity Usage (GWh)</b>													
Local Government	2,557.2	64.3	10.3	0.1	2,631.8	97.2%	2.4%	0.4%	100%	40.2%	1.0%	0.2%	41.4%
Federal Government	512.1	7.5	1.2	(0.0)	520.8	98.3%	1.4%	0.2%	100%	8.1%	0.1%	0.0%	8.2%
State Government	492.1	9.8	1.9	0.0	503.8	97.7%	1.9%	0.4%	100%	7.7%	0.2%	0.0%	7.9%
Wastewater & Treatment	108.8	4.0	0.4	0.0	113.2	96.1%	3.5%	0.4%	100%	1.7%	0.1%	0.0%	1.8%
K-12 Schools	1,183.5	92.5	5.8	0.0	1,281.8	92.3%	7.2%	0.4%	100%	18.6%	1.5%	0.1%	20.2%
Higher Education	1,211.2	10.0	0.8	(0.3)	1,221.7	99.1%	0.8%	0.1%	100%	19.1%	0.2%	0.0%	19.2%
Other Education	36.4	28.3	20.0	0.0	84.7	42.9%	33.4%	23.6%	100%	0.6%	0.4%	0.3%	1.3%
<b>Total</b>	<b>6,101.2</b>	<b>216.4</b>	<b>40.3</b>	<b>(0.21)</b>	<b>6,357.8</b>	<b>96%</b>	<b>3%</b>	<b>1%</b>	<b>100%</b>	<b>96.0%</b>	<b>3.4%</b>	<b>0.6%</b>	<b>100.0%</b>
<b>Customers (Number of customers)</b>													
Local Government	41,591	2,596	1,655	21	45,863	90.7%	5.7%	3.6%	100%	54.2%	3.4%	2.2%	59.7%
Federal Government	1,353	279	136	12	1,780	76.0%	15.7%	7.6%	99%	1.8%	0.4%	0.2%	2.3%
State Government	12,624	517	287	3	13,431	94.0%	3.8%	2.1%	100%	16.4%	0.7%	0.4%	17.5%
Wastewater & Treatment	556	152	66	1	775	71.7%	19.6%	8.5%	100%	0.7%	0.2%	0.1%	1.0%
K-12 Schools	6,655	1,767	593	12	9,027	73.7%	19.6%	6.6%	100%	8.7%	2.3%	0.8%	11.7%
Higher Education	1,421	209	82	1	1,713	83.0%	12.2%	4.8%	100%	1.9%	0.3%	0.1%	2.2%
Other Education	183	731	3,182	66	4,162	4.4%	17.6%	76.5%	98%	0.2%	1.0%	4.1%	5.3%
<b>Total</b>	<b>64,383</b>	<b>6,251</b>	<b>6,001</b>	<b>116</b>	<b>76,751</b>	<b>84%</b>	<b>8%</b>	<b>8%</b>	<b>100%</b>	<b>83.9%</b>	<b>8.1%</b>	<b>7.8%</b>	<b>99.8%</b>
<b>Average Usage (kWh per customer)</b>													
Local Government	61,483	24,763	6,205	2,450	57,383								
Federal Government	378,481	26,926	8,971	(3,328)	292,572								
State Government	38,981	18,955	6,674	0	37,511								
Wastewater & Treatment	195,758	26,230	6,149	14,256	146,127								
K-12 Schools	177,840	52,372	9,705	1,408	142,000								
Higher Education	852,334	48,047	9,182	(294,974)	713,174								
Other Education	198,714	38,675	6,292	698	20,351								
<b>Average</b>	<b>94,765</b>	<b>34,625</b>	<b>6,722</b>	<b>(1,778)</b>	<b>82,837</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
Small: < 40,000 KWh or < 10,000 Therms  
Unknown: Insufficient data (<12 months)

<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data

<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data

<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

<sup>e</sup> Other Education is a broad category which includes schools for technical and trade, cosmetology, fine art, and language; and training facilities for management, driver education, flight, sports training, exam preparation

**Table C.2: 2015 Electric Customers: Snapshot of Savings and Participants by Size**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Electricity Savings (MWh)</b>													
Local Government	32,750	447.7	19.2	-	33,217.0	99%	1.3%	0.1%	100%	43.4%	0.6%	0.0%	44.0%
Federal Government	2,001	-	-	-	2,000.9	100%	0.0%	0.0%	100%	2.7%	0.0%	0.0%	2.7%
State Government	4,893	79.5	0.6	-	4,973.3	98%	1.6%	0.0%	100%	6.5%	0.1%	0.0%	6.6%
Wastewater & Treatment	422	-	0.1	-	422.5	100%	0.0%	0.0%	100%	0.6%	0.0%	0.0%	0.6%
K-12 Schools	15,957	1,769.4	163.6	3.4	17,893.7	89%	9.9%	0.9%	100%	21.1%	2.3%	0.2%	23.7%
Higher Education	16,648	22.9	4.6	-	16,675.1	100%	0.1%	0.0%	100%	22.1%	0.0%	0.0%	22.1%
Other Education	24	110.3	114.1	19.4	267.6	9%	41.2%	42.6%	93%	0.0%	0.1%	0.2%	0.3%
<b>Total</b>	<b>72,695.2</b>	<b>2,429.9</b>	<b>302.3</b>	<b>22.80</b>	<b>75,450.1</b>	<b>96%</b>	<b>3%</b>	<b>0%</b>	<b>100%</b>	<b>96.3%</b>	<b>3.2%</b>	<b>0.4%</b>	<b>100.0%</b>
<b>Participants (Number of Participants)</b>													
Local Government	852	38	11	-	901	94.6%	4.2%	1.2%	100%	45.2%	2.0%	0.6%	47.7%
Federal Government	29	-	-	-	29	100.0%	0.0%	0.0%	100%	1.5%	0.0%	0.0%	1.5%
State Government	44	3	1	-	48	91.7%	6.3%	2.1%	100%	2.3%	0.2%	0.1%	2.5%
Wastewater & Treatment	5	-	1	-	6	83.3%	0.0%	16.7%	100%	0.3%	0.0%	0.1%	0.3%
K-12 Schools	591	109	16	2	718	82.3%	15.2%	2.2%	100%	31.3%	5.8%	0.8%	37.9%
Higher Education	124	7	2	-	133	93.2%	5.3%	1.5%	100%	6.6%	0.4%	0.1%	7.0%
Other Education	3	24	24	1	52	5.8%	46.2%	46.2%	98%	0.2%	1.3%	1.3%	2.7%
<b>Total</b>	<b>1,648</b>	<b>181</b>	<b>55</b>	<b>3</b>	<b>1,887</b>	<b>87%</b>	<b>10%</b>	<b>3%</b>	<b>100%</b>	<b>87.3%</b>	<b>9.6%</b>	<b>2.9%</b>	<b>99.8%</b>
<b>Average Savings (kWh per Participant)</b>													
Local Government	38,439	11,781	1,747	-	36,867								
Federal Government	68,998	-	-	-	68,998								
State Government	111,209	26,509	600	-	103,611								
Wastewater & Treatment	84,487	-	83	-	70,420								
K-12 Schools	27,000	16,233	10,227	1,688	24,922								
Higher Education	134,255	3,273	2,315	-	125,377								
Other Education	7,902	4,598	4,755	19,424	5,146								
<b>Average</b>	<b>44,111</b>	<b>13,425</b>	<b>5,496</b>	<b>7,600</b>	<b>39,984</b>								
<b>Participation Rates (% Participants per Cust.)</b>													
Local Government	2.0%	1.5%	0.7%	0.0%	2.0%								
Federal Government	2.1%	0.0%	0.0%	0.0%	1.6%								
State Government	0.3%	0.6%	0.3%	0.0%	0.4%								
Wastewater & Treatment	0.9%	0.0%	1.5%	0.0%	0.8%								
K-12 Schools	8.9%	6.2%	2.7%	16.7%	8.0%								
Higher Education	8.7%	3.3%	2.4%	0.0%	7.8%								
Other Education	1.6%	3.3%	0.8%	1.5%	1.2%								
<b>Average</b>	<b>2.6%</b>	<b>2.9%</b>	<b>0.9%</b>	<b>2.6%</b>	<b>2.5%</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 kWh or ≥ 250,000 Therms

Medium: 40,000 - 500,000 kWh or 10,000 - 250,000 Therms

Small: < 40,000 kWh or < 10,000 Therms

Unknown: Insufficient data (<12 months)

<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data

<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data

<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

<sup>e</sup> Other Education is a broad category which includes schools for technical and trade, cosmetology, fine art, and language; and training facilities for management, driver education, flight, sports training, exam preparation.



**Table C.3: 2015 Gas Customers: Snapshot of Usage and Average Usage by Size**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Gas Usage (MM Therms)</b>													
Local Government	254.4	2.7	0.2	0.0	257.3	98.9%	1.1%	0.1%	100%	57.7%	0.6%	0.1%	58.3%
Federal Government	22.6	0.7	0.1	0.0	23.4	96.6%	3.2%	0.3%	100%	5.1%	0.2%	0.0%	5.3%
State Government	24.5	1.0	0.0	-	25.5	96.0%	3.9%	0.2%	100%	5.6%	0.2%	0.0%	5.8%
Wastewater & Treatment	16.3	0.1	0.0	-	16.3	99.6%	0.3%	0.0%	100%	3.7%	0.0%	0.0%	3.7%
K-12 Schools	33.5	4.3	0.8	0.0	38.7	86.7%	11.2%	2.1%	100%	7.6%	1.0%	0.2%	8.8%
Higher Education	76.4	1.4	0.1	0.0	77.9	98.1%	1.8%	0.1%	100%	17.3%	0.3%	0.0%	17.7%
Other Education <sup>e</sup>	0.6	0.9	0.4	0.0	1.9	31.2%	45.4%	23.2%	100%	0.1%	0.2%	0.1%	0.4%
<b>Total</b>	<b>428.3</b>	<b>11.1</b>	<b>1.7</b>	<b>0.01</b>	<b>441.1</b>	<b>97%</b>	<b>3%</b>	<b>0%</b>	<b>100%</b>	<b>97.1%</b>	<b>2.5%</b>	<b>0.4%</b>	<b>100.0%</b>
<b>Customers (Number of customers)</b>													
Local Government	5,224	741	353	3	6,321	82.6%	11.7%	5.6%	100%	30.7%	4.3%	2.1%	37.1%
Federal Government	485	118	34	1	638	76.0%	18.5%	5.3%	100%	2.8%	0.7%	0.2%	3.7%
State Government	733	91	34	-	858	85.4%	10.6%	4.0%	100%	4.3%	0.5%	0.2%	5.0%
Wastewater & Treatment	63	9	12	-	84	75.0%	10.7%	14.3%	100%	0.4%	0.1%	0.1%	0.5%
K-12 Schools	4,012	919	480	2	5,413	74.1%	17.0%	8.9%	100%	23.5%	5.4%	2.8%	31.8%
Higher Education	1,167	154	68	1	1,390	84.0%	11.1%	4.9%	100%	6.8%	0.9%	0.4%	8.2%
Other Education	101	387	1,817	33	2,338	4.3%	16.6%	77.7%	99%	0.6%	2.3%	10.7%	13.5%
<b>Total</b>	<b>11,785</b>	<b>2,419</b>	<b>2,798</b>	<b>40</b>	<b>17,042</b>	<b>69%</b>	<b>14%</b>	<b>16%</b>	<b>100%</b>	<b>69.2%</b>	<b>14.2%</b>	<b>16.4%</b>	<b>99.8%</b>
<b>Average Usage (Therms per customer)</b>													
Local Government	48,691	3,647	703	13	40,707								
Federal Government	46,672	6,300	1,766	217	36,739								
State Government	33,423	10,827	1,194	-	29,749								
Wastewater & Treatment	258,382	6,116	601	-	194,528								
K-12 Schools	8,361	4,700	1,719	45	7,147								
Higher Education	65,472	9,097	1,616	2,065	56,057								
Other Education	5,959	2,258	246	81	824								
<b>Average</b>	<b>36,345</b>	<b>4,581</b>	<b>621</b>	<b>127</b>	<b>25,886</b>								

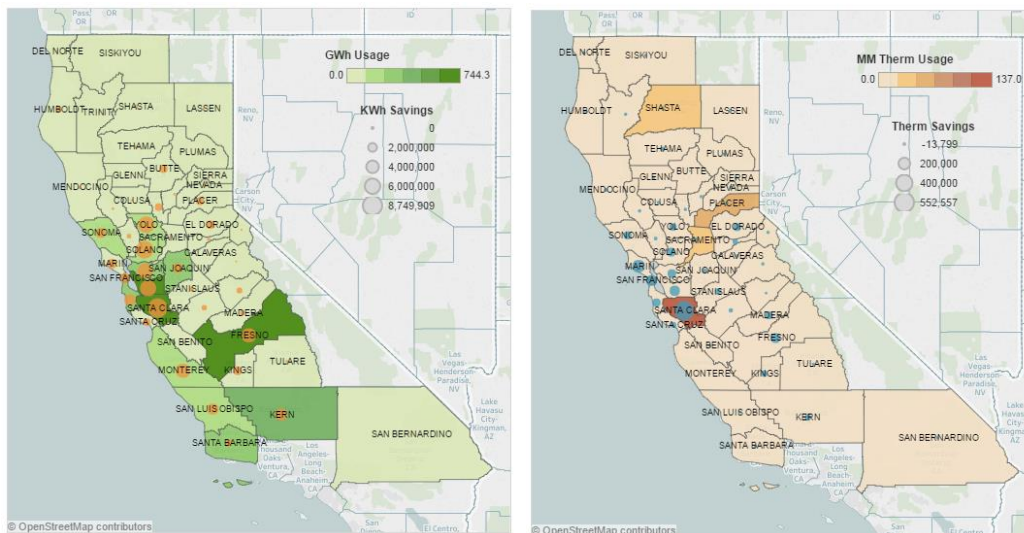
Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
<sup>b</sup> Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
<sup>c</sup> Small: < 40,000 KWh or < 10,000 Therms  
<sup>d</sup> Unknown: Insufficient data (<12 months)  
<sup>e</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>f</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>g</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>h</sup> Other Education is a broad category which includes schools for technical and trade, cosmetology, fine art, and language; and training facilities for management, driver education, flight, sports training, exam preparation

**Table C.4: 2015 Gas Customers: Snapshot of Savings and Participants by Size**

	Customer By Size*					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Gas Savings (Therms)</b>													
Local Government	245,278	(775.7)	685.9	-	245,188	100%	-0.3%	0.3%	100%	12.1%	0.0%	0.0%	12.1%
Federal Government	443,985	-	-	-	443,985	100%	0.0%	0.0%	100%	21.9%	0.0%	0.0%	21.9%
State Government	104,894	397.2	(6.9)	-	105,284	100%	0.4%	0.0%	100%	5.2%	0.0%	0.0%	5.2%
Wastewater & Treatment	102,044	-	-	-	102,044	100%	0.0%	0.0%	100%	5.0%	0.0%	0.0%	5.0%
K-12 Schools	727,610	63,614	(652.4)	1.5	790,573	92%	8.0%	-0.1%	100%	35.9%	3.1%	0.0%	39.0%
Higher Education	329,811	3,878.1	(15.3)	-	333,674	99%	1.2%	0.0%	100%	16.3%	0.2%	0.0%	16.5%
Other Education*	100.9	5,288.4	412.9	-	5,802	2%	91.1%	7.1%	100%	0.0%	0.3%	0.0%	0.3%
<b>Total</b>	<b>1,953,722</b>	<b>72,402</b>	<b>424.2</b>	<b>1.47</b>	<b>2,026,550</b>	<b>96%</b>	<b>4%</b>	<b>0%</b>	<b>100%</b>	<b>96.4%</b>	<b>3.6%</b>	<b>0.0%</b>	<b>100.0%</b>
<b>Participants (Number of Participants)</b>													
Local Government	349	29	10	-	388	90%	7.5%	2.6%	100%	30.6%	2.5%	0.9%	34.1%
Federal Government	18	-	-	-	18	100%	0.0%	0.0%	100%	1.6%	0.0%	0.0%	1.6%
State Government	32	2	1	-	35	91%	5.7%	2.9%	100%	2.8%	0.2%	0.1%	3.1%
Wastewater & Treatment	3	-	-	-	3	100%	0.0%	0.0%	100%	0.3%	0.0%	0.0%	0.3%
K-12 Schools	446	94	14	1	555	80%	16.9%	2.5%	100%	39.2%	8.3%	1.2%	48.6%
Higher Education	86	4	1	-	91	95%	4.4%	1.1%	100%	7.6%	0.4%	0.1%	8.0%
Other Education	2	23	24	-	49	4%	46.9%	49.0%	100%	0.2%	2.0%	2.1%	4.3%
<b>Total</b>	<b>936</b>	<b>152</b>	<b>50</b>	<b>1</b>	<b>1,139</b>	<b>82%</b>	<b>13%</b>	<b>4%</b>	<b>100%</b>	<b>82.2%</b>	<b>13.3%</b>	<b>4.4%</b>	<b>99.9%</b>
<b>Average Savings (Therms per Participant)</b>													
Local Government	703	(27)	69	-	632								
Federal Government	24,666	-	-	-	24,666								
State Government	3,278	199	(7)	-	3,008								
Wastewater & Treatment	34,015	-	-	-	34,015								
K-12 Schools	1,631	677	(47)	1	1,424								
Higher Education	3,835	970	(15)	-	3,667								
Other Education	50	230	17	-	118								
<b>Average</b>	<b>2,087</b>	<b>476</b>	<b>8</b>	<b>1</b>	<b>1,779</b>								
<b>Participation Rates (% Participants per Cust.)</b>													
Local Government	6.7%	3.9%	2.8%	0.0%	6.1%								
Federal Government	3.7%	0.0%	0.0%	0.0%	2.8%								
State Government	4.4%	2.2%	2.9%	0.0%	4.1%								
Wastewater & Treatment	4.8%	0.0%	0.0%	0.0%	3.6%								
K-12 Schools	11.1%	10.2%	2.9%	50%	10.3%								
Higher Education	7.4%	2.6%	1.5%	0.0%	6.5%								
Other Education	2.0%	5.9%	1.3%	0.0%	2.1%								
<b>Average</b>	<b>7.9%</b>	<b>6.3%</b>	<b>1.8%</b>	<b>2.5%</b>	<b>6.7%</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
<sup>b</sup> Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
<sup>c</sup> Small: < 40,000 KWh or < 10,000 Therms  
<sup>d</sup> Unknown: Insufficient data (<12 months)  
<sup>e</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>f</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>g</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>h</sup> Other Education is a broad category which includes schools for technical and trade, cosmetology, fine art, and language; and training facilities for management, driver education, flight, sports training, exam preparation.

**Figure C.1: 2015 Public Energy Usage and Savings by County**



**Table C.5: Local Government Details: 2015 Electric Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Local Government</b>													
Electricity Usage (GWh)	2,557.2	64.3	10.3	0.1	2,631.8	97.2%	2.4%	0.4%	100%	40.2%	1.0%	0.2%	41.4%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	41,591	2,596	1,655	21	45,863	90.7%	5.7%	3.6%	100%	54.2%	3.4%	2.2%	59.7%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	61,483	24,763	6,205	2,450	57,383								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	32,750	447.7	19.2	-	33,217.0	99%	1.3%	0.1%	100%	43.4%	0.6%	0.0%	44.0%
Savings Trends (2011-2015)													
Participants (Number of Participants)	852	38	11	-	901	95%	4.2%	1.2%	100%	45.2%	2.0%	0.6%	47.7%
Participant (2011-2015)													
Average Savings (kWh per Participant)	38,439	11,781	1,747	-	36,867								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	2.0%	1.5%	0.7%	0.0%	2.0%								
Participation Rate Trends (2011-2015)													

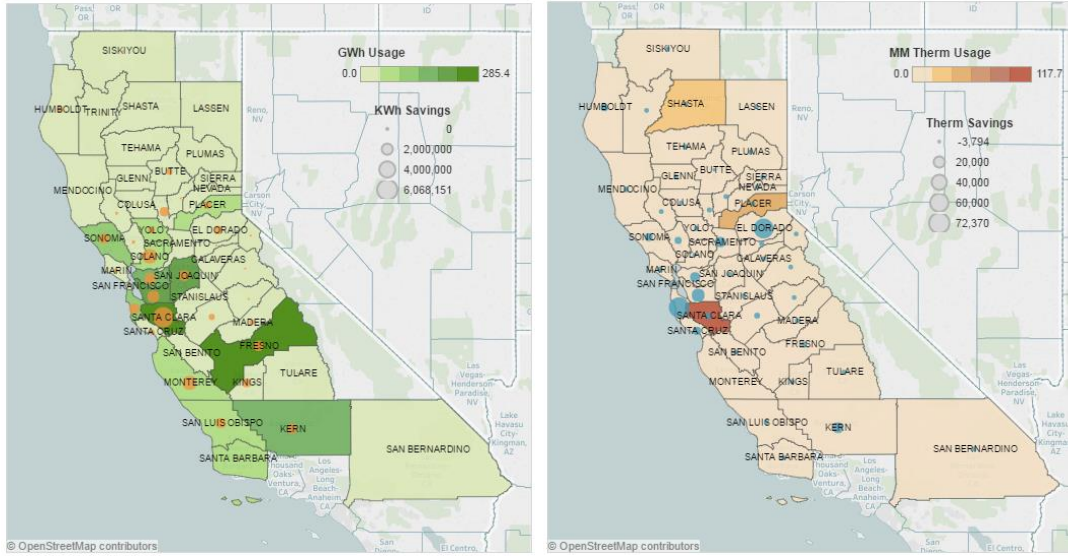
Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.6: Local Government Details: 2015 Gas Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Local Government</b>													
Gas Usage (MM Therms)	254.4	2.7	0.2	0.0	257.3	98.9%	1.1%	0.1%	100%	57.7%	0.6%	0.1%	58.3%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	5,224	741	353	3	6,321	82.6%	11.7%	5.6%	100%	30.7%	4.3%	2.1%	37.1%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	48,691	3,647	703	13	40,707								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	245,278.2	(775.7)	685.9	-	245,188.4	100%	-0.3%	0.3%	100%	12.1%	0.0%	0.0%	12.1%
Savings Trends (2011-2015)													
Participants (Number of Participants)	349	29	10	-	388	89.9%	7.5%	2.6%	100%	30.6%	2.5%	0.9%	34.1%
Participant (2011-2015)													
Average Savings (Therms per Participant)	703	(27)	69	-	632								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	6.7%	3.9%	2.8%	0.0%	6.1%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.2: Local Government Details: 2015 Energy Usage and Savings by County



**Table C.7: Federal Government Details: 2015 Electric Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Federal Government</b>													
Electricity Usage (GWh)	512.1	7.5	1.2	(0.0)	520.8	98.3%	1.4%	0.2%	100%	8.1%	0.1%	0.0%	8.2%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	1,353	279	136	12	1,780	76.0%	15.7%	7.6%	99%	1.8%	0.4%	0.2%	2.3%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	378,481	26,926	8,971	(3,328)	292,572								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	2,001	-	-	-	2,000.9	100%	0.0%	0.0%	100%	2.7%	0.0%	0.0%	2.7%
Savings Trends (2011-2015)													
Participants (Number of Participants)	29	-	-	-	29	100%	0.0%	0.0%	100%	1.5%	0.0%	0.0%	1.5%
Participant (2011-2015)													
Average Savings (kWh per Participant)	68,998	-	-	-	68,998								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	2.1%	0.0%	0.0%	0.0%	1.6%								
Participation Rate Trends (2011-2015)													

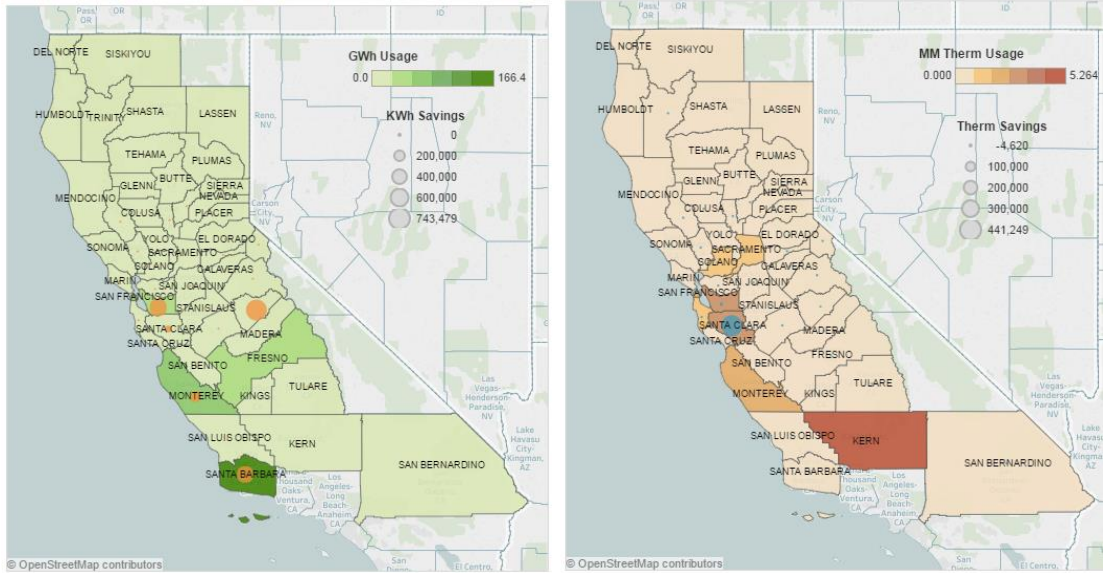
Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.8: Federal Government Details: 2015 Gas Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Federal Government</b>													
Gas Usage (MM Therms)	22.6	0.7	0.1	0.0	23.4	96.6%	3.2%	0.3%	100%	5.1%	0.2%	0.0%	5.3%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	485	118	34	1	638	76.0%	18.5%	5.3%	100%	2.8%	0.7%	0.2%	3.7%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	46,672	6,300	1,766	217	36,739								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	443,984.6	-	-	-	443,984.6	100%	0.0%	0.0%	100%	21.9%	0.0%	0.0%	21.9%
Savings Trends (2011-2015)													
Participants (Number of Participants)	18	-	-	-	18	100.0%	0.0%	0.0%	100%	1.6%	0.0%	0.0%	1.6%
Participant (2011-2015)													
Average Savings (Therms per Participant)	24,666	-	-	-	24,666								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	3.7%	0.0%	0.0%	0.0%	2.8%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.3: Federal Government Details: 2015 Energy Usage and Savings by County



**Table C.9: State Government Details: 2015 Electric Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>					Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>State Government</b>														
Electricity Usage (GWh)	492.1	9.8	1.9	0.0	503.8	97.7%	1.9%	0.4%	100%	7.7%	0.2%	0.0%	7.9%	
Usage Trends (2011-2015) <sup>e</sup>														
Customers (Number of customers)	12,624	517	287	3	13,431	94.0%	3.8%	2.1%	100%	16.4%	0.7%	0.4%	17.5%	
Customer trends (2011-2015)														
Average Usage (kWh per customer)	38,981	18,955	6,674	0	37,511									
Usage Rate Trends (2011-2015)														
Electricity Savings (MWh)	4,893	79.5	0.6	-	4,973.3	98%	1.6%	0.0%	100%	6.5%	0.1%	0.0%	6.6%	
Savings Trends (2011-2015)														
Participants (Number of Participants)	44	3	1	-	48	92%	6.3%	2.1%	100%	2.3%	0.2%	0.1%	2.5%	
Participant (2011-2015)														
Average Savings (kWh per Participant)	111,209	26,509	600	-	103,611									
Savings Rate Trends (2011-2015)														
Participation Rates (% Participants per Cust.)	0.3%	0.6%	0.3%	0.0%	0.4%									
Participation Rate Trends (2011-2015)														

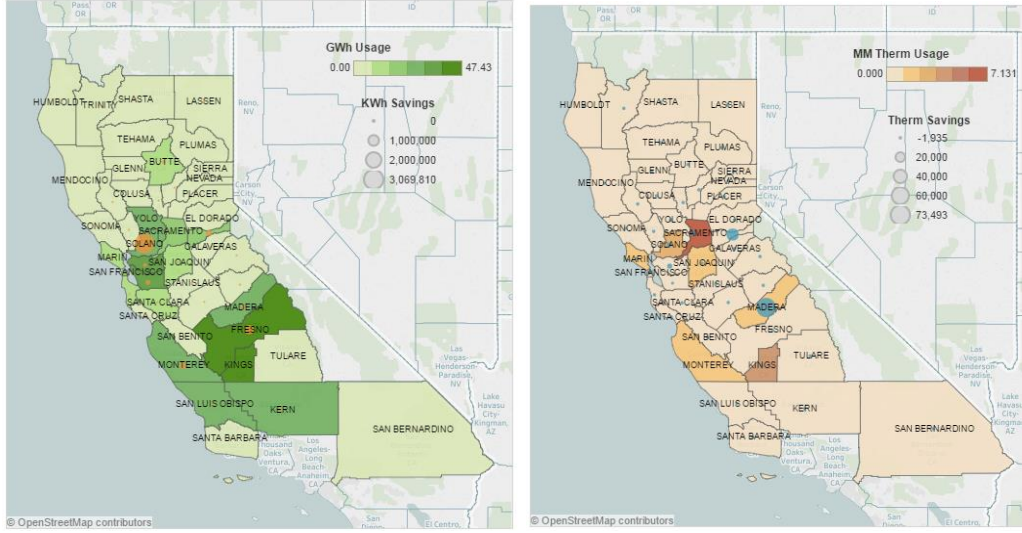
Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.10: State Government Details: 2015 Gas Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>					Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>State Government</b>														
Gas Usage (MM Therms)	24.5	1.0	0.0	-	25.5	96.0%	3.9%	0.2%	100%	5.6%	0.2%	0.0%	5.8%	
Usage Trends (2011-2015) <sup>e</sup>														
Customers (Number of customers)	733	91	34	-	858	85.4%	10.6%	4.0%	100%	4.3%	0.5%	0.2%	5.0%	
Customer trends (2011-2015)														
Average Usage (Therms per customer)	33,423	10,827	1,194	-	29,749									
Usage Rate Trends (2011-2015)														
Gas Savings (Therms)	104,893.6	397.2	(6.9)	-	105,283.8	100%	0.4%	0.0%	100%	5.2%	0.0%	0.0%	5.2%	
Savings Trends (2011-2015)														
Participants (Number of Participants)	32	2	1	-	35	91.4%	5.7%	2.9%	100%	2.8%	0.2%	0.1%	3.1%	
Participant (2011-2015)														
Average Savings (Therms per Participant)	3,278	199	(7)	-	3,008									
Savings Rate Trends (2011-2015)														
Participation Rates (% Participants per Cust.)	4.4%	2.2%	2.9%	0.0%	4.1%									
Participation Rate Trends (2011-2015)														

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.4: State Government Details: 2015 Energy Usage and Savings by County





**Table C.11: Wastewater & Treatment Details: 2015 Electric Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Wastewater &amp; Treatment</b>													
Electricity Usage (GWh)	108.8	4.0	0.4	0.0	113.2	96.1%	3.5%	0.4%	100%	1.7%	0.1%	0.0%	1.8%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	556	152	66	1	775	71.7%	19.6%	8.5%	100%	0.7%	0.2%	0.1%	1.0%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	195,758	26,230	6,149	14,256	146,127								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	422	-	0.1	-	422.5	100%	0.0%	0.0%	100%	0.6%	0.0%	0.0%	0.6%
Savings Trends (2011-2015)													
Participants (Number of Participants)	5	-	1	-	6	83%	0.0%	16.7%	100%	0.3%	0.0%	0.1%	0.3%
Participant (2011-2015)													
Average Savings (kWh per Participant)	84,487	-	83	-	70,420								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	0.9%	0.0%	1.5%	0.0%	0.8%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.12: Wastewater & Treatment Details: 2015 Gas Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Wastewater &amp; Treatment</b>													
Gas Usage (MM Therms)	16.3	0.1	0.0	-	16.3	99.6%	0.3%	0.0%	100%	3.7%	0.0%	0.0%	3.7%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	63	9	12	-	84	75.0%	10.7%	14.3%	100%	0.4%	0.1%	0.1%	0.5%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	258,382	6,116	601	-	194,528								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	102,043.8	-	-	-	102,043.8	100%	0.0%	0.0%	100%	5.0%	0.0%	0.0%	5.0%
Savings Trends (2011-2015)													
Participants (Number of Participants)	3	-	-	-	3	100.0%	0.0%	0.0%	100%	0.3%	0.0%	0.0%	0.3%
Participant (2011-2015)													
Average Savings (Therms per Participant)	34,015	-	-	-	34,015								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	4.8%	0.0%	0.0%	0.0%	3.6%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.5: Wastewater and Treatment Details: 2015 Energy Usage and Savings by County

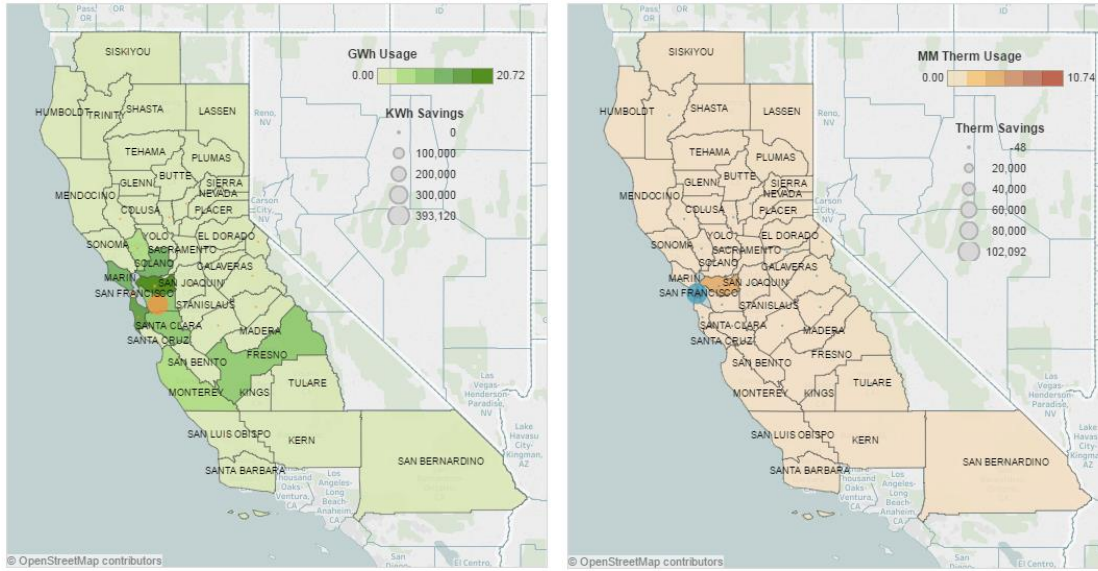


Table C.13: K-12 Schools Details: 2015 Electric Usage and Savings with 2011–2015 Trends

	Customer By Size <sup>a</sup>					Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>K-12 Schools</b>														
Electricity Usage (GWh)	1,183.5	92.5	5.8	0.0	1,281.8	92.3%	7.2%	0.4%	100%	18.6%	1.5%	0.1%	20.2%	
Usage Trends (2011-2015) <sup>e</sup>														
Customers (Number of customers)	6,655	1,767	593	12	9,027	73.7%	19.6%	6.6%	100%	8.7%	2.3%	0.8%	11.7%	
Customer trends (2011-2015)														
Average Usage (kWh per customer)	177,840	52,372	9,705	1,408	142,000									
Usage Rate Trends (2011-2015)														
Electricity Savings (MWh)	15,957	1,769.4	163.6	3.4	17,893.7	89%	9.9%	0.9%	100%	21.1%	2.3%	0.2%	23.7%	
Savings Trends (2011-2015)														
Participants (Number of Participants)	591	109	16	2	718	82%	15.2%	2.2%	100%	31.3%	5.8%	0.8%	37.9%	
Participant (2011-2015)														
Average Savings (kWh per Participant)	27,000	16,233	10,227	1,688	24,922									
Savings Rate Trends (2011-2015)														
Participation Rates (% Participants per Cust.)	8.9%	6.2%	2.7%	16.7%	8.0%									
Participation Rate Trends (2011-2015)														

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.14: K-12 Schools Details: 2015 Gas Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>K-12 Schools</b>													
Gas Usage (MM Therms)	33.5	4.3	0.8	0.0	38.7	86.7%	11.2%	2.1%	100%	7.6%	1.0%	0.2%	8.8%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	4,012	919	480	2	5,413	74.1%	17.0%	8.9%	100%	23.5%	5.4%	2.8%	31.8%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	8,361	4,700	1,719	45	7,147								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	727,610.1	63,614.2	(652.4)	1.5	790,573.5	92%	8.0%	-0.1%	100%	35.9%	3.1%	0.0%	39.0%
Savings Trends (2011-2015)													
Participants (Number of Participants)	446	94	14	1	555	80.4%	16.9%	2.5%	100%	39.2%	8.3%	1.2%	48.6%
Participant (2011-2015)													
Average Savings (Therms per Participant)	1,631	677	(47)	1	1,424								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	11.1%	10.2%	2.9%	50.0%	10.3%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.15: Higher Education Details: 2015 Electric Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Higher Education</b>													
Electricity Usage (GWh)	1,211.2	10.0	0.8	(0.3)	1,221.7	99.1%	0.8%	0.1%	100%	19.1%	0.2%	0.0%	19.2%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	1,421	209	82	1	1,713	83.0%	12.2%	4.8%	100%	1.9%	0.3%	0.1%	2.2%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	852,334	48,047	9,182	(294,974)	713,174								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	16,648	22.9	4.6	-	16,675.1	100%	0.1%	0.0%	100%	22.1%	0.0%	0.0%	22.1%
Savings Trends (2011-2015)													
Participants (Number of Participants)	124	7	2	-	133	93%	5.3%	1.5%	100%	6.6%	0.4%	0.1%	7.0%
Participant (2011-2015)													
Average Savings (kWh per Participant)	134,255	3,273	2,315	-	125,377								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	8.7%	3.3%	2.4%	0.0%	7.8%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.16: Higher Education Details: 2015 Gas Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Higher Education</b>													
Gas Usage (MM Therms)	76.4	1.4	0.1	0.0	77.9	98.1%	1.8%	0.1%	100%	17.3%	0.3%	0.0%	17.7%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	1,167	154	68	1	1,390	84.0%	11.1%	4.9%	100%	6.8%	0.9%	0.4%	8.2%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	65,472	9,097	1,616	2,065	56,057								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	329,811.1	3,878.1	(15.3)	-	333,673.9	99%	1.2%	0.0%	100%	16.3%	0.2%	0.0%	16.5%
Savings Trends (2011-2015)													
Participants (Number of Participants)	86	4	1	-	91	94.5%	4.4%	1.1%	100%	7.6%	0.4%	0.1%	8.0%
Participant (2011-2015)													
Average Savings (Therms per Participant)	3,835	970	(15)	-	3,667								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	7.4%	2.6%	1.5%	0.0%	6.5%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.17: Other Education Details: 2015 Electric Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>					Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>			Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Other Education</b>														
Electricity Usage (GWh)	36.4	28.3	20.0	0.0		84.7	42.9%	33.4%	23.6%	100%	0.6%	0.4%	0.3%	1.3%
Usage Trends (2011-2015) <sup>e</sup>														
Customers (Number of customers)	183	731	3,182	66		4,162	4.4%	17.6%	76.5%	98%	0.2%	1.0%	4.1%	5.3%
Customer trends (2011-2015)														
Average Usage (kWh per customer)	198,714	38,675	6,292	698		20,351								
Usage Rate Trends (2011-2015)														
Electricity Savings (MWh)	24	110.3	114.1	19.4		267.6	9%	41.2%	42.6%	93%	0.0%	0.1%	0.2%	0.3%
Savings Trends (2011-2015)														
Participants (Number of Participants)	3	24	24	1		52	6%	46.2%	46.2%	98%	0.2%	1.3%	1.3%	2.7%
Participant (2011-2015)														
Average Savings (kWh per Participant)	7,902	4,598	4,755	19,424		5,146								
Savings Rate Trends (2011-2015)														
Participation Rates (% Participants per Cust.)	1.6%	3.3%	0.8%	1.5%		1.2%								
Participation Rate Trends (2011-2015)														

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.18: Other Education Details: 2015 Gas Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>					Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>			Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Other Education</b>														
Gas Usage (MM Therms)	0.6	0.9	0.4	0.0		1.9	31.2%	45.4%	23.2%	100%	0.1%	0.2%	0.1%	0.4%
Usage Trends (2011-2015) <sup>e</sup>														
Customers (Number of customers)	101	387	1,817	33		2,338	4.3%	16.6%	77.7%	99%	0.6%	2.3%	10.7%	13.5%
Customer trends (2011-2015)														
Average Usage (Therms per customer)	5,959	2,258	246	81		824								
Usage Rate Trends (2011-2015)														
Gas Savings (Therms)	100.9	5,288.4	412.9	-		5,802.2	2%	91.1%	7.1%	100%	0.0%	0.3%	0.0%	0.3%
Savings Trends (2011-2015)														
Participants (Number of Participants)	2	23	24	-		49	4.1%	46.9%	49.0%	100%	0.2%	2.0%	2.1%	4.3%
Participant (2011-2015)														
Average Savings (Therms per Participant)	50	230	17	-		118								
Savings Rate Trends (2011-2015)														
Participation Rates (% Participants per Cust.)	2.0%	5.9%	1.3%	0.0%		2.1%								
Participation Rate Trends (2011-2015)														

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.19: 2015 Electric Usage and Savings by Climate Region and Customer Size**

	Customer by Size <sup>a</sup> and Region <sup>b</sup>					Percent of Region			
	Large	Medium	Small	Unk <sup>c</sup>	Total	Large	Medium	Small	Total <sup>d</sup>
<b>Usage (GWh)</b>									
Bay Area	2,853	88	20	5E-05	2,961	96%	3%	1%	100%
Central Valley	2,048	61	9	4E-05	2,119	97%	3%	0%	100%
Coastal	883	39	7	2E-05	929	95%	4%	1%	100%
Mountain	31	2	0	6E-06	34	93%	5%	1%	100%
<b>Total</b>	<b>5,815</b>	<b>190</b>	<b>37</b>	<b>0.000</b>	<b>6,042</b>	<b>96%</b>	<b>3%</b>	<b>1%</b>	<b>100%</b>
<b>Customers</b>									
Bay Area	27,518	2,099	2,959	47	32,623	84%	6%	9%	100%
Central Valley	20,641	1,805	1,322	43	23,811	87%	8%	6%	100%
Coastal	8,295	1,272	1,042	15	10,624	78%	12%	10%	100%
Mountain	476	91	84	6	657	72%	14%	13%	99%
<b>Total</b>	<b>56,930</b>	<b>5,267</b>	<b>5,407</b>	<b>111</b>	<b>67,715</b>	<b>84%</b>	<b>8%</b>	<b>8%</b>	<b>100%</b>
<b>Savings (GWh)</b>									
Bay Area	35	1	0	0.0	37	96%	3%	0%	100%
Central Valley	23	0	0	0.0	23	98%	2%	0%	100%
Coastal	10	0	0	-	11	96%	3%	1%	100%
Mountain	1	0	-	-	1	99%	1%	0%	100%
<b>Total</b>	<b>69</b>	<b>2</b>	<b>0</b>	<b>0.0</b>	<b>72</b>	<b>97%</b>	<b>3%</b>	<b>0%</b>	<b>100%</b>
<b>Participants</b>									
Bay Area	807	82	28	1	918	88%	9%	3%	100%
Central Valley	471	28	7	2	508	93%	6%	1%	100%
Coastal	238	39	16	-	293	81%	13%	5%	100%
Mountain	4	3	-	-	7	57%	43%	0%	100%
<b>Total</b>	<b>1,520</b>	<b>152</b>	<b>51</b>	<b>3</b>	<b>1,726</b>	<b>88%</b>	<b>9%</b>	<b>3%</b>	<b>100%</b>

Notes <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
Small: < 40,000 KWh or < 10,000 Therms  
Unknown: Insufficient data (<12 months)

<sup>b</sup> Regions are aggregates of Climate Zones (Z01 - Z16). There are 16 zones but not all are in PG&E's territory.  
Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, & Sonoma  
Central Valley includes: Z11 - Z13  
Coastal includes: Z01 - Z06 & Z09 (excludes Bay Area Counties)  
Mountain includes: Z14 - Z16

<sup>c</sup> "Unknown" size category included for completeness. Represents insufficient or partial-year data

<sup>d</sup> Column may not sum to 100% due to a small percentage of Unknowns not included

**Table C.20: 2015 Gas Usage and Savings by Climate Region and Customer Size**

	Customer by Size <sup>a</sup> and Region <sup>b</sup>					Percent of Region			
	Large	Medium	Small	Unk <sup>c</sup>	Total	Large	Medium	Small	Total <sup>d</sup>
<b>Usage (MM Therms)</b>									
Bay Area	239	4	0.6	0.004	245	98%	2%	0%	100%
Central Valley	116	4	0.7	0.001	121	96%	3%	1%	100%
Coastal	17	1	0.2	0.00	18	96%	3%	1%	100%
Mountain	5.7	0.4	0.021	0.0	6.143	93%	7%	0%	100%
<b>Total</b>	<b>378</b>	<b>9</b>	<b>1</b>	<b>0.005</b>	<b>389</b>	<b>97%</b>	<b>2%</b>	<b>0%</b>	<b>100%</b>
<b>Customers</b>									
Bay Area	5,815	1,041	1,306	17	8,179	71%	13%	16%	100%
Central Valley	3,196	749	825	15	4,785	67%	16%	17%	100%
Coastal	1,212	205	273	3	1,693	72%	12%	16%	100%
Mountain	41	50	16	1	108	38%	46%	15%	99%
<b>Total</b>	<b>10,264</b>	<b>2,045</b>	<b>2,420</b>	<b>36</b>	<b>14,765</b>	<b>70%</b>	<b>14%</b>	<b>16%</b>	<b>100%</b>
<b>Savings (MM Therms)</b>									
Bay Area	1.4	0.03	0.000	-	1.4	98%	2%	0%	100%
Central Valley	0.5	0.03	(0.000)	1E-06	0.5	94%	6%	0%	100%
Coastal	0.0	(0.00)	0.001	0E+00	0.031	104%	-6%	2%	100%
Mountain	0.0	-6E-05	0E+00	-	0.0	101%	-1%	0%	100%
<b>Total</b>	<b>2.0</b>	<b>0.06</b>	<b>0.00</b>	<b>0.000</b>	<b>2</b>	<b>97%</b>	<b>3%</b>	<b>0%</b>	<b>100%</b>
<b>Participants</b>									
Bay Area	462	65	26	-	553	84%	12%	5%	100%
Central Valley	230	25	6	1	262	88%	10%	2%	100%
Coastal	157	35	15	-	207	76%	17%	7%	100%
Mountain	4	2	-	-	6	67%	33%	0%	100%
<b>Total</b>	<b>853</b>	<b>127</b>	<b>47</b>	<b>1</b>	<b>1,028</b>	<b>83%</b>	<b>12%</b>	<b>5%</b>	<b>100%</b>

Notes <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
Small: < 40,000 KWh or < 10,000 Therms  
Unknown: Insufficient data (<12 months)

<sup>b</sup> Regions are aggregates of Climate Zones (Z01 - Z16). There are 16 zones but not all are in PG&E's territory.  
Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, & Sonoma  
Central Valley includes: Z11 - Z13  
Coastal includes: Z01 - Z06 & Z09 (excludes Bay Area Counties)  
Mountain includes: Z14 - Z16

<sup>c</sup> "Unknown" size category included for completeness. Represents insufficient or partial-year data

<sup>d</sup> Column may not sum to 100% due to a small percentage of Unknowns not included

## Appendix D: Local Government Partnerships (LGP) Overview

Local Government Partnerships (LGPs) are collaborations between PG&E and local partners resulting in programs that serve the public sector and broader community, including small and medium business customers. Over the past 10 years, PG&E and local partners have established 22 LGPs covering 238 cities and 44 counties across PG&E's service territory.

PG&E LGPs are built around the communities which they serve. While local governments represent a majority of lead local partners, many LGPs are led by local economic development groups, associations of governments, joint power authorities and regional non-profit organizations. These local organizations have missions aligned with supporting the economic, environmental and societal health of their communities. This roster of local partners is positioned to understand and identify customers within their communities and effectively partner with program implementers to overcome barriers to energy efficiency adoption.

LGPs are designed to accomplish three broad goals:

1. Work with local governments to generate energy and demand savings within their own facilities and in their communities;<sup>i</sup>
2. Take actions to support the California Energy Efficiency Strategic Plan (CEESP, or "Strategic Plan") objectives, and;
3. Provide demand-side management (DSM) outreach and implementation of programs in the community

In pursuit of these goals, the LGPs have developed and sustained a portfolio of community-based energy efficiency programs focused on driving comprehensive energy savings locally while supporting energy and greenhouse gas (GHG) emission reduction goals statewide. In addition, PG&E works with local partners to use their unique role to influence change in their communities as trusted advisors and change agents. The LGP structure supports the exchange of best practices and peer-to-peer knowledge transfer, and helps partners initiate discussions with community decision makers, local agency gatekeepers and local constituents to advance local, regional and statewide climate and energy goals.

LGPs are the primary delivery channel supporting cities, counties, and other local agencies seeking energy savings and greenhouse gas emission reductions on the community-scale. Promoting energy planning at a statewide and local level is a major market driver in increasing the uptake of local government energy efficiency projects and extending the reach and effectiveness of PG&E's energy efficiency programs. LGPs are leveraging the role of local governments to achieve deeper energy savings in municipal facilities and community-wide as an integral part of other community climate action and sustainability programs.

A major contributor to the success of PG&E LGP programs has been the diversity of customers served beyond local governments. In 2015, commercial Regional Direct Install programs (a downstream program offered exclusively through LGPs) delivered the majority of small and medium business (SMB) downstream energy savings for PG&E's energy efficiency Portfolio and will continue to be a major driver of SMB energy savings in the future (PG&E's SMB segment strategy is addressed in the Commercial chapter).



Beyond local governments, in support of Proposition 39 many LGPs are serving K-12 public schools through tailoring municipal energy efficiency program to better assist public schools. And many LGPs are reaching moderate income residential customers through targeted direct install programs, some which support workforce development goals. These diverse segment approaches reflects how LGPs have matured into a reliable, integrated and innovative channel for PG&E's downstream, customer-facing energy efficiency Portfolio.

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# INDUSTRIAL

CHAPTER 05

## MARKET CHARACTERIZATION & APPROACH

# INDUSTRIAL

### SETTING THE STAGE



USAGE:

**17% OF ELECTRIC  
66% OF GAS USAGE**

Nearly **86,000** customers

**Manufacturing**  
is largest consumer  
of electric and gas  
in this sector



### KEY APPROACH & STRATEGIES



**New models** that are  
adaptive to all sizes of  
industrial businesses  
to build EE into  
decision making, such  
as Strategic Energy  
Management

**Benchmarking** with  
follow-on technical  
assistance to  
identify EE  
opportunities



**Expand partnerships**  
with industry  
organizations and  
others to include  
customer targeting,  
knowledge sharing,  
and exposure for  
customers identified  
as leaders and  
“Energy Champions”



### TRENDS



Increasing  
regulation and the  
cost of doing business  
in California place  
financial pressure on  
industrial customers

Shift to self-generation to  
mitigate costs and business  
uncertainty

Market consolidation around  
high-tech manufacturing

Rise of industrial automation and  
data-driven decision making

## A. PG&E's Industrial Sector Vision

PG&E's vision for energy efficiency in the industrial sector centers on enabling customers to better understand, manage, and eliminate unnecessary energy use.<sup>1,2</sup>

Industrial customers are characterized by highly complex processes and operations that are unique to individual facilities. Customers range from highly capitalized corporations with in-house energy expertise to smaller operations with limited resources to invest in energy efficiency. This diverse customer landscape presents an opportunity to use PG&E's strengths in data capture and analysis, industrial energy engineering, as well as the broad perspective on energy grid infrastructure that a large utility is best suited to address. PG&E is committed to meeting customers on their energy journey with data-driven assistance, tools, and financial solutions to provide a targeted value proposition for customers to pursue energy efficiency.

Currently, California's industrial customers face challenges such as high costs, stringent regulations, increasing automation, and competition from abroad. Although many segments can easily relocate, others such as food processing and oil production cannot. In light of the fact that energy costs constitute a significant portion of most industrial customers' expenditures, PG&E will play an integral role in supporting customer competitiveness through comprehensive energy management solutions.

<sup>1</sup> "California Overtakes France to Become Sixth-Largest Economy"; Bloomberg; June 14, 2016: <http://www.bloomberg.com/politics/articles/2016-06-14/california-overtakes-france-to-become-sixth-largest-economy>.

<sup>2</sup> "California's Economy: The 9 Industries Driving GDP Growth"; Investopedia; January 14, 2016: <http://www.investopedia.com/articles/investing/011416/californias-economy-9-industries-driving-gdp-growth.asp>.

### Table 5.1 Customers by the Numbers

Source: PG&E program and customer data

	2011-2015 Average	Trend <sup>b</sup>	2015 Total
<b>Customer Counts (Number of customers)<sup>f</sup></b>			
Electric	72,012		72,066
Gas	24,131		23,451
<b>Total</b>	<b>85,576</b>		<b>85,059</b>
<b>Annual Sales (GWh, MM Therms)</b>			
Electric	14,157.8		14,468.2
Gas	5,058.6		5,499.7
<b>Energy Savings (GWh, MW, MM Therms)</b>			
Electric	124.1		75.9
Demand	19.2		12.7
Gas	14.0		5.2
<b>Program Participation (% of total)</b>			
Electric	2.8%		2.1%
Demand	2.6%		1.9%
Gas	6.0%		4.4%
<b>Segment Program Participation (% of segment)</b>			
<b>Electric (GWh) Savings participants</b>			
Manufacturing	2.3%		1.7%
Food Processing	5.6%		4.6%
Petroleum	5.1%		3.5%
Chemicals & Minerals	3.6%		2.4%
<b>Gas (Therms) Savings participants</b>			
Manufacturing	5.6%		3.8%
Food Processing	7.6%		7.3%
Petroleum	13.1%		7.0%
Chemicals & Minerals	6.0%		3.4%

<sup>a</sup> Sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively.

<sup>b</sup> Customer count by unique combination of Account ID and Premise ID.



## INDUSTRIAL SECTOR AND THE CALIFORNIA ENERGY EFFICIENCY STRATEGIC PLAN

### CEESP VISION

*California industry will be vibrant, profitable, and exceed national benchmarks for energy efficiency and resource management.*

The Strategic Plan identifies four strategies to achieve this vision. These are linked to PG&E's intervention strategies below:

**Integrated Solutions:** New Models for energy efficiency approaches to customers, such as Continuous Energy Improvement and Strategic Energy Management, offer integrated solutions for industrial customers.

**Education and Outreach:** Strategic Partnerships offer opportunities for education and outreach to industrial customers on energy efficiency.

**Branding and Certification:** Data Access and Data Analytics create the basis for robust benchmarking and certification opportunities.

**Workforce Training:** Both 1) Technical Assistance and Tools, and 2) Strategic Partnerships offer WE&T initiatives that PG&E plans to launch in support of industrial customers.

It is worth noting that PG&E's 2011–2015 industrial sector trends reflect declining participation and savings per customer, coupled with rising gas and electric consumption. While this runs counter to PG&E's projected industrial natural gas energy efficiency gains, as outlined in Navigant's 2015 Potential Study,<sup>3</sup> Strategic Energy Management (SEM) and other efforts seek to aggressively reverse this trend.

SEM, in particular, will be a cornerstone of PG&E's new industrial strategy. Integrating this innovative conceptualization of energy usage into industrial operations will be crucial to maximizing long-term, deep savings, as well as opportunities from behavior, retrocommissioning, and operations and maintenance (BROs) as outlined in Assembly Bill (AB) 802. Enhanced savings in industrial operations will also be a core contributor to realizing a doubling of cost-effective energy efficiency by 2030.

### PG&E's Industrial Sector Goals

PG&E has the following two overarching goals for the industrial sector: Savings goals are based on past PG&E performance relative to potential study targets.

- Save 608 GWh, 67 MW, and 38.6 MM therms by 2025, with a focus on:
  - Three high-opportunity industrial segments: manufacturing, oil and gas production and refining, and food processing
- Reach an increasing percentage of industrial customers (increasing from roughly 2% electric or gas customers in 2017 to 4% per year by 2025) — with tracking by size and key segment

**Table 5.2** maps PG&E's intervention strategies to each of these goals. Greater detail on the intervention strategies supporting these goals can be found in section *F: PG&E's Approach to Achieving Goals*.

<sup>3</sup> "Energy Efficiency Potential and Goals Study for 2015 and Beyond: Stage 1 Final Report"; prepared by Navigant Consulting for the California Public Utilities Commission; September 25, 2015: <http://www.cpuc.ca.gov/General.aspx?id=2013>

**Table 5.2**  
Goal to Intervention Strategy Map

Goal	Data Access and Awareness	Data Analytics	Technical Assistance and Tools	Loans, Rebates, and Incentives	New Program Models	Assistance for the Design and Building Communities	Upstream and Midstream Partnerships
<b>Save energy and reduce demand, with a focus on three high-opportunity industrial segments: manufacturing, oil and gas production and refining, and food processing</b>	X	X	X	X	X	X	X
<b>Reach an increasing percentage of industrial customers</b>		X	X	X	X	X	X

## B. PG&E's Industrial Sector Proposal Compared to Prior Program Cycles

For the past five years, PG&E's industrial programs focused on overcoming market barriers to energy efficiency through offerings including:

- Rebates and incentives for efficient equipment and systems
- Technical assistance (e.g. facility audits and energy savings analysis)
- Continuous Energy Improvement (CEI)

These offerings facilitated completion of energy efficiency projects in a wide range of facilities, including oil production, printing plants, plastic-injection molding, component fabrication, lumber and paper mills, cement and quarries, metals processing, petroleum refineries, chemical plants, assembly plants, and water and wastewater treatment plants.

Third-party programs enable PG&E to tap into requisite specialized technical expertise to deliver energy savings in industrial facilities with long lead times. In 2015, third party programs targeting oil fields, refineries, large manufacturing and mining, and food processors completed over 200 efficiency projects, contributing 75% of the sector's total electric savings and 29% of its gas savings.

Despite these successes, PG&E's large industrial projects have encountered low gross realization rates (GRR) and high free-ridership, as determined by net-to-gross (NTG) ratios.<sup>4</sup> Going forward, California's evolving economic and technological landscape calls for new approaches to engage industrial customers in energy efficiency. To this end, PG&E proposes the following seven strategic interventions to meet its long-term goals for the industrial sector:

- **Data Analytics:** Imperfect information about both energy efficiency programs and energy consumption patterns remains a persistent challenge to energy efficiency adoption across the industrial sector and beyond. Widespread lack of access to reliable energy savings measurements constitutes an additional hurdle. Data analytics seeks to bridge these gaps to strategically target high-opportunity projects and provide targeted value propositions.
- **Data Access:** The growth of Advanced Metering Infrastructure (AMI) enables PG&E to collect near real-time data on industrial customers' energy use. PG&E plans to employ sophisticated analytics empower these customers to take actions, as well as create a benchmarking platform to recognize energy champions and leverage behavioral intervention techniques.
  - Industrial customers are notoriously difficult to benchmark on account of the sector's diversity and a general reluctance among customers to share production data. When the data is available, PG&E can benchmark participating customers' energy use intensity against similar sites in the U.S. DOE's database.<sup>5</sup> Even with limited data, PG&E can benchmark customers based on more readily-available criteria such as program participation, energy savings, and progress toward full SEM — with the aim of motivating low-achieving customers and publicly recognizing high achievers.

- The U.S. Environmental Protection Agency (EPA) ENERGY STAR Industrial provides tools for industrial customers to benchmark facilities and share energy management best practices. PG&E will support its industrial customers' participation in EPA programs and others.<sup>6</sup>

- **Technical Assistance and Tools:** Industrial customers often require technical assistance to identify appropriate energy efficiency opportunities and articulate the value of energy efficiency investments.<sup>7</sup> Technical assistance and energy efficiency measurement tools comprise critical benefits that PG&E has delivered to its customers. Facility audits— especially those conducted for smaller customers with less in-house energy efficiency expertise— have served to identify energy efficiency opportunities within a customer's operation. PG&E has built strong, long-term relationships with its industrial customers through its network of account representative and third-party implementers, which is critical for industrial customers.<sup>8</sup> PG&E will continue to use these relationships to develop energy savings analyses and project valuations that include non-energy benefits (NEBs)<sup>9</sup> to attract the attention of key decision-makers. Overall, project identification and savings quantification capabilities in this realm (often executed by sending engineers to plants to actually improve process efficiency) add significant value.<sup>10</sup>
  - PG&E plans to expand the selection of tools and assistance currently available to include methods to incorporate BROs, improvements and updates in sub-metering of equipment, and using the growth of automation that are increasing productivity.
- **Financial Solutions:** Loans, rebates, and incentives have always been an integral component of PG&E's industrial energy efficiency programs. Moving forward, however, PG&E's application process will become increasingly holistic— by evaluating customers' needs more thoroughly,

<sup>4</sup> Itron 2014. 2010-12 W0033 Custom Impact Evaluation. Final Report; Itron 2015. 2013 Custom Impact Evaluation Industrial, Agricultural, and Large Commercial; Itron 2016a. 2014 Custom Impact Evaluation Industrial, Agricultural, and Large Commercial; Itron 2016b. 2014 Nonresidential Downstream Deemed ESPI Lighting Impact Evaluation Report; and Itron 2016c. 2014 Nonresidential Downstream Deemed ESPI Pipe Insulation Impact Evaluation Report.

<sup>5</sup> ENERGY STAR. *Tools for Tracking and Benchmarking Facility energy Performance*. <https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants/measure-track-and-benchmark/tools-tracking-and>

<sup>6</sup> ENERGY STAR. *Industrial Energy Management*. <https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants>

<sup>7</sup> DOE SEE Action study, p. ES 8.

<sup>8</sup> DOE SEE Action study, p. 28.

<sup>9</sup> DOE Barriers study, p. 50.

<sup>10</sup> DOE SEE Action study, pp. 30-31.



and appropriately packaging technical assistance, rebates, incentives, and loans. For example, some customers may only require rigorous technical analysis and financing options, instead of rebates. This process will also be integrated into an overarching SEM strategy, enabling customers to maximize their financing package.

- **New Models:** PG&E has offered Continuous Energy Improvement (CEI) to customers since 2010, which created a sandbox for testing implementation of various energy management methodologies ranging from full-scale CEI protocols to small, cohort-type training courses for industrial customer segments. Although some useful information was developed in the years that CEI has been active, there were limitations to the scope and size of data collection and analysis which created challenges in realizing a cost-effective implementation model. As a result, PG&E has been looking instead to the Strategic Energy Management (SEM) framework to promote persistent operational, organizational, and behavioral changes that yield greater efficiency gains. SEM is a key strategy of the U.S. DOE's industrial energy efficiency strategy.<sup>11</sup> Overall, with support from the CPUC, California IOUs have opted to make substantial changes to CEI and transition to a resource-acquisition program adopting major design components and measurement and verification (M&V) protocols from successful programs implemented by Northwest utilities in the U.S. and Canada.
- **Strategic Partnerships:** PG&E has marketed and delivered its offerings through myriad channels, including presence at industry events, support for education and research activities, and close partnerships with engineering and installation firms. Going forward, integrating SEM into the marketplace will require additional interaction with these partners. Additionally, PG&E will build partnerships for other benefits, including research to contribute to customer targeting, knowledge sharing, and greater exposure for customers identified as leaders and "Energy Champions."
- **Upstream Initiatives:** PG&E will explore opportunities to partner with distributors to promote the most efficient products, components, and systems for the industrial sector, where entrenched repair practices make downstream

prescriptive rebates challenging and costly on their own. Through further market research and testing, PG&E will evaluate pairing rebates across multiple market actors to ensure that incentives are aligned to adopt the most efficient option.

These seven intervention strategies will be deployed in stages, over the near, mid, and long term. PG&E discusses the individual tactics for each of these strategies in greater detail in *Section F: PG&E's Approach to Achieving Goals*. Below is a brief summary of key time horizons:

- **In the short term (1-3 years),** PG&E will conduct and analyze market research to ensure that its existing programs remain relevant and cost effective as PG&E explores new tools and services. PG&E will begin the first stage of testing an SEM framework in the market with the launch of the SEM program.
- **In the mid term (4-7 years),** PG&E will continue to expand the use of the SEM framework across key industrial segments. PG&E also plans to engage with partners and experts to stand up a benchmarking service and outreach tool based on lessons learned with existing models in market.
- **In the long term (8-10 years),** PG&E will incorporate SEM into all channels and services for industrial customers of all sizes. PG&E will offer a variety of levels to meet customer needs, ranging from online management and periodic audits for smaller firms ("low-touch" SEM) to integrated expertise and data-management systems for large customers ("high-touch" SEM). These solutions will also integrate Distributed Energy Resources (DERs) such as demand response solutions for a complete turnkey program that meets individual customers' energy needs.

Achieving these goals will involve not only new energy efficiency offerings from PG&E, but also close collaboration with partners like the U.S. DOE, national laboratories, U.S. EPA, third-party implementers, and industry trade organizations.

<sup>11</sup> DOE SEE Action study, pp. 18-21.

## EM&V Key Research Learnings of California's Industrial Sector and Energy Efficiency Programs

Almost all industrial energy consumption and major opportunities for savings are in the distribution of that fuel and conversion for production purposes. Furthermore, energy use and savings are typically concentrated among a few, very large facilities and/or end-uses. This sector accounted for 25% of PG&E's electric portfolio savings and 36% of its gas savings in 2015. Key recent evaluation learnings include:

- Industrial customers care most about production, maintaining competitiveness, and compliance with various regulations. Energy use and efficiency are less important than production-related inputs such as feedstock, labor, and compliance with safety, health, air and water quality regulations.
- Energy efficiency offerings should address industrial customers' concerns. For example, increased productivity and quality, reduced unplanned downtime, and being able to tout how "green" their production is, are typically more important benefits to highlight than saving energy and bill reductions.
- Industrial customers have different needs and concerns that affect their capability, interest, and ability to adopt more energy efficient practices and equipment. Programs need to address this diversity. Large customers may have energy teams, who although typically focused on minimizing energy procurement costs, are also very useful for incorporating major energy efficiency aspects to large production systems overhauls or new construction. Small and medium size enterprises are more limited in both human and capital capabilities and energy efficiency efforts focus more on lighting and HVAC, and less on deep process improvements.
- Industrial customers trust utilities with information on new, more energy-efficient technologies and practices.
- Industrial customers rely on utility energy efficiency programs for technical assistance, endorsement of vendor energy savings claims, and financial incentives to make the business case to upper management for energy efficiency capital investments.
- SEM can help industrial customers to improve their energy and water operations and management

practices, and develop long-term plans to reduce the energy intensity of their products. To be cost effective, the SEM program offering should target small and medium sized customers via cohorts and/or trade associations, and use individual engagements with large customers.

These key learnings have been incorporated into the industrial business plan intervention strategies. EM&V research will continue to focus on providing feedback to enhance the success of future programs.

## C. Goals, Budget and Cost-Effectiveness

As business plans were envisioned as "a comprehensive vision outlining long-term strategic initiatives and intervention strategies,"<sup>12</sup> PG&E provides energy and demand savings goals, budgets, and cost-effectiveness forecasts that represent its best estimates to realize its portfolio vision, while retaining flexibility to accommodate potential market or regulatory changes. Each year, PG&E will file a Tier 2 advice letter (AL) that provides detailed goals, budgets, and cost-effectiveness for the Commission's review and approval.<sup>13</sup>

### Annual Net Market Potential

PG&E's primary goal is to save energy. As shown in **Table 5.3**, PG&E has used the energy and demand savings targets provided in the "Energy Efficiency Potential and Goals Study for 2015 and Beyond," (Potential Study) approved in D.15-10-028 as the foundation for its projected energy savings goals for 2018-2025, along with 2017 for reference. Energy and demand savings goals are shown as net annual goals, as per D.16-08-019.

<sup>12</sup>D.15-10-028, p. 48.

<sup>13</sup>D.15-10-028, OP 4.

**Table 5.3**  
Industrial Sector Annual Net Market Potential

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
<b>GWh</b>	44	43	42	41	40	39	39	38	38	38
<b>MW</b>	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.6	3.6	3.6
<b>MM therms</b>	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	3.9	3.9

PG&E’s net annual energy and demand savings goals are directional in nature, and meant to reflect its best estimates of energy and demand savings potential. PG&E requests flexibility to accommodate potential market or regulatory changes. PG&E will file an annual Tier 2 AL that provides detailed sector-level energy and demand goals.

PG&E recognizes that energy and demand savings goals will be updated to meet the SB 350 energy efficiency targets set by the California Energy Commission (CEC) no later than November 1, 2017<sup>14</sup> and the net goals framework adopted in D.16-08-019.<sup>15</sup> PG&E will update its energy savings forecasts once the Commission approves new energy and demand savings targets.

**Table 5.4**  
PG&E Industrial Sector Budget Summary

Cost Category	2016	2017	2018	2019	2020-2025 Annual Budget <sup>a</sup>
<b>Administration</b>	\$2,897,678	\$3,926,190	\$3,417,874	\$2,909,559	\$2,596,893
<b>Marketing</b>	\$1,331,020	\$2,398,131	\$1,728,871	\$1,599,610	\$1,470,350
<b>Implementation</b>	\$12,967,612	\$17,411,177	\$17,280,247	\$17,149,318	\$17,018,389
<b>Incentive</b>	\$15,642,088	\$19,617,069	\$20,517,069	\$21,417,069	\$21,417,069
<b>Total</b>	<b>\$32,838,398</b>	<b>\$43,352,567</b>	<b>\$42,944,061</b>	<b>\$43,075,556</b>	<b>\$42,502,700</b>

<sup>a</sup> The Annual Budget from 2020 through 2025 will remain the same.

<sup>14</sup> SB 350 requires the California Energy Commission to develop and establish statewide targets that lead to a cumulative doubling of energy efficiency savings from all retail electric and natural gas end-users by 2030. <http://www.energy.ca.gov/sb350/timeline.pdf>

<sup>15</sup> “Commission staff should work with its consultants to prepare a net goals framework in time for the start of 2018, if not sooner.” D.16-08-019, p. 20.

### Sector Budget

PG&E’s business plan budget, summarized in **Table 5.4**, provides general information on the expected levels of annual spending for 2018-2025, along with 2016 and 2017 approved budgets for reference. As provided in D.15-10-028, PG&E’s business plan<sup>16</sup> budget represents its best estimates of spending for the life of the business plan.<sup>17</sup> The intent is to allow program administrators flexibility to adjust spending during the life of the business plan. PG&E will file a Tier 2 AL annually, containing a detailed budget for the next calendar year’s energy efficiency portfolio.<sup>18</sup> The Tier 2 AL budgets will include detailed budgets for cost recovery, transfer, and contracting purposes.<sup>19</sup>

For more discussion on PG&E portfolio and sector-level budgets, please see the Portfolio Overview chapter.

<sup>16</sup> D.15-10-028: “It [the budget] will establish a “ballpark” figure for spending for the life of the business plan.” p. 55.

<sup>17</sup> D.15-10-028, p. 56.

<sup>18</sup> D.15-10-028, OP 4.

<sup>19</sup> D.15-10-028, p. 56.

## Cost-effectiveness

PG&E presents its sector-level cost-effectiveness for its 2018-2025 Business Plan. See **Table 5.5** for *Industrial Projected Cost-Effectiveness Results 2018-2020*, **Table 5.6** for *Industrial Projected Net Annual Savings Impact from Cost-Effectiveness Scenario 2018-2020*, and **Table 5.7** for *Industrial Projected Emissions Reductions from Cost-Effectiveness Scenario 2018-2020*.

PG&E conducted a cost-effectiveness analysis of its proposed portfolio in compliance with D.15-10-028, and with the California Standard Practice Manual.<sup>20</sup> PG&E used the 2017 updated avoided costs and cost-effectiveness inputs approved in Resolution E-4801.

PG&E's cost effectiveness calculation represents the near-term years of its business plans (2018-2020) and is directional in nature, meaning that PG&E will strive to meet the cost-effectiveness projections set forth for the sector. However, PG&E requests flexibility to accommodate potential market or regulatory changes. Through the annual Tier 2 ALs, PG&E will provide the Commission with updated cost-effectiveness forecasts for each year of business plan implementation.

Through implementation of its business plan, PG&E seeks to make significant impact in reducing energy waste cost effectively and maximizing the value of energy efficiency for customers, for the grid, and for the state. To do this, PG&E recognizes the need to take "a more integrated, cost-effective approach"<sup>21</sup> to scale energy savings. For more discussion on PG&E's key strategies to scale energy efficiency and continue to deliver cost-effective energy efficiency portfolios, please see the *Portfolio Overview* chapter.

<sup>20</sup> California Standard Practice Manual: Economic Analysis of Demand Side Management Programs and Projects, 2002. [http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf)

<sup>21</sup> Mitchell, Cynthia 2014. "A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach." p. 1, TURN May 15, 2015 iDSM comments in R.14-10-003, p. 9.

**Table 5.5**  
Industrial Projected Cost-Effectiveness Results 2018-2020

	Results
<b>TRC</b>	1.35
<b>PAC</b>	2.27

Note: Does not include Market Effects

**Table 5.6**  
Industrial Projected Net Annual Savings Impact from Cost-Effectiveness Scenario 2018-2020

	PG&E Target	PGS Goal
<b>Energy Savings (Net GWh/yr)</b>	40.9	40
<b>Demand Reduction (Net MW)</b>	4.2	3.8
<b>Gas Savings (Net MMTh/yr)</b>	7.5	4.2

Note: Does not include Market Effects

**Table 5.7**  
Industrial Projected Emissions Reductions from Cost-Effectiveness Scenario 2018-2020

	Reductions
<b>Annual tons of CO<sub>2</sub> avoided</b>	81,654
<b>Lifecycle tons of CO<sub>2</sub> avoided</b>	917,037
<b>Annual tons of NO<sub>x</sub> avoided</b>	124,741
<b>Lifecycle tons of NO<sub>x</sub> avoided</b>	1,395,194
<b>Annual tons of SO<sub>x</sub> avoided</b>	—
<b>Lifecycle tons of SO<sub>x</sub> avoided</b>	—
<b>Annual tons of PM<sub>10</sub> avoided</b>	4,406
<b>Lifecycle tons of PM<sub>10</sub> avoided</b>	55,856

## D. Sector Overview

In 2016, California ranked as the sixth largest economy in the world, larger than France or Brazil. Manufacturing and other industrial production plays a major part in maintaining that economic success, contributing nearly 10% of the state's GDP and leading the nation in segments such as electronics and computer manufacturing. However, industry in California faces considerable challenges — rising labor costs, tightening regulations, and growing competition nationally and abroad are pushing many industrial firms to move out of state or internationally. PG&E's industrial energy efficiency programs work with firms to reduce energy waste and the overall environmental impact of their operations, and keep firms in compliance with and/or ahead of building codes and regulations.

PG&E works with industrial customers ranging from large, integrated factories employing hundreds to smaller, family-owned operations. While the largest customers consume the majority of load on the grid and therefore should continue to be the primary target of PG&E programs, PG&E is committed to helping smaller companies become energy aware to reduce their footprint as well.

### Target Audience

PG&E characterizes its industrial customers in terms of segment, size, energy efficiency program participation, end use, and geography.

**Segment Overview and Energy Usage:** PG&E divides the market into segments based on the type of business its customers conduct. Segments include manufacturing, food processing, petroleum, and chemicals & minerals. Segmenting its customer base enables PG&E to craft customized solutions for an industry's specific business needs. To date, PG&E's data analytics have identified approximately 10,000 association rules linking customer characteristics with energy efficiency offerings.<sup>22</sup>

In addition, EM&V studies provide key insights into market barriers, drivers, and trends within industries such as cement, plastics, ceramics, metalworking, paper, chemicals, motors, oil and gas extraction, produced water management and recycling, and

food processing.<sup>23,24,25</sup> This greater understanding of the obstacles and priorities for specific industrial customers enables PG&E to optimize its offerings to best suit their needs.

As depicted in **Figure 5.1: 2015 Energy Usage by Industrial Customer Segment**, in 2015, the largest consumers of electricity in the industrial sector were manufacturing (52%), food processing (24%), and petroleum (19%). The largest consumers of gas were manufacturing (65%), petroleum (25%), and food processing (7%). See *Appendix C: Customer Data* for greater detail on program participation, energy usage, and savings for each industrial segment.

<sup>22</sup> Zawadzki, Lin, Dahlquist, Bao, et al. "Personalized energy efficiency program targeting with association rule mining," *Pacific Gas and Electric Company—2016 ACEEE Summer Study on Energy Efficiency in Buildings*, p. 8-7

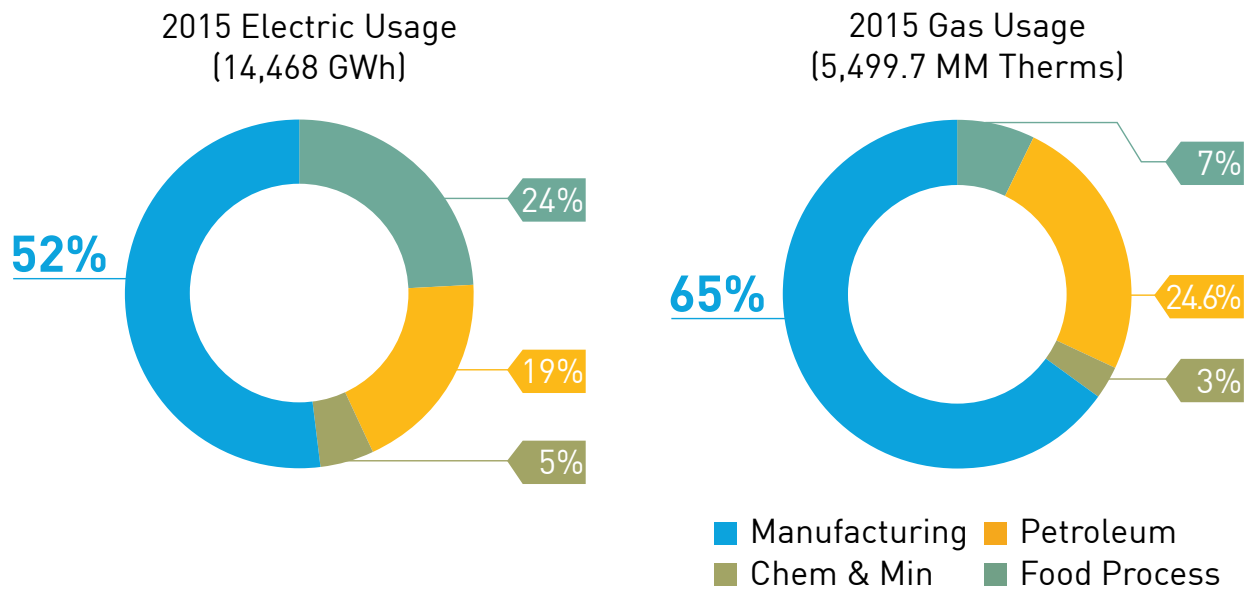
<sup>23</sup> KEMA. 2012 b - h. *Industrial Sectors Market Characterization: Chemicals Industry; Metalworking Industry; Plastics Industry; Mineral Product Manufacturing Industry; Glass Industry; Water and Wastewater Industry; Paper Industry.*

<sup>24</sup> Navigant Consulting, Inc. 2015 b-f. *Measure, Application, Segment, Industry (MASI): New Opportunities for Oil and Gas Extraction and Produced Water Management and Recycling; Food Processing Industry; Wastewater Treatment Facilities; Motors Baseline and Opportunities in the Industrial, Food Processing, and Agricultural Sectors, and Early Motor Retirement in Refineries; Integrated Design for New Construction Buildings.*

<sup>25</sup> See "Measure, Application, Segment, Industry (MASI)" studies in *Section N: Reference List*.

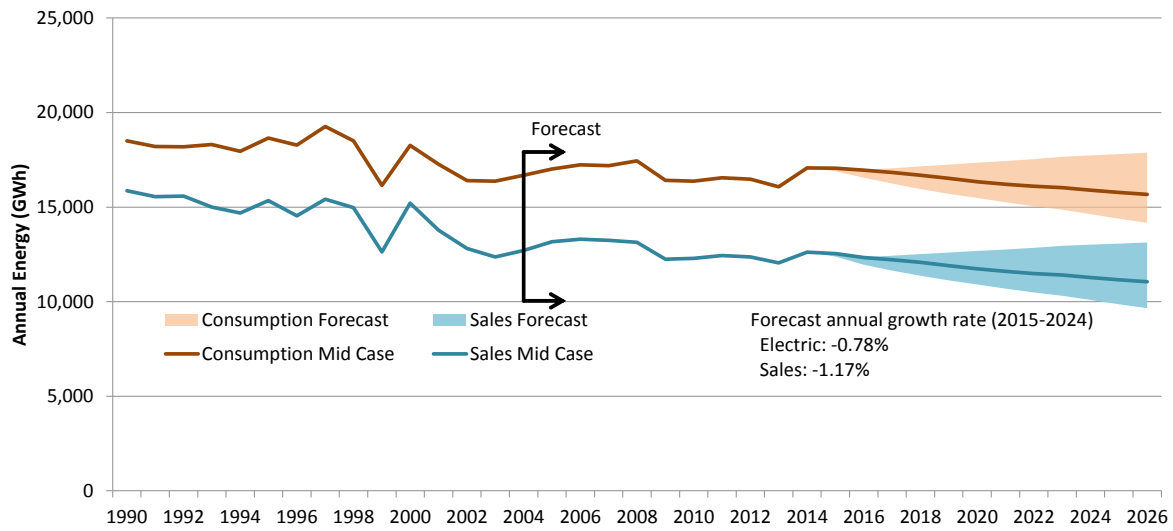
**Figure 5.1****2015 Energy Usage by Industrial Customer Segment**

Source: 2015 PG&amp;E customer data as divided by NAICS code



**Figure 5.2:** *2015 Industrial Consumption and Sales Forecast* depicts that the sales and consumption of electricity in the industrial sector is expected to decline slowly throughout the next 10 years. The state's aggressive GHG and energy-reduction goals may be contributing to this trend, as well as expectations of some industries continuing to relocate abroad to remain competitive. See *Section E: Industrial Market Trends and Challenges* for more detail on market trends and challenges.

**Figure 5.2**  
2015 Industrial Consumption and Sales Forecast



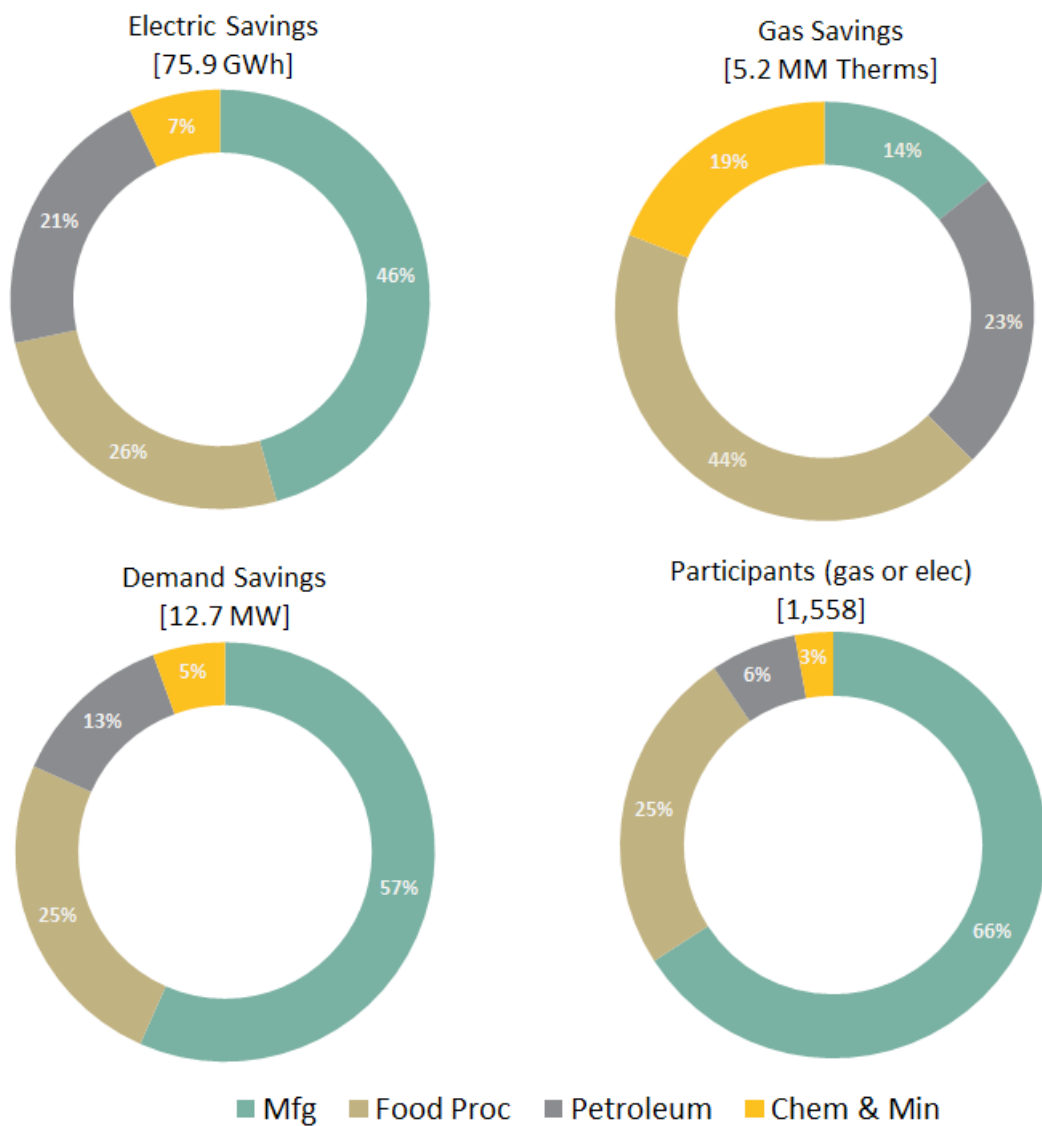
**Size and Energy Efficiency Program Participation:**  
PG&E defines customer size based on energy usage. Defining customers based on energy usage enables PG&E to tailor solutions based on customers' resources and needs.

As **Figure 5.3a**: *Industrial Sector 2015 Energy Efficiency Program Participation and Savings by Segment* identifies two-thirds of the participants in PG&E's industrial energy efficiency programs in 2015 were manufacturing customers. Accordingly, manufacturing customers drove more than half of demand savings and nearly half of electric savings

in the industrial sector in 2015. Food processing customers represented a quarter of participants in PG&E's industrial energy efficiency programs and nearly half of gas savings in the sector.

**Figure 5.3a**  
Industrial Sector 2015 Energy Efficiency Program Participation and Savings by Segment

Source: 2015 PG&E customer data as divided by NAICS code



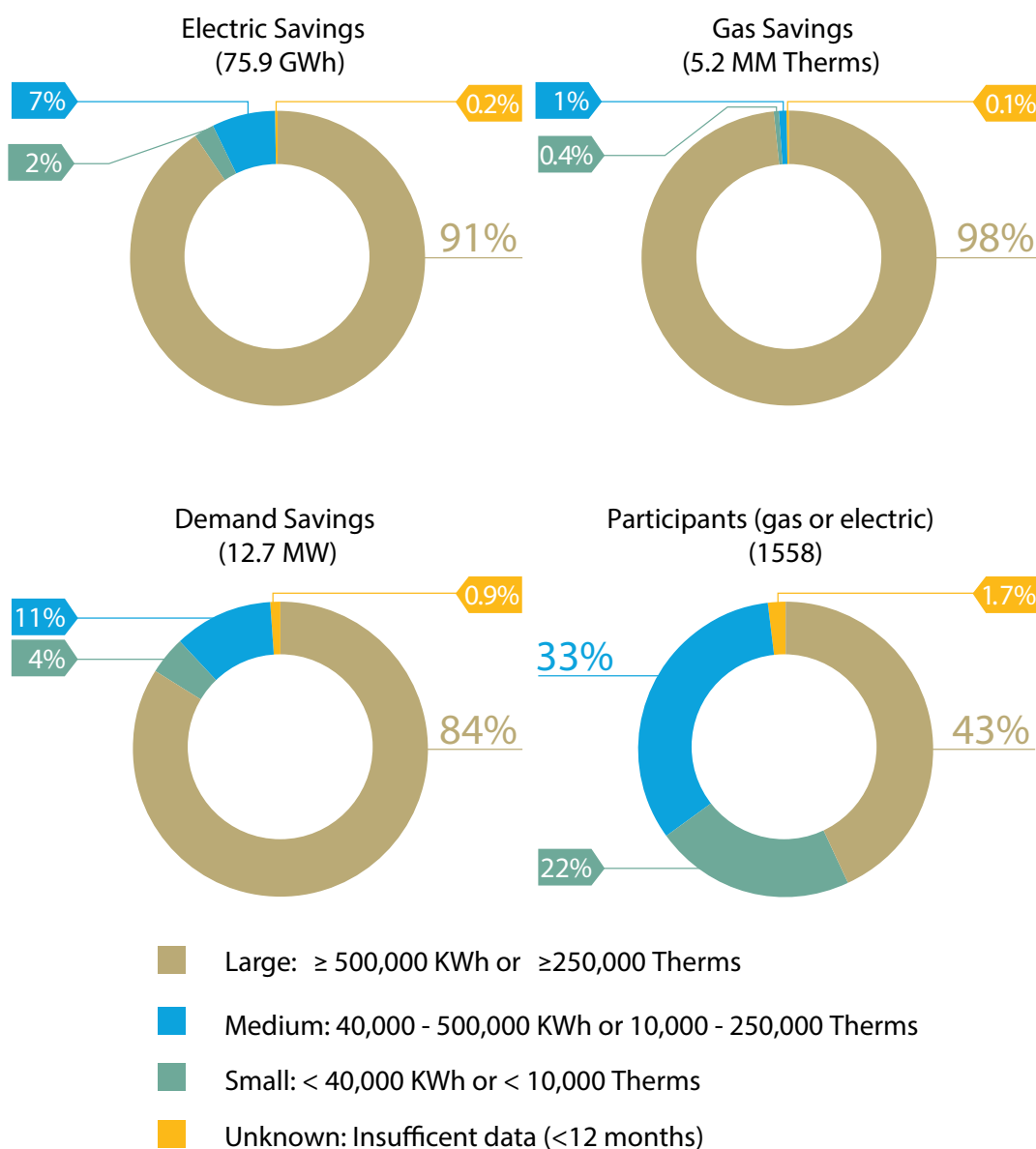


As **Figure 5.3b**: *Industrial Sector 2015 Energy Efficiency Program Participation and Savings by Size* indicates, four in ten participants in PG&E's 2015 industrial energy efficiency programs were large (> 500,000 kWh or > 250,000 therms). These customers accounted for more than 90% of electric and gas savings. In addition, more than half of the

participants in PG&E's industrial energy efficiency programs in 2015 were small (< 40,000 kWh or < 10,000 therms) or medium (40,000-500,000 kWh or 10,000-250,000 therms). These customers accounted for 15% of demand savings and less than 10% of energy savings in the industrial sector.

**Figure 5.3b**  
Industrial Sector 2015 Energy Efficiency Program Participation and Savings by Size

Source: 2015 PG&E customer data as divided by NAICS code



In addition to using more energy, large customers drive energy savings in the industrial sector largely because they have the resources to actively manage their energy usage and invest in comprehensive energy management solutions. Large industrial customers are also often associated with national or multinational corporations that have strategic energy plans. Due to the long lead times in the industrial sector,<sup>26</sup> large customers may operate for years before implementing new energy saving measures. As a result, large customers desire a long-term relationship with PG&E to provide industry-specific

persistent savings over the long-term.

Conversely, small and medium-sized industrial customers typically lack the resources to employ energy management staff. Since these customers consume less energy than larger customers, it can be difficult to capture savings opportunities in a cost-effective manner. PG&E's historical approach to these customers focused on lighter, more actionable opportunities to realize savings through expanded participation in energy efficiency offerings.<sup>27,28,29</sup>

**Tables 5.8 and 5.9** summarize 2015 Electric and Gas Usage and Savings.

**Table 5.8**  
2015 Electric Usage and Savings

	Customer By Size <sup>a</sup>				Total	Percent of Sector <sup>c</sup>				
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	
<b>Whole Sector</b>										
Electricity Usage (GWh)	13,229	994	240	6	14,468	91%	7%	2%	100%	
Usage Trends (2011-2015) <sup>e</sup>										
Customers (Number of customers)	23,497	18,576	29,261	732	72,066	33%	26%	41%	99%	
Customer trends (2011-2015)										
Average Usage (kWh per customer)	562,995	53,504	8,200	7,698	200,763					
Usage Rate Trends (2011-2015)										
Electricity Savings (MWh)	69,011	4,909	1,856	130	75,906	91%	6%	2%	100%	
Savings Trends (2011-2015)										
Participants (Number of Participants)	630	489	336	25	1,480	43%	33%	23%	98%	
Participant (2011-2015)										
Average Savings (kWh per Participant)	109,542	10,038	5,525	5,185	51,288					
Savings Rate Trends (2011-2015)										
Participation Rates (% Participants per Cust.)	3%	3%	1%	3%	2%					
Participation Rate Trends (2011-2015)										

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
Small: < 40,000 KWh or < 10,000 Therms  
Unknown: Insufficient data (<12 months)

<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data

<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data

<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

technical assistance and financial solutions that drive

<sup>26</sup> Graham Partners. December 7, 2015. Addressing Barriers to Industrial Energy Efficiency Engagement. Lizzie Grobbel. <http://aceee.org/sites/default/files/pdf/conferences/ie/2015/Session3D-Grobbel-IE15-12.7.15.pdf>

<sup>27</sup> Navigant Consulting, Inc. 2015 b-f. *Measure, Application, Segment, Industry (MASI): New Opportunities for Oil and Gas Extraction and Produced Water Management and Recycling; Food Processing Industry; Wastewater Treatment Facilities; Motors Baseline and Opportunities in the Industrial, Food Processing, and Agricultural Sectors, and Early Motor Retirement in Refineries; Integrated Design for New Construction Buildings.*

<sup>28</sup> PG&E Large Business Customer Journey Research Report; November 16, 2015; Greenberg

<sup>29</sup> Washington State University, Extension Energy Program. December 2011. Best Business Practices for Industrial Energy Efficiency. Industrial News Briefs. <http://www.energy.wsu.edu/Documents/IN-BestBusinessPractices-Dec2011.pdf>

**Table 5.9**  
2015 Gas Usage and Savings

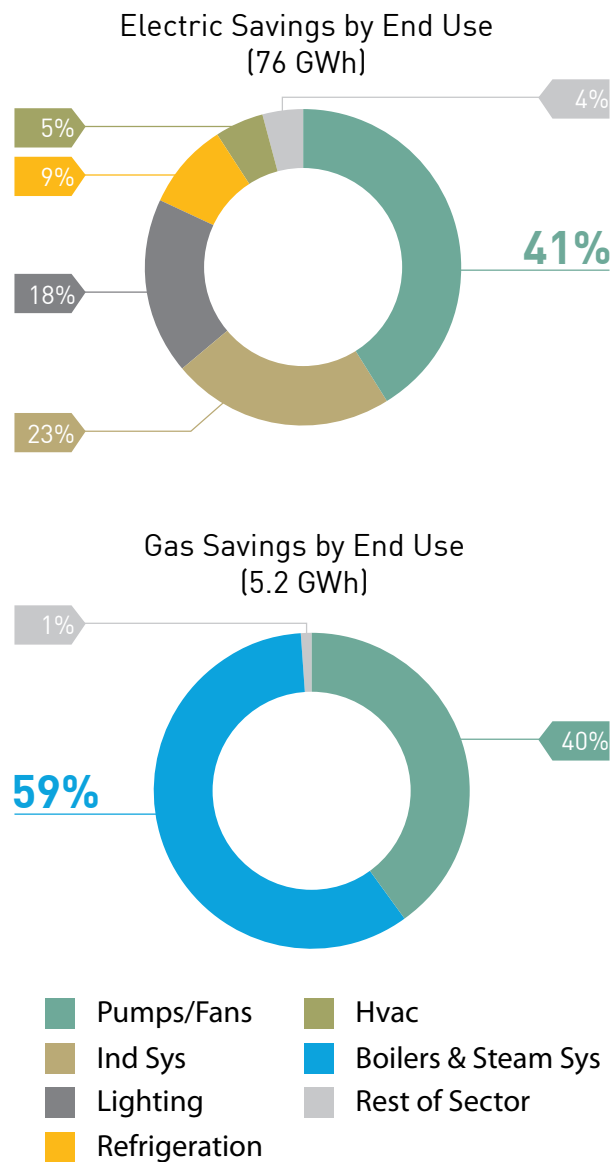
Whole Sector	Customer By Size <sup>a</sup>				Total	Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>
Gas Usage (MM Therms)	5,454	30	6	10	5,500	99%	1%	0.1%	100%
Usage Trends (2011-2015) <sup>e</sup>									
Customers (Number of customers)	4,722	6,673	11,707	349	23,451	20%	28%	50%	99%
Customer trends (2011-2015)									
Average Usage (Therms per customer)	1,154,954	4,492	505	29,117	234,520				
Usage Rate Trends (2011-2015)									
Gas Savings (Therms)	5,155,869	57,664	22,484	5,105	5,241,121	98%	1%	0.4%	100%
Savings Trends (2011-2015)									
Participants (Number of Participants)	347	382	279	17	1,025	34%	37%	27%	98%
Participant (2011-2015)									
Average Savings (Therms per Participant)	14,858.4	151.0	80.6	300.3	5,113.3				
Savings Rate Trends (2011-2015)									
Participation Rates (% Participants per Cust.)	7%	6%	2%	5%	4%				
Participation Rate Trends (2011-2015)									

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
Small: < 40,000 KWh or < 10,000 Therms  
Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**End Use:** PG&E tracks energy savings by end use to inform the design of energy efficiency offerings that target savings potential. **Figure 5.4: Industrial Sector 2015 Energy Savings by End Use** provides a breakdown of PG&E's electric and gas savings by end use from 2015.

## Figure 5.4 2015 Industrial Sector Energy Savings by End Use

Source: PG&E internal data



Pumps & fans were responsible for 41% of electricity savings from in 2015, followed by industrial systems with 23% and lighting with 18%. Boilers and steam equipment drove nearly 60% of gas savings during this same period, followed by pumps & fans with 40%. As PG&E looks ahead with the strategies and tactics identified, pumps & fans will be a key focus for its upstream initiatives since these components are fairly homogenous across industrial customers. In addition, general industrial process and boiler

and steam systems will be a central focus for new program models that PG&E explores such as SEM, given that these end uses would benefit from operations and maintenance opportunities as well as retrofit opportunities. All three end uses are critical to the productivity and profit margin of a facility; thus, PG&E will work closely with customers and partners to ensure that program designs are adaptable to customers' environments.

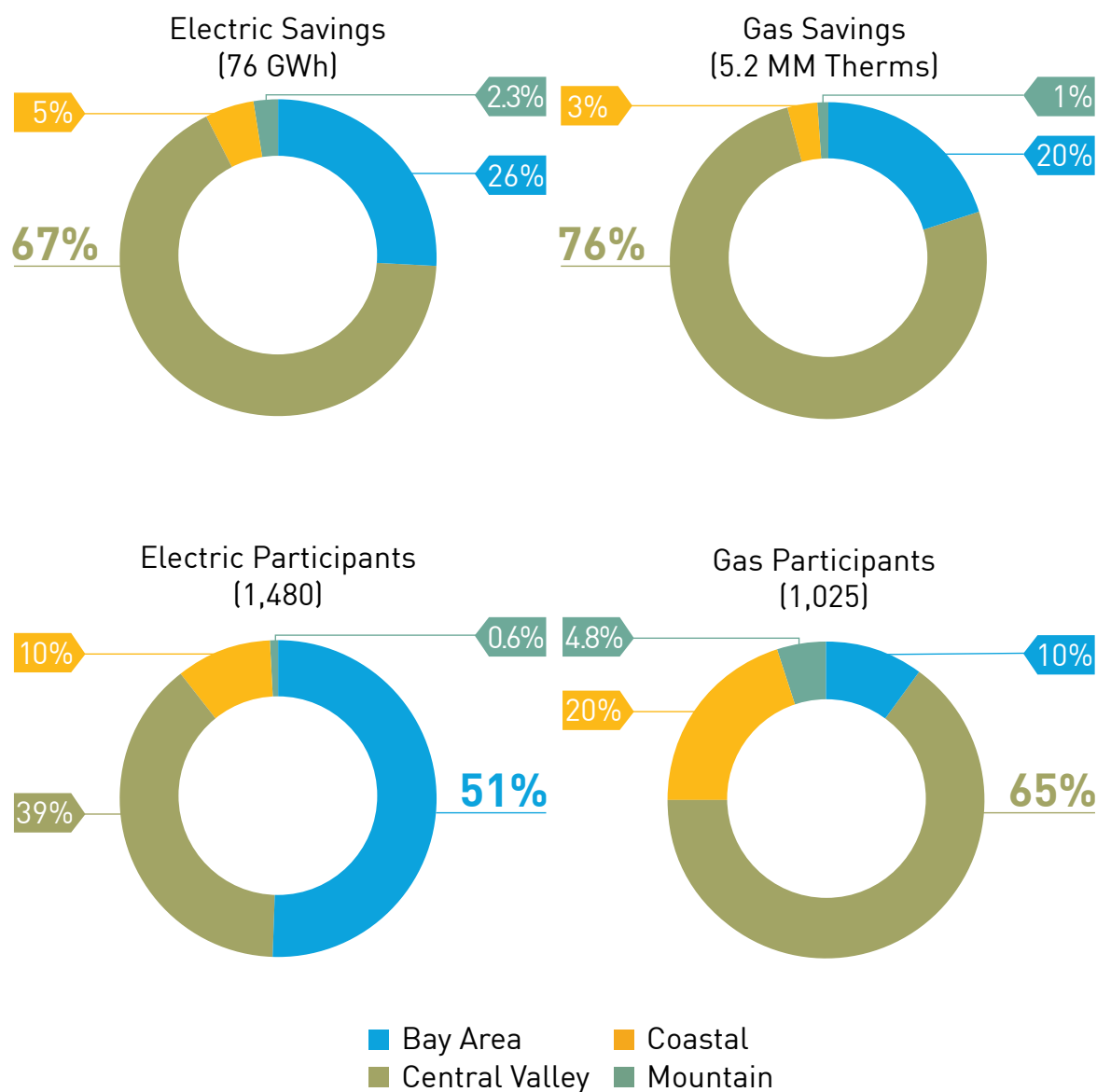
**Geography:** PG&E's service territory includes 13 of the 16 climate zones in California.<sup>30</sup> As a result, PG&E segments its industrial customers based on their location in the Central Valley, Coastal, and Mountain regions.

**Appendix C, Table C.13: Industrial Electric Customers by Climate Region and Size** and **Appendix C, Table C.14: Industrial Gas Customers by Climate Region and Size** in *Appendix C: Customer Data* provide an overview of energy efficiency program participation, energy usage, and savings by region. Despite the fact that approximately half of the participants in industrial energy efficiency programs are located in the Central Valley and Coastal regions respectively, more than three-quarters of total energy savings are achieved by Central Valley customers.

In addition, **Table C.13: Industrial Electric Customers by Climate Region and Size** and **Table C.14: Industrial Gas Customers by Climate Region and Size** provide greater detail on industrial customers by analyzing electric and gas data through the lenses of customer location and size. **Table C.13: Industrial Electric Customers by Climate Region and Size** reveals that 312 large Central Valley participants in energy efficiency programs are responsible for nearly 60% of electric usage and 70% of electric savings. This trend is also apparent in **Figure 5.5**, where 147 large Central Valley participants drive more than two-thirds of gas usage and over 80% of gas savings.

<sup>30</sup> Climate zones 7, 8, and 9 are not included in PG&E's service territory. These climate zones are included in the Los Angeles metropolitan area. For more on these climate zones, see [http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california\\_climate\\_zone\\_07.pdf](http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zone_07.pdf), [http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california\\_climate\\_zone\\_08.pdf](http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zone_08.pdf), [http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california\\_climate\\_zone\\_09.pdf](http://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zone_09.pdf)

**Figure 5.5**  
2015 Energy Savings and Participants by Climate Region



Note: Regions are aggregates of Climate Zones (Z01 - Z16). There are 16 zones but not all are in PG&E's territory.

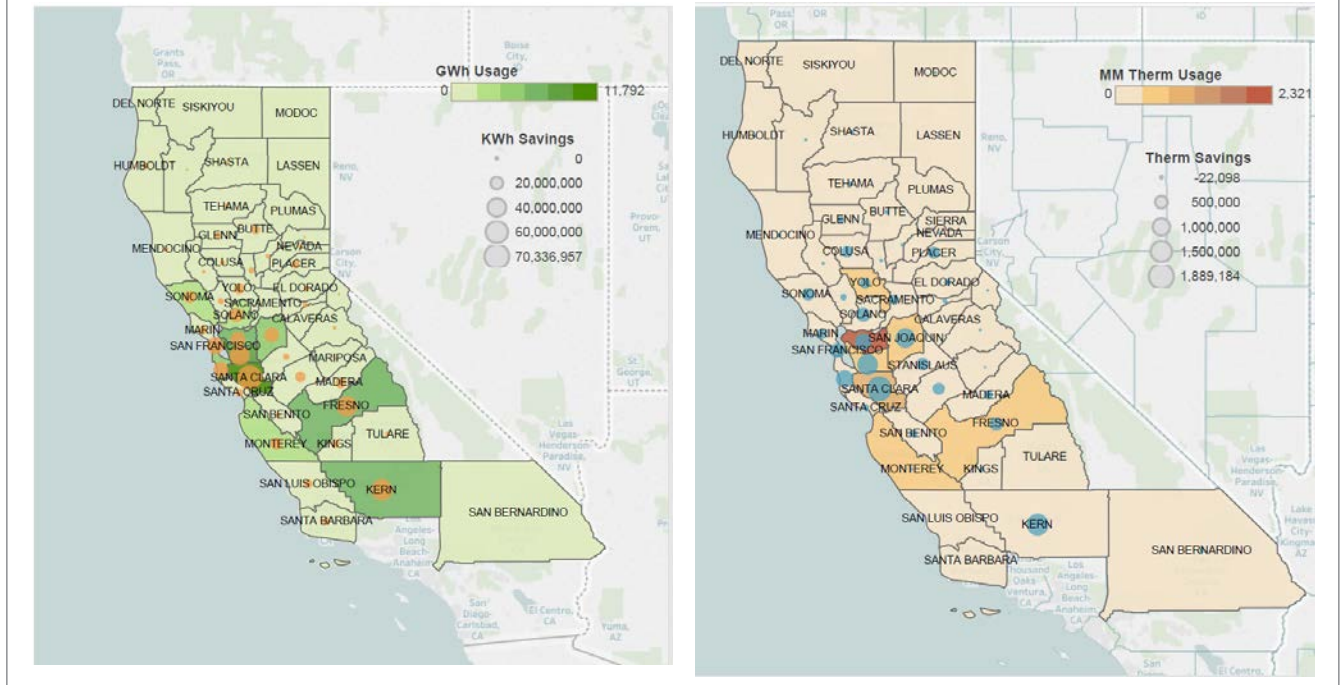
- Central Valley includes: Z11–Z13
- Coastal includes: Z01–Z06 & Z09 (excludes Bay Area Counties)
- Mountain includes Z14–Z16
- Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma

In addition to analyzing industrial customers' energy usage at the climate zone level, PG&E also uses data analytics to identify which counties consume and save the most energy. **Figure 5.6: 2015 Industrial Sector Energy Consumption and Savings by County** provides an overview of electric and gas usage and

savings at the county level. Please see *Appendix B: Customer Data* for more detailed maps displaying usage and savings broken by the key segments identified.

**Figure 5.6****2015 Industrial Sector Energy Consumption and Savings by County**

Source: PG&amp;E internal data



On a county basis across the state, industrial customers in Kern County used 3,000 GWh of electricity in 2015—nearly double the usage of any other county in California. Other counties with high industrial electric usage include Alameda (1,600 GWh), Contra Costa (1,300 GWh), Santa Clara (1,200 GWh), and Fresno (1,100 GWh). Furthermore, industrial customers in Kern County saved 26.7 million kWh in 2015, representing more savings than the next four highest saving counties combined. Other counties with high electric savings were Alameda (7.6 million kWh), Fresno (6.2 million kWh), Solano (5.5 million kWh), and Madera (2.7 million kWh). More than half of the electric usage and savings in Kern County were from petroleum customers.

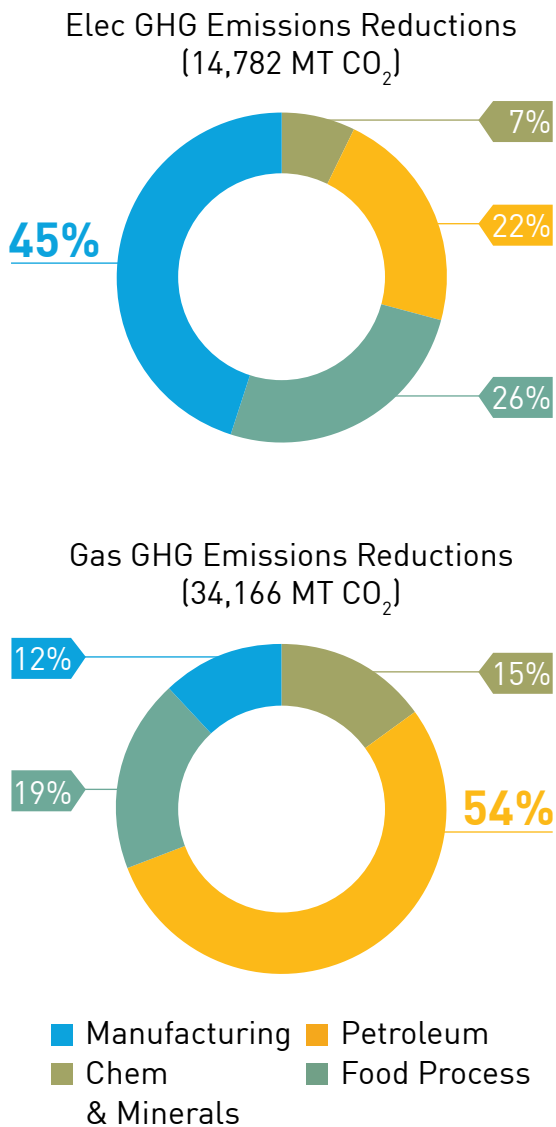
While PG&E has been fairly successful in targeting existing programs in high electric usage regions, significant untapped opportunity for natural gas savings remains. Namely, most gas usage occurs in Monterey, Santa Clara, East Bay, and Yolo regions, whereas Kern and San Joaquin counties generated most historical savings.

Overall, the highly concentrated nature of industrial usage in select areas of PG&E service territory

should make its marketing and outreach efforts easier to execute and potentially more cost effective going forward.

**Figure 5.7: 2015 GHG Savings by Segment**, which depicts PG&E's GHG savings by industrial segment in 2015, reflects little overlap between relative electric and gas-related savings. Most notably, petroleum accounted for 54% of gas GHG savings and only 22% of electric savings. Conversely, manufacturing captured the bulk of GHG savings on the electric side with 45% and only 12% of gas-related savings. In more equal proportion, food processing accounted for 26% of electric and 19% of gas-related savings. Lastly, chemicals and minerals remained more peripheral in capturing the lowest combined electric and gas GHG savings (with 7% and 15%, respectively).

**Figure 5.7**  
2015 GHG Emissions Reductions  
by Segment



### Energy Efficiency Potential

The 2015 Potential and Goals Study (Potential Study) is used to define energy savings goals; however, its utility varies across the market sectors on account of its methodology. Although the Potential Study provides measure-level savings forecasts for the residential and commercial sectors, it has typically used supply cost curves to estimate savings for the industrial and agricultural sectors. This assessment has limited the Potential Study’s usefulness in targeting savings within these sectors. The updated 2017 Potential Study will expand the model to include measure-level detail for all sectors, including industrial. PG&E looks forward to these updates and will use the updated forecast to inform the design of future industrial offerings.

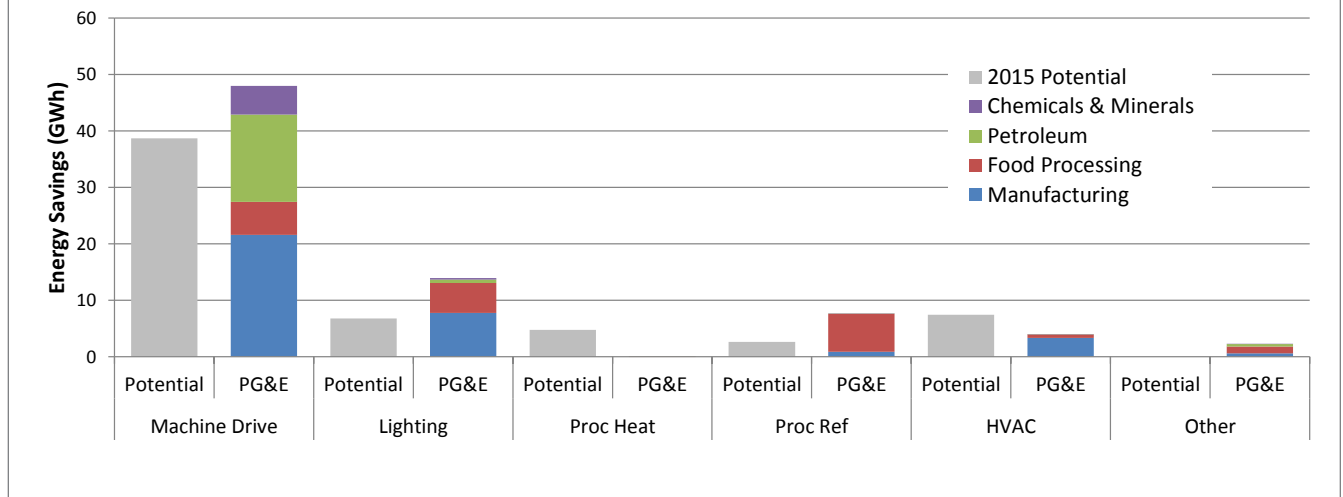
**Figure 5.8:** 2015 Energy Efficiency Potential and Program Savings by Segment compares the 2015 energy efficiency potential by end use in the industrial sector with average savings achieved during this period.<sup>31</sup> PG&E’s savings exceeded potential in machine drives,<sup>32</sup> lighting, and process refrigeration– and were below potential in HVAC and process heat.

<sup>31</sup> It should be noted that major categories of industrial savings such as industrial systems and boilers and steam do not appear in the 2015 Potential Study. PG&E is advocating for the inclusion of these end uses in forthcoming potential studies.

<sup>32</sup> California Energy Efficiency Strategic Plan: January 2011 Update,” California Energy Commission and California Public Utilities Commission, January 2011, p. 40, file:///C:/Users/C2K2/Downloads/CAEnergyEfficiencyStrategicPlan\_Jan2011%20(9).pdf

**Figure 5.8****2015 Energy Efficiency Potential and Program Savings by Segment**

Source: Navigant Consulting 2015; PG&amp;E internal data.



Overall, the Potential Study is only marginally useful in its current form and no other recent study identifies energy savings potential. The industrial, agricultural, and large commercial energy efficiency evaluation research roadmap is proposing research that will tap recent non-residential audits and other reports to identify major untapped energy efficiency opportunities in this customer segment. Better alignment between potential studies and industrial program segmentation would greatly benefit program design and solicitation efforts moving forward.

## E. Industrial Market Trends and Challenges

PG&E's industrial sector business plan is shaped by a number of market trends and challenges, as discussed below.

### Trends

According to the California Energy Efficiency Strategic Plan, a uniform approach to energy efficiency in the industrial sector is inadequate due to the diversity of customer sizes, types,

and operations.<sup>33</sup> As a result, designing strategic interventions, goals, and metrics that contribute to achieving PG&E's vision for the industrial sector requires a two-pronged approach: (1) understanding customer segments through data analytics and market assessments, and, (2) identifying and tracking market trends that impact the industrial sector as a whole. To this second point, PG&E has identified four market trends that impact its industrial customers through experience and market research.

- **Increasing regulation and the high cost of doing business in California are placing more and more financial pressure on industrial customers.**
  - State agency regulation of industry is ever-increasing surrounding nitrogen oxide (NOx) and GHG emissions, use/handling/transport of specific chemicals key to production, water usage, and hazardous waste disposal. Facing intensifying emissions limits, PG&E's largest customers are looking to energy efficiency, as well as other distributed energy resources, to meet regulations.
  - According to a 2014 study by the California Foundation for Commerce & Education, the total cost of doing business in California is 19%

<sup>33</sup> "California Energy Efficiency Strategic Plan: January 2011 Update," *California Energy Commission and California Public Utilities Commission*, January 2011, p. 40, file:///C:/Users/C2K2/Downloads/CAEnergyEfficiencyStrategicPlan\_Jan2011%20(9).pdf



higher than the national average, or \$57,000 per employee.<sup>34</sup> The high cost of real estate and labor, coupled with declining shipping costs, is driving many industrial operations overseas.

- **Many customers are turning to self-generation (often via co-generation, wind, and solar) to mitigate costs and pervasive business uncertainty.**

- This trend can complicate opportunities to achieve predictable energy savings. At the same time, energy efficiency can help to offset some of these costs and meet demands for greener energy, while targeted customer outreach will play an important role in informing customers about how energy efficiency programs can do so.

- **The industrial sector is consolidating, and manufacturing of high-tech, precision, high-margin equipment is becoming more prominent relative to other products.**

- This trend is particularly relevant in the realms of biotech and pharmaceuticals— as quality control standards, higher shipping costs, and the research and development (R&D)-intensive component will continue to remain local. These elements contribute to a relatively predictable customer segment for PG&E to target— and also one that is already savvy about energy usage. Overall, this raises bar for the means by which PG&E must influence them.

- **Industrial automation is on the rise as money and technology [i.e. automation, data analytics, and the internet of things (IoT)] are increasingly channeled into the sector.**

- As automation renders equipment costs more and more prominent in industrial operations (relative to labor cost), this opens the door to energy efficiency savings opportunities. In this emerging high-tech landscape, PG&E seeks to harness advanced technology solutions to help its customers understand their energy usage and save energy.

- Energy management information systems (EMIS) have enabled companies to gain visibility of the energy usage for these various automation systems, as well as link energy savings to the overall performance of an industrial operation. Automation, as well as general improvements in information technology, has enabled EMIS costs to drop and the desire for information and data-driven decision making to increase. This in turn has driven the price for metering to decline, and the amount of existing information technology within large industrial plants to increase.<sup>35</sup>

## Challenges

California's industrial sector faces significant challenges: competing effectively in a global market, managing increasingly scarce natural resources, and complying with increasingly strict regulations. Overall, the sector must also confront heightened concerns about food safety, cleaner air and water, worker safety, as well as the long-term sustainability of scarce natural resources, ecosystems, and species.

Several studies delved into the fundamental disconnect between industrial customers' objectives and the ability to grow energy efficiency savings in this sector. These studies contested that key barriers to energy efficiency "include limited capital, production priorities, limited staff time, and severe cost-effectiveness criteria."<sup>36</sup> Namely, many industrial operations lack sufficient resources available to prioritize energy efficiency. This is substantiated by observations that "for most facility and plant managers, keeping equipment and systems operational while meeting quality requirements and avoiding production disruptions is the highest priority."<sup>37</sup> More specifically, with investment in production machinery often requiring capital funding, PG&E's large industrial customers have a tendency to maintain and repair older equipment for as long as possible, reducing the potential for energy efficiency-related additions.<sup>38</sup>

<sup>34</sup> California Foundation for Commerce & Education (CFCE). August 12, 2014. "The Cost of Doing Business in California," p. 19. Prepared by Andrew Chang & Company. <http://www.calchamber.com/cfce/documents/cfce-cost-of-doing-business-in-california.pdf>

<sup>35</sup> Rogers, E. 2013 and 2014.

<sup>36</sup> Industrial Sectors Market Characterization: Chemicals Industry; KEMA; February 2012; p. 3.

<sup>37</sup> Industrial Sectors Market Characterization: Chemicals Industry; KEMA; February 2012; p. 78.

<sup>38</sup> PG&E Large Business Customer Journey Research Report; November 16, 2015; Greenberg.

The industrial sector is particularly challenging to target with energy efficiency programs due to the breadth of diversity, how decisions are made, and the level of technical expertise required. The most significant economic and financial challenges to be addressed in energy efficiency program design include:

**Capital constraints:** Industrial customers often face internal competition for capital and frequently require very short payback periods (one to three years). Additionally, corporate tax structures, such as depreciation and energy bills, can deter industrial customers' interest in energy efficiency upgrades.<sup>39</sup> Capital constraints are apparent in a variety of industrial segments and sizes with different degrees of severity. Generally speaking, small-to-medium customers often lack any capital for larger energy efficiency investments, whereas large customers tend to have stringent criteria for distribution of capital spend, which creates a different set of challenges.

**Decision-making complexity:** Industrial customers often split responsibilities for operations, energy management, and investment decisions across multiple lines of business, each of which may prioritize energy efficiency and energy use reductions differently. This lack of coordination can impede and delay energy efficiency upgrades.<sup>40</sup> Decision making may be easier in smaller facilities in which one manager makes most business decisions, while large customers often struggle with many layers of decision makers with different motivations.

**Energy efficiency project valuation:** In many cases, project valuation ignores co-benefits such as reduced maintenance costs, grid reliability, employee satisfaction, and improved air quality. Valuing these "non-energy benefits" as part of energy efficiency project analysis can increase the internal rate of return and decrease the payback, making the energy efficiency investments more viable and attractive to decision makers.<sup>41</sup>

**Energy prices:** Low natural gas prices can compromise interest in energy efficiency. Based on EIA data, PG&E expects natural gas prices to remain at relatively low levels in the midterm (rising from over \$2.5/MMBtu to \$4/MMBtu by 2020, and remaining at roughly \$5/MMBtu to 2040),<sup>42</sup> which may temper industrial customers' motivation to pursue energy efficiency projects.<sup>43</sup>

**IOU energy efficiency programs' ease of use:** The complexity of IOU program rules and procedures can render energy efficiency uptake difficult and unattractive, particularly given the extended wait times that customers frequently endure before getting clear answers about their incentive(s) and opportunities. PG&E constantly seeks to identify ways to clarify rules and support customers to make program participation easier, while maintaining a focus on capturing incremental savings from what are often complex and difficult-to-analyze projects. Overall, while uncertainty in utility energy efficiency programs can make participation challenging,<sup>44</sup> the U.S. DOE concluded that "not having industrial customers participate in energy efficiency programs represents a significant missed opportunity," particularly in gas savings programs.<sup>45</sup>

PG&E's seven core intervention strategies seek to overcome these key barriers for the industrial sector, as shown in **Table 5.10** and explained in greater detail in *Section F: PG&E's Approach to Achieving Goals*.

<sup>39</sup> DOE Barriers study, p. 39.

<sup>40</sup> DOE barriers study, p. 43.

<sup>41</sup> DOE Barriers study, pp. 43-44

<sup>42</sup> DOE. 2016. Annual Energy Outlook 2016. DOE/EIA -0383 (2016) August. See, for example, Figure ES-6.

<sup>43</sup> DOE Barriers study, p. 46.

<sup>44</sup> DOE Barriers study, p. 42. And M. Kelly and E. Rogers. 2016, pp. 7-8.

<sup>45</sup> DOE Barriers study p. 50.

**Table 5.10**

Industrial Market Trends and Barriers to Energy Efficiency Program Participation

Industrial-Sector Interventions	Key Industrial Sector Barriers
Data access and awareness	<ul style="list-style-type: none"> <li>• Decision-making complexity</li> </ul>
Data analytics	<ul style="list-style-type: none"> <li>• Decision-making complexity</li> </ul>
Technical assistance and tools	<ul style="list-style-type: none"> <li>• Decision-making complexity</li> <li>• Energy efficiency project valuation</li> <li>• Programs' ease of use</li> </ul>
Loans, rebates, and incentives	<ul style="list-style-type: none"> <li>• Capital constraints</li> <li>• Energy prices</li> <li>• Programs' ease of use</li> </ul>
New models	<ul style="list-style-type: none"> <li>• Decision-making complexity</li> <li>• Energy efficiency project valuation</li> <li>• Programs' ease of use</li> <li>• Capital constraints</li> <li>• Energy prices</li> </ul>
Strategic partnerships	<ul style="list-style-type: none"> <li>• Energy efficiency project valuation</li> <li>• Programs' ease of use</li> </ul>
Upstream initiatives	<ul style="list-style-type: none"> <li>• Decision-making complexity</li> <li>• Programs' ease of use</li> </ul>

## F. PG&E's Approach to Achieving Goals

### Strategic Interventions Overview

PG&E has more than a 20-year track record of providing energy efficiency offerings to its industrial customers, with critical support from field engineers, project managers, account representatives, relevant experts, vendors, and auditors. Building upon past experience, PG&E identified the following seven strategic interventions to advance California's evolving energy efficiency technology and policy landscape in the industrial sector:

- **Data Access and Awareness** effective benchmarking and proactive monitoring of results<sup>46</sup>
- **Data Analytics** to target customers and the most cost-effective energy efficiency solutions
- **Technical Assistance and Tools** to facilitate access to innovative technologies, industrial engineering expertise, and advisory services to ensure realization of opportunities<sup>47</sup>
- **Financial Solutions** such as loans, rebates, and incentives to help customers overcome first-cost barriers to energy efficiency project implementation<sup>48</sup>
- **New Models** such as Strategic Energy Management (SEM) to promote operational, organizational, and behavioral changes that yield ongoing efficiency gains to meet SB 350 goals and capture "stranded" energy savings<sup>49</sup>
- **Strategic Partnerships** to maximize outreach efforts, share technical expertise, and use cross-agency resources to help scale efficiency and meet SB 350 goals<sup>50</sup>
- **Upstream Initiatives** to support the most energy-efficient products, components, and systems

**Figure 5.9** summarizes and the next section provides further detail on the selected intervention strategies and exploratory tactics. Before proceeding with implementation, PG&E will expose each tactic described to a rigorous internal development process to assess its relative viability and cost effectiveness.

<sup>46</sup> DOE SEE Action study, p. 14.

<sup>47</sup> DOE SEE Action study, p. 14.

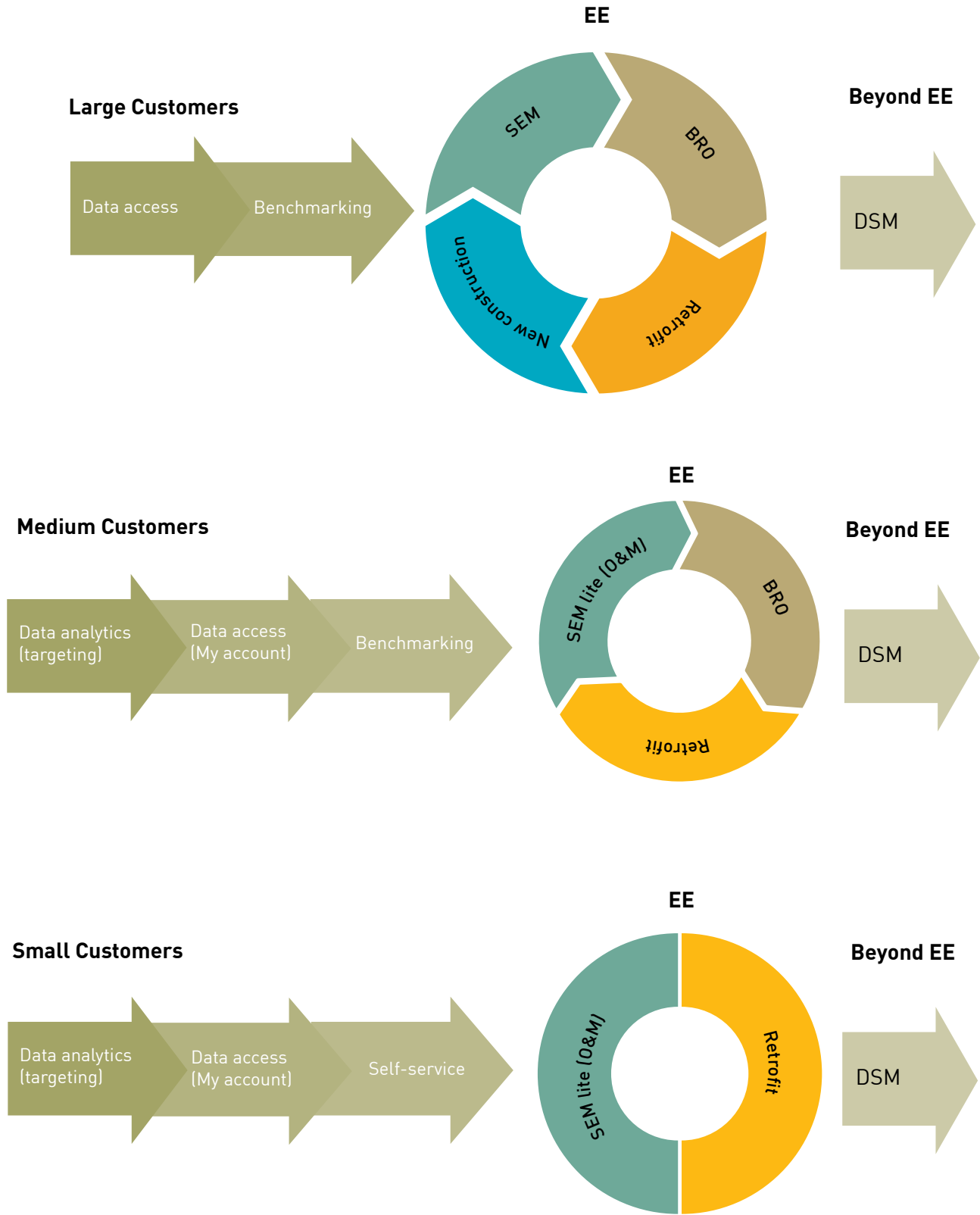
<sup>48</sup> DOE SEE Action, p. 15-16.

<sup>49</sup> DOE SEE Action Study, p. 18.

<sup>50</sup> DOE SEE Action Study, p. 35.

**Figure 5.9**

PG&E's Approach and the Customer Energy Journey



## Intervention 1 — Data Access and Awareness for effective benchmarking and proactive monitoring of results

According to the DOE, a lack of disaggregated energy usage data and tools to evaluate the data can prevent the identification and evaluation of energy efficiency opportunities.<sup>51</sup> Industrial customers need accurate and complete information to make informed decisions about energy efficiency investments.<sup>52</sup> Making customer energy consumption data accessible and useful is the first step in helping customers recognize opportunities for energy efficiency, and connecting them to technical assistance, incentives and rebates, SEM, and other resources.

Most industrial customers have highly specialized operations and are risk averse when it comes to energy efficiency improvements. Enabling greater visibility into energy efficiency opportunities and more accountability around energy use can drive increased energy efficiency investments.<sup>53</sup> Going forward, PG&E seeks to ensure that all customers have access to their energy usage data and the ability to share this data with relevant third parties. **Table 5.11** provides additional insights into this intervention strategy.

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<sup>51</sup> DOE Barriers study, p. 53.

<sup>52</sup> DOE Barrier study, p. 53.

<sup>53</sup> DOE Barriers study, p. 57.

**Table 5.11**

Intervention 1: Data Access and Awareness for effective benchmarking and proactive monitoring of results

GOAL: Save energy and reduce demand				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Data access and awareness (to promote customer understanding and management of their energy consumption, and to target high-potential energy efficiency opportunities)</b>	Decision-making complexity	Continue to use existing meters and tools through which industrial customers can view their data (e.g. Green Button Connect).	E	S
		Introduce benchmarking and recognition program: <ul style="list-style-type: none"> <li>Evaluate benchmarking techniques for industrial customers. Gather data and analyze existing industrial benchmarking programs (e.g., EPA ENERGY Star for Industry) to evaluate the feasibility of various approaches.</li> <li>Select an industrial segment with high savings potential (such as food processing or manufacturing) to serve as the focus of an initial, limited benchmarking offering.</li> </ul>	N	M
		Offer relevant and actionable comprehensive facility audits to identify energy efficiency, demand response, and distributed generation potential in customers' facilities. Large Integrated Audits (LIAs), for instance, have helped to increase awareness of energy efficiency and demand response for PG&E industrial customers.	E	S

**Partners:** Industry groups, government agencies, and research institutions involved in industrial benchmarking programs; research institutions [Electric Power Research Institute (EPRI), Lawrence Berkeley National Laboratory (LBNL), American Council for an Energy-Efficient Economy (ACEEE)] for assistance with market research.

**Data Access:** Almost all recent studies<sup>54,55</sup> tout the importance of providing more visibility to energy use data and/or sharing energy audit results that identify opportunities, to get customers to save energy. Both information and energy audits have been key components in the broader portfolio of programs to get customers to become more aware of their energy use and where opportunities exist to save. PG&E will continue to provide Large Integrated Audit (LIA) services via onsite energy assessments of qualifying customer sites to help industrial customers realize untapped opportunities in their facilities and gain better awareness of their potential for demand response. PG&E will focus on refining the qualifying process for LIAs versus other audit services, and on training account representatives, field engineers, and vendors on how to better develop and present audits to customers (using the data from audits to better target opportunities and customers, as well as increasing the conversion rates of measures identified through audits).

**Benchmarking:** Benchmarking has been a powerful tool used by residential and commercial customers to facilitate energy use awareness and drive greater energy savings potential. PG&E recognizes an opportunity to improve its industrial customers' benchmarking practices by ensuring that customers have access to disaggregated data, the ability for themselves and their partners to analyze this data and develop and refine facility energy management practices. The 2011 CSEEP set forth a goal to "build market value of and demand for energy efficiency through branding and certification," with one result being that "energy efficiency certification and benchmarking will become a standard industrial practice for businesses that are responsible for 80 percent of the sector energy usage by 2020."<sup>56</sup>

The ENERGY Star for Industry program<sup>57</sup> constitutes a viable model for PG&E's industrial customers to use as a starting point. The unique nature of industrial facilities makes it difficult to compare them against others or even procure data to do so on account of confidentiality issues. While researchers (e.g., national laboratories, international organizations such as International Energy Agency (IEA), and academia) publish energy intensities for specific segments, these studies are sporadic and non-comprehensive across industrial markets, and thus of limited use. Therefore, PG&E initially plans to evaluate what tools and best practices currently exist for industrial benchmarking to get better insight into effective methods in the market. PG&E will then use that research to develop services or possibly a stand-alone program centered on benchmarking for its industrial customers. PG&E believes using its in-house energy usage and program-participation data, as well as other customer-specific details, can inform an offering that ranks customers on both energy usage-intensity and less quantitative criteria, such as program participation, cumulative energy savings, and commitment to energy efficiency.

## Intervention 2 — Data Analytics to target customers and the most cost-effective energy efficiency solutions

According to a 2013 report by ACEEE, "imperfect information may be the most widespread barrier to energy efficiency. The most significant drivers include the difficulty of measuring energy savings and [the] challenge of separating energy use from individual devices."<sup>58</sup> These challenges are particularly pronounced in the industrial sector on account of its diversified customer base and high energy-intensity consumption patterns (representing 25% of overall electric and 36% of gas usage across PG&E's service territory in 2015<sup>59</sup>). **Table 5.12** provides additional insights into this intervention strategy.

<sup>54</sup> KEMA. 2012 b - h. *Industrial Sectors Market Characterization: Chemicals Industry; Metalworking Industry; Plastics Industry; Mineral Product Manufacturing Industry; Glass Industry; Water and Wastewater Industry; Paper Industry.*

<sup>55</sup> Navigant Consulting, Inc. 2015 b-f. *Measure, Application, Segment, Industry (MASI): New Opportunities for Oil and Gas Extraction and Produced Water Management and Recycling; Food Processing Industry; Wastewater Treatment Facilities; Motors Baseline and Opportunities in the Industrial, Food Processing, and Agricultural Sectors, and Early Motor Retirement in Refineries; Integrated Design for New Construction Buildings.*

<sup>56</sup> CSEEP 2011, p. 41.

<sup>57</sup> ENERGY STAR. *Industrial Energy Management.* <https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants>

<sup>58</sup> Vaidyanathan, Nadel, Amann, et al. "Overcoming Market Barriers and Using Market Forces to Advance Energy Efficiency," American Council for an Energy-Efficient Economy, p. vi. March 2013: <http://kms.energyefficiencycentre.org/sites/default/files/e136.pdf>

<sup>59</sup> California Energy Commission; 2015 Integrated Energy Policy Report (IEPR); [http://www.energy.ca.gov/2015\\_energypolicy/](http://www.energy.ca.gov/2015_energypolicy/)

**Table 5.12**

Intervention 2: Data Analytics to target customers and the most cost-effective energy efficiency solutions

GOALS: Save energy and reduce demand; Reach an increasing percentage of industrial customers				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Data analytics (to target customers with cost-effective energy efficiency opportunities)</b>	Decision-making complexity	Use available and/or new data to identify high-potential customers and market segments to enhance PG&E’s delivery of appropriate and timely solutions to customers, and to target customers at the optimal time in their decision-making and budget cycles. <sup>a</sup>	M	S

**Partners:** Third-party vendors; EM&V research consultants.

<sup>a</sup> DOE SEE Action study, p. 32.

**Customer Targeting:** PG&E will use insights from interval data to increase cost-effective savings by identifying customers with “stranded potential,” allowing for targeted interventions tailored to industrial customers’ specific needs.<sup>60</sup> Furthermore, PG&E will conduct market research to identify high-potential customers and market segments. The research will seek to expose high relative energy users, as well as segments with recent technological innovations. This will inform PG&E’s delivery of appropriate and timely solutions to customers on their energy efficiency journey.

PG&E will conduct in-house analyses of customer billing data, and complement these with a review of recent non-residential audits, tracking data on customers’ adoption of energy efficiency, account representatives’ knowledge of specific customers’ conditions, and further in-depth market research. Specifically, PG&E is proposing a variety of studies to 1) identify where the largest untapped energy savings opportunities exist in the IALC markets; 2) carry out in-depth market characterizations of the key markets where these opportunities exist to offer useful program design/implementation guidance; and, 3) carry out process evaluations of new interventions to provide early feedback that enables timely enhancements to programs.<sup>61</sup>

<sup>60</sup> *Analyzing Energy Efficiency Opportunities Across Building Portfolios*; ACEEE 2014 Summer Study; Ellen M. Franconi and Michael J. Bendewald, Rocky Mountain Institute; Caitlin E. Anderson, ME Engineers: [http://www.rmi.org/Content/Files/ACEEE\\_2014-Analyzing\\_Building\\_Portfolios.pdf](http://www.rmi.org/Content/Files/ACEEE_2014-Analyzing_Building_Portfolios.pdf)

<sup>61</sup> See the *EM&V Plan Update– Industrial, Ag, and Large Commercial Chapter (IALC Roadmap 2017 Update DRAFT)*; California Public Utilities Commission;: <http://www.energydataweb.com/cpuc/search.aspx?did=1644>



### Intervention 3 — Technical Assistance and Tools to facilitate access to innovative technologies, industrial engineering expertise, and advisory services to ensure realization of opportunities

Many customers face technical barriers to identifying and/or completing energy efficiency projects. In particular, small- and medium-sized customers tend to lack on-site personnel with sufficient expertise to detect energy inefficiencies. In contrast, many larger customers may be aware of efficiency opportunities, but still unable to qualify for utility incentives. Limited time, expertise, and financial resources also frequently preclude customer implementation of energy efficiency projects.<sup>62</sup> In addition, little usable benchmarking data exists for industrial facilities at present. This may be a limiting factor to customer engagement with utility programs due to pervasive lack of customer understanding of energy usage and consequent confidence in energy-related choices.<sup>63</sup>

Overall, technical assistance helps to identify and quantify energy savings opportunities that large customers' energy managers may typically overlook (in their predominant focus on procurement) and small customers lack the resources to detect. It also provides an independent review of vendor claims (vis-à-vis the relative energy savings potential of a proposed technology), which can provide crucial endorsement value.

In continuing to provide relevant technical assistance, tools, and knowledge sharing, PG&E seeks to effectively integrate energy efficiency into day-to-day operations for an increasing percentage of customers. **Table 5.13** provides additional insights into this intervention strategy.

<sup>62</sup> Christopher Russell. 2008. "The Industrial Energy Harvest." [www.energypathfinder.com](http://www.energypathfinder.com)

<sup>63</sup> Michael Sullivan. January 2009. "Behavioral Assumptions Underlying Energy Efficiency Programs for Businesses." Prepared for CIEE/CPUC. Available at: <http://uc-ciee.org/library/1/nclked/exact/behavioral-assumptions-underlying-energy-efficiency-programs-for-businesses/a/1/desc>

**Table 5.13**

Intervention 3: Technical Assistance and Tools to facilitate access to innovative technologies, industrial engineering expertise, and advisory services to ensure realization of opportunities

GOALS: Save energy and reduce demand; Reach an increasing percentage of industrial customers				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Technical assistance, tools, and knowledge sharing (to facilitate customer awareness and action)</b>	<ul style="list-style-type: none"> <li>• Decision-making complexity</li> <li>• Energy efficiency project valuation</li> <li>• Programs' ease of use</li> </ul>	Improve existing technical and project-management support to enable project identification and completion. Continue to offer on-site consultative engineering assistance through both statewide and targeted (third-party) offerings to guide customers toward efficient options, evaluate vendor proposals, and facilitate incentive submissions.	M	S
		Explore new calculation and measure-selection tools to fast-track custom project development and optimize cost effectiveness, much like the Modified Lighting Calculator.	N	L
		Create a delivery model to fast-track review for semi-complex projects with basic underlying savings and cost calculations for example, using a dollar and/or energy savings threshold. The relative rigor of the review should align with the project scope (e.g., savings potential and proposed incentive amounts).	N	S
		Offer tools and services that identify BRO (behavior, RCx, O&M), as these require little capital investment and yield maximum energy efficiency savings within a customer's financial means.	M	M
		Develop case studies and other marketing materials to help risk-averse customers overcome their concerns. Use printed materials, as well as hosted trainings, industry trade publications, conferences, testimonial videos (of efficient manufacturing plants), and site tours. <sup>a</sup>	M	S
		Improve and expand upon technical trainings offered to facility personnel. Recruit technical experts to deliver technology or industry-specific trainings (i.e., compressed air, biotech) on energy efficiency best practices. These can be at PG&E, or at customer or vendor sites.	M	M

**Partners:** Third-party vendors; engineering consultants.

<sup>a</sup> DOE SEE Action study, p. 34.

**Technical Assistance:** The expertise to identify energy efficiency opportunities is not omnipresent in existing industrial facility staff. In many cases, facility staff must address other business priorities, impeding the identification of cost-effective energy efficiency opportunities.<sup>64</sup> To overcome this barrier, PG&E will continue to offer low-cost and no-cost technical assistance in the form of engineering and audit services and project valuation services to identify energy efficiency opportunities and help industrial customers clearly articulate the value of energy efficiency investments.<sup>65</sup>

The U.S. DOE suggests that including co-benefits, or non-energy benefits (NEBs), in the cost-benefit analysis of energy efficiency projects can reduce payback times for investments.<sup>66</sup> PG&E will provide project value propositions developed by technical experts and/or account representatives to quantify NEBs as part of the project-scoping process. Given that NEBs are typically more visible and attractive to customers relative to energy efficiency offerings, it is important for PG&E to maximize the visibility of NEBs in its projects to encourage customer implementation. PG&E will continue to work with Commission staff to demonstrate the importance of NEBs and the best approach for documenting NEBs during the project development process.

PG&E plans to introduce more effective and nuanced timing when approaching customers. Most large industrial customers have long planning cycles that require capital investments to be approved well before implementation. PG&E understands this, having built long-term relationships with its industrial customers, which is critical for successful energy efficiency.<sup>67</sup> PG&E plans to use its account representatives, as well as contracted experts– to provide high-quality technical advice and support on energy efficiency options specific to individual industrial segment needs. Technical experts with a solid foundation in specific industry segments can enable IOUs to address industrial customers’ core needs, operating issues, and the environment in which the customers operate. In this way, IOUs can build trust among industrial customers, understanding their decision-making process, spurring energy efficiency uptake, and making the best use of customers’ limited resources.<sup>68</sup>

**Knowledge Sharing:** The CSEEP acknowledges that industrial customers require greater knowledge sharing and awareness to identify and develop energy efficiency projects.<sup>69</sup> Various 2012 market characterization studies exposed pervasive customer ignorance of energy efficiency programs and opportunities across the chemicals, minerals, metalworking, and glass industries. Notably, “knowledge gaps identified in program understanding appear to inhibit broader participation among customers interviewed”<sup>70</sup>:

- Chemicals industry “customers indicated that they did not feel like they were familiar with the utilities’ program offerings.”<sup>71</sup>
- “Most of the respondents [in the glass industry] expressed not being too familiar with the energy efficiency programs offered by their utility.”<sup>72</sup>

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<sup>64</sup> DOE SEE Action study, pp. 24-25.

<sup>65</sup> DOE SEE Action study, pp. 26-27.

<sup>66</sup> DOE SEE Action study, pp. 25-27.

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<sup>67</sup> DOE SEE Action study, p. 28.

<sup>68</sup> DOE SEE Action study, p. 30.

<sup>69</sup> CSEEP 2011, p. 43.

<sup>70</sup> Industrial Sectors Market Characterization: Chemicals Industry; KEMA; February 2012; p. 4.

<sup>71</sup> Industrial Sectors Market Characterization: Chemicals Industry; KEMA; February 2012; p. 78.

<sup>72</sup> Industrial Sectors Market Characterization: Glass Industry; KEMA; January 2012; p. 58.

- “In addition to not knowing about utility rebate programs, respondents of smaller firms [in the metalworking industry] had no idea what they should be looking for in terms of future energy efficiency projects.”<sup>73</sup>

The 2012 market characterization study advises that “attaining a better understanding of the customer’s world will assist [PG&E and SCE] in their design and implementation of industrial energy efficiency programs,”<sup>74</sup> suggesting the need for further market characterization studies and partnering with trusted industry associations.

PG&E plans to increase knowledge sharing among industrial customers as a means to increase investments in energy efficiency.<sup>75</sup> Ensuring that decision-makers are aware of PG&E’s energy efficiency offerings, and providing customers with tools to improve their understanding of energy efficiency and share best practices can lead to increased participation.<sup>76</sup>

In the mid to long term, PG&E will explore ways to deliver project development self-service tools paired with relevant and supportive case studies to give a broader set of customers the resources they need to take action on their own. PG&E recognizes the need to leverage industry associations to help establish legitimacy in the market place with self-service tools like this.

## Intervention 4 — Loans, Rebates, and Incentives to help customers overcome first-cost barriers to energy efficiency project implementation

Industrial customers have limited capital for equipment investments, process upgrades, and plant improvements— and energy efficiency must compete for this capital.<sup>77</sup> Furthermore, industrial facility decision-makers expect capital investments to have short payback periods of one-to-three years.<sup>78</sup> Such constraints preclude many industrial customers from considering energy efficiency upgrades. While many smaller customers may lack capital and have conflicting priorities, larger customers may have adequate capital but need a solid business justification to pursue energy efficiency. According to the U.S. DOE, for instance, industrial customers may view increasing production more favorably than producing a product with less energy.<sup>79</sup>

Although financing is an option for many customers, the extent to which it can impact industrial customers’ credit rating<sup>80</sup> renders IOUs’ loans, rebates, and incentives all the more important.

PG&E has been offering financial incentives for energy efficiency upgrades for decades, and in the near and mid-term it plans to continue engaging the industrial sector through deemed and custom incentives that improve the economics of customers’ energy efficiency investments.<sup>81</sup> Deemed rebates constitute an effective way to move targeted early/mid-stage technologies into more widespread adoption. At the same time, industrial custom incentive programs have historically delivered larger savings, driven better paybacks per project,<sup>82</sup> and proven highly cost effective.<sup>83</sup> Overall, a combination of deemed and custom options will best support diverse customer needs.<sup>84</sup>

<sup>73</sup> Industrial Sectors Market Characterization: Metalworking Industry; KEMA; March 2012; p. 79.

<sup>74</sup> Industrial Sectors Market Characterization: Chemicals Industry; KEMA; February 2012; p. 6.

<sup>75</sup> DOE SEE Action study, p. 34.

<sup>76</sup> DOE Barriers study, p. 54.

<sup>77</sup> DOE Barriers study, p. 39.

<sup>78</sup> DOE Barriers study, p. 39.

<sup>79</sup> DOE Barriers study, p. 40.

<sup>80</sup> DOE Barriers study, p. 41.

<sup>81</sup> DOE SEE Action study, p. 15.

<sup>82</sup> DOE SEE Action study, p. 15.

<sup>83</sup> DOE SEE Action study, p. 5, and PG&E data.

<sup>84</sup> DOE SEE Action study, p. 31.

In the mid to long term, PG&E plans to explore expanding OBF and OBR to capture additional savings opportunities while being mindful of budget. PG&E also sees an opportunity to potentially customize the mix of financing and incentives based on a set criterion to accommodate where customer are in their energy journey, as well as the scope and complexity of the project design.

Because industrial customers vary so widely in terms of size and sophistication, PG&E must become much more precise in determining the type of financial assistance a customer may need to increase project completion and reduce free-ridership. PG&E and the CPUC have identified the inherent problems associated with large custom projects and associated poor project documentation. As identified in the recent 2010 to 2014 Industrial, Agricultural and Large Commercial (IALC) Impact Evaluations, the 2010-2012 and the 2013-2014 custom programs continued to exhibit free-ridership levels of about 50%. PG&E has put in place processes to reduce free-ridership, and will continue to focus on efforts to maximize ratepayer dollars. At the same time, the U.S. DOE suggests that industrial customers in particular require a streamlined and expedited application process,<sup>85</sup> especially when industrial customers' operational cycles influence when energy efficiency investments are made.<sup>86</sup> Furthermore, DOE notes that identifying free-ridership is complicated, and ambiguity around measuring savings can inhibit project implementation. In some cases, "spillover-effect" can minimize and neutralize free-ridership, as the New York State Energy Research and Development Authority (NYSERDA) found.<sup>87</sup> Encouraging industrial customers' continued participation in energy efficiency is critical as industrial energy efficiency programs can provide valuable energy savings and societal benefits at lower costs than many other programs in other sectors. As noted by the DOE,<sup>88</sup> and as ACEEE stated, "Capturing energy efficiency savings through industrial programs is one of the best ways to keep energy prices low for all customers.

In addition, PG&E will collect proof of permit

closure before paying rebates or incentives for all downstream central air conditioning or heat pumps and their related fans, in accordance with SB 1414.<sup>89</sup>

Going forward, the success of this intervention will be dictated by the extent to which energy-saving projects are prioritized such that savings from industrial projects increases.

Various past evaluation studies have highlighted the value of financial offerings in enabling industrial customers to access more energy-efficient technologies for their often-complex operations.<sup>90</sup> Additionally, studies suggest changes to incentive designs to maximize net program impacts.<sup>91</sup> Through experimentation, PG&E plans to expand the tiered incentive structure currently available and eventually increase the dollar of financing over the dollar of incentive distribution. Having little-to-no interest rate financing may be a more appealing approach to addressing customer needs and timelines.

**Table 5.14** provides additional insights into this intervention strategy.

<sup>85</sup> DOE SEE Action study, p. 34.

<sup>86</sup> DOE SEE Action study, p. 25.

<sup>87</sup> DOE SEE Action study, pp. 39-40.

<sup>88</sup> "Implementation of cost-effective energy efficiency measures, if made within the context of ratepayer-funded energy efficiency programs, ultimately reduces the energy bills of all consumers." DOE SEE Action study, p. 7.

<sup>89</sup> For more information, see "Senate Bill No. 1414," California Legislative Information, [https://leginfo.ca.gov/faces/billTextClient.xhtml?bill\\_id=201520160SB1414](https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB1414)

<sup>90</sup> See, for instance, *Industrial Sectors Market Characterization: Water and Wastewater Industry* (KEMA 2012g).

<sup>91</sup> Itron. 2014. 2014. Custom Impact Evaluation Industrial, Agricultural, and Large Commercial. Final Report. Submitted to CPUC. April 29, 2016. P. 6-15.

**Table 5.14**

Intervention 4: Loans, Rebates, and Incentives to help customers overcome first-cost barriers to energy efficiency project implementation

GOALS: Save energy and reduce demand; Reach an increasing percentage of industrial customers				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Financial solutions (such as loans, rebates, and incentives to enable project completions)</b>	<ul style="list-style-type: none"> <li>• Capital constraints</li> <li>• Energy prices</li> <li>• Programs' ease of use</li> </ul>	Continue to offer custom incentives <sup>a</sup> tailored to individual customers or specific industrial facilities, and ensure sound project documentation. <sup>b</sup>	E	S
		Continue to offer deemed rebates <sup>c</sup> for eligible energy-saving technologies such as lighting, efficient boilers, and VFDs on process fans.	E	S
		Increase the use of financing products such as OBF and OBR as appropriate. "Alternative Path" OBF projects disconnected from incentive reviews and no-limit OBR loans will be particularly relevant for industrial customers.	E	S
		In partnership with CPUC staff, PG&E will explore the bundling of various forms of financial subsidies, technical assistance, and/or loans based on key project development criteria to better match individual customer needs.	M	M
		Develop a tiered incentive approach based on criteria such as past program participation, program influence, and lifecycle savings. <sup>d</sup>	M	M

**Partners:** Green banks; state/federal/local development funds and tax credits.

<sup>a</sup> DOE SEE Action study, p. 14.

<sup>b</sup> Itron. 2014 Custom Impact Evaluation of Industrial, Agricultural, and Large Commercial; pp. 1-12 to 1-15.

<sup>c</sup> DOE SEE Action study, p.14.

<sup>d</sup> Itron. 2014. 2014. Custom Impact Evaluation Industrial, Agricultural, and Large Commercial. Final Report. Submitted to CPUC. April 29, 2016. P. 6-15.

## Intervention 5– New Models such as SEM to promote operational, organizational, and behavioral changes that yield ongoing efficiency gains

SEM<sup>92</sup> is a cornerstone of PG&E’s long-term industrial strategy. Combining data access, technical assistance, tools, and knowledge sharing, and financial solutions PG&E envisions a comprehensive, customized approach to meet individual customers’ energy efficiency needs – an especially important resource given the wide variety of equipment, operation sizes, and energy efficiency expertise that industrial customers possess.

Supporting SEM across PG&E customers will require integrating the various energy efficiency offerings, as well as incorporating PG&E’s other demand-side management offerings. Some of these might include distributed generation and demand response.

SEM offers a promising framework for future energy-efficiency interventions in the industrial sector and a means of integrating energy efficiency into day-to-day operations. Namely, SEM integrates strategy, metrics, and people and management systems into a process of continuous energy improvement (CEI– as it was previously termed). PG&E will provide the tools to help customers integrate this process into their operations, offering training to create an in-house energy manager if one does not yet exist, assisting in establishing an overall energy-management strategy, creating and collecting metrics, and developing energy-management systems that will be self-perpetuating within a customer’s operations.<sup>93</sup>

SEM remains in the early planning stages, and participation and savings are expected to be minimal in the near term. The California IOUs have hired a consultant to develop SEM evaluation guidelines based on those developed for similar programs by the U.S. DOE, Energy Trust of Oregon, Bonneville Power Authority, and BC Hydro.

Having an SEM plan in place will better enable both customers and PG&E to plan ahead for specific project-financing needs, yielding greater business certainty. By pre-authorizing funding on a long-term

timeline, PG&E can give customers clear visibility into the available financial assistance that can render energy efficiency projects more attractive than other investments.

SEM draws from the experience of the proof-of-concept pilot and non-resource, CEI programs run by California IOUs over the past five years and the SEM program experience of Bonneville Power Authority, Energy Trust of Oregon, Northwest Energy Efficiency Alliance, BC Hydro (Canada), and Superior Energy Performance (SEP) of the U.S. DOE. To reduce confusion in the marketplace, California has decided to rename the CEI effort SEM. SEM seeks to execute similar activities to those in CEI, but will draw upon the experience of CEI and SEM from other realms– particularly with regard to evaluating savings and enhancing participation across the industrial customer base. The CPUC and IOUs are working collaboratively to develop a California-specific version of SEM that includes protocols and procedures for both program implementation and evaluation.

Net savings from SEM of 1.2% were demonstrated within a small study of 10 companies in the Northwest.<sup>94</sup> The Consortium for Energy Efficiency (CEE) characterized the SEM market as having few industrial end users investing in SEM, but providing about 5.4% of savings when implemented.<sup>95</sup> Despite the low uptake to date, CEE believes that “because SEM is a set of practices making up a management system and is not bound to any piece of equipment or process, it is scalable and applicable to a broad range of manufacturing facilities regardless of size or industry”.<sup>96</sup> As depicted in **Table 5.15**, PG&E plans to implement various levels of SEM. Additionally, if SEM can save between 1.2% and 5.4% of use per year, this intervention alone could provide substantial savings to industrial programs (which on average saved roughly 0.9% of electricity per year<sup>97</sup>).

<sup>92</sup> Note that many program administrators offer SEM as a fundamental tool to increase savings in the industrial sector, including the Northwest Energy Efficiency Alliance (NEEA): <http://neea.org/initiatives/industrial/commercial-and-industrial-sem-infrastructure>.

<sup>93</sup> See for instance Bonneville Power Administration. MT&R Reference Guide 4: [http://www.bpa.gov/Energy/N/pdf/MTR\\_Reference\\_Guide\\_Rev4\\_0.pdf](http://www.bpa.gov/Energy/N/pdf/MTR_Reference_Guide_Rev4_0.pdf).

<sup>94</sup> Energy 350 2014, p. 4.

<sup>95</sup> CEE 2014, pp. 8-9.

<sup>96</sup> CEE 2014, p. 8

<sup>97</sup> This calculation was derived by dividing the average GWh savings of 125.9 by the average use of 14,291 GWh; both values are included in the *Industrial Sector Snapshot* at the beginning of this chapter.

**Table 5.15**

Intervention 5: New Models such as SEM to promote operational, organizational, and behavioral changes that yield ongoing efficiency gains

GOALS: Save energy and reduce demand; Reach an increasing percentage of industrial customers				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>New models (such as SEM to promote operational, organizational, and behavioral changes that result in greater efficiency gains on a continuing basis)<sup>a</sup></b>	<ul style="list-style-type: none"> <li>• Decision-making complexity</li> <li>• Energy efficiency project valuation</li> <li>• Programs' ease of use</li> <li>• Capital constraints</li> <li>• Energy prices</li> </ul>	Launch SEM as a program: <ul style="list-style-type: none"> <li>• Develop and broadly implement an SEM program that weaves energy efficiency into the operating mentality of participating customers. SEM will fold individual energy efficiency projects into the broader context of a customer's operations and ensure that energy efficiency becomes salient for all decision makers.</li> <li>• The program seeks to test the proposed methodology and evaluation method as well as assess customer response.</li> </ul>	M	S
		Launch SEM as a platform: <ul style="list-style-type: none"> <li>• Implement SEM as a program design model with options for customers based on their available resources. Customers with limited interest/resources can enroll in an online SEM program, whereas those with greater awareness can connect via an in-person cohort model or high-touch individual approach.</li> <li>• As SEM becomes mainstream, evaluate the incorporation of enhanced incentive levels for SEM participants (i.e., an SEM "kicker") or implement cascading SEM incentives - equating to higher-than-average incentives in the first several years for program participants, followed by declining annual incentives until customers reach standard rates.</li> </ul>	M	L
		<ul style="list-style-type: none"> <li>• Explore pay-for-performance models in target segment areas to help drive adoption where traditional incentive programs may be challenged or too costly.<sup>b,c</sup></li> </ul>	N	M

**Partners:** CPUC; DOE; regional and national utilities; SEM software and service providers; third-party vendors.

<sup>a</sup> DOE SEE Action study, p. 18.

<sup>b</sup> CEC, 2015. "California's Existing Buildings Energy Efficiency Action Plan;" pp. 74-75.

<sup>c</sup> Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, 2016. "Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings." p.17.



addition to SEM, PG&E will evaluate other pay for performance models focused on verified performance of energy savings, and procuring energy efficiency as a capacity resource.<sup>98</sup> Pay for performance models have the potential to cost-effectively scale deeper energy efficiency retrofits, and ensure the persistency of energy savings. “Moving to widespread pay-for-performance, metered energy efficiency can unlock capital market investment and simplify the retrofit process.”<sup>99</sup>

### **Intervention 6 — Strategic Partnerships to maximize outreach efforts, share technical expertise, and use cross-agency resources to help scale efficiency and meet SB 350 goals**

By partnering with industry organizations, research institutions, federal, state and regional organizations, and others, PG&E can share technical expertise, program design and implementation guidance, and build capacity for customers to gain greater knowledge around energy efficiency. For example, the EPA Energy STAR for Industry program provides guidance, tools, and recognition to drive improvements in industrial customers’ energy efficiency performance.<sup>100</sup> Government organizations, industry groups, and trade organizations can help to identify and bring recognition to customers that are achieving energy efficiency success, as well as provide a new avenue to reach customers who are also members of these organizations. Partners can also play a role in creating case studies and other outreach materials tailored to their particular industry.

Overall, relative improvements in industrial customer energy efficiency knowledge will serve as a barometer for this intervention’s success going forward.

PG&E plans to facilitate a peer-to-peer Energy Champion Outreach initiative to drive continuous improvement in energy performance at industrial facilities. This initiative may start within the SEM participant pool but should expand further to help those “green” to the energy efficiency program space see the value of SEM. The DOE supports a successful Energy Champion program that trains facility energy leaders in energy management best practices and provides appropriate tools, methods, and support to ensure effective energy management expertise and employee engagement at the company’s top energy-consuming facilities.<sup>101</sup> PG&E’s peer-to-peer Energy Champion is modeled after this, and encourages dialogue amongst industrial customers focused on highlighting energy management best practices (much like the Southeast’s Industrial Energy Efficiency Network.<sup>102,103</sup> Energy Champions will provide data for case studies and other marketing materials, and serve as a resource for customers interested in energy efficiency programs. By elevating high-performing customers as models for their peer groups and industry networks such as California Manufacturers and Technology Association (CMTA) and California League of Food Processors (CLFP), PG&E can influence and promote the participation of other members of these organizations. Peer networks can drive companies to implement energy efficiency measures<sup>104</sup> and can be extremely effective in increasing awareness.<sup>105</sup> As such PG&E plans to unite industrial customers in a cross-sector, peer-to-peer group in which Energy Champions help to drive increased participation in energy efficiency programs, with a focus on continuous energy management improvement techniques.

Furthermore, many local, state, regional, and federal government organizations offer a venue to share energy efficiency best practices and lessons learned. These types of strategic partnerships are a feature of many industrial energy efficiency portfolios

<sup>98</sup> Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, 2016. “Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings.” p.17.

<sup>99</sup> Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, 2016. “Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings.” p.21

<sup>100</sup> DOE SEE Action study, p. 35.

<sup>101</sup> <https://betterbuildingssolutioncenter.energy.gov/implementation-models/energy-champion-program>

<sup>102</sup> Rick Marsh and Ben Taube. September 2012. “The Industrial Energy Efficiency Network Supports Energy Efficiency Through Peer-to-Peer Dialogues Among Industrial Manufacturers in the United States;” p. 5. ECEEE 2012 Summer Study on Industrial Efficiency in Industry. <http://proceedings.eceee.org/docs/2012/contents.pdf>

<sup>103</sup> DOE SEE Action study, p. 15.

<sup>104</sup> DOE SEE Action study, p. 14.

<sup>105</sup> Marsh and Taube, p. 6.

and a noted best practice.<sup>106</sup> Partnering with these organizations to share resources, technical expertise, training opportunities, and program implementation support capacity will extend the reach of PG&E's industrial energy efficiency initiatives. **Table 5.16** provides additional insights into this intervention strategy.

**Table 5.16**

Intervention 6: Strategic Partnerships to maximize outreach efforts, share technical expertise, and use cross-agency resources to help scale efficiency and meet SB 350 goals

**GOALS: Save energy and reduce demand; Reach an increasing percentage of industrial customers**

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Strategic partnerships (to maximize outreach efforts, share technical expertise, and use cross-agency resources)<sup>a</sup></b>	<ul style="list-style-type: none"> <li>• Energy efficiency project valuation</li> <li>• Programs' ease of use</li> </ul>	Continue to use government partnerships to support program implementation and customer installation of energy efficiency measures. PG&E is partnering with LBNL, for instance, to explore best practices for SEM M&V protocols.	E	S
		Engage industry and trade organizations to procure additional customer data, supporting customer outreach.	N	M, L
		Work with industry and trade organizations to publicly recognize customers achieving high levels of energy savings from PG&E programs through peer-to-peer Industrial Energy Outreach Champion initiatives.	N	M, L

<sup>106</sup> ACEEE "Industrial Efficiency Programs Can Achieve Large Energy Savings at Low Costs;" p. 2. <http://aceee.org/sites/default/files/low-cost-ieep.pdf>

## Intervention 7 — Upstream Initiatives to support the most energy-efficient products, components, and systems

Upstream initiatives hold great potential to increase the market penetration of efficient technologies, at a significantly reduced unit-cost, enhancing sector and portfolio cost effectiveness as well as much greater energy savings. Furthermore, partnering with upstream vendors can facilitate delivery of specific energy-efficient technologies to customers.

PG&E will explore opportunities to partner with distributors to stock and promote energy-efficient products, components, and systems (specifically focusing on fans, motors and pumps) with the intention to increase cost-effective energy savings and promote increased participation in energy efficiency initiatives. Working with distributors provides economies of scale and the ability to transform the marketplace.<sup>107</sup> The DOE notes the opportunity for market transformation in the industrial sector.<sup>108</sup> A majority of projects with industrial customers rely on a custom approach, which forces PG&E's partners and engineering staff to utilize expensive resources for relatively simple upgrades of motors or pump systems to the latest, most efficient models. Through some coordination between programs, PG&E believes it can leverage this upstream channel more effectively and focus its local implementation efforts on more complex measures and optimization efforts.

PG&E envisions an upstream program complementing its downstream initiatives by making efficient equipment readily available to industrial customers, providing resources for distributors to stock and upsell these products.

Overall, upstream (and midstream) initiatives seek to increase the availability of energy efficiency measures and decrease the cost of these measures on a sustainable basis.

PG&E plans to identify and assess the market transformation objectives, or “targeted market transformation initiatives” (TMTI), of an industrial

upstream initiative prior to implementation.<sup>109</sup> As recommended in “Guidance on Designing and Implementing Energy Efficiency Market Transformation Initiatives,” PG&E will coordinate with CPUC staff, CEC staff, CAEECC stakeholders, and other stakeholders to act as a “sounding board” throughout the implementation plan (IP) development process.<sup>110</sup> While there was some momentum toward encouraging vendors to stock more energy-efficient motors in the past, industrial upstream/midstream efforts remain largely early-stage and limited to date. **Table 5.17** provides additional insights into this intervention strategy.

<sup>107</sup> Southwest Energy Efficiency Project. May 2014. “Upstream Utility Incentive Programs: Experience and Lessons Learned;” Maureen Quaid and Howard Geller; p. 4: [http://www.swenergy.org/data/sites/1/media/documents/publications/documents/Upstream\\_Utility\\_Incentive\\_Programs\\_05-2014.pdf](http://www.swenergy.org/data/sites/1/media/documents/publications/documents/Upstream_Utility_Incentive_Programs_05-2014.pdf)

<sup>108</sup> DOE SEE Action study, pp. 17-18.

<sup>109</sup> Cathy Fogel, 2016. “Overarching Comments on Program Administrator Business Plans Focus on Market Transformation Strategies;” p. 2.

<sup>110</sup> Keating, 2014. “Guidance on Designing and Implementing Energy Efficiency Market Transformation Initiatives;” p. 15.

**Table 5.17**

Intervention 7: Upstream Initiatives to support the most energy-efficient products, components, and systems

GOALS: Save energy and reduce demand; Reach an increasing percentage of industrial customers				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Upstream initiatives (to promote the most efficient products, components, and systems)</b>	<ul style="list-style-type: none"> <li>• Decision-making complexity</li> <li>• Programs' ease of use</li> </ul>	Investigate market transformation opportunities in the industrial sector.	N	M, L

**Partners:** Upstream vendor groups (i.e. vendors of fans, drives, and other commonly-used industrial equipment).

## G. Leveraging Cross-cutting Resources

PG&E's cross-cutting sectors will play a pivotal role in advancing energy efficiency in the industrial sector. Here PG&E provides a brief overview of how cross-cutting initiatives fit into its industrial strategy. For more detail on PG&E's cross-cutting programs, refer to PG&E's Cross-cutting Business Plan chapters.

- **Finance:** Finance offerings will play a critical role in increasing energy efficiency opportunities for a broader customer base in the industrial sector—through a diversified mix of loans, rebates, and incentives. OBF and OBR will also become a larger part of the financing picture for industrial customers. See *Intervention Strategy 4: Financial Solutions* for a detailed description of how PG&E plans to expand financing offerings for its industrial customers.
- **Emerging Technologies (ET):** ET support is essential in advancing the Technical Assistance and Tools intervention strategy, monitoring the evolving energy efficiency market, and responding to new technologies, trends, and practices. See *Intervention Strategy 1: Data Access and Awareness*, and *Intervention Strategy 3: Technical Assistance and Tools* for a detailed description of how PG&E plans to explore emerging technology opportunities for its industrial customers.
- **Workforce Education and Training (WE&T):** As PG&E hones the necessary skills and knowledge to effectively implement energy efficiency projects, WE&T efforts are integral to educating partners and customers on energy efficiency opportunities. For example, SEM training, and training for pay-for-performance may be critical to the success of these initiatives.<sup>111</sup> See *Intervention Strategy 3: Technical Assistance and Tools*, and the *Intervention Strategy 6: Strategic Partnerships* for an overview of WE&T initiatives that PG&E plans to launch in support of its industrial customers.
- **Marketing:** Marketing will continue to play a major role in crafting and delivering appropriate messaging to customers and vendors to raise awareness of new energy efficiency tools and offerings, as well as building integration with Distributed Energy Resources. See *Intervention Strategy 3: Technical Assistance and Tools*, and *Intervention Strategy 6: Strategic Partnerships* for an overview of how PG&E plans to integrate marketing into its portfolio in support of its industrial customers.

<sup>111</sup> Berkeley Law; Center for Law, Energy & the Environment; The Emmett Institute on Climate Change and the Environment; UCLA School of Law. March 2016. Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings; p. 20. <https://www.law.berkeley.edu/wp-content/uploads/2016/03/Powering-the-Savings.pdf>

## H. Integrated Demand-Side Management (DSM)

While energy efficiency may be the most cost-effective way to reduce energy consumption and greenhouse gas emissions, PG&E uses a range of other DSM strategies to support its industrial customers' energy management needs. These DSM strategies can provide comprehensive, actionable, and economically-viable solutions for PG&E's industrial community.

### Industrial Facilities and Targeted Demand-Side Management (TDSM)

TDSM represents a stark contrast to standard energy efficiency offerings in its selective, targeted, 'whole-system' approach to moderating load.

Enhanced incentives currently provide a key 'carrot' for influencing customer behavior in TDSM. In 2016, PG&E incentivized non-residential projects using a \$100/kW "kicker" for business customers that complete energy efficiency projects by the end of 2017. Whereas this has proven effective in influencing select small and medium-sized industrial customers, large customers are typically more difficult to engage and can require more customized, intimate outreach from PG&E on account of their capital-intensive operations and longer lead times to implement change. This represents an untapped opportunity in PG&E's industrial customer base.

Geographical targeting is another major consideration as energy efficiency is integrated into PG&E's larger TDSM initiative. PG&E is actively taking steps to incorporate the industrial sector into TDSM, particularly surrounding grid assets where industry plays a prominent role in overall load. At the Linden substation in East Stockton, for instance, PG&E has been targeting several particularly large industrial consumers—namely a food processor (of cherries, walnuts, and apples) and a fertilizer plant—in an effort to moderate their peak loads.

PG&E envisions broader opportunities to integrate TDSM going forward, particularly as energy usage data increasingly informs the way industrial customers manage their operations. Energy-intensive industrial customers such as cold storage plants, for instance, may be prime candidates for energy efficiency upgrades using multiple forms of financing and high touch assistance to mobilize them to take action.

### Industrial Facilities and Distributed Energy Resources (DER)

As the prevalence of energy management systems and automation increases, so does the potential to integrate with demand response (DR) programs. Looking ahead, PG&E's industrial customers can work with aggregators to deliver load reduction capacity at market rates or for emergency events; most of this would occur directly on the CAISO market. Currently, PG&E provides comprehensive audits assessing energy efficiency, DR, and distributed generation potential— as well as targeted comprehensive incentives for constrained substation areas. PG&E will explore further integration of DR services in third-party programs as a natural progression from the integration achievements completed to date.

As industrial customers invest in distributed generation (DG) such as solar panels, SEM planning can help to integrate energy efficiency into the overall energy management of their operations. PG&E will strive to support customers as they move toward an integrated energy management process going forward.

### Industrial Facilities and Time-of-Use (TOU)/Rate Design

While rate design is not intended to encourage energy efficiency and often requires energy efficiency products to complement changing rates, many industrial customers actually have the flexibility to use dynamic pricing to their advantage. This is particularly true for oil producers and refineries, manufacturers, and heavy industrial customers that typically operate around-the-clock.

In general, the proliferation of renewables and the associated ‘duck curve’ is driving changes in rates. The California Large Energy Consumers Association (CLECA)’s matinee pricing pilot<sup>112</sup>– designed to bolster demand during non-peak times– should serve the industrial sector particularly well, given that most customers can change their production and relative energy use during “swing shifts” and other times to minimize their total energy bills. Growth in self-generation gives customers further control over their energy usage and related costs. All of these factors render PG&E’s planned shift in non-residential mandatory TOU/peak periods (from noon-6pm through 2018 to 5pm-10pm from 2019 onward), less of a concern for most industrial customers.

At the same time, small and medium-sized industrial customers are generally less flexible and have less understanding of and control over their energy use, and may need support from energy efficiency products to help offset impacts of these rate changes.

### Industrial Facilities and Carbon Credits Program

Given the increase in generation costs driven by PG&E’s compliance with cap-and-trade under AB 32 (the California Global Warming Solutions Act of 2006),<sup>113,114</sup> the Air Resources Board (ARB) annually allocates millions of allowances to PG&E free-of-charge with the mandate that PG&E sell them into auctions (and buy back a portion for compliance). Decision (D).12-12-033, D.14-12-037, and Resolution E-4716 further stipulate that PG&E must return GHG electric revenue to select market sectors to compensate for a portion of the GHG emission costs associated with the electricity they purchase.

Industrial facilities deemed “emissions-intensive and trade-exposed,” or “EITE,” entities are prioritized above all and eligible to receive California Industry Assistance from the state as an annual credit on their utility bill, regardless of the amount of emissions

produced. This approach aims to incentivize these industries to manufacture products in California in the most GHG-efficient manner possible on a sustainable basis.<sup>115</sup>

Overall, this paradigm implicitly recognizes the industrial sector’s strong economic value to the state, and effectively insulates key industrial customers from cap-and-trade-related revenue losses to encourage their ongoing presence in California.

## I. PG&E Helping to Meet State Policy Goals

For a summary of how PG&E’s industrial business plan is helping to meet state policy goals, see **Table 5.18**.

<sup>112</sup> “CLECA Proposal on Matinee Pricing;” Barbara R. Barkovich, Barkovich & Yap., Inc.; for California Large Energy Consumers Association; Matinee Pricing Workshop; February 24, 2016.

<sup>113</sup> *Assembly Bill No. 32; Chapter 488*; Approved by Governor on September 27, 2006. Filed with Secretary of State on September 27, 2006: [http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab\\_0001-0050/ab\\_32\\_bill\\_20060927\\_chaptered.pdf](http://www.leginfo.ca.gov/pub/05-06/bill/asm/ab_0001-0050/ab_32_bill_20060927_chaptered.pdf).

<sup>114</sup> *Assembly Bill 32 Overview*; California Environmental Protection Agency, Air Resources Board: <https://www.arb.ca.gov/cc/ab32/ab32.htm>.

<sup>115</sup> GHG Cap-and-Trade– CA Industry Assistance; CPUC: <http://www.cpuc.ca.gov/industryassistance/>.

**Table 5.18**

Summary of Relevant Energy Efficiency Policies, Guidance, and PG&E Support

Policy Drivers	Guidance Given	PG&E's Policy Support
<b>SB 350</b>	Doubling of energy efficiency savings by 2030, where cost-effective and feasible	<p>Establish strategic partnerships with industrial service providers to increase awareness of available energy efficiency programs and offerings</p> <p>Create targeted customer outreach approaches to increase customer awareness and engagement:</p> <ul style="list-style-type: none"> <li>• Conduct market research to identify high-potential market segments</li> <li>• Develop case studies and marketing materials</li> <li>• Research and offer meaningful benchmarking information to help motivate customers</li> </ul> <p>Offer SEM and pay-for-performance models to scale energy efficiency cost effectively</p>
<b>SB 32</b>	Reduce statewide GHG emissions to 40% below 1990 levels by 2030	Maintain commitments to implementing and scaling energy efficiency (See PG&E support for SB 350, outlined above).
<b>AB 802</b>	<ul style="list-style-type: none"> <li>• Benchmarking</li> <li>• Provide financial incentives and assistance for high opportunity projects</li> </ul>	<ul style="list-style-type: none"> <li>• Offer technical assistance and tools to facilitate project completions and improve customer understanding of energy use</li> <li>• Use incentive-free OBF and other tools emerging from high opportunity projects to deliver savings to industrial customers</li> <li>• Use meter-based savings to measure energy savings and ensure persistency for SEM offerings and other new program models</li> </ul>
<b>California Energy Efficiency Strategic Plan (CEESP)</b>	<ul style="list-style-type: none"> <li>• Support California industry's adoption of energy efficiency by integrating energy efficiency savings with achievement of GHG goals and other resource-management objectives.</li> <li>• Build market value of and demand for energy efficiency through branding and certification.</li> <li>• Provide centralized technical and public policy guidance for resource efficiency and workforce training.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue existing technical and project-management support</li> <li>• Scale SEM plan to integrate energy efficiency into customer consciousness</li> <li>• Create BRO (behavior, RCx, O&amp;M) programs that require little capital</li> <li>• Continue with custom and deemed rebates to offset initial project costs</li> <li>• Increase use of OBF/OBR as appropriate</li> <li>• Move toward more of a grant-application approach</li> <li>• Publicly recognize customers to motivate further energy efficiency actions</li> <li>• Develop outreach champions to drive uptake</li> <li>• Use upstream market actors to decrease costs and/or increase number of projects</li> <li>• Explore opportunities for market transformation in the industrial sector</li> </ul>
<b>SB 1414</b>	Effective January 1, 2017, IOUs must collect proof of permit closure before paying rebates or incentives to customers or contractors for central air-conditioning or heat pumps and their related fans.	PG&E will collect proof of permit closure before paying rebates or incentives for all downstream central air conditioning or heat pumps and their related fans, in accordance with SB 1414.
<b>AB 793</b>	<ul style="list-style-type: none"> <li>• Provide education on energy management technologies</li> <li>• Provide incentives for energy management technology</li> </ul>	Provide incentives, rebates and loans for energy management technologies

## J. PG&E's Partners and Commitment to Coordination

PG&E's success in the industrial sector will rely on a broad range of program administrators, regulators, government agencies, universities, and other educational entities, market actors, and stakeholders.

As discussed in Section F PG&E's Approach to Achieving Goals, PG&E's emphasis on strategic partnerships is a key component to its vision for the industrial sector.

### Program Administrators

PG&E will collaborate with program administrators and publicly-owned utilities (POUs) to share best practices and lessons learned, ensure consistent messaging and program delivery, minimize gaps and program overlap, and coordinate implementation of statewide and local offerings that cut across multiple service territories. For example, customers in overlapping counties should have access to the same program offerings. In addition, in the new statewide administration model, PG&E will work closely with statewide administrators leading statewide programs that impact the industrial sector. Please refer to PG&E Statewide Administration Business Plan chapter for more information on statewide programs.

### California Public Utilities Commission (CPUC)

PG&E will work with CPUC staff to assess business plan performance and identify opportunities for continuous improvement. Additionally, PG&E will identify and perform market research studies to confirm that the business plans metrics are effectively evaluated. As it modifies existing industrial programs and develops new programs, PG&E will work in close concert with CPUC staff to ensure that these programs are "EM&V-ready" and meet CEESP and other state policy directives. In particular, PG&E will work with CPUC staff to assess opportunities for a streamlined custom review process, tiered incentives, SEM program development, and upstream program initiatives.

### Government Agencies

PG&E will maintain and/or develop new partnerships with government agencies to advance collective interests in the industrial sector. PG&E will work closely with these agencies to develop, refine, and implement, where applicable, key intervention strategies and programmatic activities. Agencies include:

- U.S. DOE: PG&E will work with industrial customers to encourage participation in the DOE's Better Plants Program.<sup>116</sup>
- U.S. EPA: PG&E will work with industrial customers to encourage participation in the ENERGY STAR Challenge for Industry– a global call-to-action for industrial sites to reduce their energy intensity by 10 percent within five years.<sup>117</sup>

### Universities and Other Educational and Research Entities

Universities and educational institutions provide valuable information in our pursuit for innovation. Below are just few institutions with whom PG&E works in support of the industrial sector.

- PG&E will continue to work with entities such as Lawrence Berkeley National Laboratory (LBNL) to build expertise and tools to realize SEM program models.
- PG&E will continue to look to universities and other research institutions such as the Electric Power Research Institute (EPRI) to gain understanding of new technologies that may be entering the market to meet industrial customers' needs.

### Third-Party Implementers and Market Actors

In the rolling portfolio structure, IOUs turn to third-party implementers to propose, design, and deliver the bulk of energy efficiency programs. D. 16-08-019 sets a minimum target of 60% of the utility's total portfolio budget to be devoted to third-party programs by the end of 2020. As such, by 2020, PG&E will have transitioned at least 60% of its program design and delivery to third parties. This transitions allows PG&E to engage third parties to offer a more diverse and innovative portfolio of programs to help customers use energy more efficiently. PG&E will

<sup>116</sup> <http://energy.gov/eere/amo/better-plants>

<sup>117</sup> [https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants/earn\\_recognition/energy\\_star\\_challenge\\_industry2](https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants/earn_recognition/energy_star_challenge_industry2)



evolve its energy efficiency portfolio to maximize energy savings in support of California’s goal to double energy efficiency by 2030, and achieve cost effectiveness by offering programs that drive value and innovation for customers, cultivate relationships with new partners, and use its knowledge of customers to more efficiently and effectively deliver energy efficiency programs

## K. Statewide Administration and Transition Timeline

D.16-08-019 modifies the program administration structure for all upstream and midstream programs, market transformation efforts, and select downstream programs, such that these programs become “statewide.” D.16-08-019 defines statewide programs as being delivered uniformly throughout the IOU service territories and overseen by a single lead program administrator. D.16-08-019, pg. 51. Statewide efforts are required to comprise at least 25% of each IOU’s portfolio budget. D.16-08-019 p. 65  
Please refer to the Statewide Administration Chapter for program administrators’ proposals for statewide programs and/or subprograms.

## L. Solicitation Strategies

D. 16-08-019 sets a minimum target of 60% of the utility’s total portfolio budget, including administrative costs and EM&V, to be proposed, designed, and delivered by third parties by the end of 2020. D.16-08-019 p.74 Please refer to the Portfolio Overview Chapter for PG&E’s complete solicitation strategy and transition timeline, by sector.

## M. Metrics

PG&E and the other program administrators understand the importance of ensuring that all metrics provide value to the CPUC, program administrators, or other stakeholders. PG&E also recognizes that listed metrics can have powerful and unintended effects. These metrics are consistent with the agreed-upon statewide guiding principles for the metrics that was shared with the Energy Division on Aug 16, 2016.

Metrics should...
Be used and useful by PAs to manage portfolio
Be timely
Rely on data used in program implementation
Be simple to understand and clear of any subjectivity
Have longevity

The guiding principles also indicate that metrics are not a replacement for EM&V.

Additionally, not all metrics have a readily-interpretable meaning, so context is needed. As such, we provide context on the metrics in the notes section of our table below.

Note that in the business plans, PG&E is proposing to track metrics and indicators that can be frequently updated to allow PG&E staff, implementers, the CPUC, and other stakeholders understand and manage the sector. While PG&E recognizes that there are longer-term outcome and satisfaction/quality metrics and indicators that are important to track through research studies, PG&E is not proposing study-based metrics at the business plan level as they are measured less frequently, and require EM&V dollars that may or may not be available. These studies will be needed to support the program; however, PG&E recommends that these be determined through a different process (i.e., EM&V Roadmap) once the programs are finalized.

PG&E has the following two overarching goals for the industrial sector. Savings goals are based on past PG&E performance relative to potential study targets:

- Save 608 GWh, 67 MW, and 38.6 MM therms by 2025, with a focus on:
  - Three high-opportunity industrial segments: manufacturing, oil and gas production and refining, and food processing

*These goals are based on past PG&E performance relative to Potential Study targets.*

- Reach an increasing percentage of industrial customers (increasing from roughly 2% per year electric or gas customers in 2017 to 4% per year by 2025)– with tracking by size and key segment

### **Metrics Measuring Industrial Goals**

PG&E's proposed sector-level metrics that can be tracked and monitored with some frequency (i.e., monthly, quarterly, or annually) are presented in **Table 5.19: PG&E-Specific Industrial Sector Effects and Metrics.**

**Table 5.19**

PG&E-Specific Industrial Sector Effects and Metrics

PG&E Goals	Intervention Strategies	Metric	Baseline	Metric Source	Short Term Target (1-3 years)	Mid Term Target (4-6 years)	Long Term Target (7-8+years)
<b>Save 608 GWh, 67 MW, and 38.6 MM Therms</b>	All	Electricity saved (First Year Net)	Average of 126 Gross GWh/yr across 2011-2015	Annual Ex Ante Net savings from program database	79 Net GWh/yr (99 Gross GWh/yr)	75 Net GWh/yr (94 Gross GWh/yr)	73 Net GWh/yr (92 Gross GWh/yr)
		Demand saved (First Year Net)	Average of 19.4 Gross MW/yr across 2011-2015		9 Net MW/yr (11 Gross MW/yr)	8 Net MW/yr (10 Gross MW/yr)	8 Net MW/yr (10 Gross MW/yr)
		Therm Saved (First Year Net)	Average of 14.1 Gross MM therms/yr across 2011-2015		5.0 Net MM therms /yr (6.2 Gross MM Therms/yr)	4.8 Net MM therms /yr (6.0 Gross MM Therms/yr)	4.7 Net MM therms /yr (5.8 Gross MM Therms/yr)
		<b>Indicators</b>					
<ul style="list-style-type: none"> <li>• Size</li> <li>• Segment (manufacturing, oil and gas production and refining, and food processing)</li> </ul>							
<b>Notes</b>							
<ul style="list-style-type: none"> <li>• Goals are set on first year net energy savings</li> <li>• Net savings not available for baseline, therefore targets include gross savings to compare to baseline</li> </ul>							
<b>Reach an increasing percentage of customers per year (increasing from 2.5% per year to 4% per year by 2025)</b>	Data Analytics	Annual proportion of all customers participating in energy efficiency programs	2.5% per year	Program tracking databases	2.5% per year	3% per year	4% per year
		Cumulative participating in energy efficiency programs (unique customers)	12% between 2011 and 2015	Program tracking databases	12% cumulative across time frame	14% cumulative across time frame	18% cumulative across time frame
		<b>Indicators</b>					
<ul style="list-style-type: none"> <li>• Size</li> <li>• Segment (manufacturing, petroleum, and food processing)</li> </ul>							
<b>Notes</b>							
Participation may go up or down based on the type of program design. PG&E expects that the denominator for the population will need to stay constant over some period of time.							

# N. EM&V Research Needs and Considerations

## EM&V Research Needs

Evaluation, Measurement and Verification (EM&V) conducts research studies with the guidance of the CPUC Framework<sup>118</sup> and Protocols.<sup>119</sup> The main source of planned research will be the annual EM&V Research Plan<sup>120</sup> put together jointly by the CPUC and the PAs. This ongoing process enables stakeholders to understand and comment on research at PG&E. The PG&E-led research for this sector will be contingent upon the needs of the portfolio as a whole and the annual sector-specific research budget.<sup>121</sup>

In order to address declining participation and overall delivery of gross ex ante savings in the past several years, PG&E plans to execute a series of new market studies to supplement previous work (see references to Navigant's "MASI" and KEMA's "Industrial Market Characterization" studies in Industrial appendix) to:

1. Identify major untapped energy savings opportunities by market segment
2. Provide timely feedback on any new interventions carried out to tap these energy savings
3. Further its understanding of these market segments to clarify how to best capture these untapped energy savings opportunities
4. Explore process evaluation to identify ways to better align customer needs with regulatory and policy objectives

The bullets below show currently known information needs that may or may not be detailed in the most recent EM&V Evaluation Plan. For those study types

under PG&E's purview, PG&E plans to conduct this research as much as practical given annual EM&V budgets, although the specifics may change over time. Specific research needs for this sector, by study category, include:

- *EM&V framework and methods based studies to understand best ways to apply NMEC or options for determining impacts from market transformation efforts*
  - **Savings from SEM** - The SEM program is currently being developed; including work on its scope and evaluation. PG&E is collaborating with the CPUC and others to develop the most cost-effective evaluation framework and protocols for the SEM program. This may require further research.
- *Market and baseline studies to understand program gaps, needs, and inform design and metrics*
  - **Optimal Industrial metrics** - Given the variability of energy use across the sector, energy use per product (energy intensity) may be a better indicator of success. If appropriate, additional studies, in collaboration with statewide partners, are needed to better understand the best metrics for future market realities.
  - **Available and future energy information and management tools to determine optimal resources for industrial customers** - A study to elucidate which EMIS and EMS systems customers are using, if any, to understand the specific energy use within their organization. This effort should be coupled with a market-level investigation of the EMS and EMIS tools available to industrial customers that provide access to energy use data and improve process optimization and control. PG&E will coordinate this study with research conducted by the statewide Emerging Technologies (ET) program or parties such as ACEEE and the U.S. DOE.
  - **Additional market assessments to understand measure-specific use in sector:** While the updated potential study will start to shed more light on the industrial sector, PG&E anticipates that this potential study, in conjunction with internal data analysis, and possibly a statewide study mining past data (e.g., non-residential audits and impact evaluations), will identify the energy use of various measures, processes, and systems within the industrial sector and

<sup>118</sup> California Public Utilities Commission and the Project Advisory Group. The California Evaluation Framework. June 2004. [http://www.calmac.org/publications/California\\_Evaluation\\_Framework\\_June\\_2004.pdf](http://www.calmac.org/publications/California_Evaluation_Framework_June_2004.pdf).

<sup>119</sup> California Public Utilities Commission. California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals. April 2006.

<sup>120</sup> The most recent EM&V Evaluation Plan is here: <http://www.energydataweb.com/cpuc/search.aspx#>

<sup>121</sup> While PG&E provides several studies in this section, the current budgets are relatively small. The 2016 budgets in the most recent EM&V plan show approximately \$4 million for Energy Division-led impact studies and \$250,000 to \$300,000 for IOU-led process studies. These budgets cover the large commercial and industrial programs, as well as agricultural programs. The CPUC, PAs, and other stakeholders will need to discuss EM&V priorities and determine the relative availability of budget to cover any of the studies.

large remaining savings opportunities. This work will be supplemented with an effort to understand the key drivers and decision-makers and decision making processes to tap the identified savings opportunities. Any data collected for this effort could also inform the development of a “knowledge base of efficiency solutions” as described in the CEESP if the information is shared through a transparent industrial database that does not specifically identify users. Ideally, this effort would be representative of PG&E’s industrial sector, but coordinated statewide.

- *Monitoring studies to inform PG&E and stakeholders about accomplishments to date, sector needs, and remaining potential*
  - Set up studies to enable tracking of business and implementation plan metrics
  - **Updated Potential Study:** Prior potential studies have underestimated the energy savings potential of this sector. Moreover, the industrial sector data used in the Potential Study is limited. The current Potential Study includes only two measure-level categories (machine drives and process refrigeration), and thus requires additional detail. The forthcoming Energy Division-led potential study plans to include more detail on the industrial sector (e.g., lighting, HVAC, process loads, whole building). This update will be integral in determining optimal longer-term goals and targets for this sector. Future iterations of the Potential Study should explore water use to inform opportunities for embedded energy savings in water conveyance.
- *Process studies to understand whether pilots, new programs, and new strategies are working*
  - **Data access and technical assistance pilots**
    - PG&E will be piloting new data access tools and broader technical assistance, and will perform at least one process evaluation of an executed pilot (assuming available funding).

As the EM&V environment changes, PG&E is preparing to address the associated EM&V needs.<sup>122</sup> PG&E will identify specific data collection strategies early in a program’s history to support internal performance analysis and program evaluations, and will embed data collection and evaluation into the program designs whenever possible to reduce evaluation costs and increase feedback to the programs. Additionally, PG&E will ask third-party program designers to include an EM&V plan demonstrating their program evaluability, documenting what data will be collected through the program, and to propose a method for assessing impacts.

The specifics on data collection and reporting will be provided in as much detail as possible in PG&E’s Implementation Plans (IPs). Ultimately, both PG&E-led and third-party programs, PG&E will collaborate with CPUC staff and their evaluation consultants to ensure that appropriate data collection and reporting capabilities are in place to facilitate accurate evaluation.

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<sup>122</sup> PG&E’s team of evaluation specialists are assigned to specific customer segments and, among their other duties, serve as internal consultants to program managers to improve program design and implementation activities.

# Appendices

# Industrial Appendices

## Appendix A: Compliance Checklist

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
<b>Portfolio Summary</b>		
0	<b>Executive Summary</b>	
	<i>Company description</i>	Executive Summary p. A
	<i>Definition of market</i>	Executive Summary p. A
	<i>Mission Statement</i>	Executive Summary p. A
	<i>Purpose of Business Plan</i>	Executive Summary p. A
I.A.1, II.D.2	<b>Overview</b>	
	<i>About EE/DSM</i>	Energy Efficiency and It's Role in Helping PG&E Meet Its Energy Needs, pp. 11-16
	<i>CA Energy Needs</i>	California's Evolving Energy Efficiency Landscape, pp. 21-26
	<i>Regulatory Requirements</i>	California's Evolving Energy Efficiency Landscape, pp. 22-23
	<i>Strategic Plan</i>	California's Evolving Energy Efficiency Landscape, pp. 20-21
	<i>Legislation (e.g., AB 758, SB 350, AB 802, AB 793)</i>	California's Evolving Energy Efficiency Landscape, pp.

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		22-23
	<i>IOUs/PAs/CPUC/etc. overall role</i>	Roles in the Changing Landscape, pp. 8-9
I.A.2	<i>Broad socioeconomic and utility industry trends relevant to PA's EE programs (population, economics and markets, technology, environment/climate)</i>	California's Evolving Energy Efficiency Landscape pp. 23-26
I.B.1	<i>Vision (e.g., How PA thinks about and uses EE over next 10 years)</i>	PG&E's Vision, p. 1
I.5	<i>Compare/contrast to past cycles</i>	PG&E's Portfolio Evolution: Comparison to Past Cycles, pp. 9-11
I.B.2	<b>Goals &amp; Budget</b>	
I.B.2 & I.C.2.a	<i>Energy Saving Goals</i>	Goals, Budget and Cost-Effectiveness, pp. 27-28
I.C.2.a	<i>Portfolio Budget (sector and portfolio level per xls checklist)</i>	Goals, Budget and Cost-Effectiveness, pp. 28-30
I.C.2.a, I.C.2.d	<i>Cost-effectiveness (sector and portfolio level per xls checklist)</i>	Goals, Budget and Cost-Effectiveness, pp. 30-34
I.C.2.b	<i>Explanation of Admin Budgets (e.g., Direct/Indirect Labor, Professional/Admin personnel)</i>	Goals, Budget and Cost-Effectiveness, pp. 28-29
I.C.2.c	<i>Explanation of accounting practices</i>	Goals, Budget and Cost-



Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		Effectiveness, p. 30
I.C.3 and I.C.4	<b>Intervention strategies (high level)</b>	
	<i>Overall issues/challenges/barriers</i>	PG&E's Portfolio Plan, pp. 4-7
	<i>High level summary of strategies and tools (e.g., AMI data, AB 802, procurement model, up/mid/downstream, etc.)</i>	PG&E's Portfolio Plan, pp. 4-7
I.C.4; I.D	<b>Solicitation plan</b>	
I.C.4	<i>Solicitation strategies/areas that could be SW</i>	Solicitation Strategy and Transition Timeline, pp. 35-42
I.D; II.F	<i>Proposal for transitioning the majority of portfolios to be outsourced by the end of 2020.</i>	Solicitation Strategy and Transition Timeline, pp. 35-42
<b>Sector Chapter (commercial, residential, public, agricultural, industrial, x-cutting)</b>		
II.A	<b>Summary tables</b>	
II.A	<i>Table with CE, TRC, PAC, emissions, savings, budget</i>	Goals, Budget and Cost-Effectiveness, pp. 6-8
I.C.7; II.E.1.b	<i>Metrics for sector</i>	Metrics, pp. 44-46
II.D	<b>Market characterization (overview and market/gap and other analysis)</b>	
II.D.1	<i>Electricity/NG</i>	Sector Overview, pp. 9-19
II.D.2	<i>State goals include acknowledgement of goals set by Strategic Plan, SB 350, AB758, guidance as appropriate)</i>	PG&E's Industrial Sector Vision, pp. 1-2

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
II.D.3	<i>EE potential and goals</i>	Sector Overview, pp. 9-19
II.D.5	<i>Customer landscape (e.g., segments/subsegments, major end uses, participation rates, etc.)</i>	Sector Overview, pp. 9-19
II.D.6	<i>Major future trends that are key for the PA and its customers</i>	Industrial Sector Trends and Challenges, pp. 19-22
II.D.7	<i>Barriers to EE and other challenges to heightened EE (e.g., regulatory, market, data)</i>	Industrial Sector Trends and Challenges, pp. 19-22
II.2.a	<b>Description of overarching approach to the sector</b>	
	<i>Goals/strategies/approaches</i>	PG&E's Industrial Sector Vision, pp. 1-2
I.C.6; I.D	<i>How portfolio meets Commission guidance</i>	PG&E's Industrial Sector Vision, pp. 1-2
II.C	<i>Description of how this chapter addresses the performance challenges/barriers</i>	PG&E's Approach to Achieving Goals, pp. 22-39
I.C.4 a-c	<b>Intervention strategies (detailed)</b>	
II.D.2.a; II.E.3	<i>What specific strategies are being pursued (e.g., near, mid, long AND existing, modified, new)</i>	PG&E's Approach to Achieving Goals, pp. 22-39
I [cmt with excerpt]	<i>Why specific strategies were chosen (e.g., ID current weaknesses, best practices, or other rationale to support choice)</i>	PG&E's Approach to Achieving Goals, pp. 22-39
II.E.1.a; II.E.4	<i>How approaches advance goals discussed above</i>	PG&E's Approach to Achieving Goals, pp. 22-39

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
I.C.4; I.E; II.D.4	<i>How strategies use lessons learned from past cycles and EM&amp;V</i>	PG&E's Industrial Sector Proposal Compared to Prior Program Cycles, pp. 3-6
I	<i>How will interventions support/augment current approaches or solve challenges</i>	PG&E's Approach to Achieving Goals, pp. 22-39
II.D.2	<i>Explanation for how these strategies address legislative mandates from AB 802, SB350, and AB 793, as well as other Commission directives for this sector, including strategic plan.</i>	PG&E's Approach to Achieving Goals, pp. 34-56
I.C.4	<i>Future expectations for intervention strategies</i>	PG&E's Approach to Achieving Goals, pp. 34-56
I.C.1; II.E.6	<i>Description of pilots</i>	PG&E's Approach to Achieving Goals, p. 33
II.F	<i>Key Partners</i>	PG&E's Partners and Commitment to Coordination, pp. 43-44
I.C.5; I.D; II.B; II.C	<b>Compare/contrast to past cycles</b>	
	<i>Budget changes as appropriate</i>	Goals, Budget and Cost-Effectiveness, pp. 6-8
	<i>Modification to sector strategies</i>	PG&E's Industrial Sector Proposal Compared to Prior Program

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		Cycles, pp. 3-6
	<b>Cross-cutting (sector chapters and ME&amp;O)</b>	
II.E.2; II.H, II.K	<i>Program Administrator marketing and integration with SW MEO as applicable</i>	Leveraging Cross-Cutting Resources, p. 39
II.E.5; II.H	<i>Workforce, education, and training</i>	Leveraging Cross-Cutting Resources, p. 39
II.H	<i>Emerging Technologies</i>	Leveraging Cross-Cutting Resources, p. 39
II.H	<i>Codes &amp; Standards</i>	Leveraging Cross-Cutting Resources, p. 39
II.G	<b>Cross PA and Offering Coordination</b>	
II.G	<i>How strategies are coordination among regional PAs</i>	PG&E's Partners and Commitment to Coordination, pp. 43-44
II.G	<i>Proposal of statewide program administrator/approaches for this sector</i>	See Statewide Administration chapter
II.G	<i>How the sector strategies are coordinated with statewide program activities</i>	See Statewide Administration chapter
II.G	<i>How are strategies coordinated with other state agencies and initiatives (e.g., AB 758)</i>	PG&E's Partners and Commitment to Coordination, pp. 43-44
II.I	<b>EM&amp;V Considerations (statement of needs)</b>	
II.I	<i>Data collection needs</i>	EM&V Research Needs, pp. 47-48
II.I	<i>Anticipated study needs</i>	EM&V Research Needs, pp. 47-48

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
II.J	<b>Demand Response</b>	
ED Guidance (p.8)	<i>How EE measures use up-to-date DR enabling technologies to be "DR ready"</i>	Integrated Demand Side Management, pp. 40-41
ED Guidance (p.8)	<i>How duplication of costs for ME&amp;O, site visits, etc. is avoided for dual-purpose technologies</i>	Integrated Demand Side Management, pp. 40-41
ED Guidance (p.9)	<i>How strategies facilitate customer understanding of peak load, cost, and opportunities to reduce</i>	Integrated Demand Side Management, pp. 40-41
II.K	<b>Residential Rate Reform</b>	
ED Guidance (p.9)	<i>How BPs will help reduce load during TOU periods</i>	N/A
ED Guidance (p.9)	<i>How BP will diminish barriers to load reduction during TOU periods</i>	N/A
ED Guidance (p.9)	<i>How strategies will provide info to customers and/or provide a tool to show how program may impact customer energy usage during different TOU periods</i>	N/A
ED Guidance (p.9)	<i>How strategies will analyze whether a customer may experience greater savings by switching to a different, opt-in TOU rate</i>	N/A
ED guidance (p.9)	<i>ME&amp;O re: rate reform</i>	N/A
II.L	<b>Integrated Demand Side Resources</b>	Integrated Demand Side Management, pp. 40-41
II.M	<b>Zero-Emission Vehicles (EVs)</b>	N/A
II.N	<b>Energy Savings Assistance (Multi-family Focused)</b>	N/A
	<b>Appendices</b>	
	<i>Additional Customer Data</i>	Appendix C
	<i>Cited research</i>	Appendix B
	<i>CAEECC stakeholder input resolution</i>	See Input Tracker

## Appendix B: References

Barkovich, Barbara R. February 24, 2016. *CLECA Proposal on Matinee Pricing*. Barkovich & Yap., Inc; Prepared for California Large Energy Consumers Association; Matinee Pricing Workshop.

<http://slideplayer.com/slide/10923847/>

Berkeley Law; Center for Law, Energy & the Environment; The Emmett Institute on Climate Change and the Environment; UCLA School of Law. March 2016. *Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings*. <https://www.law.berkeley.edu/wp-content/uploads/2016/03/Powering-the-Savings.pdf>

Bloomberg. June 14, 2016. *California Overtakes France to Become Sixth-Largest Economy*.

<http://www.bloomberg.com/politics/articles/2016-06-14/california-overtakes-france-to-become-sixth-largest-economy>

Cadmus Group. October 26, 2012. *Process Evaluation of California's Continuous Energy Improvement Pilot Program*. Prepared for SCE, SCG, PG&E, and SDG&E.<sup>1</sup>

Cadmus Group. October 2, 2013. *Impact Evaluability Assessment of California's Continuous Energy Improvement Pilot Program*. Prepared for the CPUC.

[http://calmac.org/publications/CA\\_CEI\\_Pilot\\_Evaluability\\_Assessment\\_REVISED\\_FINAL.pdf](http://calmac.org/publications/CA_CEI_Pilot_Evaluability_Assessment_REVISED_FINAL.pdf)

California Energy Commission. June 29, 2016. *2015 Integrated Energy Policy Report (IEPR)*. Docket # 15-IEPR-01, CEC-100-2015-001-CMF. [http://www.energy.ca.gov/2015\\_energypolicy/](http://www.energy.ca.gov/2015_energypolicy/)

California Foundation for Commerce & Education (CFCE). August 12, 2014. *The Cost of Doing Business in California*. Prepared by Andrew Chang & Company. <http://www.calchamber.com/cfce/documents/cfce-cost-of-doing-business-in-california.pdf>

California Public Utilities Commission. *EM&V Plan Update– Industrial, Ag, and Large Commercial Chapter (IALC Roadmap 2017 Update DRAFT)*. Separate versions uploaded on September 26 and October 3, 2016. <http://www.energydataweb.com/cpuc/search.aspx?did=1644>

Consortium for Energy Efficiency (CEE). 2014. *CEE Industrial Strategic Energy Management Initiative*.

<https://library.cee1.org/content/cee-industrial-strategic-energy-management-initiative/>

Energy 350. 2014. *Small to Medium Industrial SEM Energy Savings Validation*. Report #E14-279.

<https://nea.org/docs/default-source/reports/small-to-medium-industrial-sem-energy-savings-validation.pdf?sfvrsn=12>

ENERGY STAR. *Industrial Energy Management*. <https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants>

---

<sup>1</sup> Note that this report had not been uploaded to CALMAC (California Measurement Advisory Council) or the CPUC website as of December 2016.

ENERGY STAR. *Tools for Tracking and Benchmarking Facility Energy Performance*.

<https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants/measure-track-and-benchmark/tools-tracking-and>

Franconi, Ellen M., and Bendewald, Michael J. Rocky Mountain Institute. Anderson, Caitlin E. ME Engineers. *Analyzing Energy Efficiency Opportunities Across Building Portfolios*. American Council for an Energy-Efficient Economy (ACEEE) 2014 Summer Study. [http://www.rmi.org/Content/Files/ACEEE\\_2014-Analyzing\\_Building\\_Portfolios.pdf](http://www.rmi.org/Content/Files/ACEEE_2014-Analyzing_Building_Portfolios.pdf)

Fogel, Cathy. September 28, 2016. "Overarching Comments on Program Administrator Business Plans Focus on Market Transformation Strategies." Energy Efficiency Branch, Energy Division, CPUC.

Graham Partners. December 7, 2015. *Addressing Barriers to Industrial Energy Efficiency Engagement*. Lizzie Grobbel. <http://aceee.org/sites/default/files/pdf/conferences/ie/2015/Session3D-Grobbel-IE15-12.7.15.pdf>

Investopedia. January 14, 2016. *California's Economy: The 9 Industries Driving GDP Growth*. <http://www.investopedia.com/articles/investing/011416/californias-economy-9-industries-driving-gdp-growth.asp>

Itron and DNV-GL. July 24, 2014. *2010-12 WO033 Custom Impact Evaluation Final Report*. Prepared for the CPUC. [http://calmac.org/publications/2010-12\\_WO033\\_Custom\\_Impact\\_Eval\\_Report\\_Final.pdf](http://calmac.org/publications/2010-12_WO033_Custom_Impact_Eval_Report_Final.pdf)

Itron. September 24, 2014. *2010-12 WO033 Custom Net-to-Gross Final Report*. Submitted to CPUC. [http://www.calmac.org/publications/2010-12\\_WO033\\_Custom\\_Net-to-Gross\\_Report\\_-\\_Final\\_-\\_Posted\\_on\\_CalmacES.pdf](http://www.calmac.org/publications/2010-12_WO033_Custom_Net-to-Gross_Report_-_Final_-_Posted_on_CalmacES.pdf)

Itron. July 17, 2015. *2013 Custom Impact Evaluation Industrial, Agricultural, and Large Commercial. Final Report*. Submitted to the CPUC. [http://calmac.org/publications/IALC\\_2013\\_Report\\_Final\\_071715.pdf](http://calmac.org/publications/IALC_2013_Report_Final_071715.pdf)

Itron. 2016a. *2014 Custom Impact Evaluation Industrial, Agricultural, and Large Commercial. Final Report*. Submitted to CPUC. April 29, 2016. <http://www.energydataweb.com/cpucFiles/pdaDocs/1518/IALC%202014%20Final%20Report%200April%202016.pdf>

Itron. 2016b. *2014 Nonresidential Downstream Deemed ESPI Lighting Impact Evaluation Report*. Prepared for the CPUC. February 23, 2016. <http://www.energydataweb.com/cpucFiles/pdaDocs/1446/Deemed%20Lighting%20Report%20and%20Appendices.pdf>

Itron. 2016c. *2014 Nonresidential Downstream Deemed ESPI Pipe Insulation Impact Evaluation Report*. Prepared for the CPUC. February 23, 2016. <http://www.energydataweb.com/cpucFiles/pdaDocs/1447/ESPI%20Pipe%20Insulation%20Report%20and%20Appendices.pdf>

Keating, Ken. December 9, 2014. *Guidance on Designing and Implementing Energy Efficiency Market Transformation Initiatives*. California Public Utilities Commission. <http://www.energydataweb.com/cpuc/search.aspx?did=1188>

Kelly, Meegan, and Ethan Rogers. 2016. *Communicating the Value of Industrial Energy Efficiency Programs*. ACEEE White Paper. February, 2016. <http://aceee.org/communicating-value-industrial-energy-efficiency>

KEMA. 2012a. *Industrial Sectors Market Characterization: Cement and Concrete Industry*. Prepared for PG&E and SCE. February, 2012.

[http://calmac.org/publications/Final\\_Cement\\_Industrial\\_Market\\_Characterization\\_Report.pdf](http://calmac.org/publications/Final_Cement_Industrial_Market_Characterization_Report.pdf)

KEMA. 2012b. *Industrial Sectors Market Characterization: Chemicals Industry*. Prepared for PG&E and SCE. February, 2012.

[http://calmac.org/publications/Final\\_Industrial\\_Sector\\_Market\\_Characterization\\_Chemicals\\_Report.pdf](http://calmac.org/publications/Final_Industrial_Sector_Market_Characterization_Chemicals_Report.pdf)

KEMA. 2012c. *Industrial Sectors Market Characterization: Metalworking Industry*. Prepared for PG&E and SCE. February, 2012.

[http://calmac.org/publications/Final\\_metalworking\\_market\\_characterization\\_report.pdf](http://calmac.org/publications/Final_metalworking_market_characterization_report.pdf)

KEMA. 2012d. *Industrial Sectors Market Characterization: Plastics Industry*. Prepared for PG&E and SCE. February, 2012. [http://calmac.org/publications/Final\\_Plastics\\_Market\\_Characterization.pdf](http://calmac.org/publications/Final_Plastics_Market_Characterization.pdf)

KEMA. 2012e. *Industrial Sectors Market Characterization: Mineral Product Manufacturing Industry*. Prepared for PG&E and SCE. January, 2012.

[http://calmac.org/publications/Final\\_Minerals\\_Market\\_Characterization\\_Report.pdf](http://calmac.org/publications/Final_Minerals_Market_Characterization_Report.pdf)

KEMA. 2012f. *Industrial Sectors Market Characterization: Glass Industry*. Prepared for PG&E and SCE. January, 2012.

[http://calmac.org/publications/Final\\_Industrial\\_Glass\\_Sector\\_Characterization\\_Report.pdf](http://calmac.org/publications/Final_Industrial_Glass_Sector_Characterization_Report.pdf)

KEMA. 2012g. *Industrial Sectors Market Characterization: Water and Wastewater Industry*. Prepared for PG&E and SCE. January, 2012.

[http://calmac.org/publications/Final\\_Industrial\\_Sector\\_Market\\_Characterization\\_Water\\_Wastewater.pdf](http://calmac.org/publications/Final_Industrial_Sector_Market_Characterization_Water_Wastewater.pdf)

KEMA. 2012h. *Industrial Sectors Market Characterization: Paper Industry*. Prepared for PG&E and SCE. January, 2012.

[http://calmac.org/publications/Final\\_Paper\\_Industrial\\_Sector\\_Market\\_Characterization.pdf](http://calmac.org/publications/Final_Paper_Industrial_Sector_Market_Characterization.pdf)

Laurain, Anne-Lise; Bao, Tingwen. Zawadski, Pawel, et al. "Better Understanding Customers: Developing SMB DNA to Improve Customer Interactions and Catalyze Positive Behavior Changes." 2016 ACEEE Summer Study on Energy Efficiency in Buildings.

[http://aceee.org/files/proceedings/2016/data/papers/8\\_403.pdf](http://aceee.org/files/proceedings/2016/data/papers/8_403.pdf)

Marsh, Rick; Taube, Ben. September 2012. *The Industrial Energy Efficiency Network Supports Energy Efficiency Through Peer-to-Peer Dialogues Among Industrial Manufacturers in the United States*. ECEEE 2012 Summer Study on Industrial Efficiency in

Industry. <http://proceedings.eceee.org/docs/2012/contents.pdf>

Navigant Consulting, Inc. 2015a. *Energy Efficiency Potential and Goals Study for 2015 and Beyond*. Prepared for the California Public Utility Commission. Final September 25, 2015.

<http://www.cpuc.ca.gov/General.aspx?id=2013>



Navigant Consulting, Inc. 2015b. *Measure, Application, Segment, Industry (MASI): New Opportunities for Oil and Gas Extraction and Produced Water Management and Recycling*. Prepared for SCE. Final. April 10, 2015. [http://calmac.org/publications/MASI\\_Oil\\_and\\_Gas\\_Final\\_Report.pdf](http://calmac.org/publications/MASI_Oil_and_Gas_Final_Report.pdf)

Navigant Consulting, Inc. 2015c. *Measure, Application, Segment, Industry (MASI): Food Processing Industry*. Prepared for SCE. Final. March 31, 2015. [http://calmac.org/publications/MASI\\_Food\\_Processing\\_Final\\_Report.pdf](http://calmac.org/publications/MASI_Food_Processing_Final_Report.pdf)

Navigant Consulting, Inc. 2015d. *Measure, Application, Segment, Industry (MASI): Wastewater Treatment Facilities*. Prepared for SCE. Final. March 13, 2015. [http://calmac.org/publications/MASI\\_Wastewater\\_Treatment\\_Plants\\_Final\\_Report.pdf](http://calmac.org/publications/MASI_Wastewater_Treatment_Plants_Final_Report.pdf)

Navigant Consulting, Inc. 2015e. *Measure, Application, Segment, Industry (MASI): Motors Baseline and Opportunities in the Industrial, Food Processing, and Agricultural Sectors, and Early Motor Retirement in Refineries*. Prepared for SCE. Final. February 27, 2015. [http://calmac.org/publications/MASI\\_Motors\\_Opportunities\\_Final\\_Report.pdf](http://calmac.org/publications/MASI_Motors_Opportunities_Final_Report.pdf)

Navigant Consulting, Inc. 2015f. *Measure, Application, Segment, Industry (MASI): Integrated Design for New Construction Buildings*. Prepared for SCE. Final. February 27, 2015. [http://calmac.org/publications/MASI\\_Integrated\\_Design\\_for\\_New\\_Construction\\_Buildings\\_Final\\_Report.pdf](http://calmac.org/publications/MASI_Integrated_Design_for_New_Construction_Buildings_Final_Report.pdf)

Perrin, Burt. September 1998. *Effective Use and Misuse of Performance Measurement*. *American Journal of Evaluation* 1998:19(3);367-379. [https://www.researchgate.net/publication/238224436\\_Effective\\_Use\\_and\\_Misuse\\_of\\_Performance\\_Measurement](https://www.researchgate.net/publication/238224436_Effective_Use_and_Misuse_of_Performance_Measurement)

Regulatory Assistance Project. February 14, 2012. "U.S. Experience with Efficiency as a Transmission and Distribution System Resource." Chris Neme and Richard Sedano. <https://www.raponline.org/wp-content/uploads/2016/05/rap-neme-efficiencyasatanddresource-2012-feb-14.pdf>

Rogers, Ethan A. July 2014. *The Energy Savings Potential of Smart Manufacturing*. ACEEE Report IE 1403. <http://aceee.org/research-report/ie1403>

Rogers, Ethan A. R. Neal Elliott, Sameer Kwatra, Dan Trombley, and Vasanth Nadadur. October 2013. *Intelligent Efficiency: Opportunities, Barriers, and Solutions*. ACEEE Report I13J. <http://aceee.org/research-report/e13j>

Rogers, Ethan A., Edward Carley, Sagar Deo, and Frederick Grossberg. December 2015. *How Information and Communications Technologies Will Change the Evaluation, Measurement, and Verification of Energy Efficiency Programs*. ACEEE Report IE1503. <http://aceee.org/research-report/ie1503>

Russell, Christopher. May 26, 2008. *The Industrial Energy Harvest: Managing Energy from the Top Down*. Energy Pathfinder, LLC. [www.energypathfinder.com](http://www.energypathfinder.com)

SEE Action. March 2014. *Industrial Energy Efficiency: Designing Effective State Programs for the Industrial Sector*. Industrial Energy Efficiency and Combined Heat and Power Working Group. Developed as a product of the State and Local Energy Efficiency Action Network (SEE Action), facilitated by the U.S. Department of Energy/U.S. Environmental Protection Agency.

<http://energy.gov/eere/amo/articles/designing-effective-state-programs-industrial-sector-new-see-action-publication>

Southwest Energy Efficiency Project. May 2014. *Upstream Utility Incentive Programs: Experience and Lessons Learned*. Maureen Quaid and Howard Geller.

[http://www.swenergy.org/data/sites/1/media/documents/publications/documents/Upstream\\_Utility\\_Incentive\\_Programs\\_05-2014.pdf](http://www.swenergy.org/data/sites/1/media/documents/publications/documents/Upstream_Utility_Incentive_Programs_05-2014.pdf)

Sullivan, Michael. January 2009. *Behavioral Assumptions Underlying Energy Efficiency Programs for Businesses*. Prepared for CIEE/CPUC. <http://uc-ciee.org/library/1/nclked/exact/behavioral-assumptions-underlying-energy-efficiency-programs-for-businesses/a/1/desc>

U.S. Department of Energy. June 2015. *Barriers to Industrial Energy Efficiency: A Study Pursuant to Section 7 of the American Energy Manufacturing Technical Corrections Act*.

[http://energy.gov/sites/prod/files/2015/06/f23/EXEC-2014-005846\\_5%20Study\\_.pdf](http://energy.gov/sites/prod/files/2015/06/f23/EXEC-2014-005846_5%20Study_.pdf)

Vaidyanathan, Nadel, Amann, et al. March 2013. "Overcoming Market Barriers and Using Market Forces to Advance Energy Efficiency." American Council for an Energy-Efficient Economy (ACEEE).

<http://kms.energyefficiencycentre.org/sites/default/files/e136.pdf>

Washington State University, Extension Energy Program. December 2011. *Best Business Practices for Industrial Energy Efficiency*. Industrial News Briefs. <http://www.energy.wsu.edu/Documents/IN-BestBusinessPractices-Dec2011.pdf>

## Appendix C: Customer Data

### Table C.1: 2015 Electric Customers: Snapshot of Usage and Average Usage by Customer Size

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Electricity Usage (GWh)</b>													
Manufacturing	6,512.0	751.5	213.7	5.0	7,482.1	87.0%	10.0%	2.9%	100%	45.0%	5.2%	1.5%	51.7%
Food Processing	3,253.3	176.1	19.9	0.3	3,449.5	94.3%	5.1%	0.6%	100%	22.5%	1.2%	0.1%	23.8%
Petroleum	2,769.8	38.2	3.8	0.3	2,812.1	98.5%	1.4%	0.1%	100%	19.1%	0.3%	0.0%	19.4%
Chemicals & Minerals	693.7	28.1	2.6	0.1	724.4	95.8%	3.9%	0.4%	100%	4.8%	0.2%	0.0%	5.0%
<b>Total</b>	<b>13,228.7</b>	<b>993.9</b>	<b>239.9</b>	<b>5.64</b>	<b>14,468.2</b>	<b>91%</b>	<b>7%</b>	<b>2%</b>	<b>100%</b>	<b>91.4%</b>	<b>6.9%</b>	<b>1.7%</b>	<b>100.0%</b>
<b>Customers (Number of customers)</b>													
Manufacturing	17,522	14,881	26,999	599	60,001	29.2%	24.8%	45.0%	99%	24.3%	20.6%	37.5%	82.4%
Food Processing	3,452	2,522	1,585	81	7,640	45.2%	33.0%	20.7%	99%	4.8%	3.5%	2.2%	10.5%
Petroleum	1,683	662	379	18	2,742	61.4%	24.1%	13.8%	99%	2.3%	0.9%	0.5%	3.8%
Chemicals & Minerals	840	511	298	34	1,683	49.9%	30.4%	17.7%	98%	1.2%	0.7%	0.4%	2.3%
<b>Total</b>	<b>23,497</b>	<b>18,576</b>	<b>29,261</b>	<b>732</b>	<b>72,066</b>	<b>33%</b>	<b>26%</b>	<b>41%</b>	<b>99%</b>	<b>32.6%</b>	<b>25.8%</b>	<b>40.6%</b>	<b>99.0%</b>
<b>Average Usage (kWh per customer)</b>													
Manufacturing	371,648	50,502	7,914	8,265	124,700								
Food Processing	942,428	69,818	12,557	3,377	451,508								
Petroleum	1,645,736	57,729	10,043	15,830	1,025,559								
Chemicals & Minerals	825,774	54,946	8,628	3,699	430,437								
<b>Average</b>	<b>562,995</b>	<b>53,504</b>	<b>8,200</b>	<b>7,698</b>	<b>200,763</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
Small: < 40,000 KWh or < 10,000 Therms  
Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

### Table C.2: 2015 Electric Savings and Participants: Snapshot of Savings and Average Savings by Customer Size

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Electricity Savings (MWh)</b>													
Manufacturing	29,462.7	3,514.5	1,563.6	108.1	34,648.9	85.0%	10.1%	4.5%	100%	38.8%	4.6%	2.1%	45.5%
Food Processing	18,219.8	1,229.0	265.3	21.5	19,735.6	92.3%	6.2%	1.3%	100%	24.0%	1.6%	0.3%	26.0%
Petroleum	16,006.2	133.0	10.4	-	16,149.5	99.1%	0.8%	0.1%	100%	21.1%	0.2%	0.0%	21.3%
Chemicals & Minerals	5,322.7	32.2	17.2	-	5,372.0	99.1%	0.6%	0.3%	100%	7.0%	0.0%	0.0%	7.1%
<b>Total</b>	<b>69,011.3</b>	<b>4,908.7</b>	<b>1,856.4</b>	<b>129.63</b>	<b>75,906.1</b>	<b>91%</b>	<b>6%</b>	<b>2%</b>	<b>100%</b>	<b>90.9%</b>	<b>6.5%</b>	<b>2.4%</b>	<b>99.8%</b>
<b>Participants (Number of Participants)</b>													
Manufacturing	351	322	297	22	992	35.4%	32.5%	29.9%	98%	23.7%	21.8%	20.1%	65.5%
Food Processing	177	138	34	3	352	50.3%	39.2%	9.7%	99%	12.0%	9.3%	2.3%	23.6%
Petroleum	71	21	3	-	95	74.7%	22.1%	3.2%	100%	4.8%	1.4%	0.2%	6.4%
Chemicals & Minerals	31	8	2	-	41	75.6%	19.5%	4.9%	100%	2.1%	0.5%	0.1%	2.8%
<b>Total</b>	<b>630</b>	<b>489</b>	<b>336</b>	<b>25</b>	<b>1,480</b>	<b>43%</b>	<b>33%</b>	<b>23%</b>	<b>98%</b>	<b>42.6%</b>	<b>33.0%</b>	<b>22.7%</b>	<b>98.3%</b>
<b>Average Savings (kWh per Participant)</b>													
Manufacturing	83,939	10,915	5,265	4,913	34,928								
Food Processing	102,937	8,906	7,802	7,182	56,067								
Petroleum	225,439	6,334	3,455	-	169,995								
Chemicals & Minerals	171,699	4,024	8,581	-	131,025								
<b>Average</b>	<b>109,542</b>	<b>10,038</b>	<b>5,525</b>	<b>5,185</b>	<b>51,288</b>								
<b>Participation Rates (% Participants per Cust.)</b>													
Manufacturing	2.0%	2.2%	1.1%	3.7%	1.7%								
Food Processing	5.1%	5.5%	2.1%	3.7%	4.6%								
Petroleum	4.2%	3.2%	0.8%	0.0%	3.5%								
Chemicals & Minerals	3.7%	1.6%	0.7%	0.0%	2.4%								
<b>Average</b>	<b>2.7%</b>	<b>2.6%</b>	<b>1.1%</b>	<b>3.4%</b>	<b>2.1%</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
Small: < 40,000 KWh or < 10,000 Therms  
Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

**Table C.3: 2015 Gas Customers: Snapshot of Usage and Average Usage by Customer Size**

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Gas Usage (MM Therms)</b>													
Manufacturing	3,533.2	18.7	4.5	10.2	3,566.6	99%	0.5%	0.1%	100%	64.2%	0.3%	0.1%	64.7%
Food Processing	380.3	10.5	1.3	0.0	392.1	97%	2.7%	0.3%	100%	6.9%	0.2%	0.0%	7.1%
Petroleum	1,354.7	0.2	0.0	0.0	1,354.9	100%	0.0%	0.0%	100%	24.6%	0.0%	0.0%	24.6%
Chemicals & Minerals	185.5	0.6	0.1	0.0	186.2	100%	0.3%	0.0%	100%	3.4%	0.0%	0.0%	3.4%
<b>Total</b>	<b>5,453.7</b>	<b>30.0</b>	<b>5.9</b>	<b>10.16</b>	<b>5,499.7</b>	<b>99%</b>	<b>1%</b>	<b>0%</b>	<b>100%</b>	<b>99.2%</b>	<b>0.5%</b>	<b>0.1%</b>	<b>99.8%</b>
<b>Customers (Number of customers)</b>													
Manufacturing	2,797	5,156	10,612	294	18,859	14.8%	27.3%	56.3%	98%	11.9%	22.0%	45.3%	79.2%
Food Processing	1,226	1,234	915	46	3,421	35.8%	36.1%	26.7%	99%	5.2%	5.3%	3.9%	14.4%
Petroleum	187	103	67	2	359	52.1%	28.7%	18.7%	99%	0.8%	0.4%	0.3%	1.5%
Chemicals & Minerals	512	180	113	7	812	63.1%	22.2%	13.9%	99%	2.2%	0.8%	0.5%	3.4%
<b>Total</b>	<b>4,722</b>	<b>6,673</b>	<b>11,707</b>	<b>349</b>	<b>23,451</b>	<b>20%</b>	<b>28%</b>	<b>50%</b>	<b>99%</b>	<b>20.1%</b>	<b>28.5%</b>	<b>49.9%</b>	<b>98.5%</b>
<b>Average Usage (Therms per customer)</b>													
Manufacturing	1,263,218	3,635	425	34,524	189,121								
Food Processing	310,192	8,491	1,402	149	114,605								
Petroleum	7,244,183	1,779	610	20	3,774,057								
Chemicals & Minerals	362,331	3,184	637	672	229,265								
<b>Average</b>	<b>1,154,954</b>	<b>4,492</b>	<b>505</b>	<b>29,117</b>	<b>234,520</b>								

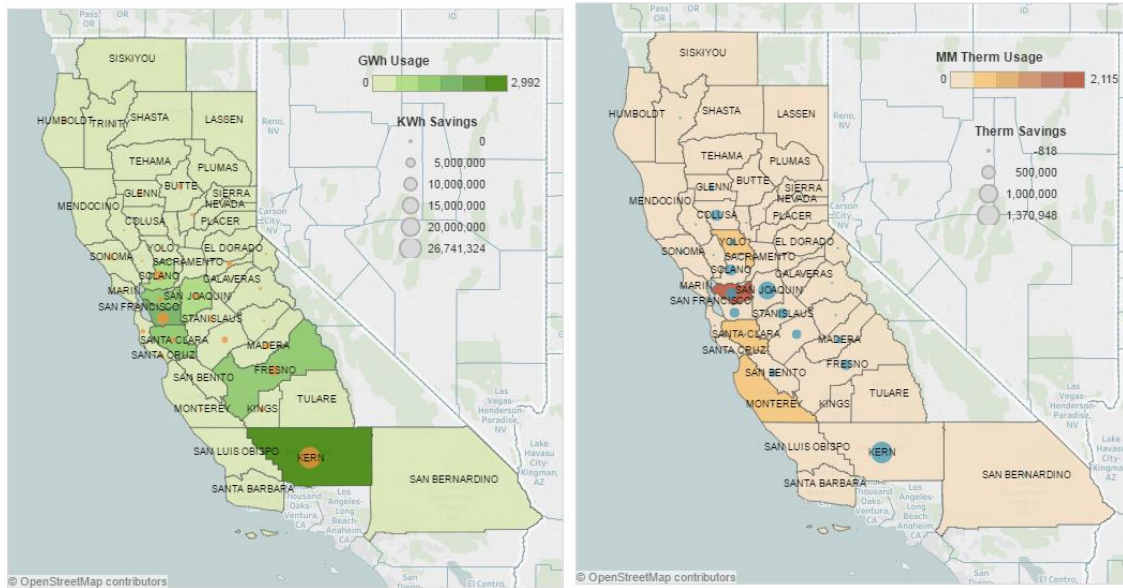
Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
<sup>a</sup> Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
<sup>a</sup> Small: < 40,000 KWh or < 10,000 Therms  
<sup>a</sup> Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

**Table C.4: 2015 Gas Savings and Participants: Snapshot of Savings and Average Savings by Customer Size**

	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Gas Savings (Therms)</b>													
Manufacturing	699,221	26,873	16,694	5,161	747,949	93.5%	3.6%	2.2%	99%	13.3%	0.5%	0.3%	14.2%
Food Processing	1,185,996	28,200	5,647	(56)	1,219,787	97.2%	2.3%	0.5%	100%	22.6%	0.5%	0.1%	23.3%
Petroleum	2,274,372	39	241	-	2,274,652	100.0%	0.0%	0.0%	100%	43.4%	0.0%	0.0%	43.4%
Chemicals & Minerals	996,279	2,552	(98)	-	998,733	99.8%	0.3%	0.0%	100%	19.0%	0.0%	0.0%	19.1%
<b>Total</b>	<b>5,155,869</b>	<b>57,664</b>	<b>22,484</b>	<b>5,105</b>	<b>5,241,121</b>	<b>98%</b>	<b>1%</b>	<b>0%</b>	<b>100%</b>	<b>98.4%</b>	<b>1.1%</b>	<b>0.4%</b>	<b>99.9%</b>
<b>Participants (Number of Participants)</b>													
Manufacturing	203	255	247	16	721	28.2%	35.4%	34.3%	98%	19.8%	24.9%	24.1%	68.8%
Food Processing	109	112	29	1	251	43.4%	44.6%	11.6%	100%	10.6%	10.9%	2.8%	24.4%
Petroleum	18	6	1	-	25	72.0%	24.0%	4.0%	100%	1.8%	0.6%	0.1%	2.4%
Chemicals & Minerals	17	9	2	-	28	60.7%	32.1%	7.1%	100%	1.7%	0.9%	0.2%	2.7%
<b>Total</b>	<b>347</b>	<b>382</b>	<b>279</b>	<b>17</b>	<b>1,025</b>	<b>34%</b>	<b>37%</b>	<b>27%</b>	<b>98%</b>	<b>33.9%</b>	<b>37.3%</b>	<b>27.2%</b>	<b>98.3%</b>
<b>Average Savings (Therms per Participant)</b>													
Manufacturing	3,444	105	68	323	1,037								
Food Processing	10,881	252	195	(56)	4,860								
Petroleum	126,354	6	241	-	90,986								
Chemicals & Minerals	58,605	284	(49)	-	35,669								
<b>Average</b>	<b>14,858</b>	<b>151</b>	<b>81</b>	<b>300</b>	<b>5,113</b>								
<b>Participation Rates (% Participants per Cust.)</b>													
Manufacturing	7.3%	4.9%	2.3%	5.4%	3.8%								
Food Processing	8.9%	9.1%	3.2%	2.2%	7.3%								
Petroleum	9.6%	5.8%	1.5%	0.0%	7.0%								
Chemicals & Minerals	3.3%	5.0%	1.8%	0.0%	3.4%								
<b>Average</b>	<b>7.3%</b>	<b>5.7%</b>	<b>2.4%</b>	<b>4.9%</b>	<b>4.4%</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
<sup>a</sup> Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
<sup>a</sup> Small: < 40,000 KWh or < 10,000 Therms  
<sup>a</sup> Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

Figure C.1: 2015 Energy Savings and Participants by Climate Region



## Segment-Specific Electric Performance Across the Industrial Sector

Table C.5: Manufacturing Details: 2015 Electric Usage and Savings with 2011–2015 Trends

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Manufacturing</b>													
Electricity Usage (GWh)	6,512.0	751.5	213.7	5.0	7,482.1	87.0%	10.0%	2.9%	100%	45.0%	5.2%	1.5%	52%
Usage Trends (2011-2015) <sup>e</sup>	[Trend sparklines for usage]												
Customers (Number of customers)	17,522	14,881	26,999	599	60,001	29.2%	24.8%	45.0%	99%	24.3%	20.6%	37.5%	82%
Customer trends (2011-2015)	[Trend sparklines for customers]												
Average Usage (kWh per customer)	371,648	50,502	7,914	8,265	124,700								
Usage Rate Trends (2011-2015)	[Trend sparklines for average usage]												
Electricity Savings (MWh)	29,463	3,515	1,564	108	34,648.9	85.0%	10.1%	4.5%	100%	38.8%	4.6%	2.1%	46%
Savings Trends (2011-2015)	[Trend sparklines for savings]												
Participants (Number of Participants)	351	322	297	22	992	35.4%	32.5%	29.9%	98%	23.7%	21.8%	20.1%	66%
Participant (2011-2015)	[Trend sparklines for participants]												
Average Savings (kWh per Participant)	83,939	10,915	5,265	4,913	34,928								
Savings Rate Trends (2011-2015)	[Trend sparklines for average savings]												
Participation Rates (% Participants per Cust.)	2.0%	2.2%	1.1%	3.7%	1.7%								
Participation Rate Trends (2011-2015)	[Trend sparklines for participation rates]												

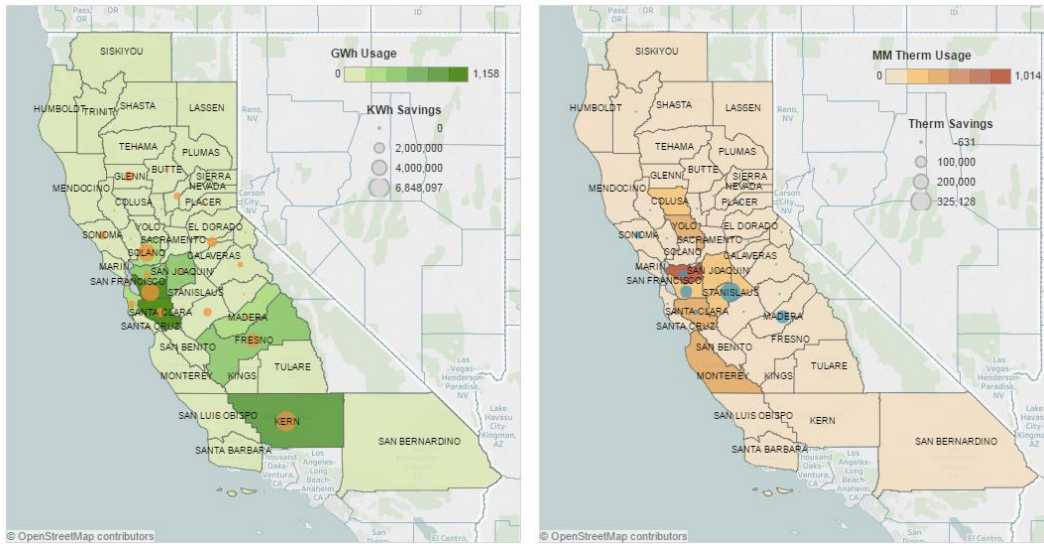
Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.6: Manufacturing Details: 2015 Gas Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Manufacturing</b>													
Gas Usage (MM Therms)	3,533.2	18.7	4.5	10.2	3,566.6	99%	0.5%	0.1%	100%	64.2%	0.3%	0.1%	65%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	2,797	5,156	10,612	294	18,859	14.8%	27.3%	56.3%	98%	11.9%	22.0%	45.3%	79%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	1,263,218	3,635	425	34,524	189,121								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	699,221	26,873	16,694	5,161.2	747,949	93%	3.6%	2.2%	99%	13.3%	0.5%	0.3%	14%
Savings Trends (2011-2015)													
Participants (Number of Participants)	203	255	247	16	721	28.2%	35.4%	34.3%	98%	19.8%	24.9%	24.1%	69%
Participant (2011-2015)													
Average Savings (Therms per Participant)	3,444.4	105.4	67.6	322.6	1,037.4								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	7.3%	4.9%	2.3%	5.4%	3.8%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Figure C.2: Manufacturing Details: 2015 Energy Usage and Savings by County**



**Table C.7: Food Processing Details: 2015 Electric Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Food Processing</b>													
Electricity Usage (GWh)	3,253.3	176.1	19.9	0.3	3,449.5	94.3%	5.1%	0.6%	100%	22.5%	1.2%	0.1%	24%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	3,452	2,522	1,585	81	7,640	45.2%	33.0%	20.7%	99%	4.8%	3.5%	2.2%	10%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	942,428	69,818	12,557	3,377	451,508								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	18,220	1,229	265	22	19,735.6	92.3%	6.2%	1.3%	100%	24.0%	1.6%	0.3%	26%
Savings Trends (2011-2015)													
Participants (Number of Participants)	177	138	34	3	352	50.3%	39.2%	9.7%	99%	12.0%	9.3%	2.3%	24%
Participant (2011-2015)													
Average Savings (kWh per Participant)	102,937	8,906	7,802	7,182	56,067								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	5.1%	5.5%	2.1%	3.7%	4.6%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.8: Food Processing Details: 2015 Gas Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Food Processing</b>													
Gas Usage (MM Therms)	380.3	10.5	1.3	0.0	392.1	97%	2.7%	0.3%	100%	6.9%	0.2%	0.0%	7%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	1,226	1,234	915	46	3,421	35.8%	36.1%	26.7%	99%	5.2%	5.3%	3.9%	14%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	310,192	8,491	1,402	149	114,605								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	1,185,996	28,200	5,647	(56.1)	1,219,787	97%	2.3%	0.5%	100%	22.6%	0.5%	0.1%	23%
Savings Trends (2011-2015)													
Participants (Number of Participants)	109	112	29	1	251	43.4%	44.6%	11.6%	100%	10.6%	10.9%	2.8%	24%
Participant (2011-2015)													
Average Savings (Therms per Participant)	10,880.7	251.8	194.7	(56.1)	4,859.7								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	8.9%	9.1%	3.2%	2.2%	7.3%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.3: Food Processing Details: 2015 Energy Usage and Savings by County

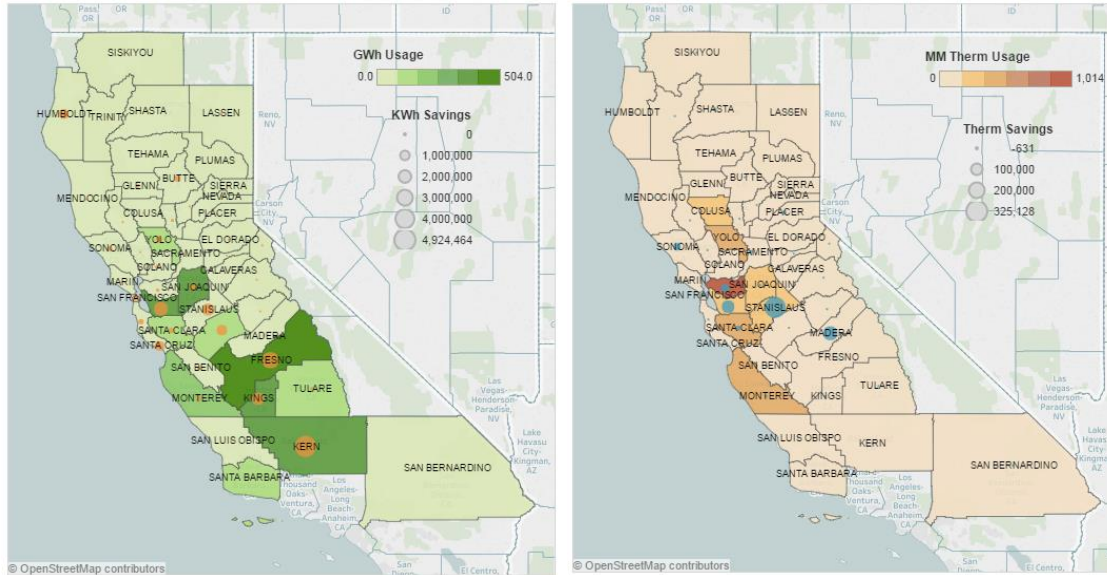


Table C.9: Petroleum Details: 2015 Electric Usage and Savings with 2011–2015 Trends

Petroleum	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
Electricity Usage (GWh)	2,769.8	38.2	3.8	0.3	2,812.1	98.5%	1.4%	0.1%	100%	19.1%	0.3%	0.0%	19%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	1,683	662	379	18	2,742	61.4%	24.1%	13.8%	99%	2.3%	0.9%	0.5%	4%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	1,645,736	57,729	10,043	15,830	1,025,559								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	16,006	133	10	-	16,149.5	99.1%	0.8%	0.1%	100%	21.1%	0.2%	0.0%	21%
Savings Trends (2011-2015)													
Participants (Number of Participants)	71	21	3	-	95	74.7%	22.1%	3.2%	100%	4.8%	1.4%	0.2%	6%
Participant (2011-2015)													
Average Savings (kWh per Participant)	225,439	6,334	3,455	-	169,995								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	4.2%	3.2%	0.8%	0.0%	3.5%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

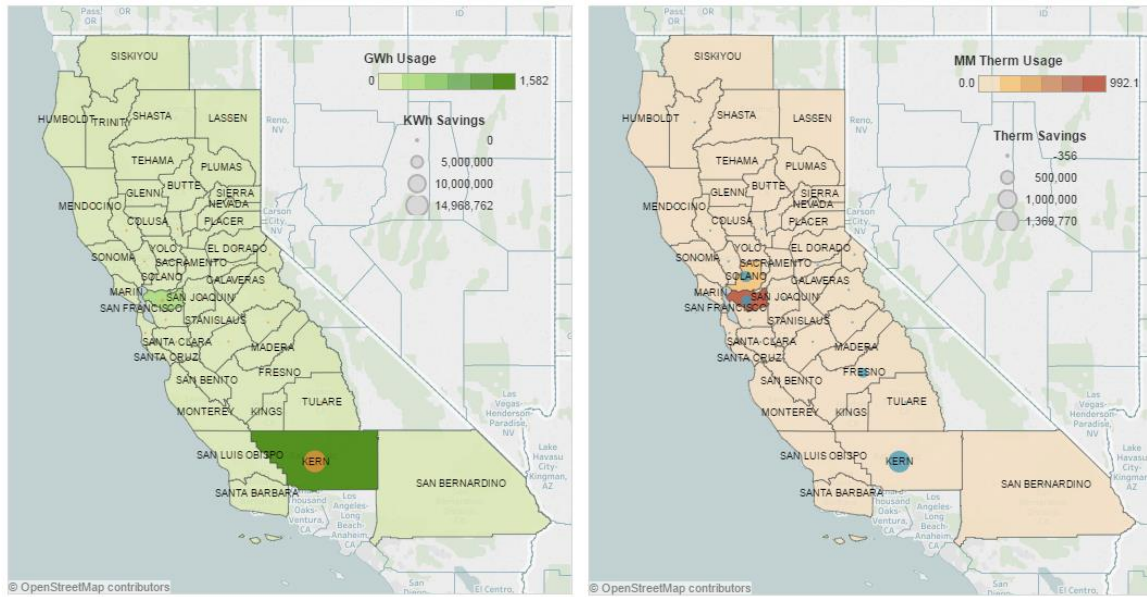


**Table C.10: Petroleum Details: 2015 Gas Usage and Savings with 2011–2015 Trends**

Petroleum	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
Gas Usage (MM Therms)	1,354.7	0.2	0.0	0.0	1,354.9	100%	0.0%	0.0%	100%	24.6%	0.0%	0.0%	25%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	187	103	67	2	359	52.1%	28.7%	18.7%	99%	0.8%	0.4%	0.3%	2%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	7,244,183	1,779	610	20	3,774,057								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	2,274,372	39	241	-	2,274,652	100%	0.0%	0.0%	100%	43.4%	0.0%	0.0%	43%
Savings Trends (2011-2015)													
Participants (Number of Participants)	18	6	1	-	25	72.0%	24.0%	4.0%	100%	1.8%	0.6%	0.1%	2%
Participant (2011-2015)													
Average Savings (Therms per Participant)	126,354.0	6.5	240.8	-	90,986.1								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	9.6%	5.8%	1.5%	0.0%	7.0%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Figure C.4: Petroleum Details: 2015 Energy Usage and Savings by County**



**Table C.11: Chemicals & Minerals Details: 2015 Electric Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Chemicals &amp; Minerals</b>													
Electricity Usage (GWh)	693.7	28.1	2.6	0.1	724.4	95.8%	3.9%	0.4%	100%	4.8%	0.2%	0.0%	5%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	840	511	298	34	1,683	49.9%	30.4%	17.7%	98%	1.2%	0.7%	0.4%	2%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	825,774	54,946	8,628	3,699	430,437								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	5,323	32	17	-	5,372.0	99.1%	0.6%	0.3%	100%	7.0%	0.0%	0.0%	7%
Savings Trends (2011-2015)													
Participants (Number of Participants)	31	8	2	-	41	75.6%	19.5%	4.9%	100%	2.1%	0.5%	0.1%	3%
Participant (2011-2015)													
Average Savings (kWh per Participant)	171,699	4,024	8,581	-	131,025								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	3.7%	1.6%	0.7%	0.0%	2.4%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.12: Chemicals & Minerals Details: 2015 Gas Usage and Savings with 2011–2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Chemicals &amp; Minerals</b>													
Gas Usage (MM Therms)	185.5	0.6	0.1	0.0	186.2	100%	0.3%	0.0%	100%	3.4%	0.0%	0.0%	3%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	512	180	113	7	812	63.1%	22.2%	13.9%	99%	2.2%	0.8%	0.5%	3%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	362,331	3,184	637	672	229,265								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	996,279	2,552	(98)	-	998,733	100%	0.3%	0.0%	100%	19.0%	0.0%	0.0%	19%
Savings Trends (2011-2015)													
Participants (Number of Participants)	17	9	2	-	28	60.7%	32.1%	7.1%	100%	1.7%	0.9%	0.2%	3%
Participant (2011-2015)													
Average Savings (Therms per Participant)	58,604.7	283.5	(49.0)	-	35,669.0								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	3.3%	5.0%	1.8%	0.0%	3.4%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.5: Chemical and Mineral Details: 2015 Energy Usage and Savings by County

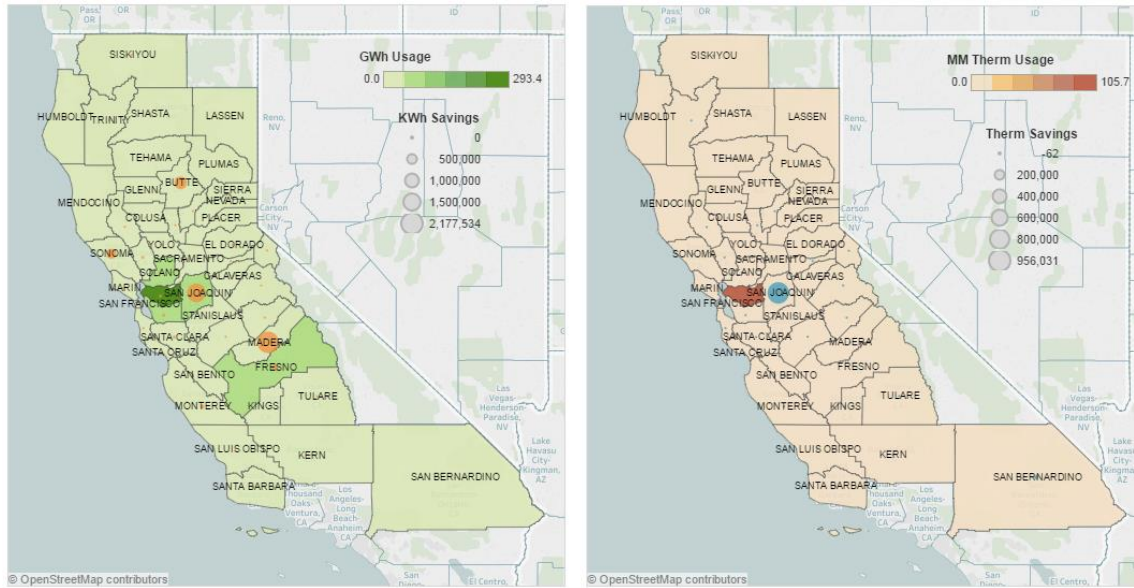


Table C.13: Industrial Electric Customers by Climate Region and Size

	Customer by Size <sup>a</sup> and Region <sup>b</sup>					Percent of Region				
	Large	Medium	Small	Unk <sup>c</sup>	Total	Large	Medium	Small	Total <sup>d</sup>	
<b>Usage (GWh)</b>										
Central Valley	8,459.0	430.7	104.7	3.3E-04	8,994	94%	5%	1%	100%	
Coastal	4,678.2	556.3	132.8	3.9E-04	5,367	87%	10%	2%	100%	
Mountain	91.5	6.9	2.5	1.4E-05	101	91%	7%	2%	100%	
<b>Total</b>	<b>13,229</b>	<b>994</b>	<b>240</b>	<b>7.3E-04</b>	<b>14,463</b>	<b>91%</b>	<b>7%</b>	<b>2%</b>	<b>100%</b>	
<b>Customers</b>										
Central Valley	13,011	8,732	12,682	328	34,753	37%	25%	36%	100%	
Coastal	10,093	9,695	16,154	390	36,332	28%	27%	44%	99%	
Mountain	393	149	425	14	981	40%	15%	43%	99%	
<b>Total</b>	<b>23,497</b>	<b>18,576</b>	<b>29,261</b>	<b>732</b>	<b>72,066</b>	<b>33%</b>	<b>26%</b>	<b>41%</b>	<b>99%</b>	
<b>Savings (GWh)</b>										
Central Valley	53.4	2.5	1.1	0.1	57.0	94%	4%	2%	100%	
Coastal	13.9	2.4	0.8	0.1	17.2	81%	14%	5%	100%	
Mountain	1.7	0.05	0.003	-	1.7	97%	3%	0%	100%	
<b>Total</b>	<b>69</b>	<b>4.9</b>	<b>1.9</b>	<b>0.13</b>	<b>76</b>	<b>91%</b>	<b>6%</b>	<b>2%</b>	<b>100%</b>	
<b>Participants</b>										
Central Valley	312	210	172	6	700	45%	30%	25%	99%	
Coastal	317	272	163	19	771	41%	35%	21%	98%	
Mountain	1	7	1	-	9	11%	78%	11%	100%	
<b>Total</b>	<b>630</b>	<b>489</b>	<b>336</b>	<b>25</b>	<b>1,480</b>	<b>43%</b>	<b>33%</b>	<b>23%</b>	<b>98%</b>	

Notes <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> Regions are aggregates of Climate Zones (Z01-Z16). There are 16 zones but not all are in PG&E's territory.  
 Central Valley includes: Z11 - Z13  
 Coastal includes: Z01 - Z06 & Z09  
 Mountain includes Z14-Z16  
<sup>c</sup> "Unknown" size category included for completeness. Represents insufficient or partial-year data  
<sup>d</sup> Column may not sum to 100% due to a small percentage of Unknowns not included

**Table C.14: Industrial Gas Customers by Climate Region and Size**

	Customer by Size <sup>a</sup> and Region <sup>b</sup>					Percent of Region			
	Large	Medium	Small	Unk <sup>c</sup>	Total	Large	Medium	Small	Total <sup>d</sup>
<b>Usage (MM Therms)</b>									
Bay Area	2,966	13	3.0	#####	2,992	99%	0%	0%	100%
Central Valley	2,020	15	2.5	0.031	2,038	99%	1%	0%	100%
Coastal	402	1	0.4	0.00	404	100%	0%	0%	100%
Mountain	65.2	0.0	0.020	-	65.204	100%	0%	0%	100%
<b>Total</b>	<b>5,454</b>	<b>30</b>	<b>6</b>	<b>10.16</b>	<b>5,500</b>	<b>99%</b>	<b>1%</b>	<b>0%</b>	<b>100%</b>
<b>Customers</b>									
Bay Area	2,388	4,061	6,417	215	13,081	18%	31%	49%	98%
Central Valley	1,945	2,157	4,376	114	8,592	23%	25%	51%	99%
Coastal	362	452	863	20	1,697	21%	27%	51%	99%
Mountain	27	3	51	-	81	33%	4%	63%	100%
<b>Total</b>	<b>4,722</b>	<b>6,673</b>	<b>11,707</b>	<b>349</b>	<b>23,451</b>	<b>20%</b>	<b>28%</b>	<b>50%</b>	<b>99%</b>
<b>Savings (MM Therms)</b>									
Bay Area	1.0	0.03	0.007	0.005	1.1	96%	3%	1%	100%
Central Valley	3.9	0.02	0.009	4E-04	4.0	99%	0%	0%	100%
Coastal	0.2	0.01	0.006	-3E-05	0.171	90%	6%	3%	100%
Mountain	0.0	-2E-04	2E-04	-	0.0	100%	-1%	1%	100%
<b>Total</b>	<b>5.2</b>	<b>0.06</b>	<b>0.02</b>	<b>0.005</b>	<b>5</b>	<b>98%</b>	<b>1%</b>	<b>0%</b>	<b>100%</b>
<b>Participants</b>									
Bay Area	34	42	32	-	108	31%	39%	30%	100%
Central Valley	237	247	162	16	662	36%	37%	24%	98%
Coastal	65	77	64	-	206	32%	37%	31%	100%
Mountain	11	16	21	1	49	22%	33%	43%	98%
<b>Total</b>	<b>347</b>	<b>382</b>	<b>279</b>	<b>17</b>	<b>1,025</b>	<b>34%</b>	<b>37%</b>	<b>27%</b>	<b>98%</b>

Notes <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
Small: < 40,000 KWh or < 10,000 Therms  
Unknown: Insufficient data (<12 months)

<sup>b</sup> Regions are aggregates of Climate Zones (Z01 - Z16). There are 16 zones but not all are in PG&E's territory.  
Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, & Sonoma  
Central Valley includes: Z11 - Z13  
Coastal includes: Z01 - Z06 & Z09 (excludes Bay Area Counties)  
Mountain includes: Z14 - Z16

<sup>c</sup> "Unknown" size category included for completeness. Represents insufficient or partial-year data

<sup>d</sup> Column may not sum to 100% due to a small percentage of Unknowns not included



# AGRICULTURE

## CHAPTER 06

MARKET  
CHARACTERIZATION  
& APPROACH

AGRICULTURE

SETTING THE STAGE



USAGE:

**8% OF ELECTRIC**  
**1% OF GAS**

PG&E agricultural  
electrical consumption  
driven  
primarily  
by crop  
production  
**(63%)**



Dominated  
by high-value  
**specialty crops**

KEY APPROACH  
& STRATEGIES



**EE measures** that save  
water and also save  
energy

**Strategic partnerships** to  
work within the current market  
structure and  
encourage EE  
at every level



**Data access tools** that enable  
agricultural customers to  
view their energy  
usage holistically,  
observe trends,  
and make smart EE  
investments



TRENDS



Persistent drought  
driving increasing  
groundwater pumping  
and intensifying  
energy demand

Farms are consolidating, trending  
toward fewer small and medium  
agricultural customers

Increased potential savings in new  
indoor growing facilities

## A. PG&E's Agricultural Sector Vision

PG&E's vision for addressing energy efficiency in the agricultural sector centers on enabling agricultural customers to better understand, manage, and eliminate unnecessary energy use in their operations.

California's historic drought will continue to impact the agricultural industry in the next five to ten years, and these customers will be forced to adapt to stay viable. While the primary focus for agricultural customers is on water and increasing environmental regulations, energy efficiency will play a vital role in sustaining agricultural operations. Enabling agricultural customers to understand and manage their energy usage can help them control energy costs and remain economically viable in the communities that rely on them. To address the unprecedented challenges confronting the sustainability of California agriculture, the California Department of Food and Agriculture (CDFA) has developed the "California Agricultural Vision," which includes twelve concerted "Strategies for Sustainability" ranging from public health and community viability to environmental impacts and natural resources.<sup>1</sup> PG&E will play an important role in supporting these strategies through its

<sup>1</sup> The vision, as articulated by the CDFA, is "of a California agriculture that is universally admired and economically rewarded for its contributions to a healthy population and a healthy planet, as well as for its productivity and the prosperity it brings to the one in five people employed in our food system." California Agricultural Vision: Strategies for Sustainability; A Report by American Farmland Trust to the California Department of Food and Agriculture and the State Board of Food and Agriculture; December 2010: [https://www.cdfa.ca.gov/agvision/docs/Ag\\_Vision\\_Final\\_Report\\_Dec\\_2010.pdf](https://www.cdfa.ca.gov/agvision/docs/Ag_Vision_Final_Report_Dec_2010.pdf).



### Table 6.1 Customers by the Numbers

Source: Internal PG&E program and customer data.

	2011-2015		2015
	Average	Trend <sup>a</sup>	Total
<b>Customer Counts (Number of customers)<sup>b</sup></b>			
Electric	96,199		98,446
Gas	2,575		2,696
<b>Total</b>	<b>97,915</b>		<b>100,190</b>
<b>Annual Sales (GWh, MM Therms)</b>			
Electric	6,053.1		6,919.0
Gas	78.5		76.5
<b>Gross First Year Ex Ante Energy Savings (GWh, MW, MM Therms)</b>			
Electric	62.5		61.3
Demand	19.1		16.4
Gas	1.2		0.5
<b>Program Participation (% of total)</b>			
Electric	1.3%		1.6%
Demand	1.2%		1.5%
Gas	18.1%		15.7%
<b>Segment Program Participation (% of segment)<sup>c</sup></b>			
<b>Electric (GWh) Savings participants</b>			
Crop Production	1.0%		1.3%
Wineries, Breweries, and Distilleries	3.6%		3.4%
Dairy	1.6%		2.5%
Green Houses	3.5%		2.4%
<b>Gas (Therms) Savings participants</b>			
Crop Production	23.8%		18.9%
Wineries, Breweries, and Distilleries	14.3%		12.1%
Dairy	37.5%		35.7%
Green Houses	13.0%		7.4%

<sup>a</sup> Sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively.

<sup>b</sup> Customer count by unique combination of Account ID and Premise ID.

<sup>c</sup> Showing the four segments of Agricultural Sector which are addressed directly in this plan. Other segments include non-dairy animal production, forestry, hunting, and support activities.

## AGRICULTURE AND THE CALIFORNIA ENERGY EFFICIENCY STRATEGIC PLAN (CEESP)

CEESP Vision: Energy efficiency will support the long-term economic and environmental success of California agriculture.

The CEESP identified three strategies to achieve this vision, which are linked to the following PG&E intervention strategies:

- 1. Develop knowledge base of efficiency solutions:** Data Access and Awareness will play a critical role in empowering customers to manage energy usage and identify appropriate solutions for their operations. At the same time, Data Analytics emphasizes the role of customer data and intelligence to help to align PG&E offerings with customer needs.
- 2. Ensure that workforce has information and training necessary to apply efficiency solutions:** Technical Assistance and Tools and Strategic Partnerships are two avenues through which PG&E will build workforce capacity in energy efficiency. Technical Assistance includes classes and other training for both customers and agricultural support services providers. Strategic Partnerships will allow PG&E to work directly with existing institutions in the agricultural space to provide training and other support.
- 3. Conduct research and development of new technologies and practices for agricultural efficiency:** Emerging Technologies will facilitate the verification and introduction of next-generation agricultural technologies, while Loans, Rebates, and Incentives will provide a pathway for customers to introduce new and innovative energy efficiency solutions into their operations.

energy efficiency programs. Energy management information, tools and analytics, measures, and financing offerings will enable customers to maximize yield while reducing unnecessary resource consumption and environmental impact. Strategic partnerships will accelerate the adoption of energy efficiency by leveraging the agricultural communities' trusted advisors.

### PG&E's Agricultural Sector Goals

PG&E's primary goal for the agricultural sector is to:

- Save 414 GWh, 89 MW, and 3.8 MM therms (net values) by 2025.

Secondary goals that PG&E intends to track are:

- Increase operational efficiency by reducing the ratio of \$/kWh saved and \$/therm saved by approximately 10% in the mid-term.
- Broaden customer participation by offering a diverse set of programs and services (increasing from roughly 1.6% electric accounts per year and 15.7% gas accounts per year to 8% electric accounts per year and 18% of gas accounts per year by 2025).
- Provide 15% of agricultural customers with access to technical assistance and tools that break down energy use within their organization by 2025 (from 0% currently being served by state-supported tools).



See **Table 6.2** for a goal to intervention strategy map. Greater detail on the intervention strategies supporting these goals can be found in Section F: PG&E’s Approach to Achieving Goals.

**Table 6.2**  
Goal to Intervention Strategy Map

Goal	Data Access and Awareness	Data Analytics	Technical Assistance and Tools	Loans, Rebates, and Incentives	Strategic Partnerships
Save energy and reduce demand	X	X	X	X	X
Increase operational efficiency		X			X
Broaden customer participation	X			X	X
Provide 15% of agricultural customers with access to technical assistance and tools	X		X		

## B. PG&E's Agricultural Sector Proposal Compared to Prior Program Cycles

PG&E's agricultural customers continue to face a variety of pressures, including ongoing drought conditions, growing regulation, and greater competition both domestically and abroad. The rolling portfolio has led to a number of changes in the way that PG&E is approaching its agricultural portfolio.

To meet the goals laid out in the vision, PG&E has identified its five major intervention strategies (further detailed in *Section F: PG&E's Approach to Achieving Goals*) for the agricultural sector, with particular focus on where they part with past practice:

- **Data Access and Awareness:** Data has played a moderate role in informing PG&E's agricultural offerings throughout 2010-2012 and 2013-2014 program cycles—encompassing integration with Demand Response (DR) and Distributed Generation (DG) programs. For several years to date, PG&E has also made energy usage data available to customers. However, PG&E's relative progress in both raising customer awareness (e.g., of energy usage patterns; the interaction between energy and water usage) and integrating energy usage data into whole-farm management remains early-stage.
  - In 2018 and beyond, PG&E plans to provide its agricultural customers with more accessible energy usage data to help them make informed energy management decisions. For example, PG&E plans to explore opportunities to promote a comprehensive energy management dashboard that uses customers' advanced metering infrastructure (AMI) data to capture information from multiple accounts within a single agricultural operation. This type of dashboard would allow customers to view their energy usage holistically, observe trends, and make smart energy efficiency investments.
  - In the long-term, all agricultural customers will have easy access to energy management tools through a variety of channels, enabling the sector to make smarter, more sustainable, and more cost-effective business decisions.
- **Data Analytics:** AMI data presents a major opportunity for strategically targeting high-opportunity projects and providing value propositions on energy efficiency opportunities in the agricultural sector. Exploring opportunities for implementers to target agricultural sector customers with AMI data will be a major component of PG&E's future strategy.
  - In the near-term, PG&E plans to fund additional market research focused on crop-management techniques and other external variables that affect energy usage to address current information gaps that have constrained PG&E's ability to identify optimal emerging technologies and cost-effectively target sub-segments.
  - In the mid-to-long-term, PG&E plans to explore ways to more effectively use interval data, along with other external data points, to help agricultural customers understand their groundwater pumping patterns. This will enable PG&E to emphasize parallel water savings opportunities as customers pursue energy efficiency.
- **Technical Assistance and Tools:** A key part of PG&E's 2013-2015 agricultural portfolio was the diverse set of tools and technical assistance to help customers eliminate unnecessary energy use. Key technical offerings included facility audits, energy savings analysis, and concierge energy efficiency solutions focused on specific technologies, segments, and approaches via a variety of third-party vendors. PG&E seeks to build on these successful approaches by connecting these tools to partners in the agricultural community, and emphasizing connections between various forms of assistance.
  - Thanks to new technologies and CPUC energy efficiency baseline policies,<sup>2</sup> PG&E may be able to expand the reach of its agricultural energy efficiency portfolio. For example, some new technologies include deemed variable frequency drives (VFDs) for new wells and irrigation systems. New baseline policies are expected to allow for more retrocommissioning and operational interventions in the agricultural sector.

<sup>2</sup> D.16-08-019 and other forthcoming baseline guidance.

- PG&E will build the energy efficiency expertise of agricultural support service providers, creating a new avenue to reach agricultural customers.
- Pump efficiency calculators will be available in the short-term, with irrigation efficiency calculators made available in later years.
- Technical assistance and tools will be integrated into broader strategic energy management (SEM) plans for agricultural customers, with a particular focus on dairies and wineries.
- **Loans, Rebates, and Incentives:** Rebates and incentives have always been a major part of PG&E's agricultural energy efficiency offerings. In 2013-2015, PG&E offered zero-interest project financing, as well as a variety of rebates and incentives to support the installation of energy efficient equipment and systems. PG&E will continue to offer loans, rebates, and incentives with a focus on expanding financing options and new ways to measure energy efficiency savings, such as normalized meter-based savings.
  - While rebates and incentives will continue to play a large role in the financial solutions offered, PG&E plans to customize on bill financing (OBF) and on bill repayment (OBR) financing programs to meet agricultural customer needs. While adoption has been limited to date, PG&E believes financing will be an integral tool for scaling energy efficiency opportunities.
  - Crop production is the largest agricultural segment. Over the last six years, PG&E has offered a limited set of energy efficiency measures to growers, the most popular of which include pump overhauls and custom VFDs. While these types of measures remain a staple of PG&E's agricultural portfolio, over the next several years, PG&E will invest in behavioral and data-based solutions beyond the pump that rely on meter-based savings approaches
  - Helping customers to reduce water waste saves energy at the pump and conserves valuable resources. PG&E will concentrate on energy efficiency offerings targeting irrigation system efficiency optimization to improve the energy and water efficiency of irrigation systems.
- **Strategic Partnerships:** Unlike 2013-2015, PG&E seeks to make partnerships with other entities within the agricultural sector a priority in building customer enrollment and maximizing savings. These other actors, beyond IOUs and other program administrators, are crucial to enabling effective energy efficiency uptake. PG&E plans to develop strategic partnerships to create paths for agricultural customers to access energy efficiency resources. These include:
  - Advocacy groups and trade organizations such as the Farm Bureau and Western Growers Association
  - Agricultural support service providers and their trade associations such as pest control advisors, pump and irrigation equipment vendors
  - Public and private universities and community colleges with agricultural programs
  - Governmental agencies, such as the United States Department of Agriculture (USDA), CDFA, Department of Water Resources (DWR), and regional water districts

These five intervention strategies will be deployed in stages, over the near, mid, and long-term. PG&E discusses the individual tactics for each of these strategies in greater detail in *Section F, PG&E's Approach to Achieving Goals*. Below is a brief summary of key time horizons<sup>3</sup>:

<sup>3</sup> Email communication from Administrative Law Judge Julie Fitch, on November 15, 2016 clarified program administrators' Business Plan timeline. "Because D.14-10-046 only authorizes funding through the end of 2025, it is my expectation that this would be the timeframe for the Business Plans as well, covering calendar years 2018-2025." However, PG&E has built its Business Plan around a 10-year vision, and has identified short (1-3 years), medium (4-7 years), and long-term (8-10 years) time periods used to indicate when strategies and tactics will be deployed and targets will be met. PG&E believes this structure is in line with the intent of the rolling portfolio concept.

- **In the short-term (1-3 years):** PG&E will roll out educational and marketing offerings around its existing, successful agricultural programs. Pump and irrigation offerings [such as pump overhauls and VFDs] will be expanded. Additionally, it will begin laying the groundwork for future offerings, gathering customer data, and performing industry and market research.
- **In the mid-term (4-7 years):** PG&E will begin to stand up programs to better integrate customer data into decision-making. Agricultural customers will be able to easily view their data, and agricultural support services and other partners will begin integrating energy efficiency into the services they provide to agricultural customers.
- **In the long-term (8-10 years):** Agricultural customers will be able to use real time information and tools to inform their daily decisions around energy and water use. These customers will view energy use as a key part of cost-management, with energy efficiency just one in a variety of demand side management (DSM) solutions available to them. All of these will be integrated into whole-farm solutions, which allow an owner or manager to view in real-time the impacts on water use, energy use, or other inputs.

To achieve its vision, PG&E anticipates meeting the following energy savings goals for the following investment, as shown in *Section C: Goals, Budget, and Cost-Effectiveness*.

## EM&V Key Research Learnings of California's Agricultural Sector and Energy Efficiency Programs

Most of the energy used by farms and in agriculture is in water pumping and conveyance. Therefore, most cost-effective savings efforts focus on reducing the amount of water used and/or the energy to pump water. Key recent evaluation learnings include:

- Farmers care most about the health of their crops; energy efficiency is much less important than water, fertilizer, biocides, prices for their products and inputs, and access to finance. Energy efficiency offerings should address and link to farmers' key concerns.<sup>4,5</sup> For example, the following points can be made rather than just mentioning that these actions save energy: farmers who can only access groundwater will benefit the most from water saving measures; better water management results in healthier and more homogeneous crops that sell sooner and better; and improved maintenance and repair of agricultural pumps increases their reliability and the likelihood that the pumps can provide the water needed by plants during hot spells.
- Farms' different needs and concerns affect their capability, interest, and ability to adopt more energy-efficient practices and equipment. Programs need to address this diversity.
- Farmers receive and trust information on new technologies and practices from observing their neighbors, word-of-mouth, and trade associations.<sup>6,7</sup> Partnering with trade allies and associations is useful.
- Technical assistance on energy efficiency and optimization of water use helps farmers to understand the benefits of more energy and/or water efficient technologies and associated savings. For example, the Advanced Pumping Efficiency Program (APEP) helps farmers understand how well their water pump is working, enabling repair or new purchase decisions.<sup>8</sup>

<sup>4</sup> Navigant Consulting 2013 & 2015

<sup>5</sup> Evergreen Economics 2013

<sup>6</sup> Navigant Consulting 2013 & 2015.

<sup>7</sup> Evergreen Economics 2015.

<sup>8</sup> ITRC/Cal Poly 2013.

- Most deep, large, and cost-effective savings are located at large farms (see *Appendix C: Customer Data*).
- Money in the form of incentives and/or financing often makes the business case for, or at least serves as an independent endorsement of, energy efficiency projects.<sup>9</sup>
- SEM platform can help farmers improve their energy and water operations and management practices, and develop long-term plans to reduce the water and energy intensity of their crops. To be cost-effective, SEM should target small and medium-sized customers via cohorts and/or trade associations, and use individual engagements with large farmers.<sup>10</sup>

The legalization of cannabis in the November 2016 election will trigger a significant increase in energy usage for this crop, unless relevant energy efficiency programs can be stood up quickly to mitigate this by promoting, for example, widespread adoption of lighting emitting diodes (LED) lighting.<sup>11 12</sup>

**Table 6.3**  
Agricultural Sector Annual Net Market Potential

Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
<b>GWh</b>	36	37	38	39	40	40	41	42	43	43
<b>MW</b>	2.30	2.40	2.40	2.50	2.50	2.60	2.60	2.70	2.70	2.70
<b>MM/therms</b>	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

<sup>9</sup> Navigant Consulting 2013 & 2015.

<sup>10</sup> Cadmus 2012.

<sup>11</sup> Evergreen Economics 2016.

<sup>12</sup> Smallwood & Vijay 2016.

## C. Goals, Budget, and Cost-Effectiveness

As Business Plans were envisioned as “a comprehensive vision outlining long-term strategic initiatives and intervention strategies,”<sup>13</sup> PG&E provides energy and demand savings goals, budgets, and cost-effectiveness forecasts that represent its best estimates to realize its portfolio vision, while also retaining flexibility to accommodate potential market or regulatory changes. Each year, PG&E will file a Tier 2 advice letter (AL) that provides detailed goals, budgets, and cost-effectiveness for the Commission’s review and approval.<sup>14</sup>

### Annual Net Market Potential

PG&E’s primary goal is to save energy. PG&E has used the energy and demand savings targets provided in the “Energy Efficiency Potential and Goals Study for 2015 and Beyond” (Potential Study), approved in D.15-10-028, as the foundation for its projected energy savings goals for 2018–2025, along with 2016 and 2017 for reference. Energy and demand savings goals are shown as net annual goals, as per D.16-08-019. See **Table 6.3** for annual net market potential for the agricultural sector.

<sup>13</sup> D.15-10-028, p. 48

<sup>14</sup> D.15-10-028, OP 4.

PG&E's net annual energy and demand savings goals are directional in nature, and meant to reflect its best estimates of energy and demand savings potential. PG&E requests flexibility to accommodate potential market or regulatory changes. PG&E will file an annual Tier 2 AL that provides detailed sector-level energy and demand goals.

PG&E recognizes that energy and demand savings goals will be updated to meet the SB 350 energy efficiency targets set by the California Energy Commission (CEC) no later than November 1, 2017<sup>15</sup> and the net goals framework adopted in D.16-08-019.<sup>16</sup> PG&E will update its energy savings forecasts once the Commission approves new energy and demand savings targets.

## Sector Budget

PG&E's Business Plan budget provides general information on the expected levels of annual spending for 2018-2025, along with 2016 and 2017 approved budgets for reference. As provided in D.15-10-028, PG&E's Business Plan budget represents its best estimates of spending for the life of the business plan.<sup>17</sup> The intent is to allow program administrators flexibility to adjust spending during the life of the Business Plan.<sup>18</sup> PG&E will file a Tier 2 AL annually, containing a detailed budget for the next calendar year's energy efficiency portfolio.<sup>19</sup> The Tier 2 AL budgets will include detailed budgets for cost recovery, transfer, and contracting purposes.<sup>20</sup> See **Table 6.4** for a summary of the agricultural sector budget. For more discussion on PG&E portfolio and sector-level budgets, please see the *Portfolio Overview* chapter.

**Table 6.4**  
PG&E Agriculture Sector Budget Summary

Cost Category	2016	2017	2018	2019	2020-2025 Annual Budget <sup>a</sup>
<b>Administration</b>	\$2,838,618.71	\$2,818,820.18	\$2,453,873.40	\$2,088,926.62	\$1,864,447.33
<b>Marketing</b>	\$1,980,999.11	\$2,075,402.99	\$1,963,537.74	\$1,851,672.50	\$1,739,807.25
<b>Implementation</b>	\$10,904,232.01	\$10,965,720.71	\$10,883,260.24	\$10,800,799.77	\$10,718,339.29
<b>Incentive</b>	\$11,326,249.04	\$16,040,883.17	\$16,940,883.17	\$17,840,883.17	\$17,840,883.17
<b>Total</b>	<b>\$27,050,098.87</b>	<b>\$31,900,827.05</b>	<b>\$32,241,554.55</b>	<b>\$32,582,282.05</b>	<b>\$32,163,477.04</b>

<sup>a</sup> The Annual Budget from 2020 through 2025 will remain the same.

<sup>15</sup> SB 350 requires the California Energy Commission to develop and establish statewide targets that lead to a cumulative doubling of energy efficiency savings from all retail electric and natural gas end-users by 2030. <http://www.energy.ca.gov/sb350/timeline.pdf>

<sup>16</sup> Commission staff should work with its consultants to prepare a net goals framework in time for the start of 2018, if not sooner." D.16-08-019, p. 20.

<sup>17</sup> D.15-10-028: "It [the budget] will establish a "ballpark" figure for spending for the life of the business plan." p. 55.

<sup>18</sup> D.15-10-028, p. 56.

<sup>19</sup> D.15-10-028, OP 4.

<sup>20</sup> D.15-10-028, p. 56.

## Cost-Effectiveness

PG&E presents its sector-level cost effectiveness for its 2018-2025 business plan. See **Table 6.5** for cost-effectiveness results, **Table 6.6** for net annual savings impacts, and **Table 6.7** for emission reductions.

**Table 6.5**  
Projected Agricultural Cost-Effectiveness Results (2018-2020)

	Results
<b>TRC</b>	1.03
<b>PAC</b>	1.42

Note: Does not include Market Effects

**Table 6.6**  
Projected Agricultural Net Annual Savings Impacts from Cost-Effectiveness Scenario 2018-2020

	PG&E Target	PGS Goal
<b>Energy Savings (Net GWh/yr)</b>	40.96	39.50
<b>Demand Reduction (Net MW)</b>	6.77	2.50
<b>Gas Savings (Net MMTh/yr)</b>	0.91	0.20

Note: Does not include Market Effects

**Table 6.7**  
Projected Agricultural Emission Reductions from Cost-Effectiveness Scenario 2018-2020

	Reduction
<b>Annual tons of CO2 avoided</b>	16,851
<b>Lifecycle tons of CO2 avoided</b>	2 — 46,539
<b>Annual tons of NOx avoided</b>	23,144
<b>Lifecycle tons of NOx avoided</b>	3 — 47,747
<b>Annual tons of SOx avoided</b>	—
<b>Lifecycle tons of SOx avoided</b>	—
<b>Annual tons of PM10 avoided</b>	4,560
<b>Lifecycle tons of PM10 avoided</b>	56,409

PG&E conducted a cost-effectiveness analysis of its proposed portfolio in compliance with D.15-10-028, and with the California Standard Practice Manual.<sup>21</sup> PG&E used the 2017 updated avoided costs and cost-effectiveness inputs approved in Resolution E-4801.

PG&E's cost-effectiveness calculation represents the near-term years of its business plans (2018-2020) and is directional in nature, meaning that PG&E will strive to meet the cost-effectiveness projections set forth for the sector. However, PG&E requests flexibility to accommodate potential market or regulatory changes. Through the annual Tier 2 ALs, PG&E will provide the Commission with updated cost-effectiveness forecasts for each year of business plan implementation.

<sup>21</sup> California Standard Practice Manual: Economic Analysis of Demand Side Management Programs and Projects, 2002. [http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf)

Through implementation of its Business Plan, PG&E seeks to significantly reduce energy waste cost effectively while maximizing the value of energy efficiency for customers, for the grid, and for the state. To do this, PG&E recognizes the need to take “a more integrated, cost-effective approach”<sup>22</sup> to scale energy savings. For more discussion on PG&E’s key strategies to scale energy efficiency and continue to deliver cost-effective energy efficiency portfolios, please see the *Portfolio Overview* chapter.

## D. Sector Characterization

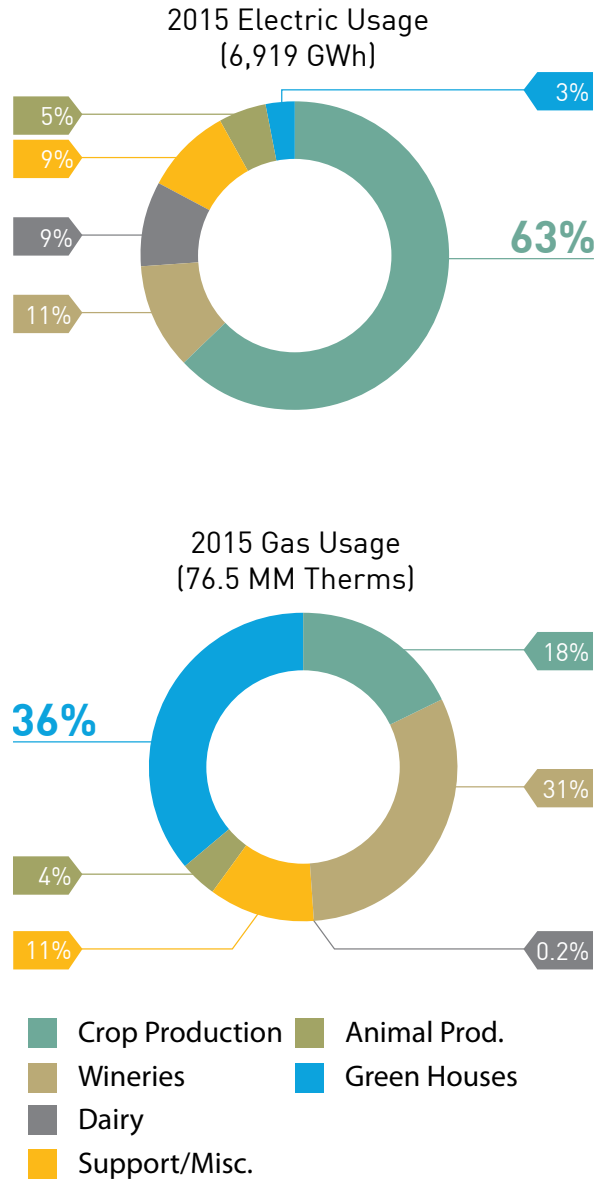
### Target Audience

PG&E characterizes its agricultural customers in terms of segment, size, energy efficiency program participation, end use, and geography.

**Segment Overview and Energy Usage:** PG&E divides the market into segments based on end use, ranging from dairies to greenhouses, as shown in **Figure 6.2: Energy Usage by Agricultural Customer Segment**. PG&E’s core agricultural segments include crop producers, dairies, wineries (also encompassing distilleries and breweries), and greenhouses. These segments tend to be comprised of a small portion of very large, high energy-consuming customers, coupled with prolific small-scale, low-tech businesses.<sup>23</sup> Food processing is another large energy intensive sub-segment tracked and reported under PG&E’s agricultural portfolio. However, due to limitations in how public market data is presented, food processing will be discussed under the Industrial sector chapter. In future iterations of this plan, PG&E will take steps to incorporate food processing information and goals into the agricultural chapter given the close relationship and connection between food processing operations and the four segments mentioned above.

**Figure 6.2**  
Energy Usage by Agricultural Customer Segment

Source: 2015 internal PG&E customer data as divided by NAICs code



<sup>22</sup> Mitchell, Cynthia 2014. “A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach.” p. 1, TURN May 15, 2015 iDSM comments in R.14-10-003, p. 9.

<sup>23</sup> California Agricultural Statistics Review, 2014–2015; CDFA (California Department of Food and Agriculture). <https://www.cdffa.ca.gov/statistics/PDFs/2015Report.pdf>



The energy consumption of PG&E's key agricultural segments is typically either predominately electric or predominately gas. PG&E's electrical consumption is dominated by crop production (63%) which is almost six times as large as the next closest consumer. Wineries and dairies are the next two largest consumers, which collectively comprise 20% of the consumption in this sector. Pumps, boilers, refrigeration, compressors, wastewater treatment, and lighting are drivers of electric usage for these customers. Gas consumption is mostly split between greenhouses and wineries, which account for 67%, followed by crop production with 18% of the consumption. The majority of the gas consumption for greenhouses is driven by heating needs, while wineries use gas primarily for water heating.

Crop production is a diverse segment with over 400 crops produced commercially in California. The average farm size in California is 334 acres, which is below the national average of 438 acres. While the exact percentage of California's 76,400 farms that lie within PG&E territory is unknown, crop production comprises a larger share of agricultural load for PG&E versus other California IOUs.

Nine of the top 10 agricultural counties lie wholly or partially within PG&E territory. PG&E has approximately 1,900 dairies in its service territory – a few hundred of which are large dairies with over 1,000 cows, and the remainder are small/medium-size operations.<sup>24</sup>

Vis-à-vis wineries, based on a 2010–2012 market characterization study by Navigant Consulting, a handful of large companies produce approximately 75% of California's wine,<sup>25</sup> and the top 15 wineries account for over 52% of energy use.<sup>26</sup>

<sup>24</sup> Based on internal PG&E customer data.

<sup>25</sup> California Agricultural Market Characterization, 2010–2012," Navigant Consulting.

<sup>26</sup> Based on internal PG&E customer data.

Lastly, PG&E's greenhouse customers comprise a mix of mostly smaller, family-owned, older, and less technologically-advanced operations, as well as a select few high-tech, large, high-value added (e.g. orchid) businesses.<sup>27</sup> In 2015, 24 California greenhouse companies ranked in the top 100 greenhouse growers nationwide, and the average square footage of U.S. greenhouses increased by 5% from 2014 to 2015.<sup>28</sup>

PG&E's agricultural sector has experienced a slow and steady increase in share of total PG&E sales over the last few decades, from 7% to over 9% of total sales.<sup>29</sup> This trend is expected to continue as the adoption of DG primarily in other sectors increases. The CEC forecast for PG&E's agricultural sector shows very little adoption of DG is expected, indicated by the small gap between sales and consumption in **Figure 6.3: Agricultural Electric Consumption and Sales Forecast**. The Integrated Energy Policy Report does not account for new growth with California's legalization of cannabis, which is expected to bolster load in the agricultural sector.

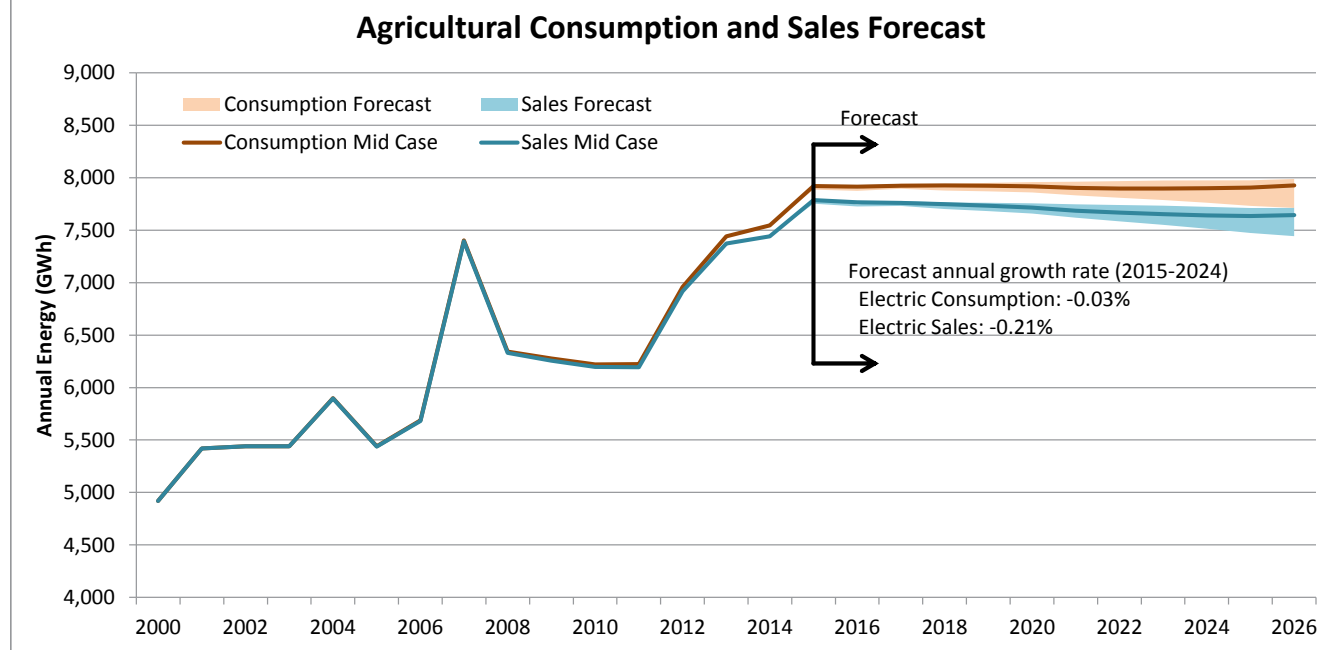
<sup>27</sup> Greenhouse Grower. May 8, 2015. 2015 Greenhouse Grower Top 100 Grower List. <http://www.greenhousegrower.com/business-management/top-100/2015-greenhouse-grower-top-100-grower-list/>

<sup>28</sup> Greenhouse Grower. May 8, 2015. 2015 Greenhouse Grower Top 100 Grower List. <http://www.greenhousegrower.com/business-management/top-100/2015-greenhouse-grower-top-100-grower-list/>; <http://www.greenhousegrower.com/business-management/2015-greenhouse-grower-top-100-growers-reading-the-rankings/>

<sup>29</sup> California Energy Commission, 2015 Integrated Energy Policy Report (IEPR), [http://www.energy.ca.gov/2015\\_energypolicy/](http://www.energy.ca.gov/2015_energypolicy/)

**Figure 6.3**

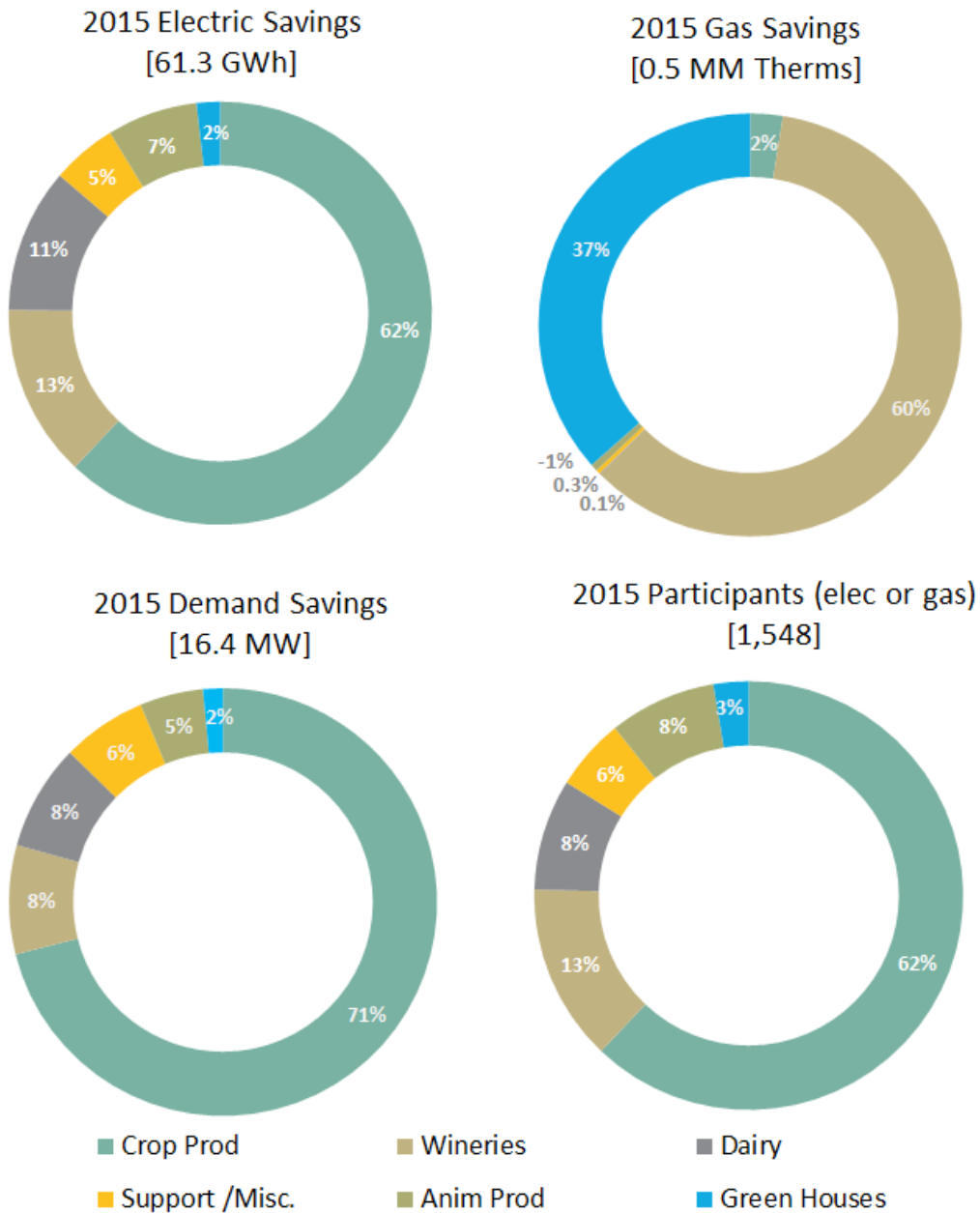
## Agricultural Electric Consumption and Sales Forecast

**Size and Energy Efficiency Program Participation:**

For its energy efficiency programs, PG&E defines customer size based on energy usage. In this context, a range of small, medium, and large customers participate in PG&E's agricultural programs, and the distribution of energy savings roughly aligns with customer size. Notably, large customers (>500 GWh or 250,000 therms) comprise the majority of participation, which has yielded substantial savings for the portfolio on account of their disproportionate load size. See **Figure 6.4a** for the agricultural sector 2015 energy savings, demand reductions, and participation by segment. See **Figure 6.4b** for the agricultural sector 2015 Energy Efficiency program participation and savings by customer size. **Table 6.8** and **Table 6.9** show the 2015 usage and savings data with 2011-2015 trends.

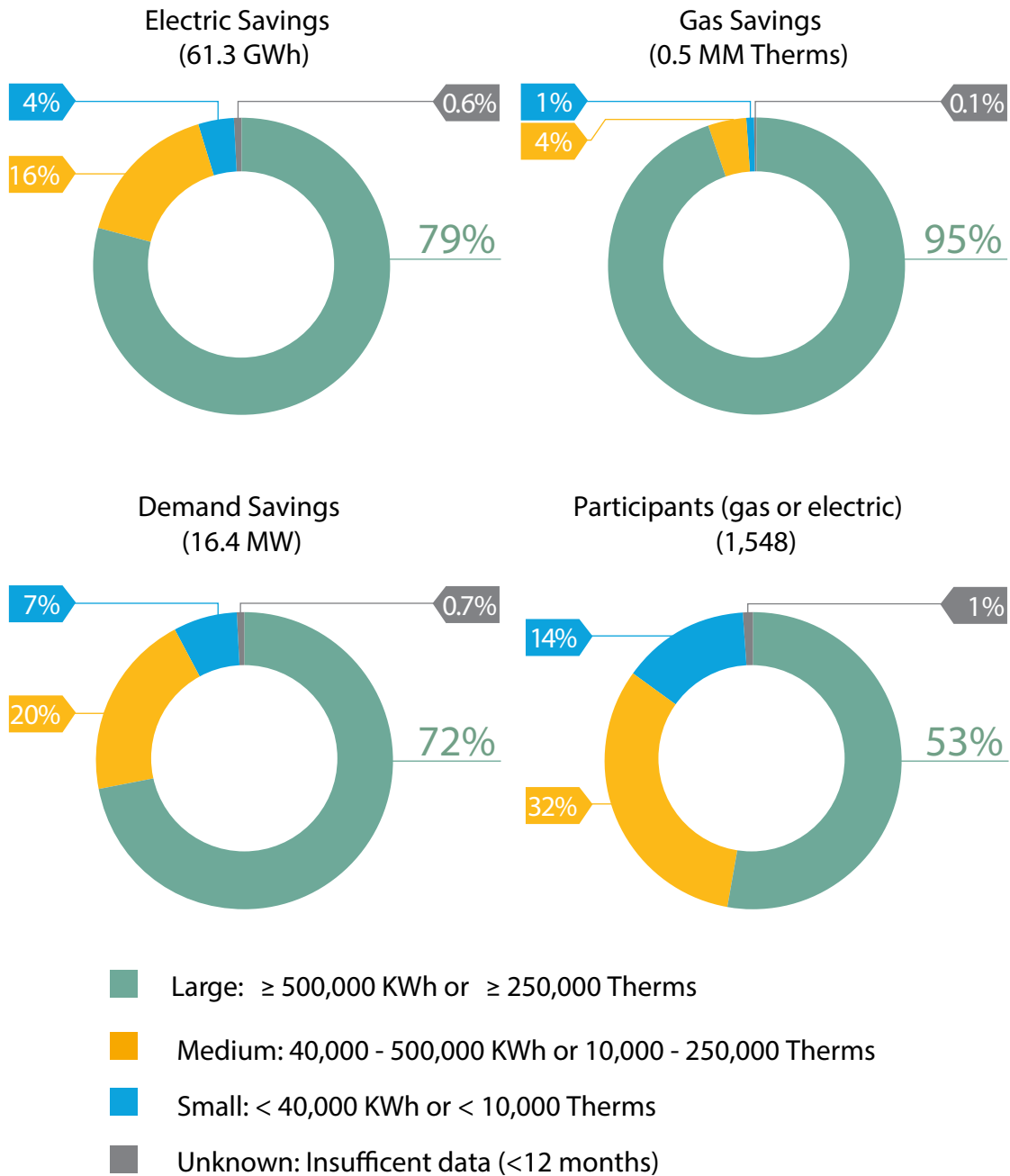
**Figure 6.4a**

Agricultural Sector 2015 Savings and Participation by Segment



**Figure 6.4 b**  
 Agricultural Sector 2015 Energy Efficiency Program  
 Participation and Savings by Size

Source: Internal PG&E customer data



**Table 6.8**

2015 Electric Usage and Savings with 2011–2015 Trends

	Customer By Size <sup>a</sup>				Total	Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>
<b>Whole Sector</b>									
Electricity Usage (GWh)	5,444	1,237	238	0	6,919	79%	18%	3%	100%
Usage Trends (2011-2015) <sup>e</sup>									
Customers (Number of customers)	35,748	29,632	31,914	1,152	98,446	36%	30%	32%	99%
Customer trends (2011-2015)									
Average Usage (kWh per customer)	152,302	41,729	7,456	14	70,282				
Usage Rate Trends (2011-2015)									
Electricity Savings (MWh)	48,703	9,578	2,575	398	61,254	80%	16%	4%	99%
Savings Trends (2011-2015)									
Participants (Number of Participants)	810	484	218	16	1,528	53%	32%	14%	99%
Participant Trends (2011-2015)									
Average Savings (kWh per Participant)	60,127	19,790	11,814	24,854	40,088				
Savings Rate Trends (2011-2015)									
Participation Rates (% Participants per Cust.)	2.3%	1.6%	0.7%	1.4%	1.6%				
Participation Rate Trends (2011-2015)									

- Notes:
- <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)
  - <sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data
  - <sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data
  - <sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers
  - <sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table 6.9**

2015 Gas Usage and Savings with 2011-2015 Usage and Trends

	Customer By Size <sup>a</sup>				Total	Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>
<b>Whole Sector</b>									
Gas Usage (MM Therms)	65	11	1	0	77	85%	14%	1%	100%
Usage Trends (2011-2015) <sup>e</sup>									
Customers (Number of customers)	871	994	808	23	2,696	32%	37%	30%	99%
Customer trends (2011-2015)									
Average Usage (Therms per customer)	74,852	10,739	793	747	28,386				
Usage Rate Trends (2011-2015)									
Gas Savings (Therms)	485,559	19,929	6,405	644	512,537	95%	4%	1%	100%
Savings Trends (2011-2015)									
Participants (Number of Participants)	178	154	88	4	424	42%	36%	21%	99%
Participant (2011-2015)									
Average Savings (Therms per Participant)	2,728	129	73	161	1,209				
Savings Rate Trends (2011-2015)									
Participation Rates (% Participants per Cust.)	20%	15%	11%	17%	16%				
Participation Rate Trends (2011-2015)									

- Notes:
- <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)
  - <sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data
  - <sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data
  - <sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers
  - <sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

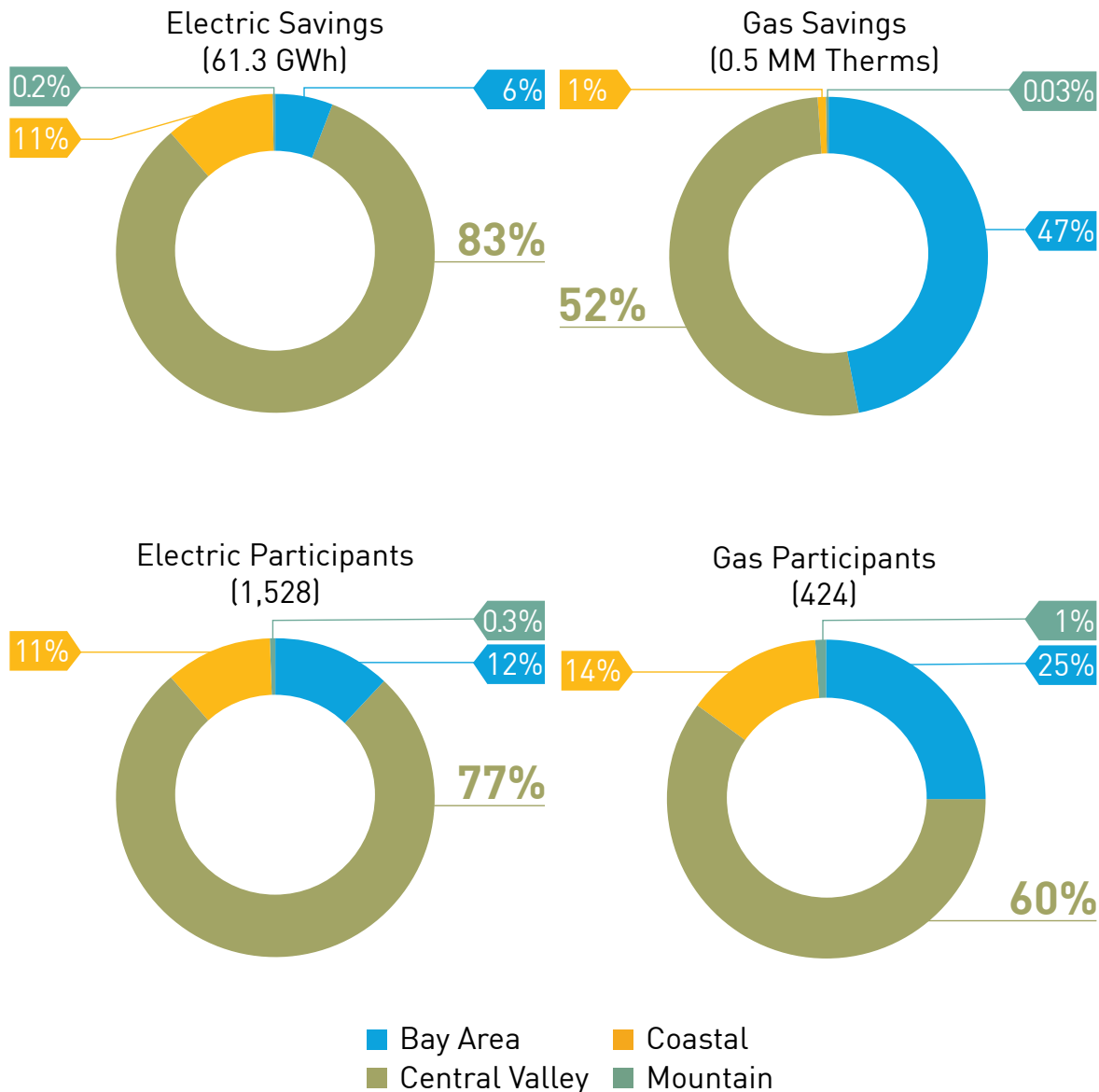
**Geography:** Agricultural customers are dispersed throughout PG&E's service territory, with primary concentrations in the Northern and Southern San Joaquin Valley, Napa/Sonoma, the Salinas River Valley, and the Central Coast. Crop production constitutes PG&E's largest agricultural segment, followed by dairies, wineries (also encompassing distilleries and breweries), and greenhouses.

See **Figure 6.5** for energy usage and savings by climate region and **Figure 6.6** for energy usage and savings maps by county.

Note: Regions are aggregates of Climate Zones (Z01 - Z16). There are 16 zones, but not all are in PG&E's territory.

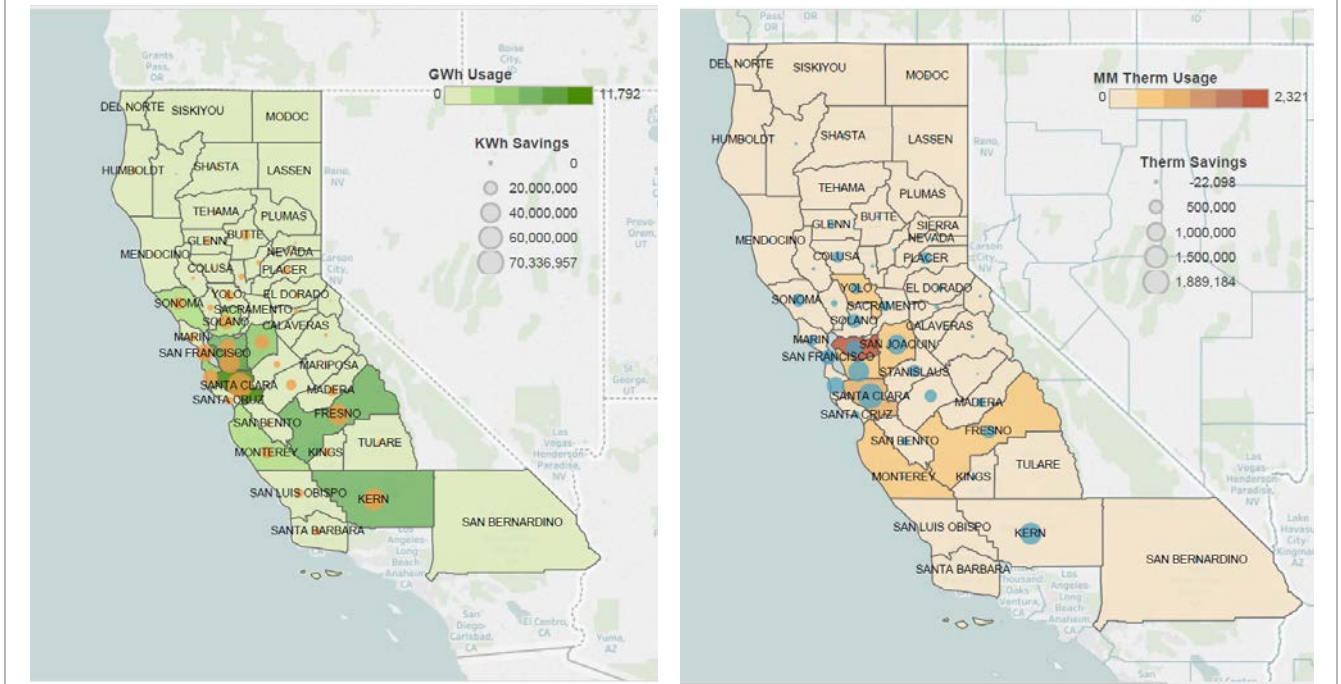
- Central Valley includes: Z11–Z13
- Coastal includes: Z01–Z06 & Z09 (excludes Bay Area Counties)
- Mountain includes Z14–Z16
- Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma

**Figure 6.5**  
2015 Energy Usage and Savings by Climate Region



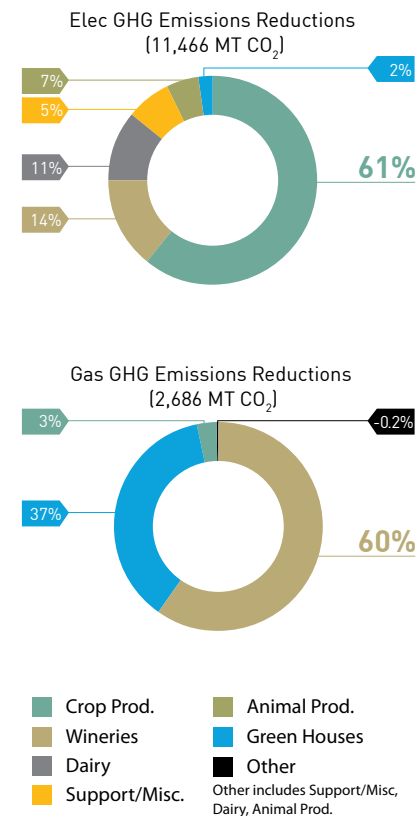
**Figure 6.6**

2015 Whole Sector Energy Usage and Savings Maps by County



**Figure 6.7:** 2015 GHG Emissions Reductions, which depicts PG&E’s greenhouse gas (GHG) savings by agricultural segment in 2015, reflects little overlap between relative electric and gas-related savings. Namely, crop production clearly monopolized GHG savings on the electric side (with 61%), followed by wineries (14%), dairies (11%), and animal production (7%). In contrast, gas-related GHG savings was far less fragmented, with wineries capturing 60% (i.e., a lead comparable to crop production’s share on the electric side) and greenhouses accounting for 37%, trailed by crop production with a distant 3%.

**Figure 6.7**  
2015 GHG Emissions Reductions





## Energy Efficiency Potential

The Navigant 2015 Potential and Goals Study<sup>30</sup> (Potential Study) is used to define utility savings goals. For the residential and commercial sectors, the potential model provides measure-level forecasts of savings [e.g., commercial HVAC — SEER-Rated Package Rooftop AC (recharge)]. However, for the agricultural and industrial sectors, the model has typically used supply cost curves to estimate savings by end use [e.g., agricultural HVAC — Equipment (Mid Cost)]. This generic assessment of the sector has limited the forecast model's usefulness in terms of targeting savings. With the impending release of the 2018 and Beyond Potential and Goals model, PG&E anticipates that the model will be expanded to include measure-level detail for the agricultural sector. PG&E will incorporate the updated forecast as it becomes available.

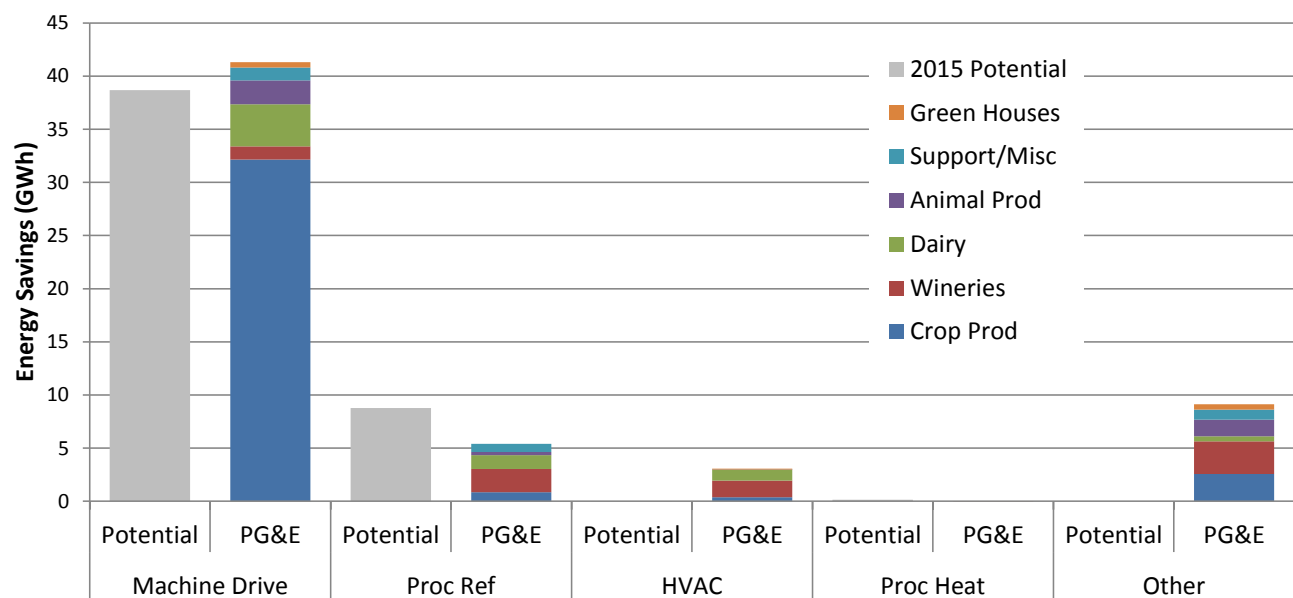
**Figure 6.8: Energy Efficiency Potential and 2015 Program Savings** shows the Potential Study categories and 2015 potential, compared with PG&E program savings of the same categories. PG&E notes that major categories of program savings such as lighting do not appear in the model. PG&E will endeavor to address this inconsistency in forthcoming potential studies.

In 2015, the Potential Study identified limited market potential for the agricultural sector. However, as illustrated in **Figure 6.8: Energy Efficiency Potential and 2015 Program Savings**, PG&E achieved savings through a variety of measures including machine drives, heating, ventilation, and air conditioning (HVAC), and others. PG&E anticipates that VFDs and pump measures will continue to dominate its agricultural portfolio, but will strive to diversify energy efficiency offerings for its customers. For example, emerging technologies (ET) will play a large role in identifying and prioritizing new technologies specifically focused on the agricultural sector, such as controls and water/energy management tools.

<sup>30</sup> Navigant 2015 Potential and Goals Study; <http://www.cpuc.ca.gov/General.aspx?id=2013>

**Figure 6.8****Energy Efficiency Potential and 2015 Program Savings**

Source: Navigant Consulting 2015; internal PG&amp;E customer data



## E. Agricultural Market Trends and Challenges

California agriculture now faces significant challenges: maintaining productivity in the face of rapid population growth, competing effectively in a global market, managing increasingly scarce natural resources, and complying with increasingly strict regulations. Overall, the agricultural sector must confront heightened public concerns about food safety, clean water, pesticide use, groundwater contamination, worker safety, and open space, as well as the long-term sustainability of scarce natural resources, ecosystems, and species.<sup>31</sup> PG&E has identified six major market trends impacting its agricultural customers.

- **95% of California is currently in a state of drought and potentially faces a “megadrought” in the future.**<sup>32</sup> Energy efficiency will play an important role in keeping costs down as well pumping becomes a necessary solution for growers facing a shortage of water. Ongoing drought has driven an increasing reliance on groundwater due to unreliable surface water supply, which in turn has led to falling water tables (and a permanent loss of groundwater storage capacity). This increases the lift for groundwater pumping and thus intensifies energy demand,<sup>33 34</sup> which is also reducing customer resources to do energy efficiency. Crop producers will continue to experience rising electric costs as they have to pump more water from further underground.

<sup>31</sup> *California Agriculture*. July 1, 2000. *Structural Adjustment, Resources, Global Economy to Challenge California Agriculture*. Warren E. Johnston, Harold O. Carter. 54(4):16-22. DOI: 10.3733/ca.v054n04p16. <http://californiaagriculture.ucanr.edu/landingpage.cfm?article=ca.v054n04p16&fulltext=yes>

<sup>32</sup> Measure, Application, Segment, Industry (MASI): Agriculture, Navigant Consulting for Southern California Edison, 2015, p. 43.

<sup>33</sup> California Natural Resources Agency. April 30, 2014. *Report to the Governor's Drought Task Force- Groundwater Basins with Potential Water Shortages and Gaps in Groundwater Monitoring*; p. 8. [http://www.water.ca.gov/waterconditions/docs/Drought\\_Response-Groundwater\\_Basins\\_April30\\_Final\\_BC.pdf](http://www.water.ca.gov/waterconditions/docs/Drought_Response-Groundwater_Basins_April30_Final_BC.pdf).

<sup>34</sup> See also *Agricultural Pumping Efficiency Program (APEP)*. PG&E. APEP-01 3/04. <http://www.pumpefficiency.org/wp-content/uploads/2015/05/APEPSeminarbooklet.pdf>

- As drought conditions become a new norm in California, water scarcity and source will be a primary driver of agricultural decision-making. Customers will prioritize water management measures and crop health over energy efficiency measures when allocating scarce resources in an uncertain future.
- A 2015 study by Evergreen Economics on San Diego Gas & Electric Company (SDG&E)'s agricultural sector concluded that IOUs' pursuit of energy savings from this sector is increasingly misaligned with most farmers' motivations, as water (rather than energy) is of primary concern under current conditions.<sup>35</sup> The study recommended that IOUs "improve and prioritize energy efficiency agricultural program offerings relevant to water conservation and the water-energy nexus [and] provide guidance and training on how to utilize tools to establish and maintain optimal irrigation practices."<sup>36</sup>
- A 2009 study by the Pacific Institute<sup>37</sup> found that a combination of agricultural technology—such as shifts from flood irrigation to sprinkler- and drip-irrigation systems— and management scenarios together could reduce agricultural water use in the state by 17 percent.<sup>38</sup>
- **GHG/environmental policies are driving agricultural customers to self-generate, reducing energy savings opportunities.**<sup>39</sup> Dairies are impacted by GHG caps. The California Air Resources Board (ARB) is drafting new regulations targeted at curbing dairy produced methane output from 25-

75% by 2030.<sup>40</sup> These increasingly stringent requirements will be a major factor for dairy customers who will consider pursuing methane capture systems in order to meet the new regulations.

- **Money is increasingly flowing into new software programs, drone technologies, big data, the internet of things (IOT), mobility, and life sciences.** As more technology is channeled into the agricultural sector, PG&E seeks to harness these advanced solutions to help its customers understand their energy usage and save energy. While investments hit roughly \$150 million in 2012, the sector grew to approximately \$1.8 billion in 2014. As farmers confront falling prices, the rise of analytics has been integral to the maximization of yields.<sup>41 42</sup>
  - As energy usage data is incorporated into these software/hardware solutions, it increases the visibility of energy usage and the ability to link energy savings to the overall performance of an agricultural operation.
- **Farms are consolidating, albeit gradually. In the long-term, PG&E anticipates fewer small and medium agricultural customers.**<sup>43</sup> Generally, larger agricultural customers have more dedicated resources to devote to energy efficiency solutions, and have historically accounted for the majority of savings in PG&E's agricultural energy efficiency programs. In contrast, many small-to-medium size operations lack sufficient resources to prioritize energy efficiency. This is substantiated by observations that farmers prioritize system operations over energy efficiency.<sup>44</sup>
  - Small and medium-size growers tend to repair equipment for as long as possible, and will only replace equipment on failure.<sup>45</sup> According to a

<sup>35</sup> Evergreen Economics, SDG&E Agricultural Sector Market Study; March 26, 2015; p. 26. [http://www.calmac.org/publications/SDG%26E\\_Agricultural\\_Sector\\_Market\\_Study\\_Final\\_Report\\_032615ES.pdf](http://www.calmac.org/publications/SDG%26E_Agricultural_Sector_Market_Study_Final_Report_032615ES.pdf)

<sup>36</sup> Evergreen Economics; SDG&E Agricultural Sector Market Study; March 26, 2015; pp. 29-31.

<sup>37</sup> Pacific Institute. *Sustaining California Agriculture in an Uncertain Future*; Pacific Institute; Heather Cooley, Juliet Christian-Smith, and Peter Gleick; July 2009.

<sup>38</sup> Greenbiz. April 13, 2015. Answers to CA drought: Regulate Groundwater Use, Grow Less Thirsty Crops, Apply Tech. <https://www.greenbiz.com/article/some-potential-answers-californias-drought>

<sup>39</sup> Nunez, Christina. Could Solar Energy Be California's Next Cash Crop? National Geographic <http://news.nationalgeographic.com/energy/2015/10/151030-farmland-agriculture-solar-energy-conversion/>

<sup>40</sup> Dairy Cares. May 2016. Dairies Dread Proposed Climate Change Regulations. San Joaquin Valley Business Journal. <http://dairycares.com/node/222>

<sup>41</sup> <http://www.globalaginvesting.com/news/blogdetail?contentid=5274>

<sup>42</sup> Gore, Bob. January 13, 2015. 6 Trends Shaping Agricultural Technology in 2015. TechWire. <http://www.techwire.net/commentary/6-trends-shaping-agricultural-technology-2015.html>

<sup>43</sup> California Agricultural Statistics Review, 2014–2015; CDFA (California Department of Food and Agriculture). <https://www.cdfa.ca.gov/statistics/PDFs/2015Report.pdf>

<sup>44</sup> Measure, Application, Segment, Industry (MASI): Agriculture, Navigant Consulting for Southern California Edison, 2015, p. 48.

<sup>45</sup> Measure, Application, Segment, Industry (MASI): Agriculture, Navigant Consulting for Southern California Edison, 2015, p. 25.

2013 Irrigation Training & Research Center (ITRC) study on Southern California Edison's (SCE) pump testing program, "because smaller entities typically have limited funding, pre-emptive repairs or upgrades are often waived until catastrophic failure occurs."<sup>46</sup>

- **California's agricultural community is dominated by high-value specialty crops (vegetables, etc.) driven by consumer demands, rather than low-value commodity crops such as wheat, corn or other field crops.**
  - Customers whose livelihoods depend on agriculture and face increasing costs could use energy efficiency to drive down costs. However, available IOU financing options are insufficient and inflexible, and often fail to meet agricultural customers' needs.
- **Forecasted load is expected to change dramatically with new crop types being introduced and demand for renewables continuing to increase.**
  - Cannabis was legalized in California in November 2016. Almost all utilities with service territories in which recreational cannabis was legalized have seen an uptick in energy demand due to the increase in growing operations.<sup>47</sup>
  - Electricity costs comprise between 20 and 50 percent of cannabis growers' operational costs. Sixty percent of this cost is estimated to be due to demand charges for time-of-use rates. Lighting is the biggest source of energy consumption, particularly in indoor greenhouse operations.<sup>48</sup>
  - There is strong potential for utility interventions—beyond lighting—in the realms of air conditioning systems, controls, and conversion to drip irrigation.<sup>49</sup>

Driven largely by these six trends, agricultural customers face several key barriers to participation in energy efficiency programs. PG&E's five major intervention strategies seek to overcome these key barriers for the agricultural sector, as shown in **Table 6.10: Agricultural Market Trends and Barriers to Energy Efficiency Program Participation** and explained in greater detail in *Section F, PG&E's Approach to Achieving Goals*.

**Table 6.10**  
Agricultural Market Trends and  
Barriers to Energy Efficiency  
Program Participation

Agricultural Sector Interventions	Key Agricultural Sector Barriers
<b>Data access and awareness</b>	<ul style="list-style-type: none"> <li>• Energy is not visible or top-of-mind</li> </ul>
<b>Data analytics</b>	<ul style="list-style-type: none"> <li>• Customers have unique operations and variable farm conditions</li> </ul>
<b>Technical assistance and tools</b>	<ul style="list-style-type: none"> <li>• New and emerging technologies create abundant opportunities, yet still require long testing cycles to confirm market viability</li> <li>• Energy resource constraints limit adoption</li> </ul>
<b>Loans, rebates, and incentives</b>	<ul style="list-style-type: none"> <li>• Available financing options are insufficient and inflexible</li> </ul>
<b>Strategic partnerships</b>	<ul style="list-style-type: none"> <li>• Customers prioritize other expenses/needs over energy</li> </ul>

<sup>46</sup> SCE Pump Testing Program Final Report. January 2013; ITRC (Irrigation Training & Research Center; Cal Poly); p. 11: [http://calmac.org/publications/SCE\\_Pump\\_Testing\\_Program\\_Final\\_Report.pdf](http://calmac.org/publications/SCE_Pump_Testing_Program_Final_Report.pdf)

<sup>47</sup> Evergreen Economics 2016.

<sup>48</sup> Evergreen Economics 2016.

<sup>49</sup> Evergreen Economics 2016.

## F. PG&E's Approach to Achieving Goals

### Strategic Interventions Overview

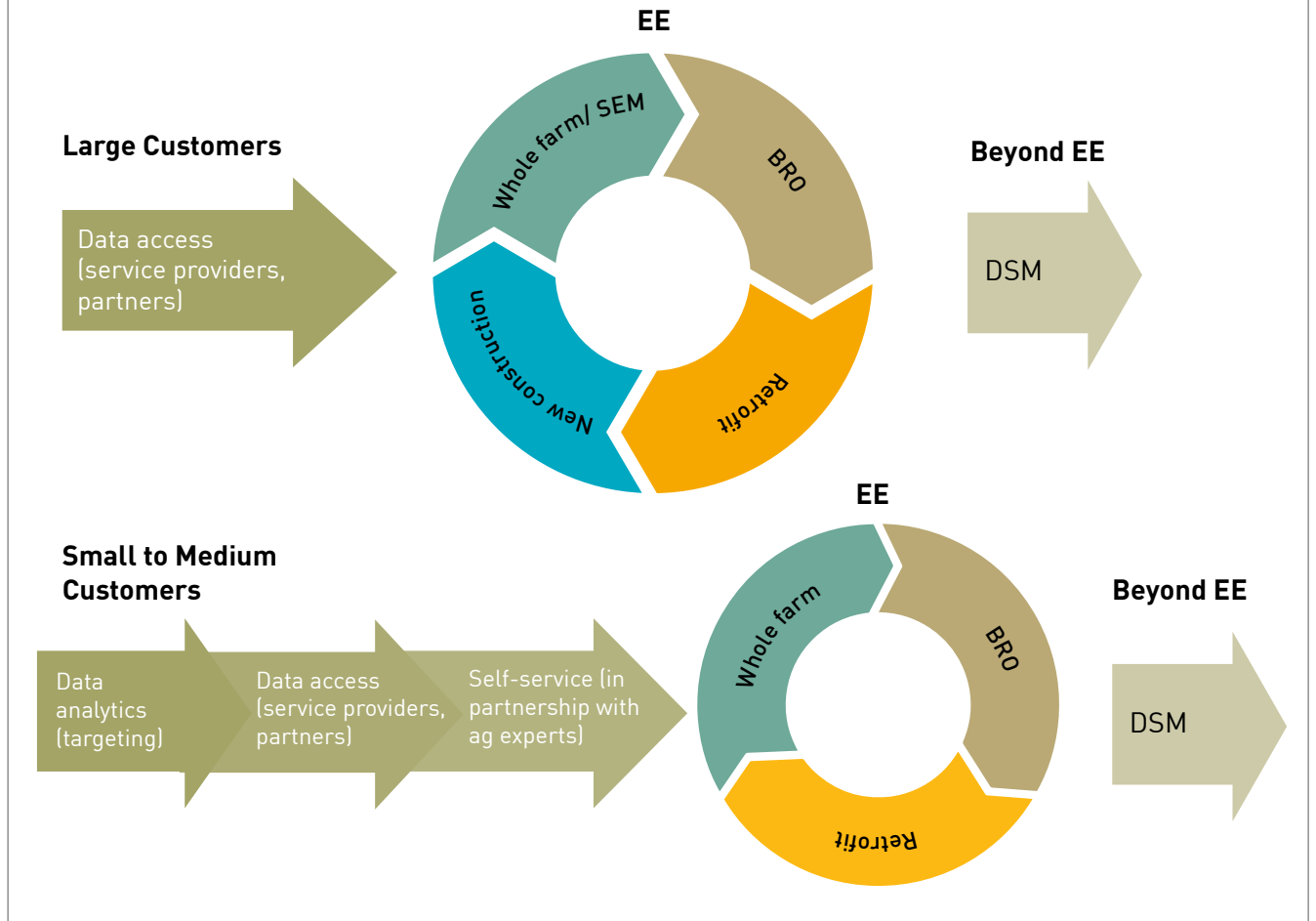
PG&E has more than a 20-year track record of providing energy efficiency offerings to its agricultural customers. Building upon past experience, PG&E identified four strategic interventions to advance California's evolving energy efficiency technology and policy landscape in the agricultural sector.

- **Data Access and Awareness** provides tools and real-time feedback to enable customers to better understand their energy use.
- **Data Analytics** emphasizes the role of customer data and intelligence in helping to align PG&E offerings with customer positioning on their energy journey.
- **Technical Assistance and Tools** empower customers to make the business case for energy efficiency. Connecting customers with solutions that make economic sense, helping them navigate the complex web of energy efficiency requirements and regulations, and integrating energy efficiency offerings into day-to-day management of agricultural operations through SEM are all important components of this intervention strategy.

- **Loans, Rebates, and Incentives** provide requisite financial impetus and assistance to get energy efficiency measures off the ground. New financing options, as well as the loans, rebates, and incentives PG&E has offered in the past, will play an important role in the future. PG&E is also seeking to reach customers with financing offerings through new avenues, such as agricultural lending institutions. Outside incentives, such as funding from irrigation districts, water agencies, and other partners may also play a role, especially for projects that include both water and energy benefits such as pumps.
- **Strategic Partnerships:** PG&E has a history of collaboration and support within the agricultural sector, including both individual customers and organizations. These relationships are a key part of how PG&E approaches the sector. Enabling agricultural customers to better understand, manage, and eliminate unnecessary energy use will not only involve the relationship between PG&E and the customer, but also strengthen PG&E's role in supporting energy efficiency with other agricultural players, such as agricultural colleges and support services.

The next section provides further detail on the selected intervention strategies and exploratory tactics (see **Figure 6.9**): PG&E's Approach and the Customer Journey).

**Figure 6.9**  
PG&E's Approach and the Customer Journey



Before proceeding with implementation, PG&E will expose each tactic described to a rigorous internal development process to assess its relative viability and cost effectiveness.

## Intervention 1 — Data Access and Awareness to enable customers to better understand their energy use

Agricultural customers have reported that lack of awareness of energy efficiency programs and lack of information around their energy usage are two of the largest barriers to implementing energy efficiency measures.<sup>50</sup> The first step in resolving this issue lies in making customer energy usage accessible and useful. The large geographical size of agricultural operations, frequently dispersed across multiple accounts, can make it difficult for data to be collected and delivered to the customer in a comprehensive and useful format. Some operations are even spread across multiple utilities. Packaging and providing this usage data to customers in a way that is meaningful to their operations is a first step in not only helping them to recognize opportunities for energy efficiency, but also connecting them with technical assistance, incentives and rebates, and other resources. While PG&E has offered a way to share and stream customer data for several years now, agricultural customers in particular often require extra help in consolidating and organizing their usage in a meaningful way due to the variety of accounts that they manage. PG&E plans to supplement currently-available tools by partnering with companies that offer comprehensive energy management services in order to deliver customer data in a format that is actionable and relevant.

Access alone is not enough — data should be accessible in a useful and applicable form that informs decision-making around energy use. In the long-term, energy usage data will be available alongside water usage data and other inputs, enabling whole-farm (or whole-winery, or whole-dairy) solutions that account for all possible impacts.

**Table 6.11** summarizes *Intervention 1: Data Access and Awareness*.

<sup>50</sup> Evergreen Economics, SDG&E Agricultural Sector Market Study; March 26, 2015; pp. 29-31.

**Table 6.11**

Intervention 1: Data Access and Awareness to enable customers to better understand their energy use

Goals: Save energy and reduce demand				
Broaden customer participation				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Data access and awareness (to enable customers to better understand their energy use)</b>	Energy is not visible or top-of-mind <ul style="list-style-type: none"> <li>Multiple accounts and a variety of different energy uses across a single operation make it difficult to collect and analyze usage data</li> <li>Lack of information is a major barrier to adoption of energy efficiency measures</li> </ul>	Continue to use existing meters and tools through which agricultural customers can view their data such as Green Button Connect for agriculture	E	S
		Complete the energy and water management solutions market assessment to identify a set of solutions appropriate for investment that meet customers' needs	N	S
		Pilot and scale a comprehensive energy-management dashboard: <ul style="list-style-type: none"> <li>Develop or source a comprehensive energy-management dashboard incorporating data from multiple accounts within a single agricultural operation, allowing customers to view their energy usage holistically and observe trends</li> </ul>	N	M/L
		Integrate energy management information into farm operations software	N	M
		Develop a benchmarking program using data sources [such as California Irrigation Management Information System (CIMIS) or Waterright] to encourage more efficient irrigation practices by promoting applied water, and therefore, energy efficiency	N	L
		Continue to offer integrated audits that explore opportunities for IDER offerings (e.g., DG/DR/EE/EV)	E	M

**Partners:** Agricultural support services; third-party software and hardware providers



Research suggests that “Analysis of communications and websites showed that very few of these reference partners provide current and consistent information about energy end-use or energy efficiency as related to farm operations. This absence of current or consistent messaging may offer utilities their most actionable opportunity for future energy efficiency programming to each segment.”<sup>51</sup> Energy management and metrics were also mentioned as an important element and that utilities should consider providing more support to agricultural customers.<sup>52</sup> PG&E will continue to improve the information and venues used to disseminate it to their agricultural customers, as increasing awareness of the benefits and value proposition of energy efficiency is the first step to move customers to take action.

The agricultural industry still lacks a comprehensive database of individual producers in the market and their respective on-farm equipment components. This makes it difficult to establish baselines, identify standard practices, and maintain communication with growers. PG&E will work with other utilities and agricultural entities to establish a database of system designs by crop and region.<sup>53</sup>

## Intervention 2— Data Analytics to help align PG&E offerings with customer positioning on their energy journey

According to a 2013 report by ACEEE, “imperfect information may be the most widespread barrier to energy efficiency. The most significant drivers include the difficulty of measuring energy savings and [the] challenge of separating energy use from individual devices.”<sup>54</sup> Overall, agricultural customers that seek to operate farms on their land face a wide range of conditions, which challenges the delivery of cost-effective programs.

PG&E will use insights from interval data to increase cost-effective savings by identifying customers with “stranded potential,” allowing for targeted interventions tailored to these customers’ specific needs.<sup>55</sup> Furthermore, PG&E will conduct market research to identify high-potential customers and market segments. The research will seek to expose high relative energy users, as well as segments with recent technological innovations. This will inform PG&E’s delivery of appropriate and timely solutions to customers on their energy efficiency journey.

**Table 6.12** summarizes *Intervention 2: Data Analytics*.

<sup>51</sup> Navigant 2013, p. xiv.

<sup>52</sup> Navigant 2013, p. xiv.

<sup>53</sup> Measure, Application, Segment, Industry (MASI): Agriculture, Navigant Consulting for Southern California Edison, 2015.

<sup>54</sup> Vaidyanathan, Nadel, Amann, et al. “Overcoming Market Barriers and Using Market Forces to Advance Energy Efficiency,” American Council for an Energy-Efficient Economy, p. vi. March 2013: <http://kms.energyefficiencycentre.org/sites/default/files/e136.pdf>

<sup>55</sup> *Analyzing Energy Efficiency Opportunities Across Building Portfolios*; ACEEE 2014 Summer Study; Ellen M. Franconi and Michael J. Bendewald, Rocky Mountain Institute; Caitlin E. Anderson, ME Engineers: [http://www.rmi.org/Content/Files/ACEEE\\_2014-Analyzing\\_Building\\_Portfolios.pdf](http://www.rmi.org/Content/Files/ACEEE_2014-Analyzing_Building_Portfolios.pdf)

**Table 6.12**

Intervention 2: Data Analytics to help align PG&E offerings with customer positioning on their energy journey

Goals: Increase operational efficiency				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
Data analytics (to help align PG&E offerings with customer positioning on their energy journey)	Customers have unique operations and variable farm conditions <ul style="list-style-type: none"> <li>• A 'one-size fits-all' approach may exclude certain classes of customers due to variable conditions</li> </ul>	Use available and/or new data to identify high-potential customers and market segments to enhance PG&E's delivery of appropriate and timely solutions to customers, and to target customers at the optimal time in their decision-making and budget cycles <sup>a</sup>	M	S
		To address data gaps, PG&E will conduct market research to identify high-potential market segments. This will inform PG&E's delivery of appropriate and timely solutions to customers on their energy efficiency journey	M	S
		Leverage energy interval data and other external data to identify ground water pumping usage patterns. This type of data will play a key role in demonstrating to growers and other agricultural customers that energy efficiency measures can also lead to significant water savings	N	M

**Partners:** Third-party vendors; local government partnerships; data service providers; EM&V research consultants

<sup>a</sup> DOE SEE Action study, p. 32.

Data analytics will play a critical role in allowing PG&E to scale energy efficiency offerings, as they enable a more accurate deployment of resources for the largest impacts. In this way, insights into customer trends not only enhance targeting efforts, but also inform strategies to promote data access and the design of technical assistance, tools, and financial incentives to get energy efficiency measures off the ground.

PG&E will conduct analyses of customer billing data and complement these with a review of tracking data on customers' adoption of energy efficiency, account representatives' knowledge of specific customers'

conditions, and further in-depth market research. Specifically, PG&E proposes further research into 1) behavioral practices in its farming communities, 2) the interaction between water and energy, and, 3) common trigger points in coming years. Data collected through various software providers targeting agricultural customers will help to inform PG&E's targeting efforts.

### Intervention 3 — Technical Assistance and Tools to empower customers to make the business case for energy efficiency

Agricultural customers face myriad challenges and decisions on a daily basis that impact the viability of their operations. Since energy efficiency is not a primary concern for most customers, it lies with PG&E to provide resources and tools to enable customers to not only understand their energy usage, but also take steps to manage it. To reach customers with these opportunities, offerings must be relevant to customer-specific operations, without impeding their ability to respond to changes. Since the drought and water availability will continue to be the primary focus for these customers, PG&E will focus on developing and delivering technologies and services that address the water/energy nexus. The intervention strategy described in **Table 6.13: Intervention 3: Technical Assistance and Tools** to empower customers to make the business case for energy efficiency shows that PG&E will implement new tactics to help customers understand and better manage their energy usage. Over the next five years, PG&E plans to build upon the success of previous programs to roll out three new tools for agricultural customers. These new tools will need to be developed and verified. The roll-out period will be phased, with the goal of having a basic calculator within two years and scaling up to new program models and Strategic Energy Management (SEM) offerings within five years.

**Table 6.13**

Intervention 3: Technical Assistance and Tools to empower customers to make the business case for energy efficiency

Goal: Provide access to technical assistance and tools				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Technical assistance and tools (to empower customers to make the business case for energy efficiency)</b>	New and emerging technologies create strong opportunity, yet still require long testing cycles to confirm market viability	Increase education and outreach to contractors and agricultural support service providers [APEP Mobile Education Centers (MEC) at pump companies for pump overhaul and VFD education] to promote current solutions and help inform future offerings	E	S
	<ul style="list-style-type: none"> <li>• Small and medium customers lack resources to effectively implement new solutions</li> <li>• Limited viable solutions exist that address customers' end-to-end operations</li> </ul>	Develop simple calculation tools that can account for specific farm conditions and can be adjusted as the market/policy changes, better enabling customers to make informed energy decisions. Pump efficiency calculators will be available in the short-term, with irrigation efficiency calculators made available in later years	N	S/M
	Energy resource constraints limit adoption	Expand pump efficiency test program model to irrigation system evaluation and design, expanding awareness and access to energy efficiency tools linked to irrigation	N	M
		Establish and launch SEM services customized for the unique conditions of the agricultural sector, with a particular focus on dairies and wineries	N	L
		Offer retrocommissioning and O&M audits and tools	M	N
		Explore new products and tools that incorporate water savings, including work with deep-root irrigation and closed-loop irrigation that save growers both energy (in reduced pumping and irrigation) and water	N	M
		Build a system for prioritizing potential agricultural products ensuring that the most needed and lowest-hanging fruit move into the marketplace at an accelerated pace. For example, engage vendors that bring national and international water/energy expertise to disseminate advanced water/energy	N	M
		Offer classes targeted toward dairies and wineries, as well as classes that incorporate specific energy efficiency technologies that impact agriculture, such as pumps and programmable logic controllers	E	S

**Partners:** Third-party vendors; local government partnerships; data service providers; EM&V research consultants

See following page for continuation of Table 6.10

**Table 6.13** (continued)

Intervention 3: Technical Assistance and Tools to empower customers to make the business case for energy efficiency

Goal: Provide access to technical assistance and tools				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Technical assistance and tools (to empower customers to make the business case for energy efficiency)</b>	New and emerging technologies create strong opportunity, yet still require long testing cycles to confirm market viability	Develop classes tailored to agricultural segments and that provide training in new technologies and techniques as they become available	N	M
		Provide training to agricultural service providers, integrating energy efficiency into the overall agricultural marketplace	N	M
	<ul style="list-style-type: none"> <li>• Small and medium customers lack resources to effectively implement new solutions</li> <li>• Limited viable solutions exist that address customers' end-to-end operations</li> </ul>	Deliver classes and materials throughout PG&E's service territory, working through regional Local Government Energy Watch programs. This model will be replicated with future trainings, allowing customers who cannot travel to the various Energy Centers to benefit	E	S
		Develop marketing materials specifically tailored to agricultural service providers that they can disseminate directly to their agricultural customers	E	S
	Energy resource constraints limit adoption	Promote opportunities for agricultural customers to use newly installed controls to support PG&E's Demand Response programs, including TDSM	E	S
		Develop resources and education to provide guidance for new entrants in coordination with PG&E service planning and customer program teams to address implications of grid integration and rate design. For example, when new or upgraded service drops are requested, information provided to customer could include details on how to participate in energy efficiency programs or educational offerings applicable to their operations	N	M

**Partners:** Agricultural support services; third-party technology and software providers; vendors; universities

Agricultural customers need assistance estimating energy savings to make the business case to invest in energy efficiency initiatives. Improved energy savings calculation tools will enhance customers' understanding of the value proposition of current and new (e.g., new sensors, controls, and water/energy management tools) agriculture energy efficiency opportunities. For example, program administrators can help assess and verify the impact of automation to offset labor costs via proactive research to identify the most energy efficient options to then provide this information to growers and vendors.<sup>56</sup>

With the legalization of cannabis in California in the November 2016 election, program administrators are starting to examine the potential growth in electric and gas demand for this agricultural segment and looking into energy efficiency options.<sup>57</sup> This is an example of how program administrators can proactively research and provide customers technical information and tools to reduce their resource use, primarily energy and water.

#### **Intervention 4 — Loans, Rebates, and Incentives to provide financial impetus to get energy efficiency measures off the ground**

Agricultural customers face first-cost barriers when it comes to purchasing new or more efficient equipment. Since energy efficiency is not a primary concern for most customers, the obligation lies with PG&E to provide financial incentives and financing options to enable customers to make investments in energy efficiency. To effectively reach customers, offerings must be relevant to customer-specific operations, without impeding their ability to respond to changes. The existing suite of financing offerings has not been adopted widely in the agricultural community. The intervention strategy outlined in **Table 6.14: Intervention 4: Loans, Rebates and Incentives** shows that PG&E will continue offering incentives/rebates to reduce the first cost and implement new tactics to help customers recognize the value of energy efficiency investments. Over the next five years, PG&E plans to build upon the success of previous programs to roll out a new offering for agricultural customers in partnership with agricultural lending institutions. PG&E also plans to pursue partnerships with government agencies to create more financially attractive solutions and lending institutions that specifically understand and serve the needs of agricultural customers. The roll-out period of these new partnerships will be phased. PG&E will maintain existing incentives/rebates, as well as On-Bill Financing (OBF) and On-Bill Repayment (OBR) offerings, while also scaling up new energy efficiency financing partnerships within the next five years.

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<sup>56</sup> Navigant 2013, p. xviii.

<sup>57</sup> Evergreen Economics 2016.

**Table 6.14**

Intervention 4: Loans, Rebates, and Incentives to provide financial impetus to get energy efficiency measures off the ground

Goal: Broaden customer participation				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Loans, rebates, and incentives (to provide financial impetus to get energy efficiency measures off the ground)</b>	<p>Available financing options are insufficient and inflexible</p> <ul style="list-style-type: none"> <li>The sector faces high upfront cost barriers to implementing energy efficiency, as well as low adoption of existing OBF/OBR offerings</li> <li>Energy efficiency alone may not offer sufficient funding to encourage customers to act<sup>a</sup></li> </ul>	Continue existing energy efficiency program offerings and measures, such as downstream calculated incentives, while also seeking nuanced, innovative means to incentivize efficiency-driven market transformation. Examples include APEP and VFDs, which target PG&E's largest energy-consuming agricultural customers	E	S
		Expand existing and planned financing offerings such as OBF and OBR, and develop new financing partnerships to address problems around capital availability for first costs, with a specific focus on project co-pays over the \$100,000 ceiling for OBF	N	M
		Explore extending OBF repayment periods beyond the current standard of five years—up to 10— to provide near-term relief for customers requiring greater flexibility for large capex investments	N	M
		Explore new, lower-risk financing structures for the sector as they become available, beyond simply supplementing existing OBF (up to the current \$20,000 cap) with OBR (which carries variable risk depending on how third-party loans are structured) for greater liquidity	N	M
		Develop partnerships with agriculture focused banks and other agricultural financial institutions	N	M
		Use outside incentives to facilitate completion of projects through water agencies and irrigation districts, as well as other partners such as the U.S. Department of Agriculture (USDA), the California DWR, and others	N	M
		Expand financial subsidies to either irrigation districts or customers that support water conservation and the water/energy nexus mandate <sup>b</sup>	M	S

**Partners:** Government agencies; agricultural lending institutions; irrigation districts; water agencies

<sup>a</sup> SDG&E Agricultural Sector Market Study.

<sup>b</sup> Evergreen Economics; SDG&E Agricultural Sector Market Study; March 26, 2015; pp. 29-31.

Major barriers to energy efficiency adoption for the agricultural sector center on having insufficient time to make upgrades or insufficient resources to replace equipment.<sup>58</sup> Other customers have reported “that first-cost of equipment and lack of financing options prevented investment in efficient equipment and energy management. Respondents from the Fruit, Tree Nut and Vine Crop, Vineyards & Wineries; and Post-Harvest Processing segments in particular reported this as an acute challenge. Utility incentives to reduce first-cost or programs to alleviate financing constraints would be meaningful prospects for new programming directed towards these segments.”<sup>59</sup> Financial support such as loans, rebates, and/or financing— as well as other sources of capital— will help agricultural customers implement more energy efficiency.

### **Intervention 5 — Strategic Partnerships to integrate energy savings into standard practices and expand customer outreach**

Through strategic partnerships with universities, agricultural support service providers, and other players in the agricultural space, PG&E will create new paths for agricultural customers to access energy efficiency resources and leverage direct support and knowledge. By engaging with customers through their trusted advisors— including institutions that have traditionally served the agricultural community— PG&E will be able to reach more customers and achieve greater uptake of energy efficiency solutions. **Table 6.15** summarizes *Intervention 5: Strategic Partnerships*.

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<sup>58</sup> Evergreen Economics 2015, Figure 9 and Figure 10.

<sup>59</sup> Navigant 2013, page xiv



**Table 6.15**

Intervention 5: Strategic Partnerships to integrate energy savings into standard practices and expand customer outreach

Goals: Increase operational efficiency Broaden customer participation				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Strategic partnerships (to integrate energy savings into standard practices and expand customer outreach)</b>	Customers prioritize other expenses/needs over energy.	Increase outreach and education to contractors and agricultural support service providers, promoting current solutions and enhancing future offerings.	E	S
	<ul style="list-style-type: none"> <li>Customers lack awareness of energy efficiency offerings.</li> </ul>	Work with universities and community colleges to incorporate new energy efficiency offerings into the existing curriculum, such as the California Agricultural Irrigation Association partnership with community colleges.	N	M
	<ul style="list-style-type: none"> <li>Agricultural customers rely on already-trusted partners when making energy decisions.</li> </ul>	Work with the Farm Bureau, trade associations, government agencies, and others to target segments with high-growth potential such as row/permanent crops, greenhouses, lighting, and HVAC loads.	M	L
		Develop materials that can be used to promote energy efficiency classes and trainings through academic partners and agricultural support service companies.	N	M

**Partners:** Agricultural support service providers; agricultural universities and community colleges; government agencies; trade associations; irrigation districts

Beyond the direct-to-customer approach, PG&E recognizes an opportunity to develop partnerships with an array of entities that support the agricultural sector. For example, PG&E will partner with agricultural support service providers (e.g., pest control applicators, irrigation and pump companies, and trade organizations) as they are the most knowledgeable about the management practices and equipment that agricultural customers are using. This allows PG&E another channel to promote and deliver new technologies or services to its agricultural customers. A complimentary approach with agricultural universities and community colleges will provide an opportunity to educate the incoming workforce on how they can optimize energy usage, and develop more robust energy-related

trainings for agricultural customers. PG&E will partner with other programs or agencies to deliver more attractive incentives beyond what energy efficiency alone could provide— especially when there is potential for water and energy savings. Through these partnerships, PG&E will increase and improve its information about its agricultural customers and how it can adapt offerings to meet their changing needs.

Beyond the direct-to-customer approach, PG&E recognizes an opportunity to develop partnerships with an array of entities that support the agricultural sector. For example, PG&E will partner with agricultural support service providers (e.g., pest control applicators, irrigation and pump companies, and trade organizations) as they are the most



## HELPING DISADVANTAGED COMMUNITIES

Energy efficiency in the agricultural sector can play a role in offering economic benefits to Californians. 7% of all jobs in California are linked to agriculture, either in the form of direct employment or through support services. Colusa, Tulare, and Merced counties, each with an unemployment rate of over 10% as of early 2016, are agriculturally dominated.

Through PG&E's WE&T program, customers in the agricultural sector can receive training in installing and maintaining energy efficient technology. Additionally, PG&E offers hands-on training in advanced pump operation and maintenance through APEP Mobile Education Centers.

knowledgeable about the management practices and equipment that agricultural customers are using. This allows PG&E another channel to promote and deliver new technologies or services to its agricultural customers. A complimentary approach with agricultural universities and community colleges will provide an opportunity to educate the incoming workforce on how they can optimize energy usage, and develop more robust energy-related trainings for agricultural customers. PG&E will partner with other programs or agencies to deliver more attractive incentives beyond what energy efficiency alone could provide— especially when there is potential for water and energy savings. Through these partnerships, PG&E will increase and improve its information about its agricultural customers and how it can adapt offerings to meet their changing needs.

Various past studies have found that industry organizations, suppliers/vendors, and/or colleagues are key information sources on how to save energy (Cadmus 2009, page v; Evergreen 2015 Fig. 3; Navigant 2015a, page xiii-xiv). For example, one study found that these non-IOU sources of energy-efficiency information were used at least three times more often than SDG&E contacts or website.<sup>60</sup> Another study found “If California utilities can leverage the credibility of these reference partners, and include efficiency opportunities in their messaging, conservation programs will likely increase measure uptake and technology adoption.”<sup>61</sup> Therefore, partnering with these other market actors with which agricultural customers are more familiar can enhance the dissemination of energy efficiency knowledge and understanding of program offerings, increasing customer's interest in pursuing energy efficiency upgrades and accessing programs to do this.

<sup>60</sup> Evergreen 2015, Figure 3.

<sup>61</sup> Navigant Consulting 2013, p. xiv.

## G. Leveraging of Cross-Cutting Resources

PG&E's cross-cutting sectors will play a pivotal role in advancing energy efficiency in the agricultural sector. PG&E has included its cross-cutting intervention strategies in each of the customer and market intervention strategy tables above. Here PG&E provides a brief review of ways in which cross-cutting initiatives fit into its agricultural strategy. For more detail on PG&E's cross-cutting programs, refer to *PG&E's Cross-Cutting Business Plan* chapter.

- **Finance:** Finance offerings will play a critical role in increasing energy efficiency opportunities for a broader customer base in the agricultural sector—through a diversified mix of loans, rebates, and incentives. See *Intervention Strategy 4: Loans, Rebates, and Incentives* for a detailed description of how PG&E plans to expand financing offerings for its agricultural customers.
- **Emerging Technologies (ET):** ET support is essential in supporting the Technical Assistance and Tools intervention strategy, monitoring the evolving energy efficiency market, and responding to new technologies, trends, and practices. See *Intervention Strategy 1: Data Access and Awareness* and *Intervention Strategy 3: Technical Assistance and Tools* for a description of how PG&E plans to explore emerging technology opportunities for its agricultural customers.
- **Workforce Education & Training (WE&T):** PG&E focuses on developing the necessary skills and knowledge to effectively implement energy efficiency projects. See *Intervention Strategy 3: Technical Assistance and Tools* and *Intervention Strategy 5: Strategic Partnerships* for an overview of the WE&T initiatives PG&E plans to launch in support of its agricultural customers.
- **Marketing:** Marketing will continue to play a major role in direct marketing of energy efficiency offerings to raise awareness of new tools and offerings, as well as building integration with Distributed Energy Resources. See *Intervention Strategy 3: Technical Assistance and Tools* and *Intervention Strategy 5: Strategic Partnerships* for an overview of how PG&E plans to integrate marketing into its portfolio in support of its agricultural customers.

## H. Integrated Demand Side Management (DSM)

While energy efficiency may be the most cost-effective way to reduce energy usage and greenhouse gas emissions, PG&E also uses other DSM strategies to support its agricultural customers best manage their energy use. These DSM strategies provide comprehensive, actionable and economically viable solutions for PG&E's agricultural community.

### Agriculture and Targeted DSM (TDSM)

Agriculture is increasingly being integrated into TDSM, particularly around grid assets where agriculture plays a major role in overall load.

Geographical targeting is a major consideration as energy efficiency is integrated into PG&E's larger TDSM initiative. One example of this is the Linden substation in East Stockton, where 212 pumps were targeted using APEP pump test data to promote pump overhauls and VFDs. PG&E has also targeted water pumping on a significant scale at the Chico substation.

Over the mid and long-term, as data around energy use becomes a larger part of how customers manage their operations, PG&E sees other opportunities to integrate TDSM — especially in dairies and wineries where there are more energy efficiency options.

### Agriculture and Distributed Energy Resources (DERs)

One of the primary goals of PG&E's energy efficiency agriculture portfolio is to better integrate controls and data into the operations of its customers permitting more control over usage and avoiding duplication of costs.

For example, demand response (DR) programs can take advantage of new controls to better integrate agricultural customers into DR programs, building a more robust response to potential grid events and leveraging control over localized, time-dependent agricultural activities like groundwater pumping. As agricultural service providers acquire greater knowledge of PG&E's energy efficiency offerings, they can tie these into other demand-side management opportunities when working with their customers.

As growers and other agricultural customers invest in distributed generation (DG), such as solar panels, strategic energy management planning can integrate DG and energy efficiency into the overall energy management of the operations. PG&E can support customers as they move toward an integrated energy management process.

### Pumping and Time of Use Rates

Groundwater pumping is the single largest contributor to overall electric load from crop production. Simultaneous groundwater pumping by large numbers of growers can have a deep impact on the overall load in the local area. PG&E has identified an alternate rate structure as one major avenue to impact customer behavior in this area, particularly when coupled with TDSM. Through rates that encourage pumping on off-peak hours, the overall electric load created by pumping can be better distributed—both beyond specific distribution circuits and throughout the course of a given week.

## I. PG&E Helping to Meet State Policy Goals

**Table 6.16** provides a summary of how PG&E's approach with the agricultural sector will address key state policies.

## J. PG&E's Partners and Commitment to Coordination

PG&E's success in the agricultural sector will rely on a broad range of program administrators, regulators, government agencies, universities and other educational entities, market actors, and stakeholders.

As discussed in Section F: PG&E's Approach to Achieving Goals, PG&E's emphasis on strategic partnerships is a key component to its vision for the agricultural sector.

### Program Administrators

PG&E will collaborate with program administrators and publicly-owned utilities (POUs) to share best practices and lessons learned, ensure consistent messaging and program delivery, minimize gaps and program overlap, and coordinate implementation of statewide offerings, and local offerings that cut across multiple service territories. For example, customers in overlapping counties should have access to the same program offerings. In addition, in the new statewide administration model, PG&E will work closely with statewide administrators leading agricultural sector statewide programs such as the Indoor Agriculture pilot. Please refer to the PG&E Statewide Administration Business Plan chapter for more information on statewide programs.

### California Public Utilities Commission (CPUC)

PG&E will work with the CPUC and staff to assess business plan performance, and identify opportunities for continuous improvement. Additionally, PG&E will coordinate with Commission staff to identify and perform market research studies and other studies to ensure the business plans metrics are effectively evaluated. As PG&E modifies existing agricultural programs, and/or develops new programs, PG&E will work in close concert with Commission staff to ensure that these programs are "EM&V-ready," and meet CEESP, and other state policy directives.

**Table 6.16**

Summary of Relevant Energy Efficiency Policies, Guidance, and PG&E Support

Policy Drivers	Guidance Given	PG&E's Support for Policy
<b>SB 350</b>	<ul style="list-style-type: none"> <li>• Double energy efficiency savings by 2030</li> <li>• Address barriers for low-income customers to energy efficiency and weatherization investments, including those in disadvantaged communities, as well as recommendations on how to increase access to energy efficiency and weatherization investments for low-income customers</li> </ul>	<p>Establish strategic partnerships with agricultural service providers to increase awareness of available energy efficiency programs and offerings</p> <ul style="list-style-type: none"> <li>• Increase outreach and education to contractors and agricultural support service providers</li> <li>• Continue to target segments with high-growth potential</li> </ul>
<b>SB 32</b>	Reduce statewide GHG emissions to 40% below 1990 levels by 2030	Maintain commitments to implementing and scaling energy efficiency (See PG&E support for SB 350, outlined above).
<b>AB 802</b>	<ul style="list-style-type: none"> <li>• Disclosure of aggregated whole building energy data</li> <li>• Benchmarking</li> <li>• Provide financial incentives based on all estimated energy savings and considering the overall reduction in normalized metered-energy consumption as a measure of energy savings</li> </ul>	<p>Offer technical assistance and tools to facilitate project completions and improve customer understanding of energy use</p> <ul style="list-style-type: none"> <li>• Develop calculators that can account for site specifics and can be adjusted as the market/policy changes</li> <li>• Expand pump efficiency test program model to irrigation system evaluation and design</li> <li>• Develop targeted and specialized SEM offerings</li> <li>• Data access to allow customers to benchmark their facilities</li> </ul>
<b>California Energy Efficiency Strategic Plan (CEESP)</b>	<ul style="list-style-type: none"> <li>• Make information on efficiency solutions readily available to motivate efficiency improvements</li> <li>• Measure and report all embedded energy savings associated with irrigation and process efficiency</li> <li>• Develop benchmarking resources, tools, and methods specific to agricultural segments</li> <li>• Identify approaches to cross market and use resource management goals across programs, funding, and technical assistance</li> <li>• Design and launch focused program for irrigation efficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Enable easy access to data to facilitate awareness of energy use</li> <li>• Develop calculators that can account for site specifics and can be adjusted as the market/policy changes</li> <li>• Expand pump efficiency test program model to irrigation system evaluation and design</li> <li>• Develop targeted and specialized SEM offerings</li> <li>• Establish strategic partnerships with agricultural service providers to increase awareness of available energy efficiency programs and offerings</li> </ul>
<b>SB 1414</b>	Effective January 1, 2017, IOUs must collect proof of permit closure before paying rebates or incentives to customers or contractors for central air-conditioning or heat pumps and their related fans.	PG&E will collect proof of permit closure before paying rebates or incentives for all downstream central air conditioning or heat pumps and their related fans, in accordance with SB 1414.
<b>AB 793</b>	<ul style="list-style-type: none"> <li>• Provide education on energy management technologies</li> <li>• Provide incentives for energy management technologies</li> </ul>	Provide incentives, rebates, and loans for energy management technologies

## Government Agencies

PG&E will maintain and/or develop new partnerships with government agencies to advance collective interests in the agricultural sector. PG&E will work closely with these agencies to develop, refine, and implement, where applicable, key intervention strategies and programmatic activities. Agencies include:

- Water agencies and irrigation districts
- California Department of Water Resources (DWR)
- California Department of Food and Agriculture (CDFA)
- United States Department of Agriculture (USDA)
  - Natural Resources Conservation Service (NRCS)
  - Rural Energy for America Program (REAP)

## Universities and Other Educational Entities

PG&E will continue to partner with universities and other educational entities that are committed to the advancement of energy-efficient agricultural practices such as Center for Irrigation Technology, CSU Fresno, and the Irrigation Training & Research Center, California Polytechnic State University (Cal Poly). Additionally, PG&E plans to build on its experience working directly with community colleges and other academic institutions to expand its work with agricultural-focused schools, incorporating new energy efficiency offerings into the existing curriculum, such as the California Agricultural Irrigation Association partnership with community colleges.

## Third-Party Implementers and Market Actors

In the rolling portfolio structure, IOUs turn to third-party implementers to propose, design, and deliver the bulk of energy efficiency programs. D. 16-08-019 sets a minimum target of 60% of the utility's total portfolio budget to be devoted to third-party programs by the end of 2020. As such, by 2020, PG&E will have transitioned at least 60% of its program design and delivery to third parties. This transition allows PG&E to engage third parties to offer a more diverse and innovative portfolio of programs to help customers use energy more efficiently. PG&E will evolve its energy efficiency portfolio to maximize energy savings in support of California's goal to double energy efficiency by 2030, and achieve cost-

effectiveness by offering programs that drive value and innovation for customers, cultivate relationships with new partners, and use its knowledge of customers to more efficiently and effectively deliver energy efficiency programs.

## K. Statewide Administration and Transition Timeline

D.16-08-019 modifies the program administration structure for all upstream and midstream programs, market transformation efforts, and select downstream programs, such that these programs become "statewide." D.16-08-019 defines statewide programs as being delivered uniformly throughout the IOU service territories and overseen by a single lead program administrator.<sup>62</sup> Statewide efforts are required to comprise at least 25% of each IOU's portfolio budget.<sup>63</sup>

Please refer to the Statewide Administration Chapter for program administrators' proposals for statewide programs and/or subprograms.

## L. Solicitation Strategies and Transition Timeline

D. 16-08-019 sets a minimum target of 60% of the utility's total portfolio budget, including administrative costs and EM&V, to be proposed, designed, and delivered by third parties by the end of 2020.<sup>64</sup> Please refer to the Portfolio Overview Chapter for PG&E's complete solicitation strategy and transition timeline, by sector.

<sup>62</sup> D.16-08-019, p. 51.

<sup>63</sup> D.16-08-019, p. 65.

<sup>64</sup> D.16-08-019, p. 74.

## M. Metrics

PG&E and the other PAs understand the importance of ensuring that all metrics provide value to the CPUC, program administrators, or other stakeholders. PG&E also recognizes that listed metrics can have powerful and unintended effects.<sup>65</sup> The following are PG&E's guiding principles for metrics.

### Metrics should...

Be used and useful by PAs to manage portfolio

Be timely

Rely on data used in program implementation

Be simple to understand and clear of any subjectivity

Have longevity

These metrics are consistent with the agreed-upon statewide guiding principles for the metrics that was shared with the Energy Division on Aug 16, 2016.

The guiding principles also indicate that metrics are not a replacement for EM&V.

Additionally, context is needed given that not all metrics have a readily-interpretable meaning. As such, PG&E provides context on the metrics in the notes section.

Note that in the business plans, PG&E is proposing to track metrics and indicators that can be frequently updated to allow PG&E staff, implementers, the CPUC, and other stakeholders to understand and manage the sector. PG&E recognizes that there are longer-term outcome and satisfaction/quality metrics and indicators that are important to track through research studies. Nonetheless, PG&E is not proposing study-based metrics at the business plan level, as they are measured less frequently and require EM&V dollars that may or may not be available. These studies will be needed to support the program; however, we recommend that these be determined through a different process (i.e., EM&V Roadmap) once the programs are finalized.

<sup>65</sup> Perrin, in an article in the American Journal of Evaluation, discussed certain known limitations of performance metrics. Among these limitations, he described varying interpretation of the "same" term and concepts, goal displacement, use of meaningless and irrelevant measures, and cost-savings vs. cost-shifting. [Perrin, Burt. 1998. *Effective Use and Misuse of Performance Measurement*. American Journal of Evaluation 1998:19;367.]

PG&E is proposing energy savings metrics as its primary metrics. PG&E also proposing additional secondary metrics, such as participation, to meet the expectations (and requests) of the CPUC; however, PG&E notes that there are times when participation may actually need to decrease in order to focus resources to reach savings goals. As such, more participation does not always track to more savings.

## Metrics Measuring Agricultural Goals

The proposed metrics are aligned with the overall program goals. Specifically, PG&E's primary goal for the agricultural sector is to:

- Save 414 GWh, 89 MW, and 3.8 MM therms (net values) by 2025. These goals are based on past PG&E performance relative to Potential Study targets.

Secondary goals that PG&E intends to track are:

- Increase operational efficiency by reducing the ratio of \$/kWh saved and \$/therm saved by approximately 10% in the mid-term.
- Broaden customer participation by offering a diverse set of programs and services (increasing from roughly 1.6% electric accounts per year and 15.7% gas accounts per year to 8% electric accounts per year and 18% of gas accounts per year by 2025).
- Provide 15% of agricultural customers with access to technical assistance and tools that break down energy use within their organization (from 0% currently being served by state-supported tools).

## Direct Effects from PG&E Efforts

PG&E's proposed sector-level metrics that can be tracked and monitored with some frequency (i.e., monthly, quarterly, or annually) are shown in **Table 6.17: PG&E-Specific Agricultural Sector Effects and Metrics**.

**Table 6.17**

**PG&E-Specific Agricultural Sector Effects and Metrics**

PG&E Goal: Save 414 GWh, 89 MW, and 3.8 MM therms by 2025 (Net Values)						
Intervention Strategies:	Metrics	Baseline (or Benchmark)	Metric Source	Short-Term Targets (1-3 years)	Mid-Term Targets (4-6 years)	Long-Term Targets (7-8+ years)
All	Electricity saved (First Year Net)	Average of 62.5 Gross GWh/yr across 2011-2015	Annual Ex Ante Net savings from program databases	49 Net GWh/yr (62 Gross GWh/yr)	52 Net GWh/yr (65 Gross GWh/yr)	54 Net GWh/yr (68 Gross GWh/yr)
	Demand saved (First Year Net)	Average of 19.1 Gross MW/yr across 2011-2015		11 Net MW/yr (13 Gross MW/yr)	11 Net MW/yr (14 Gross MW/yr)	12 Net MW/yr (15 Gross MW/yr)
	MM Therms saved (First Year Net)	Average of 1.2 Gross MM therms/yr across 2011-2015		0.5 Net MM Therms/yr (0.6 Gross MM Therms/yr)	0.5 Net MM Therms/yr (0.6 Gross MM Therms/yr)	0.5 Net MM Therms/yr (0.6 Gross MM Therms/yr)
<b>Indicators:</b> Segments (crop production, wineries, dairies, and greenhouses). <b>Notes:</b> None						
PG&E Goal: Increase operational efficiency by reducing the ratio of \$/kWh saved and \$/therm saved by approximately 10% in the mid-term						
Strategic partnerships	Levelized cost of saved energy for 2015: Net/ PAC basis	\$0.058/kWh \$0.449/Therm	Program tracking database	Same as baseline <sup>a</sup>	10% lower than baseline	TBD <sup>b</sup>
<b>Indicators:</b> Operational efficiency for third party implementers and other implementers.						
<b>Notes:</b> Levelized costs represent discounted lifecycle savings using Program Administrator Costs						
<sup>a</sup> PG&E will strive to keep levelized costs flat from baseline. However, due to new program administration and implementation structures, and other portfolio/program changes, flexibility is required to adapt to the new paradigm.						
<sup>b</sup> PG&E will update its long term targets once more data is gathered on the new administration and implementation structures.						
PG&E Goal: Reach an increasing percentage of agricultural customers through programs (increasing from 1.6% electric and 16% gas accounts to 8% electric accounts and 18% gas accounts per year by 2025)						
Loans, rebates, & incentives	Proportion of customers reached per year with energy efficiency services	<ul style="list-style-type: none"> <li>1.6% electric accounts</li> <li>15.7% gas accounts</li> </ul>	Program tracking database aggregated to the sector level	<ul style="list-style-type: none"> <li>2% electric accounts</li> <li>16% gas accounts</li> </ul>	<ul style="list-style-type: none"> <li>4% electric accounts</li> <li>17% gas accounts</li> </ul>	<ul style="list-style-type: none"> <li>8% electric accounts</li> <li>18% gas accounts</li> </ul>
<b>Indicators:</b> Segments (crop production, wineries, dairies, and greenhouses), Size						
PG&E Goal: Provide 15% of agricultural customers with access to technical assistance and tools that break down energy use within their organization by 2025						
<ul style="list-style-type: none"> <li>Data access and tools</li> <li>Technical assistance</li> </ul>	Customers with access to information that breaks down energy use within organization through PG&E-supported tools and services	New intervention, so 0% currently served by state-supported tools	Program tracking database aggregated to the sector level	Pilot efforts and identifying best tools and services; 5% of customers using tools and services within 3 years	10% of customers using tools and services	15% of customers using tools and services
<b>Indicators:</b> None. <b>Notes:</b> None						

Note: Metrics have baselines and targets, will be tracked, and when updated will compare the current value to the baseline and target. Indicators will be tracked, but have no targets and may or may not have baselines. Indicators provide useful context for the metrics.



As stated above, PG&E’s primary goal for this sector is to elicit a reduction in energy consumption, while continuing to support the health and economic growth of agricultural customers. Because a variety of uncontrollable factors can impact the energy consumption of an agricultural operation, the direct impact of energy efficiency activities may not appear as an overall decrease in demand. For instance, as water tables drop, the energy needed to lift the water increases. Addressing the efficiency of the pump and water delivery system could serve to mitigate the impact of that increasing demand. As such, there is a need for additional research to determine appropriate metrics for this sector (e.g., energy use by crop acre or weight). In the absence of better metrics, however, PG&E plans to use total energy savings and the proportion of customers participating in the program as metrics and monitor whether consolidation is occurring that may cause the metric values to lack clarity into what is occurring in the market.

## N. EM&V Research Needs

Evaluation, Measurement and Verification (EM&V) conducts research studies with the guidance of the CPUC Framework<sup>66</sup> and Protocols<sup>67</sup>. The main source of planned research will be the annual EM&V Research Plan<sup>68</sup> put together jointly by the CPUC and the PAs. This ongoing process enables stakeholders to understand and comment on research at PG&E. The PG&E-led research for this sector will be contingent upon the needs of the portfolio as a whole and the annual sector-specific research budget.<sup>69</sup>

<sup>66</sup> California Public Utilities Commission and the Project Advisory Group. The California Evaluation Framework. June 2004. [http://www.calmac.org/publications/California\\_Evaluation\\_Framework\\_June\\_2004.pdf](http://www.calmac.org/publications/California_Evaluation_Framework_June_2004.pdf)

<sup>67</sup> California Public Utilities Commission. California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals. April 2006.

<sup>68</sup> The most recent EM&V Evaluation Plan is here: <http://www.energydataweb.com/cpuc/search.aspx#>

<sup>69</sup> While PG&E provides several studies in this section, the current budgets are relatively small. The 2016 budgets in the most recent EM&V plan show approximately \$4 million for Energy Division-led impact studies and \$250,000 to \$300,000 for IOU-led process studies. These budgets cover the large commercial and industrial programs, as well as agricultural programs. The CPUC, PAs, and other stakeholders will need to discuss EM&V priorities and determine the relative availability of budget to cover any of the studies.

The bullets below show currently known information needs that may or may not be detailed in the most recent EM&V Evaluation Plan. For those study types under PG&E’s purview, PG&E plans to conduct this research as much as practical given annual EM&V budgets, although the specifics may change over time. Specific research needs for this sector, by study category, include:

- EM&V framework and methods-based studies to understand best ways to apply NMEC or options for determining impacts from market transformation efforts
  - **Energy saving methods and findings from strategic partnerships** — Because much of the program effort will revolve around scaling strategic partnerships at all levels of the agricultural ecosystem, PG&E anticipates a need for research to understand and quantify energy savings that results indirectly from strategic partnerships and support service providers.
- Market and baseline studies to understand program gap, needs, and inform design and metrics
  - **Understand and optimize metrics for the agricultural sector** — Given the variability of energy use across the agricultural sector, energy use per acre or pound of crop may be a better indicator of success for growers (although wineries, dairies, and greenhouses will require different metrics). However, it may be prudent to discuss whether evaluation resources should be spent on these relatively small energy users. If appropriate, additional studies, in collaboration with statewide partners, are needed to better understand the best metrics for future market realities.
  - **Available and future energy information tools to determine optimal resources for agricultural customers** — In coordination with the market assessments, or as a stand-alone study, PG&E recommends conducting a study to elucidate which systems customers are using, if any, to understand the specific energy use within their organization. This effort should be coupled with a market-level investigation of the tools available to agricultural customers that provide access to energy use data. PG&E will coordinate this study with research conducted by the Emerging Technologies (ET) program.

- **Additional market assessments to understand measure-specific use in sector:** While the updated potential study will start to shed more light on the agricultural sector, PG&E anticipates that it will also clearly identify key information and data gaps. As such, PG&E anticipates the need for a more detailed study to understand energy use of various measures, processes, and systems within the agricultural sector. Any data collected for this effort could also inform the development of a “knowledge base of efficiency solutions” as described in the CEESP if the information is shared through a transparent agricultural database that does not specifically identify users. Ideally, this effort would be representative of PG&E’s agricultural sector, but coordinated statewide.
- Monitoring of a sector to inform PG&E and stakeholders about accomplishments to date, sector needs, and remaining potential
  - Set up studies to enable tracking of business and implementation plan metrics
  - **Updated potential study:** Prior potential studies have underestimated the energy savings potential of this sector. Moreover, the agricultural sector data used in the potential study is limited. The current potential study includes only two measure-level categories (machine drives and process refrigeration), and thus requires additional detail. The forthcoming Energy Division-led potential study plans to include more detail on the agricultural sector (e.g., lighting, HVAC, process loads, whole building). This update will be integral in determining optimal longer-term goals and targets for this sector.
- Process studies to understand whether pilots, new programs, and new strategies are working
  - **Data access and technical assistance pilots** — PG&E will be piloting new data access tools and broader technical assistance, and will perform at least one process evaluation of a potential pilot executed (assuming available funding).

As the EM&V environment changes, PG&E is preparing to address the associated EM&V needs.<sup>70</sup> PG&E will identify specific data collection strategies early in a program’s history to support internal performance analysis and program evaluations, and will embed data collection and evaluation into the program designs whenever possible to reduce evaluation costs and increase feedback to the programs. Additionally, PG&E will ask third-party program designers to include an EM&V plan demonstrating their program evaluability, documenting what data will be collected through the program, and to propose a method for assessing impacts.

The specifics on data collection and reporting will be provided in as much detail as possible in PG&E’s Implementation Plans (IPs). Ultimately, both PG&E-led and third-party programs, PG&E will collaborate with CPUC staff and their evaluation consultants to ensure that appropriate data collection and reporting capabilities are in place to facilitate accurate evaluation.

<sup>70</sup> PG&E’s team of evaluation specialists are assigned to specific customer segments and, among their other duties, serve as internal consultants to program managers to improve program design and implementation activities.

# Agricultural Appendices

## Appendix A: Compliance Checklist

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
<b>Portfolio Summary</b>		
0	<b>Executive Summary</b>	
	<i>Company description</i>	Executive Summary p. A
	<i>Definition of market</i>	Executive Summary p. A
	<i>Mission Statement</i>	Executive Summary p. A
	<i>Purpose of Business Plan</i>	Executive Summary p. A
I.A.1, II.D.2	<b>Overview</b>	
	<i>About EE/DSM</i>	Energy Efficiency and It's Role in Helping PG&E Meet Its Energy Needs, pp. 11-16
	<i>CA Energy Needs</i>	California's Evolving Energy Efficiency Landscape, pp. 21-26
	<i>Regulatory Requirements</i>	California's Evolving Energy Efficiency Landscape, pp. 22-23
	<i>Strategic Plan</i>	California's Evolving Energy Efficiency Landscape, pp. 20-21
	<i>Legislation (e.g., AB 758, SB 350, AB 802, AB 793)</i>	California's Evolving Energy Efficiency Landscape, pp.

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		22-23
	<i>IOUs/PAs/CPUC/etc. overall role</i>	Roles in the Changing Landscape, pp. 8-9
I.A.2	<i>Broad socioeconomic and utility industry trends relevant to PA's EE programs (population, economics and markets, technology, environment/climate)</i>	California's Evolving Energy Efficiency Landscape pp. 23-26
I.B.1	<i>Vision (e.g., How PA thinks about and uses EE over next 10 years)</i>	PG&E's Vision, p. 1
I.5	<i>Compare/contrast to past cycles</i>	PG&E's Portfolio Evolution: Comparison to Past Cycles, pp. 9-11
I.B.2	<b>Goals &amp; Budget</b>	
I.B.2 & I.C.2.a	<i>Energy Saving Goals</i>	Goals, Budget and Cost-Effectiveness, pp. 27-28
I.C.2.a	<i>Portfolio Budget (sector and portfolio level per xls checklist)</i>	Goals, Budget and Cost-Effectiveness, pp. 28-30
I.C.2.a, I.C.2.d	<i>Cost-effectiveness (sector and portfolio level per xls checklist)</i>	Goals, Budget and Cost-Effectiveness, pp. 30-34
I.C.2.b	<i>Explanation of Admin Budgets (e.g., Direct/Indirect Labor, Professional/Admin personnel)</i>	Goals, Budget and Cost-Effectiveness, pp. 28-29
I.C.2.c	<i>Explanation of accounting practices</i>	Goals, Budget and Cost-

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		Effectiveness, p. 30
I.C.3 and I.C.4	<b>Intervention strategies (high level)</b>	
	<i>Overall issues/challenges/barriers</i>	PG&E's Portfolio Plan, pp. 4-7
	<i>High level summary of strategies and tools (e.g., AMI data, AB 802, procurement model, up/mid/downstream, etc.)</i>	PG&E's Portfolio Plan, pp. 4-7
I.C.4; I.D	<b>Solicitation plan</b>	
I.C.4	<i>Solicitation strategies/areas that could be SW</i>	Solicitation Strategy and Transition Timeline, pp. 35-42
I.D; II.F	<i>Proposal for transitioning the majority of portfolios to be outsourced by the end of 2020.</i>	Solicitation Strategy and Transition Timeline, pp. 35-42
<b>Sector Chapter (commercial, residential, public, agricultural, industrial, x-cutting)</b>		
II.A	<b>Summary tables</b>	
II.A	<i>Table with CE, TRC, PAC, emissions, savings, budget</i>	Goals, Budget and Cost-Effectiveness, pp. 8-11
I.C.7; II.E.1.b	<i>Metrics for sector</i>	Metrics, pp. 41-43
II.D	<b>Market characterization (overview and market/gap and other analysis)</b>	
II.D.1	<i>Electricity/NG</i>	Sector Overview, pp. 11-22
II.D.2	<i>State goals include acknowledgement of goals set by Strategic Plan, SB 350, AB758, guidance as appropriate)</i>	PG&E's Agriculture Sector Vision, pp. 1-4

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
II.D.3	<i>EE potential and goals</i>	Sector Overview, pp. 11-22
II.D.5	<i>Customer landscape (e.g., segments/subsegments, major end uses, participation rates, etc.)</i>	Sector Overview, pp. 11-22
II.D.6	<i>Major future trends that are key for the PA and its customers</i>	Agriculture Sector Trends and Challenges, pp. 20-22
II.D.7	<i>Barriers to EE and other challenges to heightened EE (e.g., regulatory, market, data)</i>	Agriculture Sector Trends and Challenges, pp. 20-22
II.2.a	<b>Description of overarching approach to the sector</b>	
	<i>Goals/strategies/approaches</i>	PG&E's Agriculture Sector Vision, pp. 1-4
I.C.6; I.D	<i>How portfolio meets Commission guidance</i>	PG&E's Agriculture Sector Vision, pp. 1-4
II.C	<i>Description of how this chapter addresses the performance challenges/barriers</i>	PG&E's Approach to Achieving Goals, pp. 23-36
I.C.4 a-c	<b>Intervention strategies (detailed)</b>	
II.D.2.a; II.E.3	<i>What specific strategies are being pursued (e.g., near, mid, long AND existing, modified, new)</i>	PG&E's Approach to Achieving Goals, pp. 23-36
I [cmt with excerpt]	<i>Why specific strategies were chosen (e.g., ID current weaknesses, best practices, or other rationale to support choice)</i>	PG&E's Approach to Achieving Goals, pp. 23-36
II.E.1.a; II.E.4	<i>How approaches advance goals discussed above</i>	PG&E's Approach to Achieving Goals, pp. 23-36

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
I.C.4; I.E; II.D.4	<i>How strategies use lessons learned from past cycles and EM&amp;V</i>	PG&E's Agriculture Sector Proposal Compared to Prior Program Cycles, pp. 5-8
I	<i>How will interventions support/augment current approaches or solve challenges</i>	PG&E's Approach to Achieving Goals, pp. 23-36
II.D.2	<i>Explanation for how these strategies address legislative mandates from AB 802, SB350, and AB 793, as well as other Commission directives for this sector, including strategic plan.</i>	PG&E's Approach to Achieving Goals, pp. 23-36
I.C.4	<i>Future expectations for intervention strategies</i>	PG&E's Approach to Achieving Goals, pp. 23-36
I.C.1; II.E.6	<i>Description of pilots</i>	PG&E's Approach to Achieving Goals, pp. 32-34
II.F	<i>Key Partners</i>	PG&E's Partners and Commitment to Coordination, pp. 38-40
I.C.5; I.D; II.B; II.C	<b>Compare/contrast to past cycles</b>	
	<i>Budget changes as appropriate</i>	Goals, Budget and Cost-Effectiveness, pp. 8-11
	<i>Modification to sector strategies</i>	PG&E's Agriculture Sector Proposal Compared to

Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
		Prior Program Cycles, pp. 5-8
	<b>Cross-cutting (sector chapters and ME&amp;O)</b>	
II.E.2; II.H, II.K	<i>Program Administrator marketing and integration with SW MEO as applicable</i>	Leveraging Cross-Cutting Resources, pp. 56-57
II.E.5; II.H	<i>Workforce, education, and training</i>	Leveraging Cross-Cutting Resources, p 37
II.H	<i>Emerging Technologies</i>	Leveraging Cross-Cutting Resources, p 37
II.H	<i>Codes &amp; Standards</i>	N/A
II.G	<b>Cross PA and Offering Coordination</b>	
II.G	<i>How strategies are coordination among regional PAs</i>	PG&E's Partners and Commitment to Coordination, pp. 38-40
II.G	<i>Proposal of statewide program administrator/approaches for this sector</i>	See Statewide Administration chapter
II.G	<i>How the sector strategies are coordinated with statewide program activities</i>	See Statewide Administration chapter
II.G	<i>How are strategies coordinated with other state agencies and initiatives (e.g., AB 758)</i>	PG&E's Partners and Commitment to Coordination, pp. 38-40
II.I	<b>EM&amp;V Considerations (statement of needs)</b>	
II.I	<i>Data collection needs</i>	EM&V Research Needs, pp. 43-44
II.I	<i>Anticipated study needs</i>	EM&V Research Needs, pp. 43-44
II.J	<b>Demand Response</b>	



Map to NRDC Compilation Document	Business Plan Element	Indicate Complete
ED Guidance (p.8)	<i>How EE measures use up-to-date DR enabling technologies to be "DR ready"</i>	Integrated Demand Side Management, pp. 37-38
ED Guidance (p.8)	<i>How duplication of costs for ME&amp;O, site visits, etc. is avoided for dual-purpose technologies</i>	Integrated Demand Side Management, pp. 37-38
ED Guidance (p.9)	<i>How strategies facilitate customer understanding of peak load, cost, and opportunities to reduce</i>	Integrated Demand Side Management, pp. 37-38
II.K	<b>Residential Rate Reform</b>	
ED Guidance (p.9)	<i>How BPs will help reduce load during TOU periods</i>	N/A
ED Guidance (p.9)	<i>How BP will diminish barriers to load reduction during TOU periods</i>	N/A
ED Guidance (p.9)	<i>How strategies will provide info to customers and/or provide a tool to show how program may impact customer energy usage during different TOU periods</i>	N/A
ED Guidance (p.9)	<i>How strategies will analyze whether a customer may experience greater savings by switching to a different, opt-in TOU rate</i>	N/A
ED guidance (p.9)	<i>ME&amp;O re: rate reform</i>	N/A
II.L	<b>Integrated Demand Side Resources</b>	Integrated Demand Side Management, pp. 37-38
II.M	<b>Zero-Emission Vehicles (EVs)</b>	N/A
II.N	<b>Energy Savings Assistance (Multi-family Focused)</b>	N/A
	<b>Appendices</b>	
	<i>Additional Customer Data</i>	Appendix C
	<i>Cited research</i>	Appendix B
	<i>CAEECC stakeholder input resolution</i>	See Input Tracker

## Appendix B: References

ACEEE 2014 Summer Study. *Analyzing Energy Efficiency Opportunities Across Building Portfolios*. Ellen M. Franconi and Michael J. Bendewald, Rocky Mountain Institute; Caitlin E. Anderson, ME Engineers.

[http://www.rmi.org/Content/Files/ACEEE\\_2014-Analyzing\\_Building\\_Portfolios.pdf](http://www.rmi.org/Content/Files/ACEEE_2014-Analyzing_Building_Portfolios.pdf)

American Farmland Trust. December 2010. *California Agricultural Vision: Strategies for Sustainability*; A Report by American Farmland Trust to the California Department of Food and Agriculture and the State Board of Food and Agriculture.

[https://www.cdfa.ca.gov/agvision/docs/Ag\\_Vision\\_Final\\_Report\\_Dec\\_2010.pdf](https://www.cdfa.ca.gov/agvision/docs/Ag_Vision_Final_Report_Dec_2010.pdf)

Cadmus Group, Inc. July 27, 2009. *Process Evaluation of PG&E's Agricultural and Food Processing Program*. Prepared for PG&E. Final Report.

[http://calmac.org/publications/SCE\\_Pump\\_Testing\\_Program\\_Final\\_Report.pdf](http://calmac.org/publications/SCE_Pump_Testing_Program_Final_Report.pdf)

Cadmus Group. October 26, 2012. *Process Evaluation of California's Continuous Energy Improvement Pilot Program*. Prepared for SCE, SCG, PG&E, and SDG&E.

Cadmus Group. October 2, 2013. *Impact Evaluability Assessment of California's Continuous Energy Improvement Pilot Program*. Prepared for CPUC.

[http://calmac.org/publications/CA\\_CEI\\_Pilot\\_Evaluability\\_Assessment\\_REVISED\\_FINAL.pdf](http://calmac.org/publications/CA_CEI_Pilot_Evaluability_Assessment_REVISED_FINAL.pdf)

*California Agriculture*. July 1, 2000. *Structural Adjustment, Resources, Global Economy to Challenge California Agriculture*. Warren E. Johnston, Harold O. Carter. 54(4):16-22. DOI: 10.3733/ca.v054n04p16.

<http://calag.ucanr.edu/Archive/?article=ca.v054n04p16>

California Department of Food and Agriculture (CDFA). *California Agricultural Statistics Review, 2014–2015*. <https://www.cdfa.ca.gov/statistics/PDFs/2015Report.pdf>

California Energy Commission. June 29, 2016. *2015 Integrated Energy Policy Report (IEPR)*. Docket # 15-IEPR-01, CEC-100-2015-001-CMF. [http://www.energy.ca.gov/2015\\_energypolicy/](http://www.energy.ca.gov/2015_energypolicy/)

California Natural Resources Agency. April 30, 2014. *Report to the Governor's Drought Task Force—Groundwater Basins with Potential Water Shortages and Gaps in Groundwater Monitoring*.

[http://www.water.ca.gov/waterconditions/docs/Drought\\_Response-Groundwater\\_Basins\\_April30\\_Final\\_BC.pdf](http://www.water.ca.gov/waterconditions/docs/Drought_Response-Groundwater_Basins_April30_Final_BC.pdf)

California Public Utilities Commission. April 27, 2016. *Staff White Paper on Energy Efficiency Baselines: For Implementation of Assembly Bill 802*.

<http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M161/K471/161471852.PDF>

Dairy Cares. May 2016. *Dairies Dread Proposed Climate Change Regulations*. San Joaquin Valley Business Journal. <http://dairycares.com/node/222>

Evergreen Economics. March 26, 2015. *SDG&E Agricultural Sector Market Study*. Prepared for San Diego Gas & Electric. Final Report. Advice Letter 2627-E-A/2309-G-A (U902-M) CALMAC ID SDG0292.0.

[http://calmac.org/publications/SDG%26E\\_Agricultural\\_Sector\\_Market\\_Study\\_Final\\_Report\\_032615.pdf](http://calmac.org/publications/SDG%26E_Agricultural_Sector_Market_Study_Final_Report_032615.pdf)

Evergreen Economics. July 15, 2016. *SDG&E Cannabis Agriculture Energy Demand Study*. Prepared for SDG&E Co. Final Report.

[http://calmac.org/publications/SDG%26E\\_Cannabis\\_Ag\\_Energy\\_Demand\\_Final\\_Report\\_071516.pdf](http://calmac.org/publications/SDG%26E_Cannabis_Ag_Energy_Demand_Final_Report_071516.pdf)

Gore, Bob. January 13, 2015. *6 Trends Shaping Agricultural Technology in 2015*. TechWire.

<http://www.techwire.net/commentary/6-trends-shaping-agricultural-technology-2015.html>

Greenbiz. April 13, 2015. *Answers to CA drought: Regulate Groundwater Use, Grow Less Thirsty Crops, Apply Tech*. <https://www.greenbiz.com/article/some-potential-answers-californias-drought>

Greenhouse Grower. May 8, 2015. *2015 Greenhouse Grower Top 100 Grower List*.

<http://www.greenhousegrower.com/business-management/top-100/2015-greenhouse-grower-top-100-grower-list/>

ITRC – Cal Poly. January 2013. *SCE Pump Testing Program: Pump Repair Attitudes and Behavior*.

Prepared for SCE. [http://calmac.org/publications/SCE\\_Pump\\_Testing\\_Program\\_Final\\_Report.pdf](http://calmac.org/publications/SCE_Pump_Testing_Program_Final_Report.pdf)

Itron. 2015. *2013 Custom Impact Evaluation Industrial, Agricultural, and Large Commercial. Final Report*.

Prepared for CPUC. July 17, 2015. [http://calmac.org/publications/IALC\\_2013\\_Report\\_Final\\_071715.pdf](http://calmac.org/publications/IALC_2013_Report_Final_071715.pdf)

Itron. April 29, 2016. *2014 Custom Impact Evaluation Industrial, Agricultural, and Large Commercial. Final Report*. Prepared for CPUC.

<http://www.energydataweb.com/cpucFiles/pdaDocs/1518/IALC%202014%20Final%20Report%20April%202016.pdf>

Itron and DNV-GL. July 14, 2014. *WO033 Custom Impact Evaluation. Final Report*. Prepared for CPUC.

[http://calmac.org/publications/2010-12\\_WO033\\_Custom\\_Impact\\_Eval\\_Report\\_Final.pdf](http://calmac.org/publications/2010-12_WO033_Custom_Impact_Eval_Report_Final.pdf)

Itron and ERS. February 23, 2016. *2014 Downstream Nonresidential Downstream Deemed ESPI Low-Pressure Sprinkler Nozzle Impact Evaluation Report*. Prepared for CPUC.

<http://www.energydataweb.com/cpucFiles/pdaDocs/1450/ESPI%20Sprinkler%20Nozzle%20Report%20and%20Appendices.pdf>

Kema. February 10, 2010. *Evaluation Report: PG&E Agriculture and Food Processing Program: Greenhouse Heat Curtain and Infrared Film Measures*. Prepared for CPUC.

[http://calmac.org/publications/PG%26E\\_Ag-Food\\_Eval\\_Report\\_V1\\_021010.pdf](http://calmac.org/publications/PG%26E_Ag-Food_Eval_Report_V1_021010.pdf)

Kennedy/Jenks. October 15, 2010. *Energy Use in Wastewater Treatment in the Food and Beverage Industry*. Prepared for PG&E. [http://calmac.org/publications/PGE\\_Energy-Use-WW-Treatment-Food-Bev-Industry\\_10-15-10\\_%28unlocked%29.pdf](http://calmac.org/publications/PGE_Energy-Use-WW-Treatment-Food-Bev-Industry_10-15-10_%28unlocked%29.pdf)

Navigant Consulting, Inc. 2013. *Market Characterization Report for 2010-2012 Statewide Agricultural Energy Efficiency Potential and Market Characterization Study*. Prepared for PG&E, CPUC, SDG&E, SCE, and SCG. May 6, 2013.

[http://calmac.org/publications/CA\\_Ag\\_Mrkt\\_Characterization\\_Final\\_5-13-13.pdf](http://calmac.org/publications/CA_Ag_Mrkt_Characterization_Final_5-13-13.pdf)

Navigant Consulting, Inc. 2015. *Energy Efficiency Potential and Goals Study for 2015 and Beyond*. Prepared for the California Public Utility Commission. Final September 25, 2015.

<http://www.cpuc.ca.gov/General.aspx?id=2013>

Navigant Consulting, Inc. 2015a. *Measure, Application, Segment, Industry (MASI): Agriculture*. Prepared for Southern California Edison. March 31, 2015.

[http://calmac.org/publications/MASI\\_Agriculture\\_Final\\_Report.pdf](http://calmac.org/publications/MASI_Agriculture_Final_Report.pdf)

Navigant Consulting, Inc. 2015b. *Energy Efficiency Potential and Goals Study for 2015 and Beyond*. Prepared for the California Public Utility Commission. Final September 25, 2015.

<http://www.cpuc.ca.gov/General.aspx?id=2013>

Nunez, Christina. October 30, 2015. *Could Solar Energy Be California's Next Cash Crop?* National Geographic. <http://news.nationalgeographic.com/energy/2015/10/151030-farmland-agriculture-solar-energy-conversion/>

Pacific Gas & Electric Company (PG&E). *Agricultural Pumping Efficiency Program (APEP)*. APEP-01 3/04.

<http://www.pumpefficiency.org/wp-content/uploads/2015/05/APEPSeminarbooklet.pdf>

Pacific Institute. July 2009. *Sustaining California Agriculture in an Uncertain Future*. Heather Cooley, Juliet Christian-Smith, and Peter Gleick. <http://pacinst.org/app/uploads/2014/04/sustaining-california-agriculture-pacinst-full-report.pdf>

Perrin, Burt. September 1998. *Effective Use and Misuse of Performance Measurement*. *American Journal of Evaluation* 1998:19(3);367-379.

[https://www.researchgate.net/publication/238224436\\_Effective\\_Use\\_and\\_Misuse\\_of\\_Performance\\_Measurement](https://www.researchgate.net/publication/238224436_Effective_Use_and_Misuse_of_Performance_Measurement)

Rogers, Everett M., 2003: *Diffusion of Innovations*. Fifth Edition. The Free Press of Glencoe, New York. 550 pp. <http://www.simonandschuster.com/books/Diffusion-of-Innovations-5th-Edition/Everett-M-Rogers/9780743222099>

Smallwood, P., and S. Vijay. November 2016. *Horticulture Lighting: Market Analysis and Forecast 2016*. Strategies Unlimited-Pennwell.

Vaidyanathan, Nadel, Amann, et al. March 2013. *Overcoming Market Barriers and Using Market Forces to Advance Energy Efficiency*. American Council for an Energy-Efficient Economy.

<http://kms.energyefficiencycentre.org/sites/default/files/e136.pdf>

## Appendix C: Customer Data

**Table C.1: 2015 Electric Customers: Snapshot of Usage and Average Usage by Customer Size**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Electricity Usage (GWh)</b>													
Crop Production	3,273.1	909.5	192.4	(0.5)	4,374.5	74.8%	20.8%	4.4%	100%	47.3%	13.1%	2.8%	63.2%
Wineries, Breweries, and Distilleries	617.3	110.3	12.2	0.3	740.1	83.4%	14.9%	1.7%	100%	8.9%	1.6%	0.2%	10.7%
Dairy	574.0	60.4	2.9	0.1	637.3	90.1%	9.5%	0.5%	100%	8.3%	0.9%	0.0%	9.2%
Support Activity / Forestry / Hunting	543.2	40.5	7.3	(0.3)	590.7	92.0%	6.9%	1.2%	100%	7.9%	0.6%	0.1%	8.5%
Animal Production (non Dairy)	268.3	87.5	17.9	0.1	373.8	71.8%	23.4%	4.8%	100%	3.9%	1.3%	0.3%	5.4%
Green Houses	168.6	28.4	5.2	0.3	202.5	83.3%	14.0%	2.6%	100%	2.4%	0.4%	0.1%	2.9%
<b>Total</b>	<b>5,444.5</b>	<b>1,236.5</b>	<b>238.0</b>	<b>0.02</b>	<b>6,919.0</b>	<b>79%</b>	<b>18%</b>	<b>3%</b>	<b>100%</b>	<b>78.7%</b>	<b>17.9%</b>	<b>3.4%</b>	<b>100.0%</b>
<b>Customers (Number of customers)</b>													
Crop Production	25,246	22,908	24,963	914	74,031	34.1%	30.9%	33.7%	99%	25.6%	23.3%	25.4%	74.3%
Wineries, Breweries, and Distilleries	2,215	1,982	1,322	49	5,568	39.8%	35.6%	23.7%	99%	2.2%	2.0%	1.3%	5.6%
Dairy	3,544	1,149	484	23	5,200	68.2%	22.1%	9.3%	100%	3.6%	1.2%	0.5%	5.3%
Support Activity / Forestry / Hunting	2,492	839	917	38	4,286	58.1%	19.6%	21.4%	99%	2.5%	0.9%	0.9%	4.3%
Animal Production (non Dairy)	1,670	2,175	3,695	101	7,641	21.9%	28.5%	48.4%	99%	1.7%	2.2%	3.8%	7.7%
Green Houses	581	579	533	27	1,720	33.8%	33.7%	31.0%	98%	0.6%	0.6%	0.5%	1.7%
<b>Total</b>	<b>35,748</b>	<b>29,632</b>	<b>31,914</b>	<b>1,152</b>	<b>98,446</b>	<b>36%</b>	<b>30%</b>	<b>32%</b>	<b>99%</b>	<b>36.3%</b>	<b>30.1%</b>	<b>32.4%</b>	<b>98.8%</b>
<b>Average Usage (kWh per customer)</b>													
Crop Production	129,648	39,701	7,706	(502)	59,090								
Wineries, Breweries, and Distilleries	278,687	55,662	9,255	5,734	132,926								
Dairy	161,966	52,539	5,944	3,444	122,563								
Support Activity / Forestry / Hunting	217,977	48,230	7,986	(7,622)	137,820								
Animal Production (non Dairy)	160,632	40,221	4,856	1,476	48,924								
Green Houses	290,257	49,043	9,773	9,455	117,732								
<b>Average</b>	<b>152,302</b>	<b>41,729</b>	<b>7,456</b>	<b>14</b>	<b>70,282</b>								

- Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

**Table C.2: 2015 Electric Savings Participants: Snapshot of Savings and Average Savings by Customer Size**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Electricity Savings (MWh)</b>													
Crop Production	28,489	7,122	2,053	346	38,009.5	75.0%	18.7%	5.4%	99%	46.5%	11.6%	3.4%	61.5%
Wineries, Breweries, and Distilleries	7,412	565	73	46	8,096.3	91.5%	7.0%	0.9%	99%	12.1%	0.9%	0.1%	13.1%
Dairy	5,956	743	55	-	6,755.2	88.2%	11.0%	0.8%	100%	9.7%	1.2%	0.1%	11.0%
Support Activity / Forestry / Hunting	2,713	164	166	6	3,048.1	89.0%	5.4%	5.5%	100%	4.4%	0.3%	0.3%	5.0%
Animal Production (non Dairy)	3,099	915	228	-	4,241.9	73.1%	21.6%	5.4%	100%	5.1%	1.5%	0.4%	6.9%
Green Houses	1,034	69	-	-	1,103.2	93.7%	6.3%	0.0%	100%	1.7%	0.1%	0.0%	1.8%
<b>Total</b>	<b>48,703</b>	<b>9,578</b>	<b>2,575</b>	<b>398</b>	<b>61,254.3</b>	<b>80%</b>	<b>16%</b>	<b>4%</b>	<b>99%</b>	<b>79.5%</b>	<b>15.6%</b>	<b>4.2%</b>	<b>99.4%</b>
<b>Participants (Number of Participants)</b>													
Crop Production	452	326	169	13	960	47.1%	34.0%	17.6%	99%	29.6%	21.3%	11.1%	62.0%
Wineries, Breweries, and Distilleries	95	73	20	2	190	50.0%	38.4%	10.5%	99%	6.2%	4.8%	1.3%	12.3%
Dairy	94	31	5	-	130	72.3%	23.8%	3.8%	100%	6.2%	2.0%	0.3%	8.5%
Support Activity / Forestry / Hunting	60	12	11	1	84	71.4%	14.3%	13.1%	99%	3.9%	0.8%	0.7%	5.4%
Animal Production (non Dairy)	76	34	13	-	123	61.8%	27.6%	10.6%	100%	5.0%	2.2%	0.9%	8.0%
Green Houses	33	8	-	-	41	80.5%	19.5%	0.0%	100%	2.2%	0.5%	0.0%	2.7%
<b>Total</b>	<b>810</b>	<b>484</b>	<b>218</b>	<b>16</b>	<b>1,528</b>	<b>53%</b>	<b>32%</b>	<b>14%</b>	<b>99%</b>	<b>53.0%</b>	<b>31.7%</b>	<b>14.3%</b>	<b>99.0%</b>
<b>Average Savings (kWh per Participant)</b>													
Crop Production	63,028	21,847	12,148	26,606	39,593								
Wineries, Breweries, and Distilleries	78,021	7,739	3,654	23,129	42,612								
Dairy	63,367	23,981	11,062	-	51,963								
Support Activity / Forestry / Hunting	45,209	13,642	15,125	5,518	36,287								
Animal Production (non Dairy)	40,780	26,909	17,514	-	34,487								
Green Houses	31,328	8,667	-	-	26,906								
<b>Average</b>	<b>60,127</b>	<b>19,790</b>	<b>11,814</b>	<b>24,854</b>	<b>40,088</b>								
<b>Participation Rates (% Participants per Cust.)</b>													
Crop Production	1.8%	1.4%	0.7%	1.4%	1.3%								
Wineries, Breweries, and Distilleries	4.3%	3.7%	1.5%	4.1%	3.4%								
Dairy	2.7%	2.7%	1.0%	0.0%	2.5%								
Support Activity / Forestry / Hunting	2.4%	1.4%	1.2%	2.6%	2.0%								
Animal Production (non Dairy)	4.6%	1.6%	0.4%	0.0%	1.6%								
Green Houses	5.7%	1.4%	0.0%	0.0%	2.4%								
<b>Average</b>	<b>2.3%</b>	<b>1.6%</b>	<b>0.7%</b>	<b>1.4%</b>	<b>1.6%</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

**Table C.3: 2015 Gas Customers: Snapshot of Usage and Average Usage by Customer Size**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Gas Usage (MM Therms)</b>													
Crop Production	9.2	4.1	0.2	0.004	13.4	68.5%	30.3%	1.2%	100%	12.0%	5.3%	0.2%	17.5%
Wineries, Breweries, and Distilleries	21.4	2.3	0.2	0.007	23.9	89.7%	9.5%	0.7%	100%	28.0%	3.0%	0.2%	31.2%
Dairy	0.1	0.02	0.02	-	0.2	72.8%	15.6%	11.6%	100%	0.1%	0.0%	0.0%	0.2%
Support Activity / Forestry / Hunting	7.1	1.4	0.1	7.00E-06	8.5	82.8%	16.4%	0.8%	100%	9.2%	1.8%	0.1%	11.1%
Animal Production (non Dairy)	2.6	0.3	0.1	1.00E-04	3.0	86.0%	11.6%	2.4%	100%	3.4%	0.5%	0.1%	3.9%
Green Houses	24.8	2.6	0.1	0.006	27.6	90.1%	9.3%	0.5%	100%	32.5%	3.4%	0.2%	36.0%
<b>Total</b>	<b>65.2</b>	<b>10.7</b>	<b>0.6</b>	<b>0.02</b>	<b>76.5</b>	<b>85%</b>	<b>14%</b>	<b>1%</b>	<b>100%</b>	<b>85.2%</b>	<b>13.9%</b>	<b>0.8%</b>	<b>100.0%</b>
<b>Customers (Number of customers)</b>													
Crop Production	268	358	291	8	925	29.0%	38.7%	31.5%	99%	9.9%	13.3%	10.8%	34.0%
Wineries, Breweries, and Distilleries	309	365	221	6	901	34.3%	40.5%	24.5%	99%	11.5%	13.5%	8.2%	33.2%
Dairy	17	11	14	-	42	40.5%	26.2%	33.3%	100%	0.6%	0.4%	0.5%	1.6%
Support Activity / Forestry / Hunting	109	103	136	1	349	31.2%	29.5%	39.0%	100%	4.0%	3.8%	5.0%	12.9%
Animal Production (non Dairy)	57	50	61	1	169	33.7%	29.6%	36.1%	99%	2.1%	1.9%	2.3%	6.2%
Green Houses	111	107	85	7	310	35.8%	34.5%	27.4%	98%	4.1%	4.0%	3.2%	11.2%
<b>Total</b>	<b>871</b>	<b>994</b>	<b>808</b>	<b>23</b>	<b>2,696</b>	<b>32%</b>	<b>37%</b>	<b>30%</b>	<b>99%</b>	<b>32.3%</b>	<b>36.9%</b>	<b>30.0%</b>	<b>99.1%</b>
<b>Average Usage (Therms per customer)</b>													
Crop Production	34,229	11,350	547	502	14,486								
Wineries, Breweries, and Distilleries	69,381	6,252	804	1,172	26,532								
Dairy	6,430	2,126	1,246	-	3,575								
Support Activity / Forestry / Hunting	64,683	13,523	501	7	24,388								
Animal Production (non Dairy)	45,210	6,945	1,161	100	17,723								
Green Houses	223,852	23,982	1,738	861	88,927								
<b>Average</b>	<b>74,852</b>	<b>10,739</b>	<b>793</b>	<b>747</b>	<b>28,386</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
Small: < 40,000 KWh or < 10,000 Therms  
Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers

**Table C.4: 2015 Gas Savings Participants: Snapshot of Savings and Average Savings by Customer Size**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total <sup>d</sup>
<b>Gas Savings (Therms)</b>													
Crop Production	1,660	5,318	5,906	(12)	12,872	12.9%	41.3%	45.9%	100%	0.3%	1.0%	1.2%	3%
Wineries, Breweries, and Distilleries	297,783	12,539	951	(21)	311,252	95.7%	4.0%	0.3%	100%	58.1%	2.4%	0.2%	61%
Dairy	276	8	113	-	397	69.5%	2.0%	28.5%	100%	0.1%	0.0%	0.0%	0.1%
Support Activity / Forestry / Hunting	(648)	1,633	(39)	676	1,622	-40%	101%	-2.4%	58%	-0.1%	0.3%	0.0%	0.2%
Animal Production (non Dairy)	(2,192)	(169)	(526)	-	(2,887)	75.9%	5.9%	18.2%	100%	-0.4%	0.0%	-0.1%	-1%
Green Houses	188,682	599	-	-	189,281	99.7%	0.3%	0.0%	100%	36.8%	0.1%	0.0%	37%
<b>Total</b>	<b>485,559</b>	<b>19,929</b>	<b>6,405</b>	<b>644</b>	<b>512,537</b>	<b>95%</b>	<b>4%</b>	<b>1%</b>	<b>100%</b>	<b>95%</b>	<b>4%</b>	<b>1%</b>	<b>100%</b>
<b>Participants (Number of Participants)</b>													
Crop Production	48	64	61	2	175	27.4%	36.6%	34.9%	99%	11.3%	15.1%	14.4%	41%
Wineries, Breweries, and Distilleries	40	56	12	1	109	36.7%	51.4%	11.0%	99%	9.4%	13.2%	2.8%	25%
Dairy	6	5	4	-	15	40.0%	33.3%	26.7%	100%	1.4%	1.2%	0.9%	4%
Support Activity / Forestry / Hunting	26	8	4	1	39	66.7%	20.5%	10.3%	97%	6.1%	1.9%	0.9%	9%
Animal Production (non Dairy)	40	16	7	-	63	63.5%	25.4%	11.1%	100%	9.4%	3.8%	1.7%	15%
Green Houses	18	5	-	-	23	78.3%	21.7%	0.0%	100%	4.2%	1.2%	0.0%	5%
<b>Total</b>	<b>178</b>	<b>154</b>	<b>88</b>	<b>4</b>	<b>424</b>	<b>42%</b>	<b>36%</b>	<b>21%</b>	<b>99%</b>	<b>42%</b>	<b>36%</b>	<b>21%</b>	<b>99%</b>
<b>Average Savings (Therms per Participant)</b>													
Crop Production	35	83	97	(6)	74								
Wineries, Breweries, and Distilleries	7,445	224	79	(21)	2,856								
Dairy	46	2	28	-	26								
Support Activity / Forestry / Hunting	(25)	204	(10)	676	42								
Animal Production (non Dairy)	(55)	(11)	(75)	-	(46)								
Green Houses	10,482	120	-	-	8,230								
<b>Average</b>	<b>2,728</b>	<b>129</b>	<b>73</b>	<b>161</b>	<b>1,209</b>								
<b>Participation Rates (% Participants per Cust.)</b>													
Crop Production	17.9%	17.9%	21.0%	25.0%	18.9%								
Wineries, Breweries, and Distilleries	12.9%	15.3%	5.4%	16.7%	12.1%								
Dairy	35.3%	45.5%	28.6%	0%	35.7%								
Support Activity / Forestry / Hunting	23.9%	7.8%	2.9%	100.0%	11.2%								
Animal Production (non Dairy)	70.2%	32.0%	11.5%	0%	37.3%								
Green Houses	16.2%	4.7%	0%	0%	7.4%								
<b>Average</b>	<b>20.4%</b>	<b>15.5%</b>	<b>10.9%</b>	<b>17.4%</b>	<b>15.7%</b>								

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
Small: < 40,000 KWh or < 10,000 Therms  
Unknown: Insufficient data (<12 months)

<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data

<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data

<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers



## Sub-Segment Tables

### Table C.5: Crop Production Details: 2015 Electric Usage and Savings with 2011-2015 Trends

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Crop Production</b>													
Electricity Usage (GWh)	3,273.1	909.5	192.4	(0.5)	4,374.5	74.8%	20.8%	4.4%	100%	47.3%	13.1%	2.8%	63%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	25,246	22,908	24,963	914	74,031	34.1%	30.9%	33.7%	99%	25.6%	23.3%	25.4%	74%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	129,648	39,701	7,706	(502)	59,090								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	28,489	7,122	2,053	346	38,009.5	75.0%	18.7%	5.4%	99%	46.5%	11.6%	3.4%	61%
Savings Trends (2011-2015)													
Participants (Number of Participants)	452	326	169	13	960	47.1%	34.0%	17.6%	99%	29.6%	21.3%	11.1%	62%
Participant (2011-2015)													
Average Savings (kWh per Participant)	63,028	21,847	12,148	26,606	39,593								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	1.8%	1.4%	0.7%	1.4%	1.3%								
Participation Rate Trends (2011-2015)													

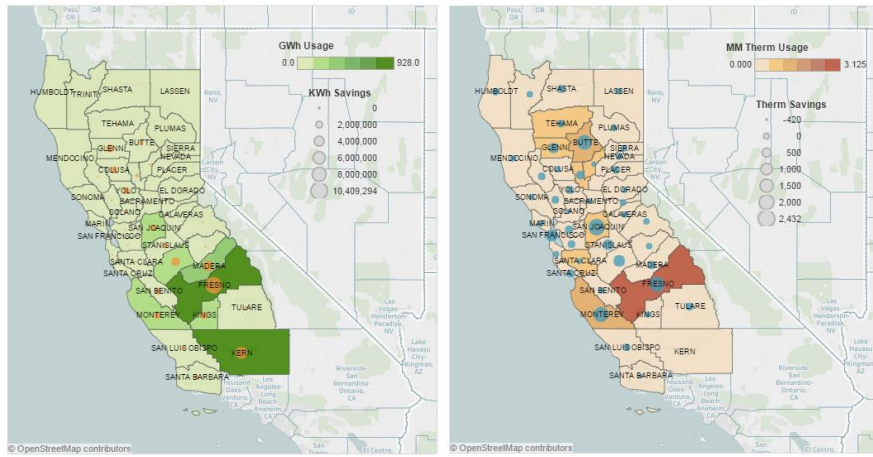
Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

### Table C.6: Crop Production Details: 2015 Gas Usage and Savings with 2011-2015 Trends

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Crop Production</b>													
Gas Usage (MM Therms)	9.2	4.1	0.2	0.0	13.4	68.5%	30.3%	1.2%	100%	12.0%	5.3%	0.2%	18%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	268	358	291	8	925	29.0%	38.7%	31.5%	99%	9.9%	13.3%	10.8%	34%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	34,229	11,350	547	502	14,486								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	1,659.7	5,317.9	5,906.0	(11.5)	12,872.0	12.9%	41.3%	45.9%	100%	0.3%	1.0%	1.2%	3%
Savings Trends (2011-2015)													
Participants (Number of Participants)	48	64	61	2	175	27.4%	36.6%	34.9%	99%	11.3%	15.1%	14.4%	41%
Participant (2011-2015)													
Average Savings (Therms per Participant)	35	83	97	(6)	74								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	18%	18%	21%	25%	19%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.1: Crop Production Details: 2015 Energy Usage and Savings



**Table C.6: Wineries, Breweries, and Distilleries Details: 2015 Electric Usage and Savings with 2011-2015 Trends**

Wineries, Breweries, and Distilleries	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
Electricity Usage (GWh)	617.3	110.3	12.2	0.3	740.1	83.4%	14.9%	1.7%	100%	8.9%	1.6%	0.2%	11%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	2,215	1,982	1,322	49	5,568	39.8%	35.6%	23.7%	99%	2.2%	2.0%	1.3%	6%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	278,687	55,662	9,255	5,734	132,926								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	7,412	565	73	46	8,096.3	91.5%	7.0%	0.9%	99%	12.1%	0.9%	0.1%	13%
Savings Trends (2011-2015)													
Participants (Number of Participants)	95	73	20	2	190	50.0%	38.4%	10.5%	99%	6.2%	4.8%	1.3%	12%
Participant (2011-2015)													
Average Savings (kWh per Participant)	78,021	7,739	3,654	23,129	42,612								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	4.3%	3.7%	1.5%	4.1%	3.4%								
Participation Rate Trends (2011-2015)													

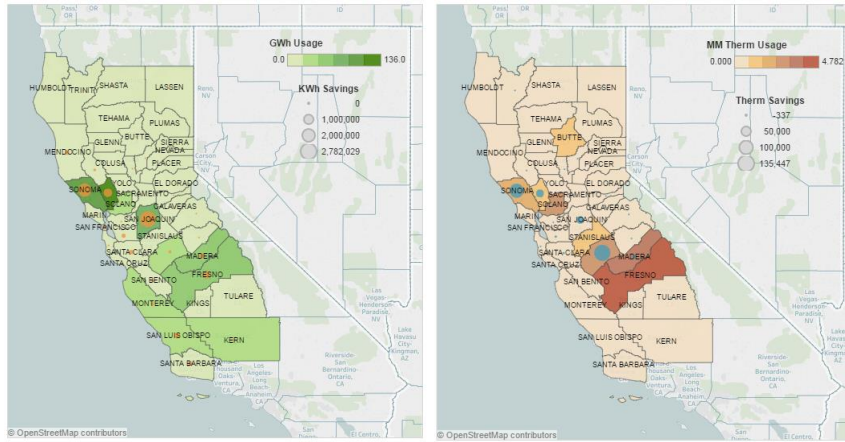
Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.7: Wineries, Breweries, and Distilleries: 2015 Gas Usage and Savings with 2011-2015 Trends**

Wineries, Breweries, and Distilleries	Customer By Size <sup>a</sup>					Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>	Total	Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
Gas Usage (MM Therms)	21.4	2.3	0.2	0.0	23.9	89.7%	9.5%	0.7%	100%	28.0%	3.0%	0.2%	31%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	309	365	221	6	901	34.3%	40.5%	24.5%	99%	11.5%	13.5%	8.2%	33%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	69,381	6,252	804	1,172	26,532								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	297,783	12,539	951	(20.7)	311,251.8	95.7%	4.0%	0.3%	100%	58.1%	2.4%	0.2%	61%
Savings Trends (2011-2015)													
Participants (Number of Participants)	40	56	12	1	109	36.7%	51.4%	11.0%	99%	9.4%	13.2%	2.8%	25%
Participant (2011-2015)													
Average Savings (Therms per Participant)	7,445	224	79	(21)	2,856								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	13%	15%	5%	17%	12%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.2: Wineries, Breweries, and Distilleries: 2015 Energy Usage and Savings



**Table C.8: Dairy Details: 2015 Electric Usage and Savings with 2011-2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Dairy</b>													
Electricity Usage (GWh)	574.0	60.4	2.9	0.1	637.3	90.1%	9.5%	0.5%	100%	8.3%	0.9%	0.0%	9%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	3,544	1,149	484	23	5,200	68.2%	22.1%	9.3%	100%	3.6%	1.2%	0.5%	5%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	161,966	52,539	5,944	3,444	122,563								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	5,956	743	55	-	6,755.2	88.2%	11.0%	0.8%	100%	9.7%	1.2%	0.1%	11%
Savings Trends (2011-2015)													
Participants (Number of Participants)	94	31	5	-	130	72.3%	23.8%	3.8%	100%	6.2%	2.0%	0.3%	9%
Participant (2011-2015)													
Average Savings (kWh per Participant)	63,367	23,981	11,062	-	51,963								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	2.7%	2.7%	1.0%	0.0%	2.5%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.9: Dairy Details: 2015 Gas Usage and Savings with 2011-2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Dairy</b>													
Gas Usage (MM Therms)	0.1	0.0	0.0	-	0.2	72.8%	15.6%	11.6%	100%	0.1%	0.0%	0.0%	0%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	17	11	14	-	42	40.5%	26.2%	33.3%	100%	0.6%	0.4%	0.5%	2%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	6,430	2,126	1,246	-	3,575								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	276	8	113	-	397.3	69.5%	2.0%	28.5%	100%	0.1%	0.0%	0.0%	0%
Savings Trends (2011-2015)													
Participants (Number of Participants)	6	5	4	-	15	40.0%	33.3%	26.7%	100%	1.4%	1.2%	0.9%	4%
Participant (2011-2015)													
Average Savings (Therms per Participant)	46	2	28	-	26								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	35%	45%	29%	0%	36%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively



**Table C.10: Support Activity Details: 2015 Electric Usage and Savings with 2011-2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Support Activity / Forestry / Hunting</b>													
Electricity Usage (GWh)	543.2	40.5	7.3	(0.3)	590.7	92.0%	6.9%	1.2%	100%	7.9%	0.6%	0.1%	9%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	2,492	839	917	38	4,286	58.1%	19.6%	21.4%	99%	2.5%	0.9%	0.9%	4%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	217,977	48,230	7,986	(7,622)	137,820								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	2,713	164	166	6	3,048.1	89.0%	5.4%	5.5%	100%	4.4%	0.3%	0.3%	5%
Savings Trends (2011-2015)													
Participants (Number of Participants)	60	12	11	1	84	71.4%	14.3%	13.1%	99%	3.9%	0.8%	0.7%	5%
Participant (2011-2015)													
Average Savings (kWh per Participant)	45,209	13,642	15,125	5,518	36,287								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	2.4%	1.4%	1.2%	2.6%	2.0%								
Participation Rate Trends (2011-2015)													

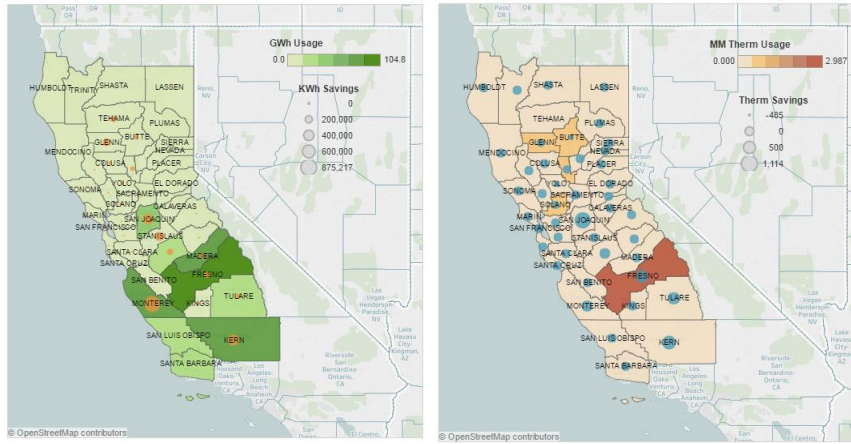
Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.11: Support Activity Details: 2015 Gas Usage and Savings with 2011-2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Support Activity / Forestry / Hunting</b>													
Gas Usage (MM Therms)	7.1	1.4	0.1	0.0	8.5	82.8%	16.4%	0.8%	100%	9.2%	1.8%	0.1%	11%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	109	103	136	1	349	31.2%	29.5%	39.0%	100%	4.0%	3.8%	5.0%	13%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	64,683	13,523	501	7	24,388								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	(648)	1,633	(39)	676.3	1,621.7	-40%	101%	-2.4%	58%	-0.1%	0.3%	0.0%	0%
Savings Trends (2011-2015)													
Participants (Number of Participants)	26	8	4	1	39	66.7%	20.5%	10.3%	97%	6.1%	1.9%	0.9%	9%
Participant (2011-2015)													
Average Savings (Therms per Participant)	(25)	204	(10)	676	42								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	24%	8%	3%	100%	11%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.4: Support Activity Details: 2015 Energy Usage and Savings





**Table C.12: Animal Production Details: 2015 Electric Usage and Savings with 2011-2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Animal Production (non Dairy)</b>													
Electricity Usage (GWh)	268.3	87.5	17.9	0.1	373.8	71.8%	23.4%	4.8%	100%	3.9%	1.3%	0.3%	5%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	1,670	2,175	3,695	101	7,641	21.9%	28.5%	48.4%	99%	1.7%	2.2%	3.8%	8%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	160,632	40,221	4,856	1,476	48,924								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	3,099	915	228	-	4,241.9	73.1%	21.6%	5.4%	100%	5.1%	1.5%	0.4%	7%
Savings Trends (2011-2015)													
Participants (Number of Participants)	76	34	13	-	123	61.8%	27.6%	10.6%	100%	5.0%	2.2%	0.9%	8%
Participant (2011-2015)													
Average Savings (kWh per Participant)	40,780	26,909	17,514	-	34,487								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	4.6%	1.6%	0.4%	0.0%	1.6%								
Participation Rate Trends (2011-2015)													

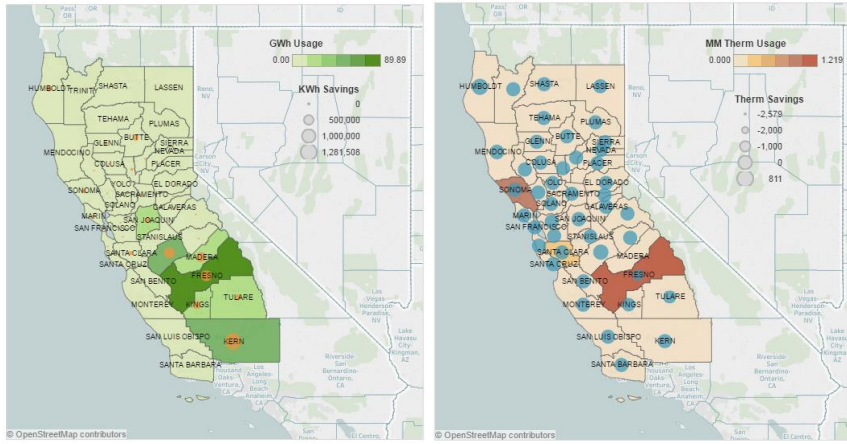
Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.13: Animal Production Details: 2015 Gas Usage and Savings with 2011-2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Animal Production (non Dairy)</b>													
Gas Usage (MM Therms)	2.6	0.3	0.1	0.0	3.0	86.0%	11.6%	2.4%	100%	3.4%	0.5%	0.1%	4%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	57	50	61	1	169	33.7%	29.6%	36.1%	99%	2.1%	1.9%	2.3%	6%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	45,210	6,945	1,161	100	17,723								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	(2,192)	(169)	(526)	-	(2,887.0)	76%	6%	18.2%	100%	-0.4%	0.0%	-0.1%	-1%
Savings Trends (2011-2015)													
Participants (Number of Participants)	40	16	7	-	63	63.5%	25.4%	11.1%	100%	9.4%	3.8%	1.7%	15%
Participant (2011-2015)													
Average Savings (Therms per Participant)	(55)	(11)	(75)	-	(46)								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	70%	32%	11%	0%	37%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

Figure C.5: Animal Production Details: 2015 Energy Usage and Savings



**Table C.14: Green Houses Details: 2015 Electric Usage and Savings with 2011-2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Green Houses</b>													
Electricity Usage (GWh)	168.6	28.4	5.2	0.3	202.5	83.3%	14.0%	2.6%	100%	2.4%	0.4%	0.1%	3%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	581	579	533	27	1,720	33.8%	33.7%	31.0%	98%	0.6%	0.6%	0.5%	2%
Customer trends (2011-2015)													
Average Usage (kWh per customer)	290,257	49,043	9,773	9,455	117,732								
Usage Rate Trends (2011-2015)													
Electricity Savings (MWh)	1,034	69	-	-	1,103.2	93.7%	6.3%	0.0%	100%	1.7%	0.1%	0.0%	2%
Savings Trends (2011-2015)													
Participants (Number of Participants)	33	8	-	-	41	80.5%	19.5%	0.0%	100%	2.2%	0.5%	0.0%	3%
Participant (2011-2015)													
Average Savings (kWh per Participant)	31,328	8,667	-	-	26,906								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	5.7%	1.4%	0.0%	0.0%	2.4%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively

**Table C.15: Green Houses Details: 2015 Gas Usage and Savings with 2011-2015 Trends**

	Customer By Size <sup>a</sup>				Total	Percent of Segment <sup>c</sup>				Percent of Sector <sup>c</sup>			
	Large	Med	Small	Unk <sup>b</sup>		Large	Med	Small	Total <sup>d</sup>	Large	Med	Small	Total
<b>Green Houses</b>													
Gas Usage (MM Therms)	24.8	2.6	0.1	0.0	27.6	90.1%	9.3%	0.5%	100%	32.5%	3.4%	0.2%	36%
Usage Trends (2011-2015) <sup>e</sup>													
Customers (Number of customers)	111	107	85	7	310	35.8%	34.5%	27.4%	98%	4.1%	4.0%	3.2%	11%
Customer trends (2011-2015)													
Average Usage (Therms per customer)	223,852	23,982	1,738	861	88,927								
Usage Rate Trends (2011-2015)													
Gas Savings (Therms)	188,682	599	-	-	189,281.0	100%	0%	0.0%	100%	36.8%	0.1%	0.0%	37%
Savings Trends (2011-2015)													
Participants (Number of Participants)	18	5	-	-	23	78.3%	21.7%	0.0%	100%	4.2%	1.2%	0.0%	5%
Participant (2011-2015)													
Average Savings (Therms per Participant)	10,482	120	-	-	8,230								
Savings Rate Trends (2011-2015)													
Participation Rates (% Participants per Cust.)	16%	5%	0%	0%	7%								
Participation Rate Trends (2011-2015)													

Notes: <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)  
<sup>b</sup> 'Unknown' size category included for completeness. Represents insufficient or partial-year data  
<sup>c</sup> Not evaluating 'Unknown' size customers due to incompleteness of this data  
<sup>d</sup> May not sum to 100% due to excluding 'Unknown' size category customers  
<sup>e</sup> Trend sparklines represent 2011 to 2015. Blue and red dots are the low and high points respectively



**Table C.16: 2015 Electric Usage and Savings by Climate Region and Customer Size**

	Customer by Size <sup>a</sup> and Region <sup>b</sup>					Percent of Region			
	Large	Medium	Small	Unk <sup>c</sup>	Total	Large	Medium	Small	Total <sup>d</sup>
<b>Usage (GWh)</b>									
Bay Area	382	140	37	2E-04	559	68%	25%	7%	100%
Central Valley	4,308	929	164	8E-04	5,401	80%	17%	3%	100%
Coastal	746	159	36	2E-04	941	79%	17%	4%	100%
Mountain	8	8	1	3E-06	17	47%	46%	7%	100%
<b>Total</b>	<b>5,444</b>	<b>1,237</b>	<b>238</b>	<b>0.001</b>	<b>6,919</b>	<b>79%</b>	<b>18%</b>	<b>3%</b>	<b>100%</b>
<b>Customers</b>									
Bay Area	2,078	3,224	5,544	160	11,006	19%	29%	50%	99%
Central Valley	28,541	22,316	20,438	808	72,103	40%	31%	28%	99%
Coastal	5,032	3,908	5,688	181	14,809	34%	26%	38%	99%
Mountain	97	184	244	3	528	18%	35%	46%	99%
<b>Total</b>	<b>35,748</b>	<b>29,632</b>	<b>31,914</b>	<b>1,152</b>	<b>98,446</b>	<b>36%</b>	<b>30%</b>	<b>32%</b>	<b>99%</b>
<b>Savings (GWh)</b>									
Bay Area	3	1	0	0.0	4	74%	23%	2%	99%
Central Valley	40	8	2	0.3	51	80%	15%	5%	100%
Coastal	6	1	0	0.1	7	83%	14%	2%	98%
Mountain	-	0	0	-	0	0%	85%	15%	100%
<b>Total</b>	<b>49</b>	<b>10</b>	<b>3</b>	<b>0.4</b>	<b>61</b>	<b>80%</b>	<b>16%</b>	<b>4%</b>	<b>99%</b>
<b>Participants</b>									
Bay Area	76	75	22	1	174	44%	43%	13%	99%
Central Valley	656	350	163	10	1,179	56%	30%	14%	99%
Coastal	78	55	32	5	170	46%	32%	19%	97%
Mountain	-	4	1	-	5	0%	80%	20%	100%
<b>Total</b>	<b>810</b>	<b>484</b>	<b>218</b>	<b>16</b>	<b>1,528</b>	<b>53%</b>	<b>32%</b>	<b>14%</b>	<b>99%</b>

Notes <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
 Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
 Small: < 40,000 KWh or < 10,000 Therms  
 Unknown: Insufficient data (<12 months)

<sup>b</sup> Regions are aggregates of Climate Zones (Z01 - Z16). There are 16 zones but not all are in PG&E's territory.  
 Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, & Sonoma  
 Central Valley includes: Z11 - Z13  
 Coastal includes: Z01 - Z06 & Z09 (excludes Bay Area Counties)  
 Mountain includes: Z14 - Z16

<sup>c</sup> "Unknown" size category included for completeness. Represents insufficient or partial-year data

<sup>d</sup> Column may not sum to 100% due to a small percentage of Unknowns not included

**Table C.17: 2015 Gas Usage and Savings by Climate Region and Customer Size**

	Customer by Size <sup>a</sup> and Region <sup>b</sup>					Percent of Region			
	Large	Medium	Small	Unk <sup>c</sup>	Total	Large	Medium	Small	Total <sup>d</sup>
<b>Usage (MM Therms)</b>									
Bay Area	13	3	0.2	0.008	16	82%	16%	2%	100%
Central Valley	34	6	0.3	0.004	40	85%	14%	1%	100%
Coastal	18	2	0.1	0.01	21	88%	12%	0%	100%
Mountain	-	-	0.001	-	0.001	0%	0%	100%	100%
<b>Total</b>	<b>65</b>	<b>11</b>	<b>1</b>	<b>0.02</b>	<b>77</b>	<b>85%</b>	<b>14%</b>	<b>1%</b>	<b>100%</b>
<b>Customers</b>									
Bay Area	280	365	285	11	941	30%	39%	30%	99%
Central Valley	406	421	367	8	1,202	34%	35%	31%	99%
Coastal	406	421	367	8	1,202	34%	35%	31%	99%
Mountain	-	-	4	-	4	0%	0%	100%	100%
<b>Total</b>	<b>871</b>	<b>994</b>	<b>808</b>	<b>23</b>	<b>3,349</b>	<b>26%</b>	<b>30%</b>	<b>24%</b>	<b>80%</b>
<b>Savings (MM Therms)</b>									
Bay Area	0.2	0.01	0.001	-	0.2	94%	5%	1%	100%
Central Valley	0.3	0.01	0.003	7E-04	0.3	96%	2%	1%	100%
Coastal	0.0	0.00	0.002	-2E-05	0.004	39%	14%	47%	101%
Mountain	-	2E-04	-9E-05	-	0.0	0%	160%	-60%	100%
<b>Total</b>	<b>0.5</b>	<b>0.02</b>	<b>0.01</b>	<b>0.001</b>	<b>1</b>	<b>95%</b>	<b>4%</b>	<b>1%</b>	<b>100%</b>
<b>Participants</b>									
Bay Area	40	54	13	-	107	37%	50%	12%	100%
Central Valley	124	76	52	3	255	49%	30%	20%	99%
Coastal	14	23	22	1	60	23%	38%	37%	98%
Mountain	-	1	1	-	2	0%	50%	50%	100%
<b>Total</b>	<b>178</b>	<b>154</b>	<b>88</b>	<b>4</b>	<b>424</b>	<b>42%</b>	<b>36%</b>	<b>21%</b>	<b>99%</b>

Notes <sup>a</sup> Large: ≥ 500,000 KWh or ≥ 250,000 Therms  
Medium: 40,000 - 500,000 KWh or 10,000 - 250,000 Therms  
Small: < 40,000 KWh or < 10,000 Therms  
Unknown: Insufficient data (<12 months)

<sup>b</sup> Regions are aggregates of Climate Zones (Z01 - Z16). There are 16 zones but not all are in PG&E's territory.  
Bay Area includes the following counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, & Sonoma  
Central Valley includes: Z11 - Z13  
Coastal includes: Z01 - Z06 & Z09 (excludes Bay Area Counties)  
Mountain includes: Z14 - Z16

<sup>c</sup> "Unknown" size category included for completeness. Represents insufficient or partial-year data

<sup>d</sup> Column may not sum to 100% due to a small percentage of Unknowns not included



# CROSS-CUTTING

EMERGING TECHNOLOGIES 07

CODES AND STANDARDS 08

WORKFORCE EDUCATION  
AND TRAINING 09

FINANCE 10

To comport with the Commission's Business Plan sector approach as outlined in D.15-10-028, PG&E's portfolio structure includes these four cross-cutting activities that make up the Cross-Cutting Business Plan chapters.

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CROSS-CUTTING SEGMENT

# EMERGING TECHNOLOGIES



## Emerging Technologies

The Commission has determined that the objectives of market transformation approaches, as well as other goals, are best achieved within a statewide framework.<sup>1</sup> PG&E identifies Southern California Edison Company (SCE) as the statewide lead for Electric Emerging Technologies and Southern California Gas Company (SCG) as the statewide lead for Gas Emerging Technologies, as the other program administrators have agreed to do in their Business Plans.

Unlike other cross-cutting programs such as Workforce Education and Training (WE&T) and Codes and Standards (C&S) that provide a combination of offerings at the statewide and local level, the entire Emerging Technologies (ET) program will be statewide. As statewide leads, SCE and SCG are presenting the statewide ET Business Plan. As such, PG&E asks the reader to refer to the full program description in SCE and SCG's Business Plans.<sup>2</sup>

ET is a non-resource program designed to help California ratepayer-funded programs meet the energy reduction needs of California by identifying innovative energy efficiency measures that deliver reliable energy savings. D.16-08-019 names three subprograms as part and parcel to the ET program. The ET program is designated as:

- Technology Development Support
- Technology Assessments
- Technology Introduction Support

---

<sup>1</sup> D.16-08-019, COL 50 and pp. 2, 51, 56-57, and 62.

<sup>2</sup> "...business plans shall be presented in one of two ways: 1) the lead program administrator could present a business plan for the statewide programs and/or subprograms in which it will be the lead administrator, or 2) all program administrators could present identical business plans developed collaboratively for each statewide program or subprogram.", D.16-08-019, p. 64.

## Sector Budget

PG&E's Business Plan budget provides general information on the expected levels of annual spending for 2016-2025. As provided in D.15-10-028, PG&E's Business Plan budget represents its best estimates of spending for the life of the Business Plan.<sup>3</sup> The intent is to allow program administrators flexibility to adjust spending during the life of the Business Plan.<sup>4</sup> PG&E will include its ET program budget within its annual Tier 2 Advice Letter for the next calendar year's energy efficiency portfolio.<sup>5</sup> The ET budgets will be itemized by basic categories for cost recovery, transfer, and contracting purposes.<sup>6</sup> See **Table 7.1** for the summary of the ET budget from 2016-2025.

**Table 7.1**  
PG&E Emerging Technology Budget Summary

Cost Category	2016	2017	2018	2019	2020-2025 Annual Budget <sup>a</sup>
<b>Administration</b>	\$645,417	\$525,725	\$457,660	\$389,596	\$347,729
<b>Marketing</b>	\$64,524	\$171,198	\$161,970	\$152,743	\$143,515
<b>Implementation</b>	\$5,582,135	\$7,328,967	\$7,273,854	\$7,218,741	\$7,163,629
<b>Incentive</b>	\$0	\$0	\$0	\$0	\$0
<b>Total</b>	<b>\$6,292,076</b>	<b>\$8,025,890</b>	<b>\$7,893,484</b>	<b>\$7,761,080</b>	<b>\$7,654,873</b>

<sup>a</sup> The Annual Budget from 2020 through 2025 will remain the same.

<sup>3</sup> D.15-10-028, "It [the budget] will establish a "ballpark" figure for spending for the life of the business plan.", p. 55.

<sup>4</sup> D.15-10-028, p.56.

<sup>5</sup> D.15-10-028, OP 4.

<sup>6</sup> D.15-10-028, p.56.

# Appendices

## Emerging Technologies Appendices

### Appendix A: Compliance Checklist

Cross Cutting Sector		
BP Page Number	Business Plan Guidance	PG&E Notes
	<b>A. Market Characterization</b>	
	a. Customer landscape (who they are, what are their needs)	See SCE's ET chapter
	b. Trends	See SCE's ET chapter
	c. Gaps/Barriers	See SCE's ET chapter
	<b>B. Value</b>	
	a. Discussion of roles for cross-cutting sector	See SCE's ET chapter
	b. How does it support portfolio	See SCE's ET chapter
	c. How does it benefit customers	See SCE's ET chapter
	d. External impacts and benefits (community/economic benefits)	See SCE's ET chapter
	<b>C. Vision</b>	
	a. Discussion of opportunities	See SCE's ET chapter
	b. Whether items are near-, mid-, long-term strategic initiatives	See SCE's ET chapter
	<b>D. Metrics</b>	
	a. One metric or more as appropriate for each intervention strategy	See SCE's ET chapter
	<b>E. Program/PA Coordination: Description of which and how strategies are coordinated regionally among PAs and/or other demand- side options.</b>	See SCE's ET chapter
	<b>F. EM&amp;V Considerations: Statement of evaluation needs "preparedness" (i.e., data collection strategies and internal performance analysis)</b>	See SCE's ET chapter

## Appendix B: References

California Public Utilities Commission. October 22, 2015. *Decision 15-10-028: Decision Re Energy Efficiency Goals for 2016 and Beyond and Energy Efficiency Rolling Portfolio Mechanics.*  
<http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M155/K511/155511942.pdf>

California Public Utilities Commission. August 18, 2016. *Decision 16-08-019: Decision Providing Guidance for Initial Energy Efficiency Rolling Portfolio Business Plan Filings.*  
<http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M166/K232/166232537.PDF>

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CROSS-CUTTING SEGMENT

# CODES AND STANDARDS

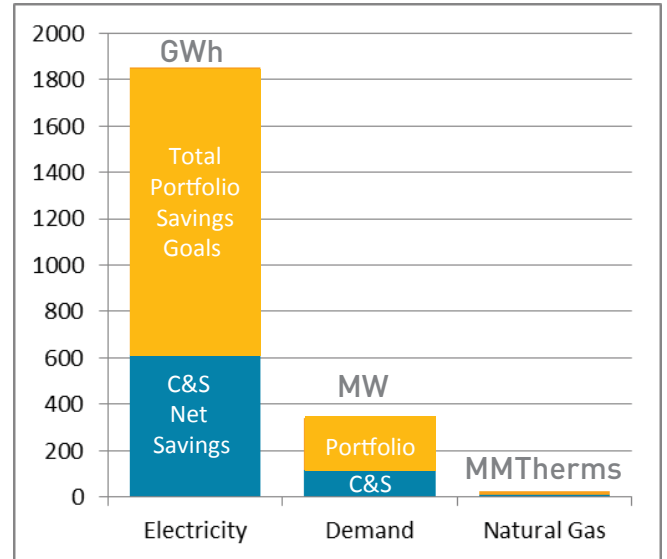
# PG&E Codes & Standards Snapshot

## C&S Influence on Energy Savings

**52%** of PG&E's 2016 Portfolio energy savings came from the C&S program

**vs.**

**3%** Of PG&E's Energy Efficiency budget is spent on C&S.



Source: PG&E Codes and Standards and EE Regulatory budget and Savings Filings

## Program Achievements from 2005-2016

**46** Title 20 CASE Studies

**111** Title 24 CASE Studies

**9,184** Attendees at C&S training sessions.

Source: PG&E Codes and Standards documentation 2005-2016

## C&S Influence on Customer Bill

Building Type	Average Yearly Dollar Savings
<b>Multifamily</b>	
Existing	\$62.57
New Construction	\$131.47
<b>Nonresidential</b> (per 1,000 ft <sup>2</sup> )	
Existing	\$121.79
New Construction	\$440.59
<b>Single Family</b>	
Existing	\$112.45
New Construction	\$385.31

Source: Comparison of projected energy use and savings based on C&S CASE studies 2005 Code baseline vs. 2016 Code baseline buildings

## A. Codes and Standards Vision

California has ambitious state policy goals that include doubling cost-effective energy efficiency savings in electricity and natural gas end uses by 2030 (SB 350), Zero Net Energy (ZNE) for new and existing buildings, as well as longer-term greenhouse gas (GHG) objectives (SB 32). To achieve these goals, the state must increase energy savings and change the way it uses resources. Past codes and standards (C&S) efforts have delivered substantial cost-effective savings, and program administrators envision continuing and refining these activities to maximize energy savings.<sup>1</sup> The vision for C&S moving forward is based on:

- **Refining the existing program**

- Supporting all building codes and appliance standards with significant potential savings that are of interest to code setting bodies will ensure savings opportunities are realized.<sup>2</sup>
- Continued compliance improvement efforts, including targeted compliance efforts and development of electronic compliance infrastructure, will ensure potential savings from advocacy are realized “on the ground.”

<sup>1</sup> “California’s Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals,” National Resources Defense Council, August 2015, p. 17.

<sup>2</sup> Most C&S work is directed at code setting bodies such as the California Energy Commission (Energy Commission), Department of Energy (DOE). Others include the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), the International Code Council (ICC), and entities that produce data or ratings referenced by codes and standards, and those in compliance-related professions.



- **Supporting multifaceted objectives**

- California’s energy and climate-related policy goals are diverse in scope, including energy efficiency, demand reduction, renewable energy, onsite generation, grid connectivity, automated demand response, energy storage capacity, ZNE buildings, water efficiency, and alternative fuel vehicles. C&S must be designed and implemented with these multifaceted objectives in mind to support continued progress. While energy efficiency will continue to be C&S’s foundational goal, program administrators will also engage in other activities that have indirect energy impacts.
- Success will entail broader stakeholder engagement to achieve the state’s policy goals.

“A broad range of aggressive and continually improving minimum and higher voluntary sets of energy codes and standards will be adopted to greatly accelerate the wide-spread deployment of zero-net energy and highly efficient buildings and equipment. The effectiveness of codes and standards will be enhanced by improved code compliance as well as coordinated voluntary efficiency activities.”

— *California Energy Efficiency Strategic Plan*

## Codes and Standards Goals

The C&S program strives to reach energy use reduction targets of 2,545 GWh and 46 MMT between 2018 and 2025, and a reduction in demand of 739 MW over the same period, throughout the IOU territories. These goals are based on PG&E's past performance relative to Potential Study goals.

C&S supports California's energy and climate-related policy goals through four overarching strategies, including:

- Advocacy that responds to all opportunities for significant savings through new codes and standards (i.e., local reach codes, state, and federal)
- Technical assistance to local governments that increases the adoption of local reach codes that support the development and adoption of statewide and national code changes
- Compliance improvement activities that strive to maintain high compliance margins for buildings constructed or altered within the Title 24, Part 6 compliance process; and improve compliance margins for selected, high-importance building code measures and appliance standards
- Code readiness activities that aim to introduce promising building systems and appliances to actors within building industry supply chains to determine their readiness for codification

## B. C&S Proposal Compared to Prior Program Cycles

Some of the differences between past C&S efforts and proposed future efforts include more targeted compliance activities focusing on high-impact areas, updating antiquated compliance processes, and the inclusion of code readiness activities within PG&E's service territory. C&S will continue to conduct primary research and analyses to support C&S objectives and state policy goals, guided by the California Public Utilities Commission (CPUC), California Energy Commission (Energy Commission), and other state agencies' goals. Investment in research and data collection efforts will enhance advocacy by increasing the quality of code change proposals. C&S will also collaborate with code setting entities to identify high value research areas.

To meet the goals laid out in the vision, the program

administrators identified four major intervention strategies (further detailed in *Section E: Approach to Achieving C&S Goals*) for C&S, with particular emphasis on where they part from past practice.<sup>3</sup>

## Advocacy to Support Building Codes and Appliance Standards

Advocacy activities develop proposals for building codes and appliance standards. In prior years, these efforts were housed within a single program that addressed C&S issues at the state and national levels (e.g., the Energy Commission's Order Instituting Rulemaking (OIR) for Title 20 Appliance Standards and the US Department of Energy's (DOE) ongoing rulemaking for Federal Appliance Standards).

- In the near-term, the statewide Building Code & State Appliance Standards subprograms will be separated from the work that supports national (and possibly international) codes and standards. The national standards program will focus on DOE appliance standards and test procedures, multiple national (and possibly international, as applicable) agencies or organizations that develop mandatory or voluntary standards, test procedures, labels, and/or protocols that could directly impact California customers and goals.<sup>4</sup>

## Technical Assistance to Local Governments to Help Adopt Reach Codes

This strategy has traditionally included technical support for local governments interested in adopting ordinances that exceed state building energy codes (Title 24, Part 6). This resulted in cost-effectiveness reports that local governments used to adopt ordinances, which were submitted to the Energy Commission for approval and filed with the Building Standards Commission (BSC). As local governments are increasingly focused on reducing GHG emissions, their interest expands beyond

<sup>3</sup> For more information on C&S in prior cycles, see the 2013-2014 program implementation plans (PIPs) at <http://eestats.cpuc.ca.gov/>.

<sup>4</sup> These includes, but are not limited to, American Society of Heating, Refrigerating, and Air Conditioning Engineers (model building codes, such as ASHRAE 90.1 and 189.1), International Code Council (model building codes, such as the International Energy Conservation Code and the International Green Construction Code), the Environmental Protection Agency (ENERGY STAR labels), the Federal Trade Commission (EnergyGuide labels), Institute of Electrical and Electronics Engineers (e.g., IEEE 802.3 Energy Efficient Ethernet), International Electrotechnical Commission (test procedures), etc.

the standard performance-based reach codes. In response, C&S reach code efforts will expand to include support for ordinances requiring measures beyond traditional energy efficiency measures, such as voluntary standards, renewable energy, alternative fuels vehicle infrastructure, energy storage, demand response, and water saving measures.

- In the near-term, program administrators will educate local elected officials and staff regarding the value of reach codes, and help prepare cost-effectiveness studies that support both the CALGreen Voluntary Tier rulemaking process and the development of comprehensive ZNE reach codes. Program administrators will support the development of tools to support local jurisdictions as they track, quantify, and report reach code energy savings and GHG reductions.

### Compliance Improvement Activities

These activities complement advocacy efforts by ensuring potential savings from C&S are realized and persist over time. This strategy targets market actors throughout the compliance supply chain, providing technical support, education, outreach, and resources to improve compliance with both building and appliance energy standards. Moving forward, program administrators will place a greater emphasis on developing clear code proposals that minimize misinterpretation. The program administrators will also design and market trainings that use the appropriate modality for specific market actors.

- In the near-term, this strategy will help market actors understand C&S and provide role-based trainings to improve compliance, particularly for the areas that have the highest potential impacts.
- This strategy will support the development of an electronic repository to track new construction and building alteration activity, as well as software tools to ensure accurate monitoring and compliance reporting.

### Code Readiness Activities<sup>5</sup>

PG&E initiated code readiness activities in January 2016 with the goal of collecting data and vetting promising building systems and appliances to actors within building industry supply chains<sup>6</sup> to determine their readiness for codification.

- In the near-term, PG&E will broaden code readiness to include other primary research and analysis.

### Key Learnings from Recent EM&V Reports of California's Codes and Standards Programs

Past evaluations have focused on building codes, appliance standards, and compliance improvement. As a result, evaluation recommendations are restricted to these subprograms. The following summary of recommendations is adapted from findings in the *2010-2012 C&S Impact Evaluation*<sup>7</sup> and the *Codes and Standards Compliance Improvement Program Years 2013-14 Process Evaluation Final Report*.<sup>8</sup>

#### Building Codes and Appliances Standards Advocacy

- A major challenge in program evaluation has been the lack of program documentation typical to other energy efficiency programs. Improving program documentation to include market data and increased documentation on IOU efforts would facilitate program evaluation. Completing the program documentation at a more regular interval would ensure that information is retained.
- Building envelopes present IOUs with opportunities for codes and standards intervention. This major building component was shown to be just below 2008 code requirements in all surveyed sites.

<sup>5</sup> CPUC approved a new Code Readiness for PG&E local C&S subprogram for 2016. [https://www.pge.com/nots/rates/tariffs/tm2/pdf/GAS\\_3656-G.pdf](https://www.pge.com/nots/rates/tariffs/tm2/pdf/GAS_3656-G.pdf).

<sup>6</sup> Here we will leverage the Compliance Improvement subprogram training platform (e.g., Energy Code Ace).

<sup>7</sup> Cadmus, DNV GL. 2014. Statewide Codes and Standards Program Impact Evaluation Report for Program Years 2010-2012. [http://calmac.org/publications/CS\\_Evaluation\\_Report\\_FINAL\\_10052014-2.pdf](http://calmac.org/publications/CS_Evaluation_Report_FINAL_10052014-2.pdf).

<sup>8</sup> DNV GL. 2016. Codes and Standards Compliance Improvement Program Years 2013-14 Process Evaluation Final Report. [http://calmac.org/publications/ComplianceImprovementImpactEvaluationDraftReport\\_FINAL-OUT.pdf](http://calmac.org/publications/ComplianceImprovementImpactEvaluationDraftReport_FINAL-OUT.pdf).

- IOUs should continue their appliance standards work, as appliance standards compliance has been high (typically 80+%).

### Compliance Improvement

- The IOUs have made noticeable progress with the development and improvement of the Energy Code Ace website, which provides code compliance trainings and resources to building industry professionals. Building professionals identified increasing awareness of the tools, training and resources offered via Energy Code Ace. C&S can continue this progress by identifying code areas that are particularly vulnerable to noncompliance and tailoring trainings to continually highlight and target those areas.
- Although in-person trainings have been well-received, building industry professionals are less likely to attend. IOUs can tap into the remote training market by expanding online Energy Code Ace training.
- IOUs can use external partnerships to make training materials and links available on other industry sites where professionals are known to seek information and support.
- IOUs have an opportunity to increase code compliance by providing education to counter perceptions that code compliance is unmanageably complex.

## C. Goals, Budget and Cost-Effectiveness

As Business Plans were envisioned as “a comprehensive vision outlining long-term strategic initiatives and intervention strategies,”<sup>9</sup> PG&E provides energy and demand savings goals, budgets, and cost-effectiveness for Energy Code Ace that represent its best estimates to realize its portfolio vision, while retaining flexibility to accommodate potential market or regulatory changes. Each year, PG&E will file a Tier 2 advice letter (AL) that provides detailed goals, budgets and cost-effectiveness for the Commission’s review and approval.<sup>10</sup>

### Energy Saving Goals

PG&E’s primary goal is to save energy. PG&E has used the energy and demand savings targets provided in the “Energy Efficiency Potential and Goals Study for 2015 and Beyond,” approved in D.15-10-028, as the foundation for its projected energy savings goals for 2018-2025, and shows 2016 and 2017 for reference in **Table 8.1**. PG&E C&S goals are shown as net annual goals. Also shown are the net potential C&S goals for the statewide IOUs.

PG&E’s net annual energy and demand savings goals are directional in nature, and meant to reflect our best estimates of energy and demand savings potential. PG&E recognizes energy and demand savings goals will be updated to meet the SB 350 energy efficiency targets set by the Energy Commission no later than November 1, 2017.<sup>11</sup> PG&E will update its energy savings for Energy Code Ace once the Commission approves new energy and demand savings targets.

<sup>9</sup> D.15-10-028, p.48.

<sup>10</sup> D.15-10-028, OP 4.

<sup>11</sup> SB 350 requires the Energy Commission to develop and establish statewide targets that lead to a cumulative doubling of energy efficiency savings from all retail electric and natural gas end-users by 2030. <http://www.energy.ca.gov/sb350/timeline.pdf>.

**Table 8.1**

## Statewide IOU Codes and Standards Sector Annual Net Market Potential

Year		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
PG&E	GWhs	611	506	408	401	381	326	295	254	240	240
SCE	GWhs	631	522	421	414	393	337	304	262	247	247
SDG&E	GWhs	143	119	96	94	89	76	69	59	56	56
Year		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
PG&E	MWs	141	105	103	103	101	94	90	84	82	82
SCE	MWs	145	108	106	107	104	97	92	87	84	84
SDG&E	MWs	33	25	24	24	24	22	21	20	19	19
Year		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
PG&E	MMTherms	5.5	6	6	6	6	6	6	6	5	5
SCG	MMTherms	11.7	12.2	12.7	12.6	12.2	10.9	10.3	9.6	9.1	9.1
SDG&E	MMTherms	0.6	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6
<b>IOU Total</b>	<b>GWhs</b>	1385	1147	925	909	863	739	668	575	543	543
	<b>MWs</b>	319	238	233	234	229	213	203	191	185	185
	<b>MMTherms</b>	17.8	18.8	19.4	19.3	18.9	17.6	16.9	16.2	14.7	14.7

**Sector Budget**

PG&E's Business Plan budget provides general information on the expected levels of annual spending for 2018-2025, along with 2016 and 2017 approved budgets for reference. As provided in D.15-10-028, PG&E's Business Plan budget represents its best estimates of spending for the life of the Business Plan.<sup>12</sup> The intent is to allow program administrators flexibility to adjust spending during the life of the Business Plan.<sup>13</sup> PG&E will file Tier 2 AL annually, containing a detailed budget for the next calendar year's energy efficiency portfolio.<sup>14</sup>

The Tier 2 AL budgets will include detailed budgets for cost recovery, transfer, and contracting purposes.<sup>15</sup> See **Table 8.2** for a summary of the Codes & Standards budget.

For more discussion on PG&E portfolio and sector-level budgets, please see the *Portfolio Overview* chapter.

<sup>12</sup> D.15-10-028 "It [the budget] will establish a "ballpark" figure for spending for the life of the business plan." p. 55.

<sup>13</sup> D.15-10-028, p.56.

<sup>14</sup> D.15-10-028, OP 4.

<sup>15</sup> D.15-10-028, p.56.

**Table 8.2**  
PG&E C&S Budget Summary

Cost Category	2016	2017	2018	2019	2020-2025 Annual Budget <sup>a</sup>
<b>Administration</b>	\$733,889	\$679,899	\$591,874	\$503,849	\$449,704
<b>Marketing</b>	\$0	\$0	\$0	\$0	\$0
<b>Implementation</b>	\$14,601,359	\$16,535,300	\$16,410,957	\$16,286,614	\$16,162,272
<b>Incentive</b>	\$0	\$0	\$0	\$0	\$0
<b>Total</b>	<b>\$15,335,248</b>	<b>\$17,215,199</b>	<b>\$17,002,831</b>	<b>\$16,790,463</b>	<b>\$16,611,976</b>

<sup>a</sup> The Annual Budget from 2020 through 2025 will remain the same.

### Cost-Effectiveness

PG&E presents its sector-level cost-effectiveness for its 2018-2025 Business Plan. See **Table 8.3** for cost-effectiveness results, **Table 8.4** for net annual savings impacts, and **Table 8.5** for emission reductions.

**Table 8.3**  
Projected PG&E C&S Cost-Effectiveness Results (2018-2020)

	Result
<b>TRC</b>	1.49
<b>PAC</b>	46.90

Note: Does not include Market Effects

**Table 8.4**  
Projected PG&E C&S Net Annual Savings Impacts from Cost-Effectiveness Scenario

	PG&E Target	PGS Goal
<b>Energy Savings (Net GWh/yr)</b>	803.12	381.00
<b>Demand Reduction (Net MW)</b>	180.49	101.00
<b>Gas Savings (Net MMTh/yr)</b>	16.21	6.00

PG&E conducted a cost-effectiveness analysis of its proposed C&S activities in compliance with D.15-10-028, and with the California Standard Practice Manual.<sup>16</sup> PG&E used the 2017 updated avoided costs and cost-effectiveness inputs approved in Resolution E-4801.

**Table 8.5**  
Projected PG&E C&S Emission Reductions from Cost-Effectiveness Scenario 2018-2020

	Reduction
<b>Annual tons of CO2 avoided</b>	455,733.95
<b>Lifecycle tons of CO2 avoided</b>	2,551,708.80
<b>Annual tons of NOx avoided</b>	568,018.96
<b>Lifecycle tons of NOx avoided</b>	7,500,555.19
<b>Annual tons of SOx avoided</b>	—
<b>Lifecycle tons of SOx avoided</b>	—
<b>Annual tons of PM10 avoided</b>	194,647.81
<b>Lifecycle tons of PM10 avoided</b>	2,147,236.88

<sup>16</sup> California Standard Practice Manual: Economic Analysis of Demand Side Management Programs and Projects, 2002. [http://www.calmac.org/events/spm\\_9\\_20\\_02.pdf](http://www.calmac.org/events/spm_9_20_02.pdf).



PG&E's cost-effectiveness calculation represents the near term years of its Business Plans (2018-2020), and is directional in nature. Meaning, PG&E will strive to meet the cost-effectiveness projections set forth for the sector. However, PG&E requests flexibility to accommodate potential market or regulatory changes. Through the annual Tier 2 ALs, PG&E will provide the Commission updated cost-effectiveness for Energy Code Ace for each year of Business Plan implementation.

Through implementation of its Business Plan, PG&E seeks to make significant impact in reducing energy waste cost-effectively and maximizing the value of energy efficiency for customers, for the grid, and for the state. To do that, PG&E recognizes the need to take "a more integrated, cost-effective approach"<sup>17</sup> to scale energy savings. For more discussion on PG&E's key strategies to scale energy efficiency and continue to deliver cost-effective energy efficiency portfolios, please see the Portfolio Overview chapter.

## D. C&S Landscape

Building codes impact a broad range of stakeholders in the building industry supply chain, while appliance standards impact all customers purchasing regulated products (see *Appendix C* for a complete list of C&S customers and stakeholders). Since C&S efforts impact virtually all of the program administrators' customers, identifying salient trends and barriers is critical to designing intervention strategies that advance progress towards state and national policy goals. See **Figure 8.1** for select California policy goals.

California's energy efficiency building codes and standards have saved more than 15,000 GWh since 2003 and over \$75 billion since the mid-1970s.

<sup>17</sup> Mitchell, Cynthia 2014. "A New Energy Efficiency Manifesto: California Needs a More Integrated, Cost-Effective Approach." p. 1, TURN May 15, 2015 iDSM comments in R.14-10-003, p. 9.

**Figure 8.1**  
Select California Policy Goals

	2020	2025	2030	2050
<b>Greenhouse Gases</b>	1990 levels (AB 32)		40% below 1990 levels (SB 32)	80% below 1990 levels (E.O. B-30-15)
<b>Efficiency</b>			2x energy efficiency <sup>a</sup>	
<b>Zero Net Energy Buildings</b>	100% of new Res. <sup>b</sup>	100% of new state buildings <sup>b</sup>	100% of new Commercial, 50% Com. Retrofits <sup>b</sup>	
<b>Renewable Portfolio Standard</b>	33% <sup>c</sup>		50% <sup>a</sup>	
<b>Transportation</b>		1.5 million ZEVs <sup>d</sup>		
<b>Fuels</b>			Displace 30% of petroleum use with alternative fuels <sup>e</sup>	
<b>Water</b>	20% less water per capita in Res. & Com. buildings <sup>f</sup>			
<b>High-GWP Gases</b>	Reduce GHG emissions from HFCs by 10 MMtCO <sub>2</sub> e <sup>g</sup>			
<b>Energy Storage</b>	1.3 GW Storage Procurement <sup>h</sup>			

<sup>a</sup> Senate Bill 350

<sup>b</sup> CA's Long-Term Energy Efficiency Strategic Plan

<sup>c</sup> Senate Bill X1-2

<sup>d</sup> Governor's Zero-emission Vehicle Action Plan

<sup>e</sup> Assembly Bill 1007

<sup>f</sup> Senate Bill X&-7

<sup>g</sup> AB 32 Scoping Plan (CARB)

<sup>h</sup> CPUC D.10-03-040

## Trends

- **Increasing CPUC and Energy Commission emphasis on C&S:** In recent years, the CPUC has communicated the importance of C&S.<sup>18,19,20</sup> Additionally, the Energy Commission expects IOUs to support building standards in accordance with the Warren-Alquist Act.<sup>21</sup> These agencies recognize the primacy of C&S in achieving state policy goals.
- **Increasing number of state policy drivers:** California has a growing number of energy and climate-related policy goals that are expressed in executive orders, legislative bills, and state agency action plans, such as SB 350 and SB 32.
  - The CPUC has indicated that California’s publicly-funded energy efficiency programs are an integral part of the state’s fight against climate change and GHG reductions.<sup>22</sup> California’s policy goals are diverse in scope, including targets over the next 35 years for energy efficiency, demand reduction, renewable energy, onsite generation, grid connectivity, demand response, energy storage capacity, ZNE buildings, water efficiency, and alternative fuels vehicles. To these ends, C&S must be deployed holistically with these multifaceted objectives in mind.<sup>23</sup>
- **Evolving state and federal activities:** State and national regulatory agencies are affected by the Energy Commission’s funding fluctuations, which impact their ability to allocate resources toward C&S topics. As a national leader in energy efficiency policy, California’s rulemakings influence national agendas. When activity increases in California, the effect is seen in other states and in federal rulemakings. For example, appliance rulemakings in California can spur action on new or stalled proceedings at the DOE. Over the next ten years, priorities at the state and national levels may evolve, requiring flexibility in how California executes its C&S strategies. Program administrators’ consistency in C&S support allows California to achieve its state policy objectives despite evolving state and federal funding priorities.
- **Increasing requirements for rigorous data to support Energy Commission rulemakings:** Statewide C&S initiatives support the Energy Commission in their various rulemakings by providing data that the building and manufacturing industries require to support underlying calculations of costs and benefits. In addition to energy savings, the Energy Commission increasingly considers pricing information, technology readiness, user amenity, and how the measure will be applied in practice in buildings and equipment.<sup>24</sup> Verifiable analysis is needed to respond to these needs.

<sup>18</sup> CPUC D.12-05-015, pg. 246.

<sup>19</sup> CPUC D.12-05-015, pg. 249.

<sup>20</sup> CPUC. “Regulating Energy Efficiency: A Primer on the CPUC’s Energy Efficiency Programs.” February 2016. [http://www.cpuc.ca.gov/uploadedFiles/CPUC\\_Public\\_Website/Content/News\\_Room/Fact\\_Sheets/English/Regulating%20Energy%20Efficiency%200216.pdf](http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/News_Room/Fact_Sheets/English/Regulating%20Energy%20Efficiency%200216.pdf).

<sup>21</sup> Warren Alquist Act section § 25402.7. Utility support for building standards.

<sup>22</sup> California Long-Term Energy Efficiency Strategic Plan (January 2011 update): <http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5303>, p. 3.

<sup>23</sup> Pat Eilert, Pacific Gas and Electric Company, Eric Rubin, Alex Chase, Energy Solutions, Yanda Zhang, YDZ Energy, “Codes and Standards Climate Strategy,” 2016, ACEEE Summer Study.

<sup>24</sup> For a more in depth discussion, see “Codes and Standards: A Path to Affordable Amenity and Customer Satisfaction.” Jon McHugh, Alex Chase, Gary Fernstrom, Mike McGaraghan, Chad Worth, and Pat Eilert. 2016 ACEEE Summer Study on Energy Efficiency in Buildings Proceedings. August 2016.

- **Rising Miscellaneous Electrical Loads (MELs) require evolving processes:** Particular attention must be paid to miscellaneous electrical loads (MELs)<sup>25</sup> and plug-in electric vehicles (PEV) to achieve California's ZNE goals. Many MELs have a short product cycle (e.g., cell phones, tablets, smart watches, etc.), so these MELs cannot be effectively managed by the DOE's existing energy efficiency rulemaking process, which can take up to ten years.<sup>26</sup> Furthermore, determining these MELs' annual energy consumption, energy usage patterns, and product cycles requires significant resources. A need exists to explore different paths to transform the market for MELs with a short product cycle and support new appliance standards to reach ZNE goals.
- **Increasing focus on existing buildings:**<sup>27</sup> The code for new construction is rapidly approaching ZNE targets for residential buildings, with nonresidential goals soon thereafter. As a result, existing buildings offer a prime opportunity for energy savings. In particular, dramatic increases in the energy efficiency of appliances and system solutions in existing buildings are necessary to achieve SB 350's goals to double the efficiency of existing buildings by 2030. Retrofitting existing buildings poses veritable challenges due to the broad range of project types, design and construction arrangements, and constraints caused by existing conditions. The efficiency of existing buildings may be improved through code enhancement proposals focused on building alterations and inefficient appliances. In addition, compliance improvement efforts are especially important to ensure intended savings are fully realized.

<sup>25</sup> The Department of Energy defines MELs as "...the electricity used by appliances and devices outside of a building's core functions of heating, ventilation, air conditioning, lighting, water heating, and refrigeration." For more, see Sofos, Marina "Miscellaneous Electric Loads: What Are They and Why Should You Care?" Department of Energy: Office of Energy Efficiency & Renewable Energy, September 15, 2016, <http://energy.gov/eere/buildings/articles/miscellaneous-electric-loads-what-are-they-and-why-should-you-care>.

<sup>26</sup> The Energy Commission's process is a faster, 3-4 years but we need to get the process from research to adoption down to a couple years to achieve the best standards.

<sup>27</sup> [http://www.energy.ca.gov/ab758/documents/ab\\_758\\_bill\\_20091011\\_chaptered.pdf](http://www.energy.ca.gov/ab758/documents/ab_758_bill_20091011_chaptered.pdf).

## Barriers

Trends offer insight into the gaps between the needs of the end customer and what is available to fill them. To overcome these barriers, a range of activities—from policy changes to process improvements—are needed.

- **Lack of consistent state policies and holistic long-term planning to meet those goals:** Disconnects between state policies present barriers to integrated implementation.
  - The California Energy Efficiency Strategic Plan's (CEESP) ZNE goals do not fully align with AB 32's GHG reduction goals in terms of metrics, measurements, and milestones.<sup>28</sup>
  - Energy Commission's building energy standards (Title 24, Part 6) include the scope to accommodate a robust set of integrated requirements for renewable generation, energy storage, and automated demand response.<sup>29,30</sup> However, IOU funding for energy efficiency and other distributed energy resources (DERs) efforts are authorized in separate proceedings, which can inhibit seamless advocacy efforts across DERs.
  - For Southern California IOUs, stringent air quality requirements<sup>31</sup> for reduced NOx and particulate matter in non-attainment areas have been difficult to reconcile, as they conflict at times with the efficiency of stationary sources.

<sup>28</sup> California Long-Term Energy Efficiency Strategic Plan (January 2011 update): <http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=5303>. AB 32 Scoping Plan: <https://www.arb.ca.gov/cc/scopingplan/scopingplan.htm>.

<sup>29</sup> § 25000.1, § 25402, § 25402.6, and § 25403.5 of the Warren Alquist Act describe scoping that includes these topics: <http://www.energy.ca.gov/2016publications/CEC-140-2016-002/CEC-140-2016-002.pdf>.

<sup>30</sup> Hauenstein, H. A. Beasley, C. Uraire, C. Worth, S. Tartaglia, and M. Anderson. "Putting it All Together: Leveraging Codes and Standards to Accelerate Integration of Demand-Side Resources." Proceedings for the 2016 ACEEE Summer Study on Energy Efficiency in Buildings.

<sup>31</sup> South Coast Air Quality Management District Draft 2016 Air Quality Management Plan (AQMP), Appendix IV-A: SCAQMD's Stationary and Mobile Source Control Measures, Page IV-A-49. Link: <http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/draft-final-aqmp/strikeout/appivA2016.pdf?sfvrsn=11>.

- Program administrators believe the greatest impacts will come from looking across policy drivers, broad DER areas, and technologies. For example, achieving ZNE for new and existing buildings while maintaining transmission and distribution (T&D) grid stability benefits from the flexibility brought about by the integration of various systems in buildings and communities, integration of photovoltaic (PV) and battery storage, and expansion of automated demand response and alternative fuels and electric vehicle (EV) infrastructures. Moreover, with rapidly approaching ZNE goals and relatively short code cycles, this work must accelerate.<sup>32</sup>
- **Data deficits:** Program administrators find rulemakings end often in compromise between code setting bodies and industry representatives, and the amount of compromise depends on the quality of data available to defend a proposed rule. Since code setting bodies are required to demonstrate the cost effectiveness and feasibility of proposed standards, successful advocacy efforts are built on defensible, up to date, and rigorous data. However, many industry representatives consider their product-related data to be confidential, and most useful data is derived from research conducted by either the code setting body or IOUs.
  - Defending a proposed rule requires information that demonstrates the viability of the technology and its role in energy efficient systems. Beyond this basic viability, program administrators find a dearth of accurate and useful data on the performance of newer technologies, as well as a deficient understanding of the impact of widespread adoption on the intended system—both areas that are critical for setting new codes. This need can be filled by gathering population data, advancing technical research, and conducting market analyses that are directly related to a public rulemaking.
- **State resource constraints:** Developing code change proposals, gathering stakeholder input,

designing compliance processes, and offering resources to support the implementation of C&S is a resource-intensive process. Code setting entities, such as the Energy Commission, have relied on stakeholders to contribute code change proposals and participate in the rulemaking process.

- Insufficient resources exist for state agencies to conduct all the supporting activities necessary to evolve state standards in pursuit of policy goals. Since 2002, the IOUs have submitted 157 Codes and Standards Enhancement (CASE) reports,<sup>33</sup> and developed a Compliance Improvement subprogram to support resource shortfalls.
- **Federal preemption:** As the scope of the DOE's federal appliance program expands, it becomes increasingly important for California's C&S initiatives to actively participate in the federal rulemaking process due to "federal preemption."<sup>34</sup>
  - California often desires to have higher minimum standards than the federal standards. For example, after commercial clothes washers (California adopted commercial clothes washers standards in Title 20 in 2003) became federally covered products through the Energy Policy Act of 2005 (EPA 2005), California could no longer update standards beyond federally adopted efficiency criteria. Accordingly, as the DOE's appliance program expands, fewer appliances are available to the Energy Commission to incorporate into Title 20.

<sup>32</sup> For a more in depth discussion, see "Putting it All Together: Leveraging Codes and Standards to Accelerate Integration of Demand-Side Resources." Heidi Hauenstein, Aimee Beasley, Christopher Uraire, Chad Worth, Stu Tartaglia, and Mary Anderson. 2016 ACEEE Summer Study on Energy Efficiency in Buildings. August 2016.

<sup>33</sup> 46 Title 20 CASE Reports and 111 Title 24, Part 6 CASE Reports.

<sup>34</sup> Federal preemption is the invalidation of any state law that conflicts with federal law; and for appliance efficiency regulations, the effect of minimum federal standards is to cap state appliance standards. Federal law includes an option for states to petition DOE for a preemption waiver, but no state has successfully done so and the program administrators do not consider this a practical option.

Efforts must be focused on the federal level and on completing California's adoption of energy efficient standards with the highest levels of efficiency before the DOE begins its rulemaking process for those appliances. The DOE process is much longer than the Energy Commission's process, stranding cost-effective energy savings.

- **Local governments lack awareness about which reach codes can help them achieve their goals, and lack the resources needed to adopt reach codes:** A "reach code" is a locally mandated code or alternative compliance path that is more aggressive than the current California Building Energy Efficiency Standards, resulting in buildings that achieve higher energy savings.

In California, the unique authority given to cities and counties to adopt reach codes allows local jurisdictions to aggressively pursue their local Climate Action Plan goals as well as the CPUC's goal of achieving ZNE for all new residential construction by 2020 and for all new nonresidential construction by 2030.<sup>35</sup>

- Every local government must determine the type of reach code ordinance best suited to meet its unique GHG reduction goals.<sup>36</sup> However, local governments may lack the awareness, knowledge, and resources needed to develop and adopt these codes. Typically, this includes deciding whether to adopt "performance based" CALGreen Energy Efficiency Tiers (e.g., exceeding base code by 15%),<sup>37</sup> mandate "prescriptive" energy

efficiency measures (e.g., cool roofs),<sup>38</sup> or require "renewable energy" installation (e.g., solar photovoltaic systems).<sup>39</sup>

- State law requires "local governmental agencies wishing to enforce locally adopted energy conservation standards" to submit a study with supporting analysis to the Energy Commission demonstrating how they calculated energy savings and cost-effectiveness. However, local governments are often limited in their ability to meet this requirement.<sup>40</sup>

- **Inadequate or absent compliance infrastructure and burdensome compliance processes:**

California's collective investment in a modernized electronic infrastructure to increase the efficiency of the compliance process for Title 24, Part 6 has lagged and compliance continues to be perceived as a time consuming and paper-heavy endeavor.<sup>41</sup> Transitioning to a streamlined compliance process, including the potential creation of registries, databases and other electronic infrastructure, will require a significant investment. However, program administrators believe developing easy-to-use compliance tools and processes is critical for enabling increased compliance.

- Compliance software struggled to keep pace with the rapid increase in the complexity, breadth, and stringency of building codes over the last two code cycles. This was due in part to the transition from the two-dimensional building modeling DOE 2 program to CBECC-COM, which uses a three-dimensional user interface and an underlying engine based on EnergyPlus.

<sup>35</sup> Reach codes play an important role in ZNE by providing an opportunity to test advanced energy efficiency building practices with designers, building owners, plan examiners, field inspectors, and other development stakeholders. Further, reach code measures work in tandem with utility energy efficiency program incentives designed to accelerate market acceptance and adoption of ZNE building energy practices.

<sup>36</sup> Cadmus, DNV-GL. 2014. Reach Code Subprogram 2010-2012 Process and Pilot Impact Evaluations. pp. 2-6.

<sup>37</sup> CAL Green (Title 24 Part 11) identifies several voluntary Tiers requiring "performance-based" energy code compliance thresholds that exceed the Title 24 building energy efficiency standards by a certain percentage (e.g., 15%). The performance approach allows considerable flexibility in the way that designers and builders can customize the set of energy measures that are best suited to the project's needs and characteristics, provided the building energy performance meets or exceeds the minimum requirements.

<sup>38</sup> Prescriptive-based requires installing specific Title 24 building energy measure(s) such as cool roofs, lighting, hot water distribution systems, water efficiency, and/or commercial kitchen applications.

<sup>39</sup> Mandating installation of renewable energy measures does not necessarily require following California's Preferred Loading Order: energy efficiency, demand response, renewables, and distributed generation.

<sup>40</sup> Section 10-106 of the California Code of Regulations, Title 24, Part 1, Article 1.

<sup>41</sup> Compliance Improvement Advisory Group: <http://www.caciag.com/Issues>.

While the EnergyPlus software engine is more capable of simulating advanced building technologies, the transition caused delays in the implementation of the standards.<sup>42</sup>

- There is a gap between the compliance software results, which are an “asset rating” of a building, and the actual operation or performance of a building. This issue has been increasingly problematic because a code compliant ZNE building does not necessarily reflect actual ZNE operation, in which case customers and building owners are expecting ZNE code buildings to have a zero energy bill.
- To achieve the state’s goal of ZNE for all newly constructed commercial buildings by 2030, building owners and operators must employ compliance software that offers new functionality to both analyze advanced building and design strategies and demonstrate that projects meet ZNE goals.

C&S strategies seek to overcome these key barriers, as explained in greater detail in *Section E, Approach to Achieving C&S Goals*.

## E. Approach to Achieving C&S Goals

### Intervention 1—Advocacy for Building Codes and Appliance Standards at All Levels<sup>43</sup>

The CEESP’s first goal for C&S is to “continually strengthen and expand building and appliance codes and standards as market experience reveals greater efficiency opportunities and compelling economic benefits.”<sup>44</sup> To this end, C&S advocacy efforts will reach multiple levels of decision making across building codes and appliance standards. Specifically, advocacy efforts include strategies to change:

- **State Building Codes:** A state building codes strategy influences proceedings conducted by the Energy Commission and other state agencies. Since building codes determine the efficiency of new buildings, additions, and changes to existing buildings that trigger a permit, they directly influence building design and construction as they relate to ZNE goals.<sup>45</sup> The scope of Title 24, Part 6 has expanded over time to control plug loads, outdoor lighting and some industrial process equipment. The relatively new Title 24, Part 11 Green Building Standards cover water efficiency including site irrigation, building materials, and provisions for electric vehicle charging.<sup>46</sup>

<sup>42</sup> “Revised Effective Date for the 2013 California Building Energy Efficiency Standards,” [http://www.energy.ca.gov/title24/2013standards/2013\\_standards\\_revised\\_effective\\_date.html](http://www.energy.ca.gov/title24/2013standards/2013_standards_revised_effective_date.html).

<sup>43</sup> Advocacy strategies are implemented statewide, per D.16-08-019.

<sup>44</sup> “California Energy Efficiency Strategic Plan: January 2011 Update,” California Public Utilities Commission and California Energy Commission, p. 63.

<sup>45</sup> For more information on efforts to improve state building standards in existing buildings see “California’s Existing Buildings Energy Efficiency Action Plan—2016 Update,” California Public Utilities Commission and California Energy Commission, October 2016, p. 19-20. For more information on plans to improve building codes in new construction, see “Zero Net Energy Action Plan: Commercial Building Sector 2010-2012,” California Public Utilities Commission, June 2011, pp. 10-12.

<sup>46</sup> For more information, see “2016 Green Building Standards Code, Part 11,” International Code Council, <http://codes.iccsafe.org/app/book/toc/2016/California/Green/index.html>.

- **State Appliance Standards:** The state appliance standards strategy influences rulemakings conducted by the Energy Commission to improve the efficiency of appliances in California. Since appliance standards impact efficiencies of equipment in both new and existing buildings, they are a powerful policy tool for saving energy and reducing GHG emissions. Appliance standards are enforced by the Energy Commission through the appliances database and occasional monitoring of products sold into the California market. Appliance standards are also referenced by the building standards and enforced by building officials in more than 500 California jurisdictions.
- **National Codes and Standards:** This strategy seeks to influence a broad range of national building codes and appliance standards that impact California regulations. For example, federal appliance and equipment standards, which are embodied in Title 20, have grown to cover products representing about 90% of home energy use, 60% of commercial building energy use, and 30% of industrial energy use.<sup>47</sup> Hence, federal appliance standards are often the strongest policy tool for reducing energy use in existing buildings and a large part of achieving ZNE in both new and existing buildings. In addition to DOE appliance standards and test procedures, multiple national agencies or organizations exist that develop mandatory or voluntary standards, test procedures, labels, and/or protocols that could directly impact California customers and goals.<sup>48</sup>

In the short-term, the program administrators will continue to inform the design of code proposals through research and analysis, such as CASE reports for particular measures of interest. Program administrators will also play an active role in expanding research and analyses, providing targeted research on specific measures (e.g., water use, building materials, and ventilation), and updating test methods and ratings used by industry groups, technical committees, and regulatory agencies to ensure they reflect the most recent information and align with policy goals.

In addition to continuing these efforts through the mid-term, program administrators will improve the quality of information provided to the Energy Commission and engage a broader range of stakeholders to participate in regulatory proceedings. Program administrators will also expand advocacy efforts to focus on code proposals that enable the grid of the future,<sup>49</sup> such as automated demand response and grid connectivity. **Table 8.6** summarizes *Intervention 1: Advocacy for Building Codes and Appliance Standards*.

“...the scale of the goals and challenges at hand—including that of putting all new commercial buildings on a path to zero net energy by 2030, and meeting AB 32’s emission reduction targets—prompts an accelerated strategy to make the codes more stringent and cover more end uses and measures.”  
— CEESP, p. 63

<sup>47</sup> DOE. (Accessed September 10, 2016). <http://energy.gov/eere/buildings/appliance-and-equipment-standards-program>. Values are national estimates.

<sup>48</sup> These includes, but are not limited to, American Society of Heating, Refrigerating, and Air Conditioning Engineers (model building codes, such as ASHRAE 90.1 and 189.1), International Code Council (model building codes, such as the International Energy Conservation Code and the International Green Construction Code), the Environmental Protection Agency (ENERGY STAR labels), the Federal Trade Commission (EnergyGuide labels), Institute of Electrical and Electronics Engineers (e.g., IEEE 802.3 Energy Efficient Ethernet), International Electrotechnical Commission (test procedures), etc.

<sup>49</sup> <http://www.pgecurrents.com/2016/11/15/pge-leaders-take-part-in-the-national-distributed-energy-future-conference/>.



**Table 8.6**

Intervention 1: Advocacy for Building Codes and Appliance Standards

Intervention Strategy	Barriers	Example Tactics	Existing, Modified or New	Short, Mid, Long-term
<b>Advocacy for Building Codes and Appliance Standards to maximize energy savings</b>	State resource constraints	Lead the creation of detailed CASE proposals for agreed upon topics of interest to the California Energy Commission and other code setting bodies	E	S,M,L
	Data deficits	Expand research and analyses to improve the quality of data included in code change proposals <sup>a</sup>	M	S,M,L
	Federal preemption	Provide research and analysis for measures such as water use, building materials, ventilation, and source pollutants	M	S,M,L
		Actively participate and influence the development and updating of test methods and ratings with industry groups (NEMA, AHRI, etc.), technical committees (ASHRAE, IES, IEEE, etc.) voluntary programs (DLC, CEE, Eprogram administrator/ ENERGY STAR, etc.), and regulatory agencies (DOE, ICC, etc.)	M	S,M
		Provide market analysis and gather high-quality market data, usage patterns and product performance to inform code change proposals.	M	M
		Lead a general review of test procedures used to determine performance of appliances for federal and state standards	N	S
		Proactively engage and foster improved working relationships with a broader range of affected stakeholders and recruit them to directly communicate to the Energy Commission and participate in rulemakings	N	M
		Proactively enhance regulations to include automated demand response requirements, grid connectivity, etc. to enable the plug and play grid	N	M
		Improve quality of information supplied to the Energy Commission for their interactions with federal agencies	N	M

**Sectors:** Residential, Commercial, Industrial, Public, ET, Other: DR

**Partners:** Code-setting entities: California Energy Commission (Energy Commission), Building Standards Commission (BSC), Housing and Community Development (HCD), California Air Resources Board (CARB), State Fire Marshall (SFM); Code enforcement community members (CALBO, CSLB); IOU Energy Efficiency Programs; National Building Code Development Entities: International Code Council (ICC), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), IAPMO, National Fire Protection Association (NFPA); Standards Setting entities: ASHRAE, ICC, Illuminating Engineering Society of North America (IES), ASTM International, ENERGYSTAR, International Association of Plumbing and Mechanical Officials (IAPMO); Manufacturing community representatives; Design and construction community members; Municipal utilities: Sacramento Municipality Utility District (SMUD), Los Angeles Department of Water and Power (LADWP); Compliance software developers; Simulation software developers (e.g., DOE EnergyPlus developers: DOE, National Renewable Energy Laboratory (NREL), Lawrence Berkeley National Laboratory (LBNL); Energy efficiency and automated demand response advocates

<sup>a</sup> Research may include a variety of activities: field surveys to collect population data; collection of internet data to determine costs, availability, performance, and compliance; tactical surveys on specific technologies, industries, markets, behavior, and satisfaction; lab tests, etc. Research will be conducted in multiple subprograms and there will be some overlap. While most data collection and market analysis aimed at long-term code objectives will be conducted out of the code readiness subprogram, codes and standards research on specific measures and building types for open or near-term rulemakings will continue be conducted in other subprogram areas: California Building Codes, California Appliance Standards, and National Regulations. Additionally, support for Reach Codes will continue to include research in various areas.

## Intervention 2— Technical Assistance for Local Governments to Develop and Pass Reach Codes

The CEESP defines reach codes as “codes that direct contractors to construct buildings significantly more energy efficient than required by conventional building codes.”<sup>50</sup> These progressive codes are often part of a local government’s climate action plan and provide crucial experience for understanding the implementation issues associated with a new code before it is rolled out on a statewide basis. While program administrators will continue existing support such as developing cost-effectiveness studies per climate zone, drafting model ordinance templates, creating compliance support tools (e.g., carbon calculator), and assisting with the reach code application process, this strategy will be expanded in the future by raising the bar for reach code measures (e.g., CAL Green Voluntary Tiers and a ZNE reach code). Program administrators will increase the adoption of local reach codes that support the development and adoption of statewide and national code changes.

“Local governments play an important role, both in the enforcement of Title 24, Part 6 for building construction and renovation and in the development of local ‘reach’ codes that can serve as pilots for statewide codes...These important efforts serve to continually ‘raise the bar’ for California’s state-wide standards.”

— CEESP, p. 64

In the short-term, program administrators will collaborate with the Energy Commission, Building Standards Commission (BSC), and Housing & Community Development (HCD) to prepare cost-effectiveness studies of Title 24, Part 11 CALGreen Voluntary Tiers to explore incorporating these measures into future reach code designs.<sup>51</sup> This tiered approach aligns with the CEESP’s call for a “...balance between mandatory, prescriptive, and beyond-code ‘reach standards’.”<sup>52</sup> Program administrators will also develop a comprehensive ZNE reach code in support of the CEESP’s call for all non-residential buildings to be ZNE by 2030—this tactic is also identified as a long-term strategy in the CEESP.<sup>53</sup> In addition, program administrators will coordinate energy efficiency program offerings with reach code measures and increase education efforts to help local governments understand the benefits and best practices of implementing reach codes in their communities.

In the mid-term, program administrators will explore opportunities to provide resources for homebuyers, tenants, landlords, appraisers, and lenders to become aware and appreciate the value of highly energy efficient homes compared to conventional homes. Opportunities may include developing tools for appraisers and lenders to facilitate the process of recognizing and valuing high performance energy efficiency features in homes. These tools may include home energy score, green multiple listing service, energy efficiency mortgages, and mandatory building energy disclosure at time-of-sale.

Ultimately, reach codes play a leading role in spurring above-code innovation that advances progress towards the state’s energy efficiency and ZNE goals. **Table 8.7** summarizes *Intervention 2: Technical Assistance for Local Government to Develop and Pass Reach Codes*.

<sup>50</sup> “California Energy Efficiency Strategic Plan: January 2011 Update,” California Public Utilities Commission and California Energy Commission, p. 121.

<sup>51</sup> CALGreen “incorporates three levels of energy efficiency: a basic level (Title 24), 15 percent over T24 and 30 percent over T24.” For more information, see “Zero Net Energy Action Plan: Commercial Building Sector 2010-2012,” California Public Utilities Commission, June 2011, p. 8.

<sup>52</sup> “California Energy Efficiency Strategic Plan: January 2011 Update,” California Public Utilities Commission and California Energy Commission, p. 65.

<sup>53</sup> “California Energy Efficiency Strategic Plan: January 2011 Update,” California Public Utilities Commission and California Energy Commission, p. 64.

**Table 8.7**

Intervention 2: Technical Assistance for Local Government to Develop and Pass Reach Codes

Intervention Strategy	Barriers	Example Tactics	Existing, Modified or New	Short, Mid, Long-term
<b>Technical assistance for local governments to develop and pass reach codes</b>	Local governments lack awareness about which reach codes can help them achieve their goals, and lack the resources needed to adopt reach codes	Develop tools in collaboration with local jurisdictions that track, quantify, and report reach code energy savings and greenhouse gas reductions	E	S
		Coordinate with energy efficiency programs (e.g., Savings By Design , Local Government Partnerships) to align programs with reach code measures	M	S, M
		Support coordination between Energy Commission, BSC and HCD staff to leverage Title 24 Part 11 CALGreen Voluntary Tiers as a primary source for reach code measures by preparing cost-effectiveness studies that support the CAL Green Voluntary Tier rulemaking process	M	S
		Support collaboration with Energy Commission, regional energy networks, local government partnerships, regional public affairs, and other stakeholders to educate elected officials and staff regarding the value of reach codes, requirements and best practices for reach code adoption, and tools and resources available to aid implementation	M	S
		Support local initiatives to improve efficiency in existing residential buildings (e.g., home energy score, green multiple listing service, energy efficiency mortgage, mandatory energy disclosure, etc.)	N	M
		Develop a comprehensive ZNE reach code that integrates energy efficiency, renewables, alternative fuels and electric vehicle infrastructure, energy storage, automated demand response, and water saving measures with prescriptive measures for each targeted area	N	S

**Sectors:** Public, Commercial, Residential

**Partners:** Code-setting entities: California Energy Commission; IOU Internal Programs: Local Government Partnership Program; State and local governments; Code enforcement community; IOU Statewide C&S Team

“Compliance with California’s efficiency codes and standards varies enormously, especially with respect to building codes...It has been estimated that at least 30 percent of the technical energy savings potential of energy codes is lost due to non-compliance—but in reality there is inadequate understanding of code compliance rates or the resulting degradation of performance.”

— CEESP, p. 66

### Intervention 3— Compliance Improvement Activities

Although rigorous and progressive code development has saved Californians more than 15,000 GWh since 2003 and \$75 billion since the mid-1970s,<sup>54</sup> non-compliance remains a barrier to achieving even deeper savings.<sup>55</sup> Moving forward, program administrators will enhance compliance improvement activities to maintain high compliance margins for whole buildings and appliances and improve compliance margins for selected, high importance C&S. Through compliance improvement efforts, critical market actors will better understand their unique role in compliance, and will be equipped with the specific knowledge, skills, and tools they need to quickly, easily, and effectively perform their compliance job tasks.

Activities conducted in support of this strategy target market actors throughout the entire compliance supply chain by providing needs-based tools, training, resources and outreach. **Table 8.8** summarizes *Intervention 3: Compliance Improvement Activities*.

<sup>54</sup> “California’s Golden Energy Efficiency Opportunity: Ramping Up Success to Save Billions and Meet Climate Goals,” National Resources Defense Council, August 2015, p. 17.

<sup>55</sup> For more information, see “California’s Existing Buildings Energy Efficiency Action Plan – 2016 Update,” California Energy Commission, p. 20-21; “California Energy Efficiency Strategic Plan,” California Public Utilities Commission and California Energy Commission, p. 66.

**Table 8.8**

Intervention 3: Compliance Improvement Activities

Intervention Strategy	Barriers	Example Tactics	Existing, Modified or New	Short, Mid, Long-term
<b>Compliance improvement activities</b>	Inadequate or absent compliance infrastructure and burdensome compliance processes	Develop and implement role-based training that teaches market actors how to perform their unique compliance job tasks	E	S
		Develop tools and resources that help market actors understand codes and standards, and reduce burdensome processes	M	S
		Develop training using the appropriate modalities per market actor	M	S
		Conduct outreach to increase awareness of the value of compliance with California’s energy standards and publicize the availability of tools, training and resources to support improved compliance	M	S
		Increase clarity and usability of codes by incorporating user-centered design in code development	M	M
		Develop an electronic repository to track repeated patterns of non-compliance by builders and repeated errors by energy analysts. This data can be used to improve the next version of the standards.	N	M,L
		Utilize the electronic repository to identify common errors, understand which measures are used in practice, and inform the next versions of the standards.	N	M,L

**Sectors:** Residential, Industrial, Commercial, Public, WE&T, emerging technologies (ET), Other: DR

**Partners:** Code-setting entities: California Energy Commission, HCD, BSC; Other state agencies; Investor Owner Utilities: IOU Statewide C&S Team, Programs, WE&T, DR, Local Government Partnerships; Utilities: publicly owned utilities (POUs) and water districts; Code enforcement community; Design, construction, energy consultant community members; Manufacturing community representatives; State and local governments; Regional Energy Networks; Research community members; California’s higher education institutions; energy and sustainability non-profits

## Intervention 4 – Code Readiness Activities<sup>56</sup>

The Code Readiness strategy is a PG&E-specific intervention strategy that has three key objectives:

1. Produce high quality information and data (savings are not the initial priority) to support industry transformation. In 2016, PG&E applied this strategy to three residential projects and one nonresidential project. PG&E’s plan is to expand this area of work in 2017 and beyond. The data will also identify market barriers that need to be overcome to achieve high level market adoption.
2. Leverage a vast pool of C&S research (technology and market research, cost-effectiveness, impacts on manufacturers, etc.) conducted by DOE, IOUs, Northwest Energy Efficiency Alliance (NEEA), and others, adding information garnered from industry representatives during negotiated rulemakings. This research can be used to accelerate the development of new measures for incentive programs, in particular, when there is a long delay between final rules and the effective dates of standards.

3. Improve primary data collection through field research surveys, online data harvesting, and laboratory tests to increase the quality and effectiveness of advocacy efforts. Code readiness work will be closely coordinated with ET, with any C&S code readiness elements comprising a new, complementary source of innovation for the portfolio.

The primary outcome of code readiness activities is high-quality data sets for measures and systems needed to support specific codes and standards objectives and documents summarizing C&S research. Through this investment in robust data, PG&E will decrease the cost of future code enhancement proposals. **Table 8.9** summarizes *Intervention 4: Code Readiness Activities*.

**Table 8.9**  
Intervention 4: Code Readiness Activities

Intervention Strategy	Barriers	Example Tactics	Existing, Modified, or New	Short, Mid, Long-term
<b>Code readiness activities to gather data for future C&amp;S proposals</b>	Data deficits “Stranded” potential	Conduct field research surveys to collect population data, including detailed on-site audits and metering to determine equipment performance, load shapes, etc. Support with lab testing, tactical surveys, etc.	M	S,M,L
		Design and implement promising technology packages and systems to collect accurate, code-relevant data: enforceability, feasibility, and cost effectiveness. Support with various other tactics, including collection of costs and compliance from web data	N	S, M
		Summarize codes and standards research and other information in a format that can be easily extracted to develop work papers.	N	S,M,L

**Sectors:** ET, Other IOU Test Labs

**Partners:** Incentive program staff; equipment manufacturers; architects, engineers, and building scientists; builders and manufacturing partners; residential and nonresidential building owners; contractors

<sup>56</sup> Code Readiness activities are PG&E specific.

## Rescuing “Stranded” Potential

California’s C&S are moving forward rapidly to help meet the state’s policy goals. While increasingly stringent codes create new opportunities to save energy in new and existing buildings, bringing existing buildings into compliance with current codes can be out of reach for many customers. IOU program incentive structures have historically focused on getting customers who are in compliance with code to go beyond code. Before the passage of AB 802, IOUs offered limited energy efficiency programs and incentives to effectively target outdated, inefficient equipment, operating significantly below current code levels. The combination of more progressive building codes and the limitations of historic incentive structures create a wedge of “stranded” savings potential.

PG&E proposes an integrated approach to mitigate stranded potential by strategically shifting to existing conditions baselines for voluntary programs, launching code readiness efforts, and improving collaboration between C&S and voluntary programs.

### Existing Conditions Baseline

Prior to AB 802, most IOU energy efficiency programs only incentivized efficiency savings that exceeded current building codes, operating under the default assumption that existing equipment would be replaced with new code-compliant equipment absent the program. Thanks to AB 802, baselines will more frequently be based on existing conditions. This shift presents the opportunity for IOUs to mitigate stranded potential by further incentivizing equipment upgrades using an existing condition or repaired equipment baseline. In this way, customers who have the most inefficient – but otherwise fully functional equipment – may be offered greater incentives than before, helping to bring code-compliance and beyond within reach. Further, using existing condition baselines allow for targeting of customers with high energy use using advanced metering infrastructure (AMI) data – a powerful tool for identifying stranded potential.

## Code Readiness

PG&E’s code readiness activities, in conjunction with voluntary incentive programs, help minimize stranded potential. Code readiness is able to do this by collecting data on promising technologies that will be incorporated into future C&S, such as project cost, contractor education gaps, customer acceptance, commissioning obstacles, technological issues, and market fit. The collected data will be used in C&S and voluntary programs to support industry transformation by informing rebate levels, contractor and industry actor training, feedback to manufacturers, and marketing efforts. This will include a constant feedback loop with IOU programs to respond to market feedback. The intent is to work through market failures for new technologies before the measure is adopted into code to reduce stranded potential in the market.

### Improved Collaboration with Voluntary Programs

C&S works closely with the Energy Commission to implement new building codes and appliance standards through an open stakeholder process. Although this process has effectively achieved energy savings, it has not incorporated the lessons learned from voluntary programs on market effects. The C&S program and the voluntary programs are increasing their collaboration to incorporate lessons learned from the implementation of each code cycle. This feedback will provide lessons on improved stakeholder collaboration, insight into loopholes, increases in costs to customers, contractor education gaps, and customer acceptance of specific technologies. Work to simplify codes during development of new code change proposals should help alleviate stranded potential by reducing complexity and improving code compliance.

## F. Statewide Administration and Transition Timeline

D.16-08-019 modifies the program administration structure for all upstream and midstream programs, market transformation efforts, and select downstream programs, such that these programs become “statewide.” D.16-08-019 defines statewide programs as being delivered uniformly throughout the IOU service territories and overseen by a single lead program administrator.<sup>57</sup> Statewide efforts are required to comprise at least 25% of each IOU’s portfolio budget.<sup>58</sup>

Please refer to the *Statewide Administration Chapter* for program administrators’ proposals for statewide programs and/or subprograms.

## G. Solicitation Strategies and Transition Timeline

D. 16-08-019 sets a minimum target of 60% of the utility’s total portfolio budget, including administrative costs and EM&V, to be proposed, designed, and delivered by third parties by the end of 2020.<sup>59</sup> Please refer to the *Portfolio Overview Chapter* for PG&E’s complete solicitation strategy and transition timeline, by sector.

## H. Metrics and EM&V

PG&E and the other program administrators understand the importance of ensuring that all metrics provide value to the CPUC, program administrators, or other stakeholders. We also recognize that listed metrics can have powerful and unintended effects.<sup>60</sup>

These metrics are consistent with the agreed-upon statewide guiding principles for the metrics shared with the Energy Division on August 16, 2016.

### Metrics should...

Be used and useful by PAs to manage portfolio

Be timely

Rely on data used in program implementation

Be simple to understand and clear of any subjectivity

Have longevity

The guiding principles also indicate that metrics are not a replacement for EM&V.

Additionally, not all metrics have a readily interpretable meaning, so context is needed. As such, we provide context on the metrics in the notes section of our table.

BEnergy Code Aceuse C&S is a program rather than a sector, in this section we present information on program-level metrics and indicators that will be explored more in the development of the implementation plan for C&S. We also show the savings goals for this program in **Table 8.10**.

<sup>57</sup> D.16-08-019, p. 51.

<sup>58</sup> D.16-08-019, p. 65.

<sup>59</sup> D.16-08-019, p.74.

<sup>60</sup> Perrin, in an article in the American Journal of Evaluation, discussed certain known limitations of performance metrics. Among these limitations, he described varying interpretation of the “same” term and concepts, goal displacement, use of meaningless and irrelevant measures, and cost-savings vs. cost-shifting. [Perrin, Burt. 1998. Effective Use and Misuse of Performance Measurement. American Journal of Evaluation 1998:19;367.]



**Table 8.10**  
PG&E Codes and Standards Metrics

GOAL: Save 2,545 GWh, 739 MW, 46 MM therms from C&S efforts						
Intervention Strategies	Metrics	Baseline (or Benchmark)	Metric Source	Short-Term Targets (1-3 years)	Mid-Term Targets (4-7 years)	Long-Term Targets (8-10+ years)
Advocacy Technical assistance for Local Governments	Electricity Savings (Net)	Average of 361 Net GWh / year across 2011-2015	<ul style="list-style-type: none"> <li>Energy Efficiency Annual Report</li> <li>CPUC impact evaluation</li> </ul>	1,190 Net GWh / 18 Net MMT / 307 Net MW	875 Net GWh / 18 Net MMT / 268 Net MW	480 Net GWh, 10 Net MMT, 164 Net MW
Compliance Improvement Activities	Demand Savings (Net)	Average of 60 Net MW / year across 2011-2015				
Code Readiness	MM Therm Savings (Net)	Average of 0.59 Net MM Therms / year across 2011-2015				
Indicators <sup>b</sup>						
Annual GHG reduction						
Number of cost effective measures adopted into building codes or appliance standards by state agencies						
Number of cost effective measures adopted into appliance standards by federal agencies						
Number of analyses (e.g. CASE studies and appliance standard studies)						
Number of tools and resources that support new codes (available for use before the effective date)						

Note: **Metrics** have baselines and targets, will be tracked, and when updated will compare the current value to the baseline and target. **Indicators** will be tracked but have no targets and may or may not have baselines. Indicators provide useful context for the metric.

<sup>a</sup> Green House Gas (GHG) emission reductions are calculated based on emission factors for electricity and natural gas energy savings provided in the California Energy Commission 2016 Title 24, Part 6 Impact Analysis.

<sup>b</sup> We list some indicators that we intend to use at the program-level. This list of indicators will be finalized after the program design and budgets are allocated. Note that the metrics and indicators for this program will be a mix of outputs that can be regularly tracked, and outcomes that will be studied as funds become available. For any program-level metrics, baselines and targets will be specified in the C&S implementation plan or during the program-design phase.

## Metrics Measuring C&S Goals

PG&E's C&S and the other cross-cutting programs are focused on supporting statewide policy objectives, such as the doubling of energy efficiency by 2030 and efforts to work towards ZNE buildings. Each of the cross-cutting programs supports statewide goals.

C&S's primary goal is to cost-effectively reduce energy use for ratepayers and significantly increase the likelihood that California will achieve its climate goals.

Specific energy saving goals for PG&E's advocacy efforts include the following:

- PG&E's C&S program strives to reach energy use reduction targets of 2,545 GWh and 46 MMT between 2018 and 2025, and a reduction in demand of 739 MW over the same period. These goals are based on PG&E's past performance relative to Potential Study goals.

C&S supports California's energy and climate-related policy goals through four overarching strategies, including:

- Advocacy that responds to all opportunities for significant savings through new codes and standards (i.e., local reach codes, state, and federal)
- Technical assistance to local governments that increases the adoption of local reach codes that support the development and adoption of statewide and national code changes
- Compliance improvement activities that strive to maintain high-compliance margins for buildings constructed or altered within the Title 24, Part 6 compliance process; and improve compliance margins for selected, high-importance building code measures and appliance standards
- Code readiness activities that aim to introduce promising building systems and appliances to actors within building industry supply chains to determine their readiness for codification

Energy savings is the primary metric for C&S at the business plan level. C&S savings goals are shown in **Table 8.11**. We also list several indicators that will be used to measure strategies at the implementation-plan level; however, this list will be revised and finalized based on the final program design.

## I. EM&V Preparedness and Research Needs

C&S has identified several overarching data gaps in C&S. The research for this sector will be contingent on the needs of the portfolio as a whole and the annual research budget for this sector. However, C&S believes that the following studies should be considered in the EM&V Research Plan.

Studies to support C&S:

- **Program attribution study (forthcoming):** Program attribution has been difficult to determine. Studying the potential indicators for program attribution will provide greater clarity on attributing program savings to the IOUs.
- **Code compliance study:** Anecdotal evidence on code compliance is often discussed but actual measurements of code compliance are minimal, especially with HVAC measures and NR lighting retrofits. Studying code compliance on HVAC measures and NR lighting will provide information on areas for the program to improve code proposals in these two key areas.
- **Periodic market studies to determine market effects:** The Potential Study provides a market baseline for specific building systems that will be targeted by the program. Tracking the uptake of efficient systems requires additional data collection and analysis. The baseline study should be updated twice, once by the end of year five and the other by the end of year nine.

The 2015 planned IOU-led studies include those to 1) determine code readiness, 2) explore methods for Title 24, Part 6 improvement, and 3) conduct a process evaluation of IOU C&S Program trainings, classes, and tools.

## EM&V within C&S

The activities within the C&S Program serve two distinct EM&V needs as shown below. The efforts described below employ C&S, rather than EM&V, dollars. As such, they are considered part of the program implementation process, rather than the formal EM&V process. We point these out to assist the reader in understanding how the C&S activities are set up to be prepared for EM&V.

**1. Baseline data collection:** Detailed baseline data collection forms the basis for support of federal and State standards development and as such, is one of the integral parts of the C&S advocacy work. Our standards development work, at both the state and federal levels, is grounded in a firm understanding of existing conditions of energy use by appliance, system, and market segment. Without current, appliance/equipment usage information by market segment credible estimates of standard's savings, lifecycle cost, and prospective cost effectiveness it is impossible to present a persuasive case for adoption of a proposed standard. The C&S work uses large, statistically valid samples of customer-specific appliance holdings, building conditions, and consumption patterns wherever possible to establish the appropriate scope and level of a proposed standard. Our advocacy support efforts demand carefully designed sampling plans, extensive on-site survey efforts, and energy use metering at both the appliance/system and whole building levels. Optimally the sample designs must be sufficiently robust to allow testing of potential efficiency changes to support the standard development process.

**2. Program and sub-program effectiveness:** Development and tracking of program implementation metrics to gauge sub-program effectiveness is essential to continued improvement of program implementation efforts. Advocacy efforts are the key driver of readily measurable energy savings for the C&S Program. C&S will conduct rigorous recording and detailing of IOU advocacy efforts in order to determine the relative impact of IOU efforts on passage of new codes and standards. Such information is gathered as part of program implementation efforts and is used in the preparation of Code Change Theory Reports (CCTRs) that form the basis for program attribution determination by CPUC impact consultants.

The use of program implementation metrics is also important in determining the effectiveness of C&S efforts for which direct energy savings information is not readily available. Compliance Improvement efforts, for example, are not easily measured by changes in program savings due to the cost of obtaining detailed compliance data. In particular, building standards compliance data is notoriously costly to obtain. Hence, program efforts are measured by a variety of non-savings implementation metrics that track the effectiveness of compliance improvement/education efforts.

Non-resource implementation metrics are also necessary to track the reach code support efforts that comprise the IOUs' Reach Code subprogram. While reach codes do generate direct savings the IOU efforts are aimed at providing tools for local jurisdictions to implement reach codes. It is up to the jurisdictions to use the tools as part of their enforcement efforts.

Non-resource program implementation metrics will also be needed to track code readiness subprogram efforts. The intent of code readiness efforts is to accelerate the market transformation effects of C&S efforts, rather than directly generating large amounts of near-term savings. Consequently, a set of new program implementation metrics will need to be developed to track code readiness efforts and effectiveness.

# Appendices

## Codes and Standards Appendices

### Appendix A: Compliance Checklist

	<b>Cross Cutting Sector</b>	
<b>BP Page Number</b>	<b>Business Plan Guidance</b>	<b>Notes</b>
	<b>A. Market Characterization</b>	
	<b>a. Customer landscape (who they are, what are their needs)</b>	C&S Landscape, pp. 9-14
	b. Trends	C&S Landscape, pp. 9-14
	c. Gaps/Barriers	C&S Landscape, pp. 9-14
	<b>B. Value</b>	
	a. Discussion of roles for cross-cutting sector	Appendix B
	b. How does it support portfolio	Appendix B
	c. How does it benefit customers	Appendix B, Appendix C
	d. External impacts and benefits (community/economic benefits)	Appendix B
	<b>C. Vision</b>	
	a. Discussion of opportunities	Codes and Standards Vision, pp. 3-4
	b. Whether items are near-, mid-, long-term strategic initiatives	Approach to Achieving C&S Goals, pp. 15-23
	<b>D. Metrics</b>	
	a. One metric or more as appropriate for each intervention strategy	Metrics and EM&V, pp. 24-26
	<b>E. Program/program administrator Coordination: Description of which and how strategies are coordinated regionally among program administrators and/or other demand- side options.</b>	Approach to Achieving C&S Goals, pp. 15-23
	<b>F. EM&amp;V Considerations: Statement of evaluation needs “preparedness” (i.e., data collection strategies and internal performance analysis)</b>	EM&V Preparedness and Research Needs, pp. 26-27

## Appendix B: Codes and Standards Value

### **Roles for Codes & Standards Program within the Cross-Cutting Sector**

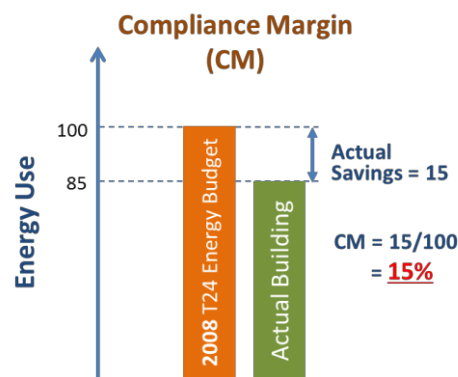
The C&S Program emerged during the late 1990s when California's first attempted to transition away from resource acquisition to market transformation programs. The program objective was to cause permanent reductions in energy use through improvements to the Building Energy Efficiency Standards and Appliance Standards. Circa 2005, advocacy was extended to include federal appliance standards, which are embodied in Title 20 after a DOE final rule.

For measures included in incentive programs, codification of a measure provides an exit strategy to sunset incentive support for technologies that have graduated from emerging to standard practice, completing transformation and liberating funds to be used for new technologies. To ensure the savings from newly adopted codes and standards are realized, the compliance improvement team conducts education and training, and develops tools, to help individuals within compliance supply chain (builders, contractors, manufacturers, etc.) correctly implement state and federal regulations.

Figure B.1 shows, based on CPUC evaluations, that compliance margins (percent beyond code) for whole buildings and lighting alterations exceed code baselines, indicating robust compliance with building codes from an energy use perspective.

Figure B.1. Compliance Margins from CPUC Evaluations<sup>1</sup>

	Standards	Compliance Adj. Factor (CAF)	Compliance Margin (% above code)
2006 – 08 Evaluation	2005 T24 RNC (whole Building)	120% (Electric) 235% (Gas)	Not available
	2005 T24 NRNC	61.5% (8 – 100%)	
2010 – 12 Evaluation	2008 T24 NRNC	410% (kWh) 328% (kW) 118% (Therm)	13% (kWh) 14% (kW) 1% (Therm)
	2008 T24 NR Alteration	304% (Indoor lighting, kWh) 83% (Re-roof)	7% (Indoor lighting, kWh) Unknown for re-roof*



Through reach codes, and planning and coordination activities, the program conducts activities to advance and harmonize codes, standards, and ratings by local governments, ASHRAE and others, such that they support California building codes and appliance standards and other goals. Internal coordination serves to inform programs regarding upcoming changes and gather information to support future code enhancement proposals.

### How Does it Support the Portfolio

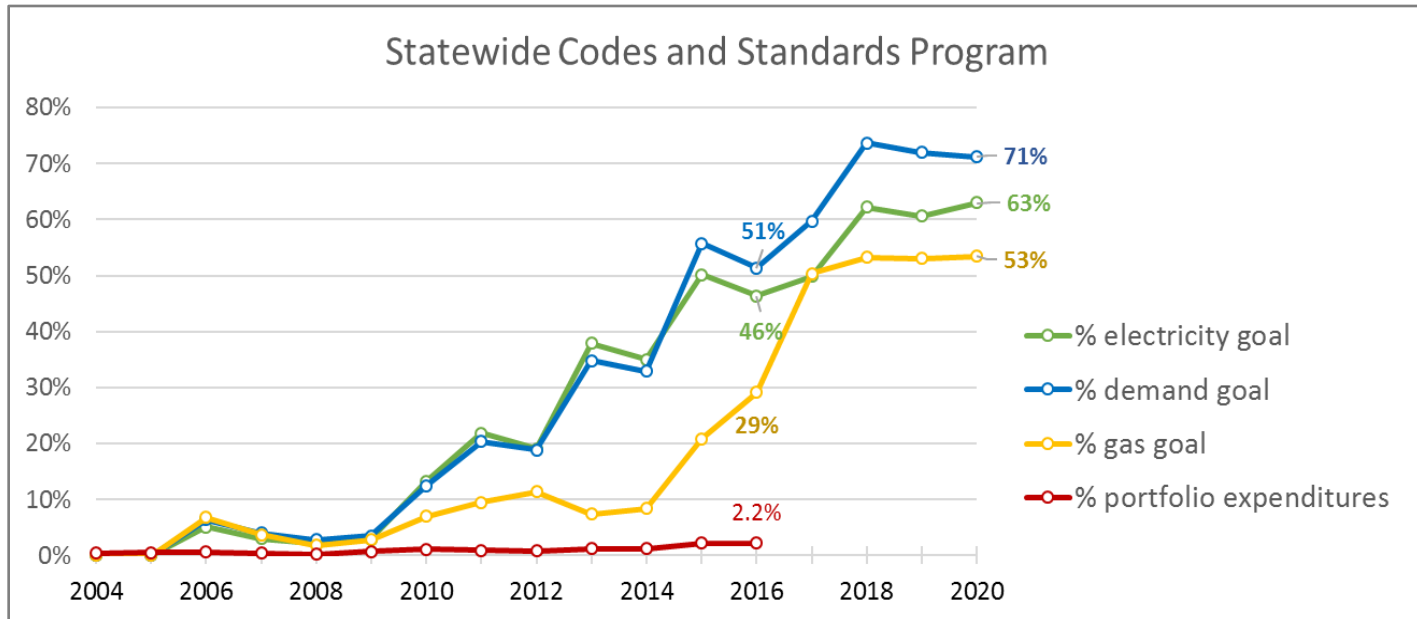
The C&S program is an extremely cost-effective program since savings continue to accrue for many years following the C&S program advocacy activities. In 2016, with a statewide budget equal to approximately 2.2 percent of the portfolio total, the C&S Program will generate approximately half of the portfolio electric savings (46 percent electricity, 51 percent demand) and almost one-third (29 percent) of gas savings.

Given delays between research and rulemakings, and between adoption and effective dates, several years may lapse between advocacy efforts realized savings. The savings shown illustrate that measures adopted because of C&S Program efforts conducted through March 2016 will continue to produce savings equal to more than half of the total portfolio savings through 2020. The activities described in

<sup>1</sup> CPUC 2010 (Cadmus). "CA IOU C&S Program Evaluation for Program Years 2006-08." CPUC 2014 (Cadmus). "Statewide C&S Program Impact Evaluation Report PY 2010-12."

this Business Plan will produce savings from appliance and building standards scheduled for adoption before 2020, and will set the stage for a stream of savings to be realized in future code cycles.

Figure B.2: Codes and Standards Program Budget and Savings



Note: the estimated demand, electricity, and gas percentages are calculated by dividing the C&S savings by the total portfolio savings (C&S and incentive programs). The C&S Program savings are based on adopted standards (thru March 2016) for which Statewide IOU team conducted advocacy efforts. The C&S savings are derived from either CPUC Impact Evaluations (for standards that became effective in 2006 thru 2012) or IOU estimates (for standards that become effective in 2013 and beyond). The incentive program savings are estimated based on CPUC evaluation results (for savings from 2004 to 2012), IOU estimates (for savings from 2013-15), and incentive programs goals provided in the CPUC Decision 15-10-028 (2016 and beyond). Per prior CPUC policy, C&S Program savings are *net* and incentive programs savings are *gross*. [Note: The August 2016 CPUC decision D.16-08-019 has now recommended that incentive program goals be measured in *net* goals rather than *gross* goals to address potential free ridership concerns.]

Just as the C&S program serves a diverse customer landscape, it also plays a cross-cutting role in supporting the other programs within energy efficiency. Accurate data derived from data gathering from code-driven research and market analysis to support the development of effective standards may also be a resource for program developers and implementers serving customers that the standard will eventually impact. This positions the C&S program to share knowledge through existing relationships.



## Benefits to Customers

C&S activities benefits California's customers by:

- 1) Significantly reducing in energy bills for all customers;<sup>2</sup>
- 2) Providing a solution for the "split incentive" problem faced by a larger percentage of customers who are tenants. (Many landlords purchase appliances based upon first cost, so the improved standards provide the best chance for improved energy efficiency for tenants.); and
- 3) Supporting building design teams, contractors, customers and government agencies to improve their ability to comply with codes and standards.

C&S activities benefits state agencies by:

- 1) Achieving progress toward CPUC, Energy Commission, and California Air Resources Board (CARB) policy goals;
- 2) Coordinating with other entities to support the state's ambitious energy policy goals; and
- 3) Assisting local governments in developing ordinances that exceed statewide minimum requirements.

## External Community and Economic Impacts and Benefits

Codes and standards have far-reaching impacts, throughout California and beyond. California frequently leads the nation in setting stringent codes and standards, and many of the benefits realized in California spillover to other states nationwide, and also internationally.

When a code or standard is adopted, it begins permanently changing the market, and the covered technology (or equipment or activity) typically becomes standard practice. Impacts from these market changes provide significant benefits to both IOU and non-IOU customers throughout the state. This benefit affects those who participate in IOU incentive programs as well as those who do not. The Energy Commission estimates that savings from implementation of the 2016 building standards will reduce annual statewide greenhouse gas emissions by 160,000 metric tons of CO<sub>2</sub>e<sup>3</sup>.

In addition, the economic benefits continue to accrue with each transaction following a code adoption translating to reduced operating costs which directly impact the bottom line for everyone, including:

- Local governments: increase ability to meet local goals through supporting standards implementation;
- Local businesses: increase profits, reduce prices; and
- Homeowners and residents: lower energy costs, increase in discretionary income.

An increase in discretionary income produces increased spending, at least some of which will be spent at locally-owned businesses, compounding the benefits further through the local multiplier effect, which

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<sup>2</sup> For example, annual bill reductions per home resulting from the Statewide C&S program advocacy is estimated at \$400/y for newly constructed homes and \$100/y for existing homes. See slide 4 of the May 4, 2016 Stage 2 Statewide C&S presentation for the EE Coordinating Council. [http://media.wix.com/ugd/0c9650\\_7b6b1a4581114c73b658ca50b37ba625.pdf](http://media.wix.com/ugd/0c9650_7b6b1a4581114c73b658ca50b37ba625.pdf)

<sup>3</sup> 2016 Building Energy Efficiency Standards, June 2015. [http://www.energy.ca.gov/2015publications/ENERGY\\_COMMISSION-400-2015-037/ENERGY\\_COMMISSION-400-2015-037-CMF.pdf](http://www.energy.ca.gov/2015publications/ENERGY_COMMISSION-400-2015-037/ENERGY_COMMISSION-400-2015-037-CMF.pdf)

posits that money spent within the community produces a greater local economic benefit as it recirculates and is re-invested in the community.

Updated codes often spur market innovation to increase customer functionality and energy efficiency. One good example of this is residential clothes washers. In 2006 DOE implemented a clothes washer standard that improved the efficiency to push most top loader washers out of the market. This was a pretty progressive move towards energy efficiency at a time when top loading washers still dominated the market. Front loaders were a premium product in the US even if they dominated the market in Europe. As a result of DOE's regulation manufacturers now produce a low cost front loading washing machine that saves water and energy (while still effectively cleaning clothes). This type of code-driven innovation has encouraged manufacturers to engineer better products while saving energy.

The C&S program creates jobs through direct employment, indirect employment, and induced employment. The program creates jobs in all three categories with a significant amount created from induced employment which accounts for the expenditure-induced effects in the general economy due to the economic activity and spending of direct and indirect employees. These shared benefits are reinvested in local economies by millions of customers. Wei et al. (2010) estimates that energy efficiency creates 0.17 to 0.59 net job-years per GWH saved.<sup>4</sup> By comparison, they estimate that the coal and natural gas industries create 0.11 net job-years per GWH produced. When utilizing a mid-point for the energy efficiency range (0.38 net job-years per GWH saved), and assuming 80,000 GWH in committed statewide efficiency savings from codes and standards by 2026, the resulting cumulative job creation would be a projected 30,400 jobs.

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<sup>4</sup> "Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US?" Max Wei, Shana Patadia, and Daniel M. Kammen. *Energy Policy* 38 (2010) 919–931.

## Appendix C: Customer Landscape

C&S affect many stakeholders in the building industry supply chain. Appliance standards impact all customers who purchase regulated products. Considering this, the influence of C&S has an effect on virtually all customers. With respect to advocacy engagement, priority stakeholders include those who can affect the success of standards in the rulemaking process and through implementation.

Stakeholders include, but are not limited to:

- a. Local, state and federal government agencies
  - i. Local jurisdictions
  - ii. State agencies
  - iii. Federal agencies
- b. Utility colleagues
  - i. California investor-owned utility (IOU) partner utilities
  - ii. Non-California based IOUs operating in California
  - iii. California-based municipal utilities
  - iv. National utility partners
  - v. Third party implementers
  - vi. Trade professionals
- c. Standards, testing, and ratings organizations
  - i. Professional organizations (ASHRAE, IES etc.)
  - ii. Industry organizations (AHRI, NEMA, AGA, CTI etc.)
  - iii. Voluntary equipment rating programs (ENERGYSTAR, DesignLights, etc.)
  - iv. Building rating programs (LEED, PassiveHouse, Eprogram administrator PortfolioManager, Living Building Rating etc.)
  - v. Building testing organizations (HERS, NatHERS, ATTs, Commissioning Orgs)
  - vi. Governmental organizations (DOE, NIST, National Labs, Eprogram administrator)
- d. Enforcement agencies
  - i. Building inspectors
  - ii. Plans examiners
  - iii. Building official advocacy groups (CALBO)
- e. Regional partnerships & advocacy groups
- f. Construction industry market actors
  - i. Design professionals, contractors, engineering firms, energy consultants, HERS raters, and acceptance test technicians
- g. Construction industry suppliers
  - i. Manufacturers, distributors, and retailers
  - ii. Industry associations
- h. Building owners and operators
  - i. Building owners (BOMA, California Business Properties Association, etc.)
  - ii. Occupants (employee unions, retailers etc.)
- i. Demand response providers
  - i. California utilities
  - ii. Third party implementers
  - iii. DR Equipment providers
- j. Renewable energy providers
  - i. Solar equipment manufacturers
  - ii. Solar installation companies
- k. Renewable energy advocacy groups (CalSEIA, Environmental Groups)
  - i. Energy Commission

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CROSS-CUTTING SEGMENT

# WORKFORCE EDUCATION & TRAINING

CHAPTER 09

WE&T

# SNAPSHOT

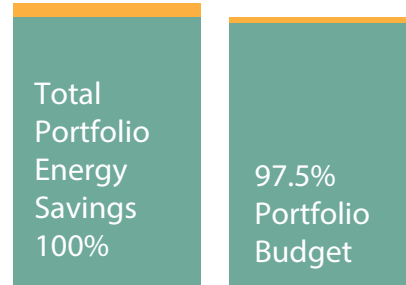
**8%**

of PG&E zipcodes disadvantaged.\*  
of PG&E WE&T attendees from disadvantaged zipcodes.

Based on zipcodes of WE&T course attendees.  
\* see footnote 6 for definition of disadvantaged.

5% additional savings from WE& T

WE&T 2.5% of Portfolio Budget



WE&T Influence on Energy Savings

Savings estimated by Opinion Dynamics Corporation, *Indirect Impact Evaluation of Statewide Energy Efficiency Education and Training Program, 2006-2008*, pg. 3. 2008 Budget Figures based on 2006 filed budgets.

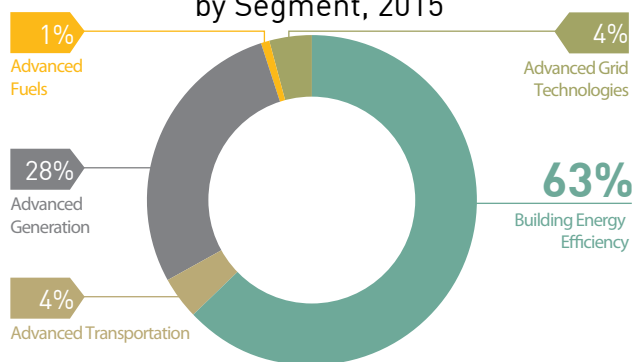
## In the California Advanced Energy Economy, including Energy Efficiency:

**38%** of workers are racial or ethnic minorities.

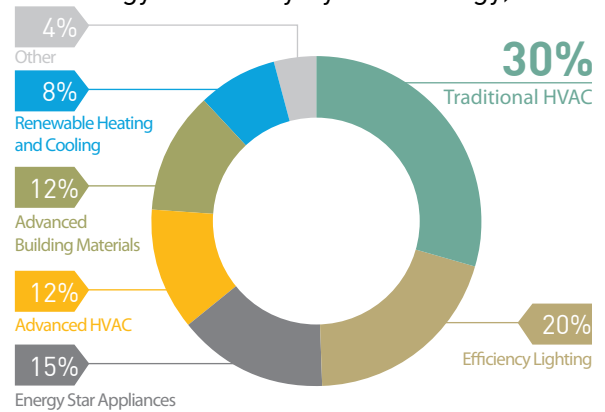
**39%** of hires from 2014-2015 are ethnic minorities.

**6%** growth in Energy Efficiency jobs 2014-2015.

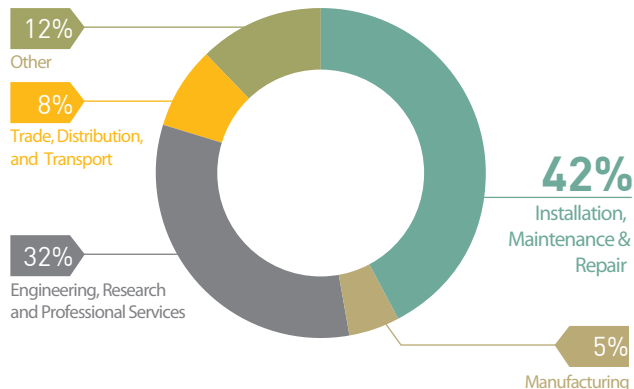
### Advanced Energy Employment by Segment, 2015



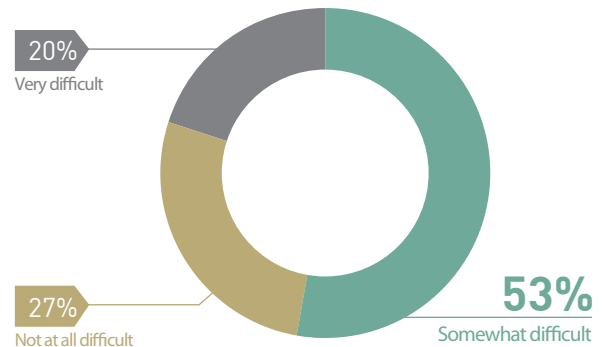
### Energy Efficiency by Technology, 2015



### Advanced Energy Employment by Value Chain, 2015



### Hiring Difficulty, 2015



AEE Institute, *Advanced Energy Jobs in California: Results of the 2016 California Advanced Energy Employment Survey*; 2016 multiple pages.

## In the California Education and Training System:

**49** Workforce Investment Boards

**112** Community Colleges

**265** Apprenticeship Program Tracks

**285** Adult Schools Programs

California Workforce Education and Training Needs Assessment, Don Vial Center on Employment in the Green Economy, 2011, p. 122.

## A. PG&E's WE&T Vision

PG&E's Workforce Education and Training (WE&T) initiatives support its larger energy efficiency mission—to inspire and empower PG&E customers to eliminate unnecessary energy use and reduce per capita greenhouse gas (GHG) emissions— by teaching customers how to recognize energy savings and GHG-reduction opportunities, and by providing them with necessary skills, tools, and resources to act upon those opportunities. Overall, PG&E envisions a workforce capable of meeting California's energy savings goals and implementing its demand side management (DSM) programs.

PG&E's portfolio of WE&T offerings spans a wide range of market sectors, building systems, technologies, end uses, and audiences (ranging from end-use customer to contractors and other market actors).

PG&E uses the California Energy Efficiency Strategic Plan (CEESP) as the cornerstone of its WE&T initiatives. The CEESP proposes that “[b]y 2020, California’s workforce is trained and fully engaged to provide the human capital necessary to achieve California’s economic energy efficiency and demand-side management potential.”<sup>1</sup> The CEESP envisioned the investor-owned utilities (IOUs) “as a catalyst to action by sponsoring several foundational activities to review their existing programs and better align them within the context of a comprehensive WE&T strategy,” working collaboratively with stakeholders, other training organizations, and workforce-development agencies to collectively realize this goal.<sup>2</sup>

WE&T plays a vital role in shaping the extent to which

building professionals (e.g., designers, contractors, engineers, building operators) incorporate the ultimate goal of saving energy into their core job functions. EM&V studies broadly indicate that people who participate in WE&T initiatives take action and save energy in multiple projects,<sup>3</sup> thereby reducing stranded savings. Over the next ten years,<sup>4</sup> PG&E will continue to build upon past successes and implement new WE&T solutions to strengthen the ability of its customers and building professionals to market and execute energy efficiency projects, supporting the development of a “thriving energy efficiency market.”<sup>5</sup>

### PG&E's Workforce Education and Training Goal and Strategies

WE&T's primary goal is to support the development of an energy workforce capable of meeting state energy goals. WE&T uses four primary strategies (#1-4) and one cross-cutting strategy (#5) to achieve this objective.

**1. Career Connections:** Support teachers and organizations training future generations of the energy workforce by providing teaching materials and resources to schools and teachers to educate students about energy and sustainability fundamentals, and by providing green career awareness and exploration resources.

<sup>1</sup> California Energy Efficiency Strategic Plan (CEESP), January 2011 Update, Engage 360, p. 70.

<sup>2</sup> Ibid.

<sup>3</sup> Opinion Dynamics Corporation, “Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program Report, p.2. [www.calmac.org/publications/06-08\\_Statewide\\_Education\\_and\\_Training\\_Impact\\_Eval\\_Vol\\_I\\_FINAL.pdf](http://www.calmac.org/publications/06-08_Statewide_Education_and_Training_Impact_Eval_Vol_I_FINAL.pdf).

See also: Evaluation of the 2003 Statewide Education and Training Services Program Final Report, Wirtshafter Associates, p. E5.

<sup>4</sup> Email communication from Administrative Law Judge Julie Fitch, on November 15, 2016 clarified program administrators' Business Plan timeline. “Because D.14-10-046 only authorizes funding through the end of 2025, it is my expectation that this would be the timeframe for the Business Plans as well, covering calendar years 2018-2025.” However, PG&E has built its Business Plan around a ten year vision, and has identified short (1-3 years), medium (4-7 years) and long-term (8-10 years) time periods used to indicate when strategies and tactics will be deployed, and targets will be met. PG&E believes this structure is in line with the intent of the rolling portfolio concept.

<sup>5</sup> Berkeley Law, Center for Law, Energy & the Environment, and the Emmett Institute on Climate Change and the Environment, UCLA, 2016. “Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings,” p.20.



**2. Career & Workforce Readiness:** Support members of disadvantaged<sup>6</sup> communities to enter the energy workforce through training-related collaborations with workforce development organizations whose primary mission includes serving disadvantaged communities.

**3. Core (Post-Secondary) Energy Education Collaboration:** Support established training organizations preparing the incoming energy workforce through collaborations to expand and enhance their energy training efforts through Integrated Energy Education and Training.

**4. Technical Upskill:** Train, support, and advise the current energy workforce by focusing on the sectors with the greatest potential energy savings and targeting efforts on high-impact jobs through Integrated Energy Education and Training.

**5. Long-Term Integrated Planning and Advocacy Support:** Coordinate and align strategic planning within the energy efficiency portfolio, with stakeholders, with other program administrators, and with other training organizations.

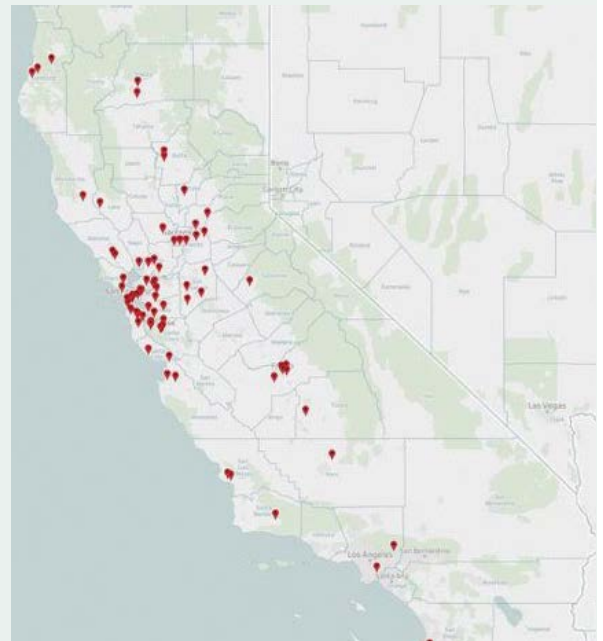
Greater detail on the intervention strategies supporting these goals can be found in Section F:

*PG&E's Approach to Achieving Goals.*

## B. PG&E's WE&T Proposal Compared to Prior Program Cycles

Since 2006, WE&T has been organized into three sub-programs—Centergies, Connections, and Planning. Centergies has predominantly served the energy workforce at any given time, with some collaboration with post-secondary education institutions and community-based organizations serving disadvantaged communities. Connections served students and teachers from kindergarten through college. Planning was cross-cutting across Centergies and Connections, and focused on strategic planning, stakeholder engagement, and EM&V coordination. Per guidance in the CEESP and Senate Bill (SB) 350, PG&E will continue to serve these

<sup>6</sup> In late 2015, with input from stakeholders, the IOUs arrived at a definition of a disadvantaged worker as an individual who meets at least one of the following three criteria: 1) lives in a high unemployment zip code where unemployment rate is at least 150% of the median unemployment rate for the county or for the state; or 2) lives in a low-income zip code where the average household income is 50% below Area Median Income (AMI); or 3) has a referral from a collaborating community-based organization (CBO), state agency, or workforce investment board.



### PG&E WE&T QUICK FACTS ENERGY CENTERS (2013–2015)

- Over 1,200 classes offered to 31,000+ professionals
- Classes offered in over 60 cities and via internet, across nine climate zones
- 98.5% post-course student survey satisfaction
- Over 2,600 Tool Lending Library loans; 32,000+ tools; 400+ locations
- Satisfaction “very high” (85%) among in-person attendees
- Satisfaction “high” for online classes

### 2015 CONNECTIONS (K–COLLEGE)

- 168,000+ K–12 students distributed across over 1,450 schools
- 50% of schools were Title 1
- Supported seven college campuses

*Note: Red markers in map denote WE&T course sites in 2013–2015.*



audiences with a modified structure for K-12 students and teachers, post-secondary students and teachers, the current energy workforce, people who are in career transition, and students and adults in disadvantaged communities.

**Table 9.1** summarizes the WE&T components and audiences they will serve. The functions of the Planning subprogram will continue across all components and audiences, but is not a formal component.

**Table 9.1**  
Current and Proposed WE&T Structure and Audiences

Current WE&T Program Structure					
Program	K-12	Post-secondary <sup>a</sup>	Current workforce	Career transition	Disadvantaged Communities
Connections	P	P	S/C <sup>b</sup>	S/C	S/C
Centergies		S/C	P	S/C	S/C
Proposed WE&T Program Structure					
Career Connections	P		S/C <sup>b</sup>	S/C	S/C
Career & Workforce Readiness		S/C	S/C	S/C	P
Integrated Energy Education & Training (IEET) • Includes both Core (Post-Secondary) Energy Education and Technical Upskill intervention strategies		P	P	S/C	S/C
<b>&lt; &lt;— Long-Term Integrated Planning and Advocacy Support — &gt;&gt;</b>					

**P** = Primary audience; **S/C** = Secondary/Coincidental audience

<sup>a</sup> Post-secondary refers to post-high school education and training programs such as certificate programs, apprenticeships, four-year college and universities, community colleges, and vocational training.

<sup>b</sup> K-12 and college instructors are in the current workforce, and can play an integral role in preparing the energy work workforce, although they do not necessarily design, build, or maintain buildings.

Building upon lessons learned and best practices from prior program efforts, EM&V study results, and input from stakeholders, PG&E will implement cost-effective WE&T changes to better serve California's energy workforce. Each strategy is briefly explained in the context of PG&E's existing offerings, with additional focus on where they depart from past practice. Further details can be found in Section F: *PG&E's Approach to Achieving Goals*.

**Career Connections:** Career Connections is a statewide program, as designated in D.16-08-019.<sup>7</sup> PG&E has been proposed as the statewide administrator. Moving forward, the program will continue to provide resources for K-12 students and teachers focused on learning about energy careers and teaching energy and sustainability fundamentals. Career Connections serves disadvantaged communities by providing resources to teachers at Title 1 schools, and by partnering with organizations whose primary audience is disadvantaged communities.

PG&E will continue to support individual schools, school districts, and K-12 education organizations that have prioritized energy efficiency, conservation, and sustainability. PG&E will also focus on producing and tracking outcomes while it tracks the number of students, teachers, and organizations served.

**Career Workforce Readiness (CWR):** CWR is a new WE&T offering that the IOUs plan to launch in 2018. CWR is a statewide program that targets disadvantaged workers and aims to integrate existing workforce development organizations' services and resources (case management, soft skills training, job placement, etc.) with technical energy education and training resources. PG&E has been proposed as the statewide lead administrator for CWR efforts. Because some people are underemployed and/or seeking to move into the energy sector, CWR has a secondary target audience of the current energy workforce and people seeking to change careers.

CWR will build on the IOUs' energy efficiency expertise as energy efficiency subject matter experts and trainers, and pair it with the expertise of organizations that serve disadvantaged workers and disadvantaged communities. This will be accomplished through services including case management, job placement, and soft skills training. Ultimately, the goal of CWR is to bring awareness to disadvantaged communities of energy education pathways in California, and to then provide relevant energy training.

“High school students' understanding of what environmental stewardship means and their commitment to it has increased many times, and their understanding of how to tie that with future career goals in green/clean technology has expanded in a way that I don't know would have been possible without participating in the Green 360.”<sup>8</sup>

—High School Teacher  
Testimonial, 2016

#### **Integrated Energy Education & Training (IEET):**

The Integrated Energy Education & Training (IEET) program includes both the Core (Post-Secondary) Energy Education Collaboration and the Technical Upskill intervention strategies. In past cycles, PG&E offered energy education through Centergies. PG&E will continue its track record through Core Energy Education.

PG&E recognizes that educating the energy workforce to reduce energy use cannot be done solely by PG&E, nor should PG&E create parallel efforts to train the energy workforce. In 2018 and beyond, PG&E will refine and expand its partnerships with organizations that have training programs for jobs in the building and construction industry.

<sup>7</sup> D.16-08-019, OP 4.

<sup>8</sup> Green 360 is an online PG&E-sponsored career awareness and exploration resource.

(Figure 9.1 provides an overview of these key connections.) PG&E has historically collaborated with such organizations in the past, primarily by serving as instructors, guest lecturers, or by offering classes to these organizations, often at their classrooms sites. More recently, PG&E collaborated with several community colleges and trade organizations, including carpenters, electricians, stationary engineers, and sheet metal workers. PG&E provided “train the trainer” sessions, technical teaching materials, and customized technical training. PG&E will build upon these efforts and support other organizations’ training programs through several key activities, including:

- Developing and providing energy efficiency teaching materials;
- Serving as subject matter expert curriculum advisors;
- Training other organizations’ trainers;
- Supporting the needs of building measurement tools;
- Convening engaged and motivated instructors; and
- Using the online/on-demand platforms to provide training to other organizations’ students.

Technical Upskill has been a key feature of PG&E’s WE&T offerings. PG&E will continue to provide technical training to the current energy workforce through its energy training centers. The energy centers will also serve people transitioning careers, college students, and people who live in disadvantaged communities through the centers’ classes and other resources.

EM&V studies have highlighted challenges regarding the WE&T audience’s access to energy education offerings, as well as its awareness of trainings.<sup>9</sup> PG&E will work with industry, professional, and trade organizations to increase awareness of WE&T resources and ensure that given target audiences are enrolled in appropriate classes. In addition, PG&E plans to expand its online and on-demand class offerings.<sup>10</sup> Curriculum content will also shift to become more data-driven and focused on the specific energy savings potential of various facilities and/or technologies.

Past studies indicate WE&T course participants have reported increased knowledge, and incorporated course information into their jobs.<sup>11</sup> As a way to continually improve its WE&T offerings, PG&E will focus more on tracking participants’ increased knowledge gain, as well as their incorporation of knowledge, skills, and abilities (KSAs) into their job activities. PG&E will seek support from its collaborating organizations to assist in documenting outputs such as knowledge gain and on-the-job implementation.

### WE&T Customer Journey “Stations”

WE&T resources and collaborating organizations

**Figure 9.1**  
WE&T Focus Diagram



<sup>9</sup> Opinion Dynamics Corporation, *PY2013-2014 California Statewide Workforce Education and Training Program, Contractor Training Market Characterization*, June 2016, p.21.

<sup>10</sup> California Energy Commission, “California’s Existing Buildings Energy Efficiency Action Plan,” 2015, p.78.

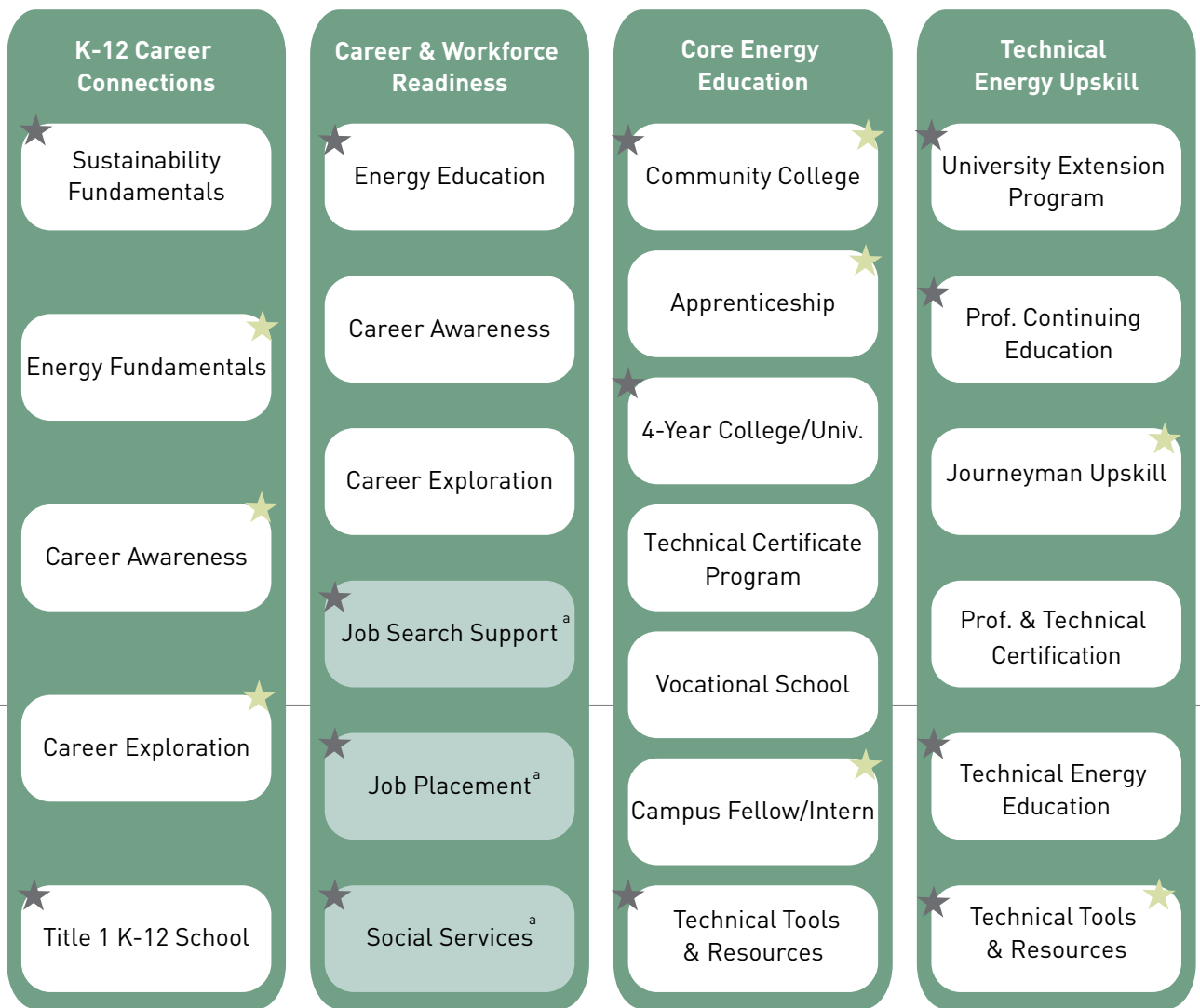
<sup>11</sup> Opinion Dynamics Corporation, “Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program Report, Volume 1,” 2010, p. 1.

can support multiple stages of an individual’s energy education and energy career journey. **Figure 9.2** illustrates sample energy education and energy career journey “stations” where an individual can acquire important knowledge, skills, services, and resources directly from PG&E and/or partnering organizations.

For example, an individual who enters the energy workforce as an engineer could have the hypothetical education and career journey described below while visiting the stations illustrated in **Figure 9.2**.

**Figure 9.2**  
WE&T Career Journey “Stations”

Source: Provided by partnering workforce development organizations



★ Possible WE&T “Support Stations” for a Carpenter’s Journey

★ Possible WE&T “Support Stations” for an Engineer’s Journey

<sup>a</sup> Provided by partnering workforce development organization

- Learns about sustainability through a WE&T Career Connections program at a Title 1 school
- Earns a GED and receives workforce development services from a non-profit organization
- Graduates from a building-trade related job training program that included energy efficiency content provided by PG&E
- Earns a degree from a community college in which an instructor used teaching materials he/she acquired during a train-the-trainer session sponsored by PG&E
- Transfers to a four-year college where a professor incorporated tools from PG&E's Tool Lending Library into his/her energy classes
- Works as an entry level engineer where he/she uses building diagnostics tools from PG&E's Tool Lending Library
- Completes a UC Extension HVAC certificate whose curriculum was in part shaped by PG&E WE&T subject-matter experts
- Broadens his/her engineering knowledge base with PG&E building envelope classes targeted at architects

“Today I accepted a position...as a residential auditor/ surveyor...I have been wanting to make a career move for some time, and several years ago started taking classes at the PEC [PG&E Pacific Energy Center]...The high quality and breadth of classes that you...offer provided me with the training and expertise I needed to qualify for this new position. Thank you...”

—PG&E WE&T Student  
Testimonial, 2016

This scenario is illustrative and intended to communicate that WE&T and its collaborators offer various “journey stations” that provide a range of resources for participants’ energy education and career journeys. Also, an individual’s journey is not always linear and can include vertical, left-to-right, and right-to-left “steps.” Lastly, this example does not intend to convey that WE&T is a comprehensive core education institution into which individuals would formally enroll, but rather that WE&T supports such organizations.

A similar trajectory could be formulated for a hypothetical carpenter’s journey (See **Figure 9.2**). In this case, an individual learns about energy in grammar school, learns about and explores energy careers using PG&E-supported resources in high school, goes to a community college and works part-time as a campus energy fellow, and becomes a carpenter apprentice at a program that has collaborated with PG&E’s WE&T program for incorporating energy efficiency topics into its curriculum. The person eventually becomes a journeyman who attends WE&T classes to expand his/her skillset, while using tools from the PG&E Tool Lending Library.

## EM&V Key Research Learnings of California's WE&T and Energy Efficiency Programs

Numerous EM&V studies, process evaluations, and impact evaluations conducted over the past 11 years have informed and shaped PG&E's WE&T strategy for 2018 and beyond. Below is a summary of key findings (with further detail and references discussed in the appendix).

- The IOUs are moving toward outcome-based Program Performance Metrics (PPMs) to more effectively gauge and monitor program performance.<sup>12</sup>
- The 2014 *Impact Evaluation of the California Statewide Building Operator Certification Program* study identified successes of the Building Operator Certification (BOC) Program.
- The Tool Lending Library (TLL) is a unique program with high potential for energy savings that provides building performance measurement tools and technical advice. The TLL will undergo a CPUC-led *Tool Lending Library Impact Study* expected to be completed in 2017.
- There is sufficient availability and variety of training to support contractors, but contractor awareness of these training options remains a barrier.<sup>13</sup>
- A 2012 process evaluation study revealed that all of the Connections K-12 programs brought new energy saving concepts into schools and classrooms.<sup>14</sup>
- In response to study recommendations:
  - The IOUs are moving toward outcome-based Program Performance Metrics (PPMs) to more effectively gauge and monitor program performance.<sup>15</sup>
  - The IOUs have incorporated adult learning principles<sup>16</sup> into their Energy Center courses, where relevant, and can continuously improve by incorporating future learnings and developments.
  - The energy centers have improved data tracking and collection efforts to have more consistency across IOUs in support of WE&T program theory and logic.<sup>17</sup>

<sup>12</sup> Opinion Dynamics Corporation, "2013-2014 Statewide WE&T Program, Program Theory and Logic Model Update; Centergies Data Needs; And Critical WE&T Data Needs," June 2014, p. 2, [http://www.calmac.org/warn\\_dload.asp?e=0&id=3024](http://www.calmac.org/warn_dload.asp?e=0&id=3024).

<sup>13</sup> Opinion Dynamics Corporation, "PY2013-2014 California Statewide Workforce Education and Training Program, Contractor Training Market Characterization," June 2016, p. 7, [www.energydataweb.com/cpucFiles/pdaDocs/1631/CPUC%20WET%20Contractor%20Training%20Market%20Characterization\\_FINAL\\_V5.docx](http://www.energydataweb.com/cpucFiles/pdaDocs/1631/CPUC%20WET%20Contractor%20Training%20Market%20Characterization_FINAL_V5.docx).

<sup>14</sup> Opinion Dynamics Corporation and Lisa McLain ID Consulting, "2010-2012 WE&T Process Evaluation Volume II: Connections," December 2012.

<sup>15</sup> Opinion Dynamics Corporation, "2013-2014 Statewide WE&T Program, Program Theory and Logic Model Update; Centergies Data Needs; And Critical WE&T Data Needs," June 2014, p. 2.

<sup>16</sup> <http://eric.ed.gov/?id=ED181292>.

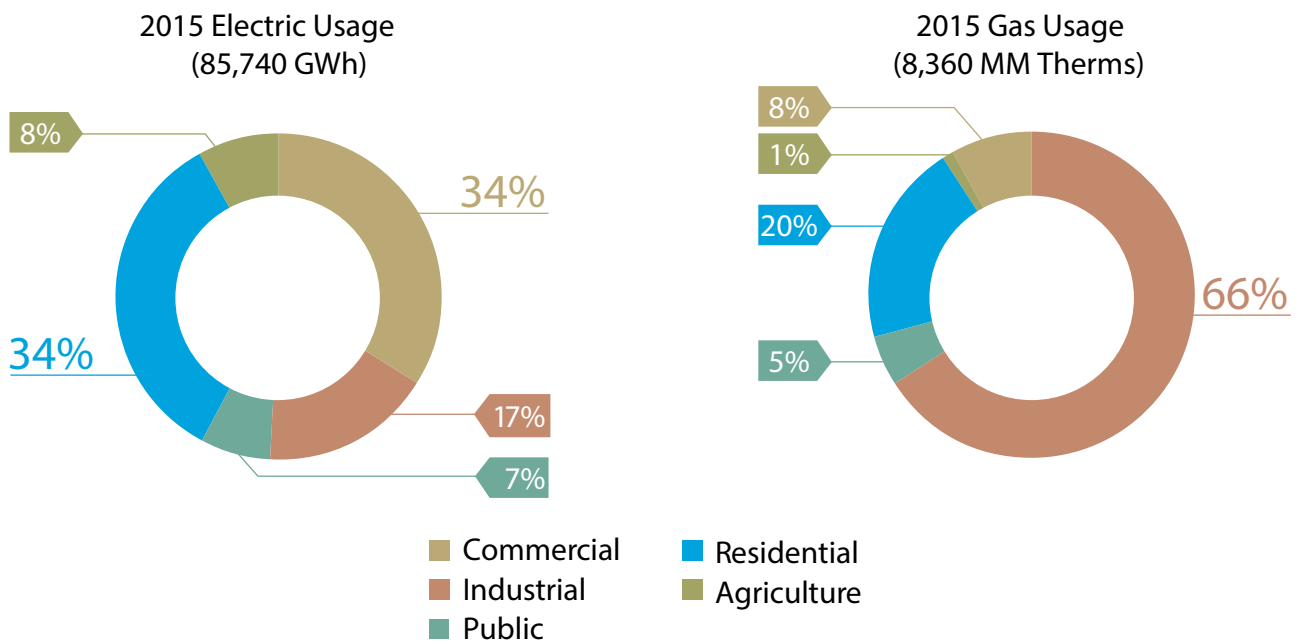
<sup>17</sup> Opinion Dynamics Corporation, June 2014, p. 2.

## C. WE&T Sector Overview

To best align with California’s energy goals, PG&E will address the sectors that present the greatest potential for energy savings, serve parts of the energy workforce with the greatest potential to realize those energy savings, and provide the knowledge, resources, and skills required to act on those energy savings opportunities (see **Figure 9.3**

for sector usage). For example, teaching carpenters how to properly seal a building envelope and test their constructed building shells by using a blower door will advance carpenters’ ability to participate in the energy workforce. In 2015, PG&E led a multi-IOU effort to partner with the Southwest Carpenters Training Fund to help them meet their energy technical training needs.<sup>18</sup>

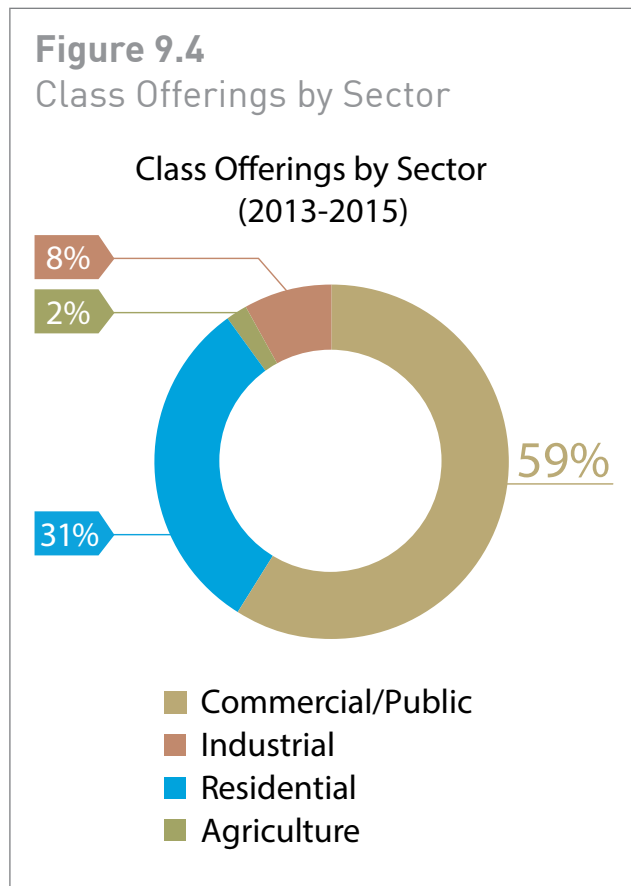
**Figure 9.3**  
2015 Energy Usage by Sector



<sup>18</sup> "CAC [California Apprenticeship Council] Impacts the Apprenticeship Community," Apprenticeship Newsletter, Richard Harris and Jamie Robison, 3rd Quarter 2015.

## Energy and Customer Landscape

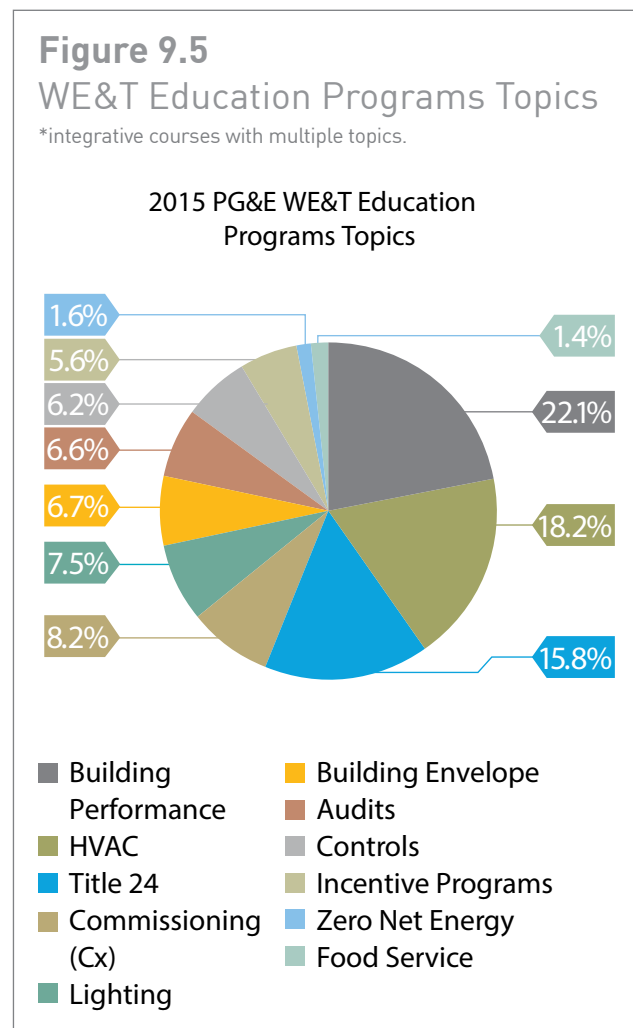
Given that the top three PG&E gas and electricity use sectors are residential, commercial, and industrial (as shown in **Figure 9.4**),<sup>19</sup> approximately 95% of course offerings through PG&E energy centers target these sectors.<sup>20</sup>



WE&T has two primary audiences — customers and energy efficiency market actors. Key customers include in-house facility-management staff, building owners, homeowners, and business owners; whereas, primary energy efficiency market actors are the professionals who perform and/or influence energy efficiency projects. Market actors include: designers, architects, contractors, builders, technicians, engineers, and educators. These actors work throughout the various stages of a building's life — engaging in financing, design, construction, maintenance, and operations — and are either part of the current workforce or in training to participate in the future energy workforce. These customers and

market actors have distinct needs and requirements depending upon the sector in which they are engaged. The majority of PG&E's WE&T classes (59%) are focused on the commercial sector, with another 31% focused on residential audiences, and 10% focused on industrial and agricultural audiences. PG&E offers a wide range of class topics, with the top five topics being building performance (22%), HVAC (18%), codes & standards (16%), commissioning (8%), and lighting (8%).

PG&E's 2015 course topics (**Figure 9.5**) align with the energy potential data, which indicated that the largest areas for savings across all sectors included lighting, whole building, building envelope, and HVAC. Current potential studies indicate a forecast similar to 2015.<sup>21</sup> When evaluated by sector, the data shows that (in order of magnitude) the commercial, residential, and industrial sectors are among the



<sup>19</sup> 2015 Integrated Energy Policy Report (IEPR), Docket # 15-IEPR-01, CEC-100-2015-001-CMF.

<sup>20</sup> PG&E Energy Centers student registration database.

<sup>21</sup> Navigant, "CPUC Potential Goals and Targets, PGRESULTSVIEWER2015," Public Draft; June 26, 2015.



highest energy-saving sectors. The number of PG&E courses offered during this time was also aligned with savings potential in these sectors.

## D. Trends and Challenges

In administering a viable workforce training program, it is important to use market employment data to shape program offerings by region, sector, and job types. Studies from the Advanced Energy Economy Institute (AEEI) characterize California's "advanced energy"<sup>22</sup> job market. Once these trends and increasing job markets are identified, reaching this target audience has its challenges. Herein lies an opportunity to collaborate with industry to address these barriers to best serve the growing energy workforce.

### Trends

#### California's Expanding Green Energy Economy<sup>23</sup>

California's clean energy and energy efficiency job market has grown for the last three years, a trend that is expected to continue in the coming years.<sup>24</sup> This presents WE&T with an opportunity to provide critical resources and skills to this burgeoning segment to drive increased energy efficiency. It also presents a challenge to identify the specific workforce segments that can best impact energy savings and/or exert market influence via education and training. AEEI studies identified another challenge — when an employer requires, or strongly encourages, a certification from its employees, it is typically not directly related to the energy efficiency aspect of the certification, but rather a desire for a certification for a specific product line or manufacturer. (See **Figure 9.6** and **Figure 9.7**)

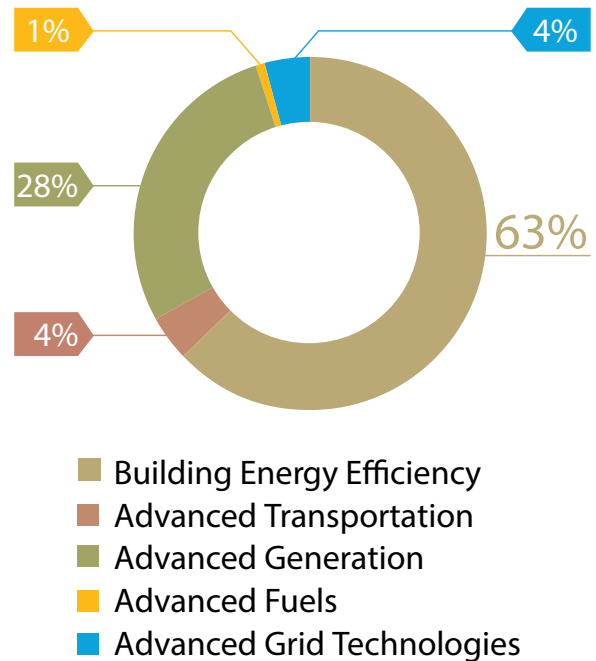
<sup>22</sup> The AEEI report defines an "advanced energy" firm [or job] is defined as being directly involved with researching, developing, producing, manufacturing, distributing, selling, or implementing components, goods or services related to alternative fuels and vehicles; energy efficiency; renewable, nuclear, and natural gas electricity generation; smart grid; and other related technologies. Advanced Energy Economy Institute and BW Research, "California Advanced Energy Employment Survey;" December 2014; p. 15.

<sup>23</sup> Advanced Energy Economy Institute and BW Research, "California Advanced Energy Employment Survey;" December 2014.

<sup>24</sup> AEEI Institute, Prepared by BW Research Partnership "Advanced Energy Jobs in California: Results of the 2016 California Advanced Energy Employment Survey;" 2016; p. 6.

**Figure 9.6**  
Energy Employment  
by Segment, 2015

Source: Advanced Energy Economy Institute and BW Research.



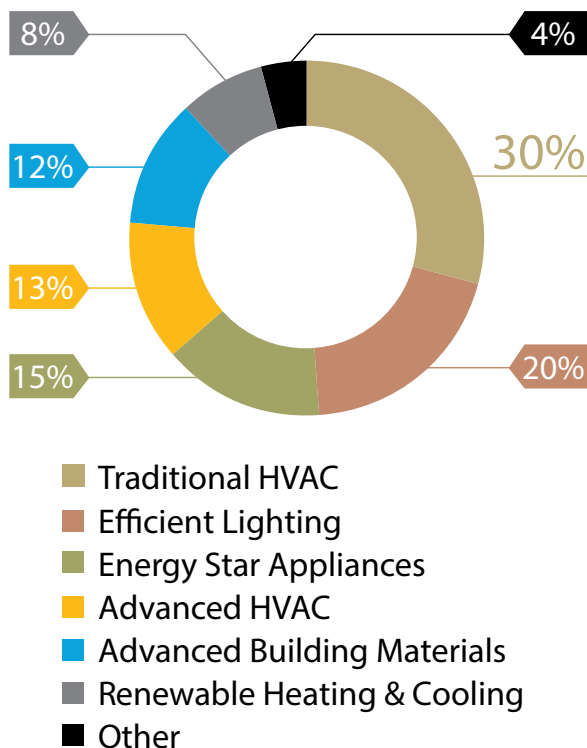
In 2016, AEEI reported that California is home to nearly 43,000 advanced energy businesses that span the entire value chain and include a wide range of energy technologies that address supply and demand.

Some highlights from the AEEI report include:

- Advanced energy technologies employ an estimated 507,703 workers in California.
- Advanced energy employment grew 18% in 2015 (and 23% since 2013), while overall statewide employment grew at one sixth of this rate — 3% in 2015.
- Energy efficiency-related firms reported 6% employment growth, equivalent to approximately 18,060 new jobs.

### Figure 9.7 Energy Efficiency by Technology, 2015

Source: Advanced Energy Economy Institute and BW Research.



- Energy efficiency accounts for the largest share of advanced energy jobs in California. 63% of advanced energy workers are employed in the energy efficiency sector, supporting over 321,000 jobs in total. Approximately 43% of the energy efficiency jobs are in PG&E's service territory.<sup>25</sup>
- The advanced energy workforce in California is diverse. Although predominantly male (74%), advanced energy workers are 38% racial or ethnic minorities: Four in ten recent hires (roughly 39%) over the last year are reported ethnic minorities.
- Employers expect to add advanced energy workers in California at a rate of 8% over the coming year, totaling approximately 548,300 jobs in 2016 — up from approximate 411,000 jobs in 2013.

To maximize energy savings potential, the current advanced energy workforce that is most aligned with energy savings potential needs to be trained. However, specialized energy efficiency training is typically absent from traditional education institutions. PG&E's future WE&T initiatives will focus on design, construction, installation, and maintenance training. These future initiatives will also go beyond energy efficiency to include distributed energy, demand response, water, electric vehicles, rates, and other relevant sustainability and GHG-related policy areas important for achieving California's policy goals.

<sup>25</sup> BW Research for Advanced Energy Economy Institute, "California Advanced Energy Employment Survey," 2015; p. 11.

## KEY DRIVERS FOR PG&E'S WE&T STRATEGIES

- Energy is currently not a core priority of the design and construction industries.
- With a rapidly-growing construction industry, there is potential to improve the energy efficiency knowledge and skills of California's energy workforce.
- Focus on occupations that have the most potential for energy savings.
- Since most of the design and construction workforce receive training through existing educational institutions, partner with such organizations to expand or enhance energy efficiency within existing training curricula.
- Current workforce needs continuing education to remain relevant on energy codes, technologies, and design strategies

“California’s workforce development infrastructure is made up of a complex web of institutions providing skills development, job matching and other workforce development activities. These institutions are funded by a variety of state and federal programs and sources, including, but not limited to, private employers, student fees, and charitable contributions.”

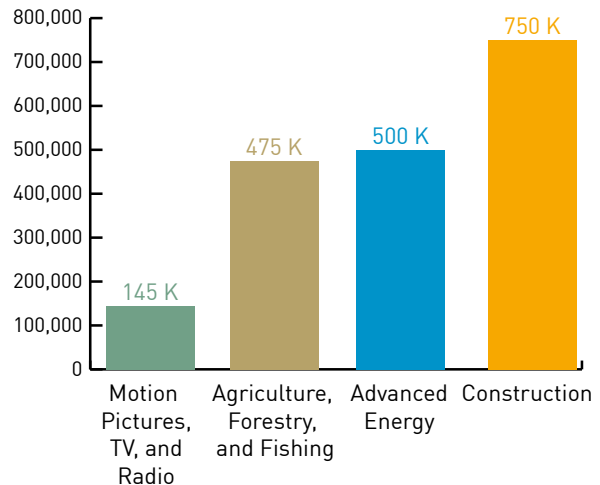
— *WE&T Needs Assessment*, p. 121

## Energy Jobs in the Greater Labor Market Landscape: Trends and Challenges

Energy and energy efficiency are not chief priorities for the building design and construction industry, as evidenced by the AEEI 2016 Advanced Energy Jobs in California 2016 survey. This survey indicates, “less than a quarter (23%) of the state’s efficiency workers spend all of their time on energy efficiency-related work and about 50% spend at least half their time on efficiency-related activities.”<sup>26</sup> Notably, these data points originate from firms that self-identify as energy efficiency-focused firms (as opposed to “Construction”), as illustrated in **Figure 9.8**.<sup>27</sup> It follows that even less time is spent on energy and energy efficiency-related elements in the construction industry at large.

**Figure 9.8**  
California Major Industry Comparisons, 2015

Source: Advanced Energy Economy Institute and BW Research.



<sup>26</sup> AEE Institute, Prepared by BW Research Partnership “Advanced Energy Jobs in California: Results of the 2016 California Advanced Energy Employment Survey;” 2016; p. 9.

<sup>27</sup> Ibid, p. 1.

At the same time, the construction industry boasts some of the fastest-growing job classifications in the California economy since the recession (approximately 2007-2009).<sup>28</sup>

In 2016, the California Employment Development Department published a list of the top 100 fastest-growing occupations in California from 2014-2024. These projections suggest the top 100 fast-growing occupations will add approximately 954,000 jobs during this period. Approximately one-third of these jobs are building-related, representing approximately 19% of the total estimated job increase. The top 13 building-related jobs are included in **Table 9.2**, with the top five fastest-growing building-related jobs identified with asterisks (\*).

These five jobs are estimated to yield an additional 12,200 jobs, or approximately 1.3% of the total projected 954,000 job growth. While the relative size of the increased workforce is small, it presents an opportunity for collaboration with organizations that see value in training their workers on energy efficiency.

Existing training institutions, such as trade unions, community colleges, and universities provide training to all levels of the design and construction industries. Rather than attempting to address all workers in these industries, PG&E will collaborate with stakeholders to identify organizations that train not only the most relevant members of the energy workforce, but also those that are willing to enter into a partnership to expand and enhance the energy efficiency elements of their training program.

**Table 9.2**

Top 13 Building-Related Fast-Growing Occupations in California, 2014–2024<sup>a</sup>

Source: California Employment Development Department.

Occupation Title	Employment		%Change
	2014	2024	
Reinforcing Iron and Rebar Workers	3,800	6,000	57.9%
Brick Masons and Block Masons	5,500	8,600	56.4%
Stonemasons	1,900	2,900	52.6%
Roofers*	16,400	24,400	48.8%
Helpers—BrickMasons,BlockMasons,Stonemasons,andTile and Marble Setters	3,100	4,600	48.4%
Insulation Workers, Mechanical*	1,300	1,900	46.2%
Solar Photovoltaic Installers*	2,900	4,200	44.8%
Insulation Workers, Floor, Ceiling, and Wall*	1,500	2,100	40.0%
Helpers—Electricians*	4,500	6,200	37.8%
Elevator Installers and Repairers	1,600	2,200	37.5%
Cement Masons and Concrete Finishers	19,200	26,400	37.5%
Floor Layers, Except Carpet, Wood, and Hard Tiles	3,700	5,000	35.1%

\* Primary target audience professions for WE&T energy efficiency courses based on their regular job tasks.

<sup>a</sup> Employment Development Department (EDD); State of California. Top 100 Fastest-Growing Occupations in California, 2014–2024. [www.labormarketinfo.edd.ca.gov/OccGuides/FastGrowingOcc.aspx](http://www.labormarketinfo.edd.ca.gov/OccGuides/FastGrowingOcc.aspx).

<sup>28</sup> [www.labormarketinfo.edd.ca.gov/OccGuides/FastGrowingOcc.aspx](http://www.labormarketinfo.edd.ca.gov/OccGuides/FastGrowingOcc.aspx).

The range of educational providers in California is diverse and complex.<sup>29</sup> The number and extent of offerings provides a rich and deep set of institutions and topics from which to choose. While PG&E looks to partner with other educational providers to complement the IOUs' WE&T offerings, PG&E also recognizes the need to help students navigate the diverse education and training options to find those best suited to their energy educational needs.

PG&E sees an opportunity to collaborate with existing educational institutions to enhance the energy-related aspects of existing curriculum providing breadth and reach. Additionally, depth is necessary for those jobs having potentially disproportional impacts on energy savings (e.g., a site superintendent overseeing the work of multiple trades). As an energy efficiency subject matter expert, PG&E can provide energy efficiency content, and the partnering organization can identify curriculum gaps. This approach will ensure energy efficiency content is disseminated to students, and that educational institutions can provide feedback on outcomes such as knowledge gain.

### Increasing Number of State Policy Drivers

2015 and 2016 saw unprecedented activity at the California legislature in support of energy efficiency and clean energy policies such as SB 350, AB 802, AB 793, and SB 1414, among others. WE&T will continue to prioritize and diversify its offerings to include topics such as distributed energy resources, demand response, water, electric vehicles, rates, and other relevant sustainability and GHG-related policy areas important for achieving California's policy goals.

### Challenges

PG&E will continue to address barriers to participating in energy efficiency training, and will collaborate across IOUs and stakeholders to implement appropriate approaches and track progress.

- **Wide-ranging audience and needs of WE&T audience:** The WE&T audience spans diverse professionals with varying skill sets, ranging from entry level to seasoned professionals. The WE&T target audience designs, builds, operates, and maintains facilities across all sectors. A "one size fits all" approach to course delivery fails to account for this diverse audience's needs. Instead, WE&T needs to offer multiple delivery mechanisms. A recent contractor training market characterization EM&V

study identified relatively minimal awareness of WE&T opportunities as a significant barrier to participation in WE&T program offerings. The study also concluded that hands-on training is preferred by many industry stakeholders.<sup>30</sup>

- **Lack of prioritization for energy efficiency (among workers and training providers) or lack of expertise to teach energy efficiency:** The wide range of critical concerns among building design, construction, and operations organizations (including training organizations) — including life safety, soft skills, job placement, and financial competitiveness — often take priority over energy efficiency.<sup>31</sup> Furthermore, PG&E has supported and will continue to support training organizations that have sought and received subject matter expertise in the form of technical advice, trainer training, and curriculum materials.
- **"Siloe'd" nature of specialized professions:** Given the complex nature of buildings and commensurate highly-skilled and specialized workforce required to design, build, operate, and maintain them, it is unrealistic to expect all tradespeople and professionals to master multiple and broadly-applicable trades or professions. However, it is important to bridge this gap by providing an understanding of how individual actions and decisions can impact other parts of a given building. A contractor training market characterization study confirmed that "the gaps that were common to most programs centered on understanding the value of energy efficiency, how different systems work together, and how to communicate these concepts to customers."<sup>32</sup>

<sup>29</sup> UC Berkeley Labor Center, Don Vial Center on the Green Economy, *California Workforce Education & Training Needs Assessment for Energy Efficiency, Distributed Generation, and Demand Response*, 2011; p. 21.

<sup>30</sup> Opinion Dynamics, for California Public Utilities Commission, Energy Division. *PY2013-2014 California Statewide Workforce Education and Training Program, Contractor Training Market Characterization*, p. 7.

<sup>31</sup> *Ibid.*, pp. 21-22.

<sup>32</sup> Opinion Dynamics Corporation, "PY2013-2014 California Statewide Workforce Education and Training Program, Contractor Training Market Characterization," June 2016, p.8.

## E. Sector-Level Budget

PG&E’s Business Plan budget provides general information on the expected levels of annual spending for 2018-2025, along with 2016 and 2017 approved budgets for reference. As Business Plans were envisioned as “a comprehensive vision outlining

long-term strategic initiatives and intervention strategies,”<sup>33</sup> PG&E provides its budget forecast that represents its best estimates to realize its portfolio vision, while retaining flexibility to accommodate potential market or regulatory changes (see **Table 9.3**). Each year, PG&E will file a Tier 2 advice letter (AL) that provides a detailed budget for the Commission’s review and approval.<sup>34</sup>

**Table 9.3**  
PG&E WE&T Budget Summary

Cost Category	2016	2017	2018	2019	2020-2025 Annual Budget <sup>a</sup>
<b>Administration</b>	\$261,274	\$554,368	\$482,595	\$410,822	\$366,675
<b>Marketing</b>	\$269,109	\$4,211	\$3,984	\$3,757	\$3,530
<b>Implementation</b>	\$12,030,960	\$10,336,332	\$10,258,605	\$10,180,877	\$10,103,149
<b>Incentive</b>	\$0	\$0	\$0	\$0	\$0
<b>Total</b>	<b>\$12,561,342</b>	<b>\$10,894,911</b>	<b>\$10,745,183</b>	<b>\$10,595,456</b>	<b>\$10,473,354</b>

<sup>a</sup> The Annual Budget from 2020 through 2025 will remain the same.

<sup>33</sup> D.15-10-028, p.48.

<sup>34</sup> D.15-10-028, OP 4.

## F. PG&E's Approach to Achieving Goals

PG&E's WE&T efforts embrace the following core intervention strategies:

- **Career Connections:** Support teachers and organizations training future generations of the energy workforce.
- **Career & Workforce Readiness (CWR):** Support organizations helping members of disadvantaged communities to enter the energy workforce.
- **Integrated Energy Education & Training (IEET):** Encompasses Core (Post-Secondary) Energy Education Collaboration and Technical Upskill.
  - Core (Post-secondary) Energy Education: Support established training organizations preparing the incoming energy workforce.
  - Technical Upskill: Train, support, and advise the current energy workforce.
- **Long-Term Integrated Planning and Advocacy Support:** Long-term integrated planning is a new program-wide strategy that adopts an integrated approach to coordinate and align strategic planning within the energy efficiency portfolio, with stakeholders, with other program administrators, and with other training organizations. These efforts are informed by factors including relevant energy legislation, energy efficiency potential studies, EM&V needs and results, economic forecasts, collaborative partners, and changing market needs for education and training. PG&E will also support advocacy efforts for education and training in support of energy training requirements for relevant professional licenses.

**Table 9.4** summarizes the overarching WE&T goal, the strategies in support of that goal, sample tactics for executing the strategies, and sample potential metrics to track and/or measure progress of program tactics and outcomes.

Each intervention strategy is described in greater detail in the following sections, with additional details for Career Connections and CWR in the *Statewide Administration Business Plan* chapter. As is illustrated in **Table 9.4**, all intervention strategies will have an increased focus on high energy savings topics and/or audiences related to high potential areas for energy savings.

**Table 9.4**

WE&T Goal, Strategies, and Tactics<sup>a</sup>

GOAL: A workforce capable of meeting state energy goals		
Strategies	Example Tactics	Sample Potential Implementation Plan Metrics
<p><b>1. CareerConnections:</b> Support teachers and organizations training future generations of the energy workforce</p>	<ul style="list-style-type: none"> <li>• Teacher training</li> <li>• Career awareness and exploration</li> <li>• Teaching materials</li> </ul>	<ul style="list-style-type: none"> <li>• Percent of offerings that align with high energy savings topics or audiences related to high potential areas for energy savings</li> <li>• Market penetration</li> <li>• Number and percent of schools adopting materials and resources</li> <li>• Percent of participating Title 1 schools</li> <li>• Student awareness of energy education and career options</li> </ul>
<p><b>2. Career &amp; Workforce:</b> Readiness Support organizations helping members of disadvantaged communities to enter the energy workforce</p>	<ul style="list-style-type: none"> <li>• Leverage career support services</li> <li>• Train-the-trainer</li> <li>• Curriculum materials</li> <li>• Tools and resources</li> </ul>	<ul style="list-style-type: none"> <li>• Percent of offerings that align with high energy savings topics or audiences related to high potential areas for energy savings</li> <li>• Curriculum enhancements or expansions</li> <li>• Achievement of workforce development organization’s funded goals around job placement</li> <li>• Achievement of organization’s goals serving disadvantaged communities</li> <li>• Student participation in program</li> </ul>
<p><b>3. Core (Post-Secondary) Education Collaboration:</b> Support established training organizations preparing the incoming energy workforce through Integrated Energy Education &amp; Training (IEET)</p>	<ul style="list-style-type: none"> <li>• Technical training and advice</li> <li>• Curriculum materials</li> <li>• Tools and resources</li> <li>• Train-the-trainer</li> </ul>	<ul style="list-style-type: none"> <li>• Percent of offerings that align with high energy savings topics or audiences related to high potential areas for energy savings</li> <li>• Curriculum enhancements or expansions</li> <li>• Matching funds from non-IOU organizations</li> <li>• IOU-initiated program(s) become(s) self-sustaining</li> </ul>
<p><b>4. Technical Upskill:</b> Train, support, and advise the current energy workforce through Integrated Energy Education &amp; Training (IEET)</p>	<ul style="list-style-type: none"> <li>• Tools and resources</li> <li>• Technical training and advice</li> </ul>	<ul style="list-style-type: none"> <li>• Percent of offerings that align with high energy savings topics or audiences related to high potential areas for energy savings</li> <li>• Market penetration</li> <li>• Knowledge gain</li> <li>• Use of information at work</li> </ul>

<sup>a</sup> See Section K: Metrics & EM&V Considerations for further detail on metrics.



## Intervention Strategy 1 — Career Connections for K-12 Students and Teachers

Part of the energy efficiency workforce that will contribute to meeting California’s long-term energy efficiency goals is currently in K-12. Educating these students on energy and sustainability fundamentals, and raising awareness of energy education and career paths is an important part of priming our future energy workforce. The CEESP calls for WE&T to support all levels of education.<sup>35</sup>

Career Connections focuses on two key audiences: K-12 students and teachers, and career-seeking young adults. As noted in a 2010–2012 evaluation, “the WE&T Connections program contributes to the Strategic Plan’s WE&T goal of establishing energy efficiency education and training at all levels of California’s educational systems.”<sup>36</sup> Career Connections provides energy and sustainability fundamentals teaching materials, as well as energy career awareness and exploration resources.

Past studies have highlighted the value of topics such as K-12 Science, Technology, Engineering, and Mathematics (STEM) education and career readiness.<sup>37</sup>

The Career Connections program intends to minimize gaps and misalignments in energy efficiency and energy and resource conservation. The program will provide support and resources to Title 1<sup>38</sup> K-12 schools as a way of supporting disadvantaged communities. Consistent with the 2011 California WE&T Needs Assessment, “the purpose of K-12 career development programs is to inform students about the careers available to them and provide them with the necessary occupational skills and/or knowledge for entering into these careers, and/or moving into a post-secondary education on a selected career track.”<sup>39</sup> (See **Table 9.5** for overview of how this intervention strategy and tactics will address current barriers.)

Career Connections’ primary objectives are to:

- Educate K-12 students on energy and sustainability fundamentals.
- Increase awareness of energy and sustainability career pathways for high school students and career-seeking adults.
- Support Title 1<sup>40</sup> K-12 schools as a way of supporting disadvantaged communities.

See the *Statewide Administration Business Plan* chapter for further detail, including the solicitation strategy and transition timeline for this program. Example tactics in support of this strategy are discussed in further detail on the next page.

<sup>35</sup> CPUC California Energy Efficiency Strategic Plan (January 2011 Update), Section 9, p. 70.

<sup>36</sup> CPUC California Energy Efficiency Strategic Plan (January 2011 Update), Section 9, p. 70, [www.energy.ca.gov/ab758/documents/CAEnergyEfficiencyStrategicPlan\\_Jan2011.pdf](http://www.energy.ca.gov/ab758/documents/CAEnergyEfficiencyStrategicPlan_Jan2011.pdf).

<sup>37</sup> STEM Smart Brief; STEM Smart: Lessons Learned from Successful Schools – “Preparing Students for College and Careers in STEM.”

<sup>38</sup> <http://www2.ed.gov/programs/titleiparta/index.html>.

<sup>39</sup> 2011 California WE&T Needs Assessment, p. 229, [http://laborcenter.berkeley.edu/pdf/2011/WET\\_Part2.pdf](http://laborcenter.berkeley.edu/pdf/2011/WET_Part2.pdf).

<sup>40</sup> Title 1 schools are defined as schools in which children from low-income families make up at least 40 percent of enrollment., U.S. Department of Education, <http://www2.ed.gov/programs/titleiparta/index.html>.

**Table 9.5**

Intervention 1: Career Connections for K-12 Students and Teachers

GOAL: A workforce capable of meeting state energy goals				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Career Connections for K-12 Students and Teachers</b>	<ul style="list-style-type: none"> <li>Schools lack resources or expertise to teach energy and sustainability</li> <li>Energy and sustainability education is not mandated by California schools</li> <li>Limited career awareness resources focused on energy efficiency and green careers</li> </ul>	Focus on and support teachers and schools that have an interest in energy education	E, N, M	M
		Promote and disseminate career awareness resources to middle and high school students, and their teachers	E, M	S

**Partners:** K-12 schools and school districts in PG&E territory; California Employment Development Department; PG&E departments that support K-12 schools; PG&E Energy Efficiency Low Income team; teacher development organizations; teacher conference sponsors

**Focus on and support teachers and schools that have an interest in energy education.**

Energy efficiency is not a curriculum topic required by the State of California. Some California high schools, such as those participating programs like Linked Learning, have dedicated resources to education tracks that are in alignment with the broader energy sector, while others are more focused on environmental conservation and general sustainability topics. PG&E will target these types of schools and school districts since they prioritize environmental awareness and tend to have a structure in place for both energy-focused teaching and career awareness resources for energy efficiency. This tactic may also include targeting K-12 teachers via teacher conferences and education organizations to disseminate age appropriate energy and environmental education materials for classroom use.

**Promote and disseminate career awareness resources to middle and high school students and their teachers.**

Middle and high school students are one step away from making choices regarding education and career paths. For example, some middle school students will go onto high schools where they may have the option to enter a specific education track through programs such as Linked Learning. In addition, high school students will be making decisions about whether to enter the workforce or pursue higher education. In this way, increasing middle and high school students' awareness of career opportunities in the energy sector is a critical component of supporting the future energy workforce.

## Intervention Strategy 2 — Career and Workforce Readiness (CWR) for Disadvantaged Workers

CWR serves the overall goal of developing a workforce capable of meeting the state’s ambitious energy goals. To this end, CWR prepares disadvantaged workers to enter the energy workforce by leveraging career support services provided by workforce development organizations, training trainers of career training organizations, developing curriculum, and providing tools and resources to career training organizations. CWR will provide its primary target audience with energy education and workforce development resources through collaborations with organizations whose missions support disadvantaged workers and communities. Examples of these organizations include workforce investment boards, community-based organizations, building-related job training programs, and workforce development agencies.

As a secondary target audience, CWR also targets the current energy workforce and those seeking to change careers, since some individuals are underemployed and/or seeking to move into the energy sector. CWR is a statewide program that will integrate existing workforce development organizations’ services and resources (case management, soft skills training, job placement, etc.) with technical energy education and training resources.

To avoid a duplication of efforts, CWR will fund the integration and addition of energy efficiency funding to some of those existing efforts. Ultimately, the goal of CWR is to facilitate entry from disadvantaged communities to energy education pathways, and to provide these individuals with relevant energy training through existing agencies and organizations that already serve disadvantaged workers.

In summary, CWR aims to accomplish the following:

- Support the integration of energy efficiency content into existing workforce development training programs whose primary audience is disadvantaged communities and workers.
- Support trainers of programs supporting disadvantaged workers and communities in support of overarching energy efficiency portfolio objectives.
- Provide energy and green career awareness resources to workforce development organizations serving disadvantaged workers and communities.
- Provide energy and resource conservation education materials and resources to organizations who train disadvantaged workers.

CWR funds will be used for energy and resource efficiency education and training, and are not intended to fund energy efficiency education and training activities that are already occurring. CWR funds shall also not be used to fund activities that workforce development agencies and organizations are funded to do (i.e., case management, job placement, etc.) (See **Table 9.6** for overview of how this intervention strategy and tactics will address current barriers.)

**Table 9.6**

Intervention 2: Career and Workforce Readiness (CWR) for Disadvantaged Workers

GOAL: A workforce capable of meeting state energy goals				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
Career & Workforce Readiness for Disadvantaged Workers	Training and workforce development organizations do not prioritize energy education, and/or lack in-house subject matter expertise	Use partnerships to expand and enhance energy efficiency within other organizations' curricula, targeting high energy efficiency impact jobs	M	S
		Collaborate with workforce development organizations that serve disadvantaged communities	M	S

**Partners:** Community colleges; apprenticeship and pre-apprenticeship training programs; local/regional/state workforce development organizations; community-based organizations

CWR's overarching objectives are as follows:

- Build upon existing efforts of community-based organizations, workforce development organizations, and workforce investment boards with a focus on energy and resource efficiency, to help disadvantaged workers enter core education or job/career pathways.
- Increase awareness among disadvantaged workers about green career pathways.
- Increase disadvantaged workers' knowledge of energy and resource efficiency concepts, technologies, and systems.

Please see the *Statewide Administration Business Plan* chapter for further detail, including the solicitation strategy and transition timeline for this program. Example tactics in support of this strategy are discussed in further detail on the next page.

**Collaborate with workforce development organizations whose core mission is to serve disadvantaged communities.**

The CEESP establishes a goal that “...minority, low income, and disadvantaged communities fully participate in training and education programs.”<sup>41</sup> While participation in PG&E’s WE&T program is proportional to the current percentage of disadvantaged communities within PG&E’s service territory,<sup>42</sup> California legislative policy — specifically SB 350 — states the Energy Commission shall consider workforce development for residents in disadvantaged communities, and promote greater project penetration in disadvantaged communities.<sup>43</sup>

PG&E will lead a statewide RFP to develop a program that leverages existing workforce development resources and supplements their services with energy education and training. PG&E’s WE&T core expertise is in energy education and training, and will not duplicate other workforce development organizations’ efforts. Most of PG&E’s WE&T efforts to serve disadvantaged workers will come from the CWR program. This statewide downstream program is not intended to replace successful collaborations with regional workforce development organizations. PG&E will build upon successful WE&T efforts through this program. Furthermore, PG&E will continue or expand some regional efforts to collaborate with workforce development agencies.

**Intervention Strategy 3 — Core (Post-Secondary) Energy Education Collaboration**

PG&E will collaborate with other training organizations to expand and enhance energy efficiency within their training programs, and to provide career awareness resources for their students. Core education institutions include community colleges, four-year colleges and universities, and apprenticeship programs. These organizations have existing training programs that prepare students to enter the energy workforce.

This effort will lead to the appropriate transformation of other organizations’ curricula by integrating PG&E’s energy efficiency content and expertise with other organization’s training programs. Over the past two years, PG&E has collaborated with Local 39 of the International Union of Operating Engineers (Stationary Engineers) to develop energy efficiency course content that Local 39 has integrated with its core training program. This course content has been shared with Local 501 in Southern California and is being used by Local 501 trainers. PG&E is also working with the California Carpenters Training Fund to train their educators on the use of blower doors and infrared cameras in inspecting and testing the energy performance of building envelopes. These examples of energy efficiency curricula infusion have effectively expanded PG&E’s reach.

(See **Table 9.7** for overview of how this intervention strategy and tactics will address current barriers.) Example tactics in support of this strategy are discussed in further detail below.

<sup>41</sup> California Public Utilities Commission, 2011, *California Long-term, Energy Efficiency Strategic Plan*, Section 9, p. 70.

<sup>42</sup> Data from PG&E Energy Centers’ student registration database, and ICF International “Survey of Inclusion Workforce Landscape,” June 29, 2016.

<sup>43</sup> California Senate Bill 350, Sec. 8.25943.a.1; c.7-8.

**Table 9.7**

Intervention 3: Core (Post-Secondary) Energy Education Collaboration

GOAL: A workforce capable of meeting state energy goals				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Core (Post-Secondary) Energy Education Collaboration</b>	Other organizations do not prioritize energy education, and/or lack in-house subject matter expertise	Use partnerships to expand and enhance energy efficiency within other organizations' curricula, targeting high energy efficiency impact jobs	M	M
		Train other organizations' trainers	M	M

**Partners:** Community colleges; four-year colleges and universities; apprenticeship training programs; professional organizations; workforce development organizations; community-based organizations

**Use partnerships to introduce, expand, or enhance efficiency within other organizations' curricula.**

Core post-secondary education organizations' training programs cover a wide range of topics, and energy efficiency is not always part of the program — or at least not as extensively as it could be. PG&E will collaborate with technical training organizations to provide training materials and curriculum development, as well as to serve as technical curriculum advisors.

**Collaborate to train other organizations' trainers.**

Training other organizations' trainers on energy efficiency is a cost-effective way of expanding PG&E's reach. For example, PG&E has embarked upon this effort in a statewide fashion with the Carpenter's Training Fund in Southern California. These collaborations include not only training trainers, but also providing curriculum materials, serving as subject matter expert curriculum advisors, and loaning building diagnostics equipment for carrying out teaching exercises.

The collaborating organization can also help collect and track data in support of the outputs and outcomes described in *Section L: Metrics*.

## Intervention Strategy 4 — Technical Upskill for the Current Workforce

PG&E will provide technical education and training to members of the current energy workforce by developing WE&T education programs that deliver appropriate curricula to an appropriate range of

audiences in a timely fashion. This effort aims to enhance knowledge gain and transfer of skills-acquired from WE&T initiatives into participants' daily work activities. (See **Table 9.8** for overview of how this intervention strategy and tactics will address current barriers). Example tactics in support of this strategy are discussed in further detail on the next

**Table 9.8**  
Intervention 4: Technical Upskill for the Current Workforce

GOAL: A workforce capable of meeting state energy goals				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Technical Upskill for the Current Workforce</b>	<ul style="list-style-type: none"> <li>• WE&amp;T audience is large in scale and needs vary widely in depth and breadth</li> <li>• Energy education is not always the highest priority</li> <li>• Professions are siloed</li> </ul>	Use energy potential and job market data to prioritize training efforts	M	S, M, L
		Collaborate with partners to focus participation to the right audiences	E, M	S, M, L
		Match course content to course attendees	M	S, M, L
		Align course delivery method to post-course expected student actions	E	S, M, L
		Develop and deliver integrative design course for project managers and target trades site supervisors and superintendents	N	S, M, L

**Partners:** Building trades organizations; professional organizations; employers committed to partnering with PG&E to inform and having employees participate in training programs

**Use energy potential and job market data to prioritize training efforts.** WE&T programs will be informed by energy efficiency potential data and California labor and employment market data. This data will be discussed with program managers and stakeholders to determine which professions in the energy workforce are best influenced through education and training programs. PG&E will also use its knowledge and interaction with employers to understand who is likely to have the greatest impact.

**Collaborate with trade and professional organizations to focus participation on the right audiences.** Most of PG&E's classes are open to the general public. While this approach allows professionals to create their own training plan, it can inhibit instructors from focusing on a specific topic at a specific level of technical depth. Well-structured partnerships with trade/professional organizations will increase the likelihood that appropriate course content is delivered to appropriate target audiences with specific education needs. Furthermore, such partnerships will increase the chances that given skills acquired in training will be used on the job. PG&E will also collaborate with trade and professional organizations to increase awareness of education and training offerings.

**Match course content to course attendees.** PG&E has observed that advanced courses are often attended by students lacking requisite knowledge and skills for meaningful participation in an advanced-level course, which results in a slower pace and suboptimal learning experience for other, qualified participants. The contractor training market characterization EM&V study cited earlier confirms the need to assure that appropriate audiences are served with appropriate course content. "Contractors and technicians may need help determining which are the best trainings for their needs. IOUs may be able to help package together trainings and provide guidance for individuals at different points in their careers."<sup>44</sup> By implementing pre-course exams and/or prerequisite requirements for participation, PG&E will ensure participants are engaging in appropriate courses to fill relevant needs or skills gaps.

**Align course delivery method to post-course expected student actions.**<sup>45</sup> Course delivery methods, including online, on-demand, lectures, hands-on activities, and in-the-field training serve a range of purposes and needs. For instance, if a student is expected to perform a specific installation or system diagnostic procedure, the course should provide an opportunity not only to learn the process, but also to practice execution techniques for the field.

**Develop and deliver integrative design courses for project managers.** Integrative design constitutes a collaborative approach to buildings that integrates people, building systems, business structures, and practices into a process that leverages the expertise of all participants. This process seeks to maximize energy efficiency and optimize a building's design, construction, and operations. Overall, integrative design courses are best suited for workforce participants that can bring professions and trades together, such as project managers that define goals for members of building design, construction, operation teams, building owners, and high-level decision makers.

**Target trades site supervisors and superintendents.** Foremen and superintendent leaders are an ideal target audience for training programs focused on understanding and collaborating across multiple trades because they supervise, advise and guide apprentices and journeymen. In effect, providing such heightened awareness to foremen and superintendents can in turn guide apprentices and journeymen to recognize and execute energy efficiency opportunities.<sup>46</sup>

<sup>44</sup> Opinion Dynamics Corporation, "PY2013-2014 California Statewide Workforce Education and Training Program, Contractor Training Market Characterization," June 2016, p.8.

<sup>45</sup> CEC, 2015. "California's Existing Buildings Energy Efficiency Action Plan," p. 78.

<sup>46</sup> PG&E's experience in the building industry and conversations with Division of Apprenticeship Standard leadership and trades training staff informed our position that targeting foremen and superintendents is an efficient way of addressing energy across the building trades.



## Intervention Strategy 5 — Long-Term Integrated Planning and Advocacy Support

Long-term integrated planning incorporates an integrated dynamic approach to coordinate, inform, and align WE&T strategic planning and offerings with the energy efficiency portfolio, non-IOU educational organizations, and state policy goals. Current work in this area ensures the WE&T program aligns with the objectives of other internal and external groups, such as IOU resource programs, joint utility efforts, and other organizations with responsibilities in providing energy education (e.g., unions, community colleges, CBOs, and universities). WE&T long-term integrated planning will go beyond energy efficiency, and include distributed energy, demand response, water, electric vehicles, rates, and other relevant sustainability and GHG-related policy areas important for achieving California's policy goals.

- In the near-term, PG&E will continue to hold stakeholder engagement forums to solicit stakeholder feedback and to report out on intervention strategies and implementation plans that align with 2030 and 2050 GHG targets and state policy goals.
- In the short and mid-term, PG&E will establish and implement a regular WE&T data-gathering plan. The data will inform WE&T program design and offerings. Collected data may include: energy efficiency potential data across sectors; state and regional jobs forecast data; data from EM&V studies; and data collected through WE&T program offerings.
- In the long-term, this integrated planning intervention strategy will use the data collected through the WE&T program and the short-term and mid-term actions to guide PG&E on where to focus efforts to facilitate greenhouse gas reduction and energy efficiency across the educational landscape.

With regard to advocacy support, PG&E will also support data-driven and program-aligned advocacy efforts for continuing education and training requirements for relevant licenses. (See **Table 9.9** for overview of how this intervention strategy and tactics will address current barriers.)

**Table 9.9**

Intervention 5: Long-Term Integrated Planning and Advocacy Support

GOAL: A workforce capable of meeting state energy goals				
Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Long-Term Integrated Planning and Advocacy Support</b>	<ul style="list-style-type: none"> <li>Disparate policies and regulatory proceedings</li> <li>Changing market needs</li> </ul>	Stakeholder engagement forums to solicit feedback and report out on intervention strategies and implementation plans that align with state policy goals	E	S, M, L
		Collaborate with policymakers, regulators, and stakeholders	E	S, M, L
		Support advocacy efforts for education and training in support of energy training requirements for relevant professional licenses	E, M	S, M, L
		Data collection to inform program design and class offerings	E	S, M, L

**Partners:** Building trades organizations; professional organizations; employers committed to partnering with PG&E to inform and having employees participate in training programs

## G. Value: WE&T Supports PG&E's Energy Efficiency Portfolio

WE&T provides education and training programs to market actors who can reduce their own or a customer's energy use. These market actors design, build, and operate buildings across all five core energy efficiency market sectors, and impact buildings from design through construction and operations. Past EM&V studies broadly indicate people who participate in WE&T initiatives take action and save energy in multiple projects.<sup>47</sup>

### Market Sector WE&T Initiatives

WE&T will continue to provide education and training to various market actors in each of the market sectors. WE&T will develop and deliver energy efficiency technical training programs that focus on specific technologies, skills, and energy-saving strategies that are most appropriate for the sectors' goals. WE&T will develop and target trainings to specific market actors that have the highest likelihood of taking action to use the course material to realize energy savings. WE&T will also collaborate with professional, trade, and industry organizations to leverage their insight regarding trainings, and how to best reach their members.

### Residential Sector

- Residential sector education and training offerings will align with energy savings potential data and focus primarily on HVAC quality installation, HVAC sales training for existing buildings, HVAC system replacement assessment, and buildings shell measures. For new buildings, education and training programs will focus on cost effectively realizing zero-net energy (ZNE), high performance walls and attics, and Title 20/ Title 24 code awareness.
- Training programs will be targeted at HVAC contractors and technicians, carpenters, weatherization contractors, insulation installers, and relevant trade superintendents.
- PG&E will also have a track focusing on real estate professionals such as realtors, appraisers, and lenders to help them understand, value, and market energy efficiency, renewables, and other green home features.
- WE&T will collaborate with the residential sector to leverage existing partnerships with organizations, including: the Sheet Metal and Air Conditioning Contractors National Association (SMACNA), the National Association of Realtors (NAR), and the California Building Industry Association (CBIA) to develop the appropriate training programs and to assure that their members are informed about training program benefits.

<sup>47</sup> Opinion Dynamics Corporation, "Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program Report, p.2. [www.calmac.org/publications/06-08\\_Statewide\\_Education\\_and\\_Training\\_Impact\\_Eval\\_Vol1\\_FINAL.pdf](http://www.calmac.org/publications/06-08_Statewide_Education_and_Training_Impact_Eval_Vol1_FINAL.pdf)  
See also: Evaluation of the 2003 Statewide Education and Training Services Program Final Report, Wirtshafter Associates, p. E5.

### Commercial Sector

- Commercial education and training offerings will focus primarily on lighting, HVAC, refrigeration for existing buildings, controls, and whole building approach and Title 24 for new construction.
- Training programs will be targeted at designers, engineers, contractors, building operators, building owners, property managers, and facility managers who have the potential to reduce energy use across building types, including: offices, retail, high tech, and hospitality.
- WE&T will collaborate with the commercial sector to leverage existing partnerships with organizations, including: Building Owners and Managers Association, U.S. Green Building Council, ASHRAE, American Institute of Architects, International Facility Managers Association, Illuminating Engineering Society, and the Association of Energy Engineers.

### Public Sector

- Public sector education and training offerings will align with energy savings potential data and focus primarily on lighting, HVAC, boilers, and steam plants.
- Training programs will be targeted at designers, engineers, contractors, building operators, building owners, facility managers, elected officials, and local government staff who have the potential to reduce energy use across building types, including: local government buildings, K-12 schools, and higher education campuses.
- WE&T will collaborate with the public sector to leverage existing partnerships with entities, including: local government agencies, local government partnerships, and the International Facility Managers Association.

### Industrial Sector

- Industrial education and training offerings will focus primarily on pumps, motors, benchmarking, water conservation, and operational efficiency.
- Training programs will be targeted at facility managers, energy managers, small facilities owners and process engineers who are designing, building, analyzing, and maintaining food processing, manufacturing, and petroleum facilities.
- WE&T will collaborate with industrial programs and PG&E's Business Energy Solution team to coordinate outreach with existing partnerships, such as: California water agencies, industrial conference organizers, food process associations, and industrial manufacturers associations.

### Agricultural Sector

- Education and training offerings will focus primarily on pumps, motors, lighting, refrigeration and refrigeration, and water conservation.
- Training programs will be targeted at engineers, facilities and maintenance staff, plant managers, and business owners who are designing, building, and maintaining facilities such as dairies, breweries, distilleries, wineries, and green houses.
- Additional market actors who will be targeted include agriculture service providers, as well as agriculture extension agents.
- WE&T will collaborate with agriculture to leverage existing partnerships with universities and community colleges, regional water districts, and relevant trade associations.

## WE&T Support for Cross-Cutting Programs

Since WE&T's target audience includes market actors (designers, engineers, contractors, building operators, technicians), as well as customers and building owners, WE&T is in a position to not only support cross-cutting sectors with subject matter expertise, but also inform market actors and customers about the cross-cutting sectors' programs and initiatives.

### Codes and Standards (C&S)

- WE&T will support C&S with its education and training needs.
- WE&T will inform market actors and customers about upcoming code changes, code compliance, and modeling software tools and resources.
- WE&T will assist in marketing C&S education and training resources to customers and market actors in WE&T's student database.
- WE&T will also coordinate on code compliance and relevant software classes.

### Emerging Technologies (ET)

- WE&T will provide ET with technical subject matter expertise in support of its pilots and products.
- WE&T will include information about ET projects as part of WE&T educational programs, and develop education and training programs specific to ET projects.
- WE&T will make its energy centers available for ET demonstrations and installations, and incorporate them within appropriate WE&T courses.
- The PG&E Tool Lending Library will provide building performance measurement tools in support of ET projects.
- WE&T will leverage ET market characterization studies, which look at the market from various perspectives, including technology, market actors, cost, and others.
- WE&T will leverage ET data, identified barriers, and technical information.

## Finance

- WE&T has historically offered finance courses on how to make a business case for energy-efficient design and energy efficiency retrofits.
- WE&T will integrate financing programs within relevant WE&T courses, particularly those targeted at customers and their building operators and maintenance staff.
- These courses and programs will also be marketed to design team leads and consultants that have direct connections to building owners who are making design and long-term investment decisions. PG&E will use energy training centers to market relevant finance programs.

## H. PG&E's Partners and Commitment to Coordination

WE&T's reach extends beyond the walls of its energy centers, working with a variety of community organizations and educational partners. These partners act "as a catalyst to action by sponsoring several foundational [energy efficiency-related WE&T] activities"<sup>48</sup> that contribute to a comprehensive WE&T strategy for California. In almost all cases, the IOUs are charged with oversight and coordination with other providers and partners, with a focus on the energy efficiency technical training component.

- **Kindergarten to 12th grade (K-12):** Work with California Department of Education to develop content and curricula, leverage the governor's career tech initiative, and support outreach on energy, water, and environmental issues.
- **Adult Education and Community Colleges:** Support and coordinate with these providers to incorporate energy efficiency within their offerings.
- **Technical Training:** Expand or establish training programs and career development programs for traditional contractors and technicians to include DSM and energy efficiency.

<sup>48</sup> California Public Utilities Commission, "California Long-term Energy Efficiency Strategic Plan," 2011, p. 72.

- **Colleges and Universities:** Coordinate with University of California/California State University (UC/CSU) institutional partnership programs to create continuing education and expand professional energy-related degree offerings.
- **Minority, Low-Income, and Disadvantaged Communities:** Coordinate low income energy efficiency workforce training with other training; coordinate with Green Jobs Act, EDD, and Department of Social Services; leverage ME&O and WE&T taskforce partners. Furthermore, PG&E subject matter experts have served as curriculum technical advisors and held leadership board positions to advise CBOs helping disadvantaged workers.

Furthermore, PG&E will continue to collaborate with a wide variety of statewide organizations and training providers. PG&E will look for opportunities to collaborate with other program administrators, including other IOUs and Regional Energy Networks. The following is a general list of the type of collaborators with whom WE&T currently works or plans to engage to extend the reach of WE&T initiatives:

#### Training Providers

- California Home Energy Efficiency Rating Services (CHEERS)
- California Certified Energy Rating & Testing Services (CalCERTS)
- Build It Green Utilities (BIG)
- Affordable Comfort
- HVAC Redu

#### Trade and Professional Associations

- Air Conditioning Contractors of America (ACCA)
- Institute of Heating and Air Conditioning Industries (IHACI)
- American Society of Heating, Ventilating, and Air-conditioning Engineers (ASHRAE)
- American Institute of Architects (AIA)
- Association of Energy Engineers (AEE)
- US Green Building Council (USGBC)

## COLLABORATING WITH THE TRADES AND CBOs

PG&E is collaborating with three building trades—carpenters, stationary engineers, and sheet metal workers—and the Center for Employment Training to enhance and expand the energy efficiency portion of their training programs. PG&E has trained their trainers, developed and provided teaching materials, and delivered customized classes to apprentices, journeymen, disadvantaged workers, and people making career transitions.

Furthermore, PG&E subject matter experts have served as curriculum technical advisors and held leadership board positions to advise CBOs helping disadvantaged workers.

## OVER A QUARTER CENTURY OF COLLABORATION WITH CSD

For over 25 years, PG&E has worked with California's Department of Community Services and Development (CSD) to help meet its need for training and teaching facilities for training staff working in the CSD LiHEAP programs, and providing weatherization and other services to income-qualified households. PG&E has collaborated with CSD to develop training and testing procedures for CSD services throughout California.

## Education

- K-12 Schools and Districts
- California Community Colleges (CCC)
- 4-year Colleges/Universities

## Industry

- California Advanced Lighting Controls Training Program (CALCTP)
- Affordable Comfort Institute (ACI)

## Workforce Development Organizations

- Community-based Organizations (CBOs)
- Regional Workforce Investment Boards (WIBs)
- Vocational training providers

## Certification Organizations

- North American Technician Excellence (NATE)
- National Council on Qualifications for the Lighting Professions (NCQLP)
- Building Performance Institute (BPI)
- Builder Operator Certification (BOC)

## Government Agencies

- California Energy Commission
- California Community Services and Development (CSD)
- California Workforce Investment Board
- Los Angeles Steam Operators Certification
- Local, Regional, and State Governments
- California Regional Energy Networks (RENs)

## Unions and Trade Organizations

- International Association of Plumbing and Mechanical Officials (IAPMO)
- International Union of Operating Engineers (IUOE)
- Local 39 and Local 501 Stationary Engineers
- Southern California Carpenters
- International Brotherhood of Electric Workers (IBEW)
- Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

## I. PG&E Helping to Meet State Policy Goals

**Table 9.10** provides a summary of how PG&E's approach with WE&T will address key state policies.

## J. Statewide Administration and Transition Timeline

D.16-08-019 modifies the program administration structure for all upstream and midstream programs, market transformation efforts, and select downstream programs, such that these programs become "statewide." D.16-08-019 defines statewide programs as being delivered uniformly throughout the IOU service territories and overseen by a single lead program administrator.<sup>49</sup> Statewide efforts are required to comprise at least 25% of each IOU's portfolio budget.<sup>50</sup>

Please refer to the Statewide Administration Chapter for program administrators' proposals for statewide programs and/or subprograms.

## K. Solicitation Strategies and Transition Timeline

D. 16-08-019 sets a minimum target of 60% of the utility's total portfolio budget, including administrative costs and EM&V, to be proposed, designed, and delivered by third parties by the end of 2020.<sup>51</sup> Please refer to the Portfolio Overview Chapter for PG&E's complete solicitation strategy and transition timeline, by sector.

<sup>49</sup> D.16-08-019, pg. 51.

<sup>50</sup> D.16-08-019, p. 65.

<sup>51</sup> D.16-08-019, p.74.

**Table 9.10**

Summary of Relevant Energy Efficiency Policies, Guidance, and PG&E Support

Policy Drivers	Guidance Given	PG&E's Support for Policy
<b>SB 350</b>	<ul style="list-style-type: none"> <li>• Doubling energy efficiency savings by 2030 where cost-effective and feasible</li> <li>• Address barriers for low-income customers to energy efficiency and weatherization investments, including those in disadvantaged communities, as well as recommendations on how to increase access to energy efficiency and weatherization investments to low-income customers</li> </ul>	<ul style="list-style-type: none"> <li>• WE&amp;T offerings will prepare the workforce in support of doubling energy efficiency savings through educational opportunities that provide technical training, continuing education, and certifications as well as reducing confusion for workers considering these educational opportunities</li> <li>• Contractor standards will remain in place and be updated as appropriate so that energy projects are implemented in alignment with safety and energy saving standards. As responsible contractor policies and program requirements for qualifications are adopted, Workforce Education &amp; Training will make appropriate training available to market actors.</li> <li>• WE&amp;T continue to educate participants from disadvantaged communities through the statewide Career &amp; Workforce Readiness (CWR) program as well as through ongoing local efforts through the Integrated Energy Education and Training (formerly Centergies) Program</li> </ul>
<b>SB 32</b>	<ul style="list-style-type: none"> <li>• Reduce statewide greenhouse gas emissions to 40% below the 1990 level by 2030</li> </ul>	<ul style="list-style-type: none"> <li>• PG&amp;E's support for SB 32 mirrors its approach to SB 350's goals, as described above</li> </ul>
<b>AB 793</b>	<ul style="list-style-type: none"> <li>• Provide education on energy management technologies</li> <li>• Provide incentives for energy management technology</li> </ul>	<ul style="list-style-type: none"> <li>• PG&amp;E may facilitate the development or enhancement of market actor education on how to properly design, install, or maintain home energy management technology, based on any education and training gaps in the market</li> </ul>
<b>AB 758</b> Existing Buildings Energy Efficiency Action Plan	<ul style="list-style-type: none"> <li>• 3.3 — Implement WE&amp;T strategies that integrate Knowledge, Skills &amp; Abilities with WE&amp;T curriculum; update training to include best practice building science and code requirements</li> <li>• 3.3.4 — Train contractors and other market actors to sell energy efficiency</li> <li>• 3.3.6 — Include special skills training in core WE&amp;T activities to help meet demand, spur innovation, and increase the body of knowledgeable building professionals</li> </ul>	<ul style="list-style-type: none"> <li>• PG&amp;E will include special skills training (i.e., Retrocommissioning, facility management) in core WE&amp;T activities to help meet demand and increase the body of knowledgeable building professionals</li> <li>• PG&amp;E WE&amp;T offerings will train contractors in how to sell energy efficiency to customers</li> <li>• PG&amp;E will provide education and training around dynamic code changes, new technologies, and skills needed to meet legislative needs (such as ZNE Design, Benchmarking and Retrocommissioning)</li> </ul>
<b>AB 802</b>	<ul style="list-style-type: none"> <li>• Disclosure of aggregated whole building energy data</li> <li>• Benchmarking</li> <li>• Provide financial incentives and assistance for High Opportunity Projects and Programs</li> </ul>	<ul style="list-style-type: none"> <li>• PG&amp;E will provide education and training around dynamic code changes, new technologies, and skills needed to meet legislative needs (such as ZNE Design, Benchmarking, and Retrocommissioning)</li> <li>• PG&amp;E will continue to educate contractors and building operators in how to benchmark energy usage and use software in facilities so they understand their energy use</li> <li>• PG&amp;E will continue to educate decision makers about the value of benchmarking and the increase in value of their investments for the purpose of selling or leasing their property</li> </ul>



## L. Metrics

PG&E and the other program administrators understand the importance of ensuring that all metrics provide value to the CPUC, PAs, or other stakeholders. PG&E also recognizes that listed metrics can have powerful and unintended effects.<sup>52</sup> All of the metrics that PG&E proposes are consistent with the agreed-upon statewide guiding principles for metrics that were shared with the Energy Division on August 16, 2016.

### Metrics should...

Be used and useful by PAs to manage portfolio

Be timely

Rely on data used in program implementation

Be simple to understand and clear of any subjectivity

Have longevity

The guiding principles also indicate that metrics are not a replacement for EM&V.

Additionally, not all metrics have a readily interpretable meaning, so context is needed. As such, we provide context on the metrics in the notes section of **Table 9.11**.

Because WE&T is a program rather than a sector, this section presents information on program-level metrics and indicators that will be further explored in the development of the implementation plan for WE&T.

**Metrics Measuring WE&T Goals for PG&E's cross-cutting programs** are intended to support statewide policy objectives, such as the doubling of energy efficiency by 2030 and efforts to work toward ZNE buildings by supporting all sectors within PG&E's energy efficiency portfolio. WE&T's primary goal is to support the development of a workforce capable of meeting state energy goals. WE&T uses four strategies to achieve this objective, including:

- **Career Connections:** Support teachers and organizations training future generations of the energy workforce by providing teaching materials and resources to schools and teachers to educate students about energy and sustainability fundamentals and by providing green career awareness and exploration resources.
- **Career & Workforce Readiness:** Support members of disadvantaged communities to enter the energy workforce through training-related collaborations with workforce development organizations whose primary mission includes serving disadvantaged communities.
- **Core (Post-Secondary) Energy Education Collaboration:** Support established training organizations preparing the incoming energy workforce through collaborations to expand and enhance their energy training efforts.
- **Technical Upskill:** Train, support, and advise the current energy workforce by focusing on the sectors with the greatest potential energy savings and targeting efforts on high-impact jobs.

<sup>52</sup> Perrin, in an article in the *American Journal of Evaluation*, discussed certain known limitations of performance metrics. Among these limitations, he described varying interpretation of the "same" term and concepts, goal displacement, use of meaningless and irrelevant measures, and cost-savings vs. cost-shifting. (Perrin, Burt. September 1998. *Effective Use and Misuse of Performance Measurement*. *American Journal of Evaluation* 1998:19:367.)

To support state policy goals, PG&E is in the process of developing several short, medium and long-term targets for the program. These targets will be measured through program-level metrics and indicators and are expected to be developed in coordination with the program implementers based on the design of the program, and the level of budget for each effort.

PG&E is also currently conducting research to understand how other education and training centers around the country are tracking and reporting on both their accomplishments overall, and whether/ how they change workplace practices. As more information becomes available, PG&E expects to share this information with the CPUC and stakeholders, and adjust the program-level metrics to ensure WE&T measurements meet best practices in the industry.

Note that the metrics and indicators for this program will be a mix of outputs that can be regularly tracked, and outcomes that will be studied as funds become available.<sup>53</sup>

Wherever possible, PG&E will work with implementers to embed data collection into the program design. In addition, PG&E is currently developing a dashboard that will allow the program to collect, monitor, and track some of the basic outputs to provide frequent feedback to the program. This dashboard effort will help the program make mid-course adjustments, as necessary.

The potential metrics and indicators that PG&E intends to use at the program level are listed by strategy below. The list includes program metrics and indicators. For any program level metrics, baselines and targets will be specified in the WE&T implementation plan or during the program-design phase.

<sup>53</sup> Note that historically, WE&T has had a low level of funding for EM&V research, which would limit the ability to measure outcomes at a study level.

**1. Career Connections** will be monitored through metrics and indicators such as:

- Number and percentage of K-12 schools adopting teaching materials or resources provided by WE&T (over the total number of K-12 schools or targeted schools)
- Number and percentage of Title 1 schools adopting teaching materials or resources provided by WE&T (over total number of Title 1 or targeted Title 1 schools)
- Number of schools that adopt WE&T resources to build energy career awareness and facilitate energy career exploration
- Number of K-12 students served (in all schools, in Title 1 schools)
- Outcomes, as applicable to the specific program design and EM&V budget, include:
  - Student contact hours of instruction
  - Value to teachers, where information can be collected
  - Ongoing use of educational materials provided to teachers
  - Student knowledge gain, information shared with family, or behavior change, where information can be collected
  - Student awareness and exploration of energy education and career pathways, where information can be collected
  - IOU-initiated program(s) becomes self-sustaining over a period of approximately 3 years

**2. Career & Workforce Readiness** will be monitored through metrics and indicators such as:

- Curriculum enhanced or expanded with EE for organizations that serve disadvantaged workers and that have training programs in high impact EE careers or jobs
- Achievement of workforce development organization's funded goals around job placement
- Achievement of workforce development organization's goals serving disadvantaged communities
- Student participation in program
- Outcomes as applicable to the specific program design, such as achievement of the specific goals of the collaborating organizations, such as:
  - Organization's curriculum development, enhancement, or expansion

- Organizations’ job placement rates and job types
- Organizations’ increased ability to serve disadvantaged communities
- Individuals served (and knowledge gain), where possible to assess

### 3. Core (Post-Secondary) Energy Education Collaboration

will be monitored through metrics and indicators such as:

- Program focus on “high energy savings” topics or audiences related to high potential areas for energy savings
- Outcomes as applicable to the specific program design, such as achievement of the stated goals of the collaboration, including:
  - Achievement of specific goals around curriculum development, enhancement, or expansion
  - Achievement of specific goals around training activities
- Individuals served and knowledge gain, where possible to assess
- Skills taught get used on the job, where possible to assess

### 4. Technical Upskill

will be monitored through metrics and indicators such as:

- Percentage of classes (number/total number of classes) targeting “high energy savings”<sup>54</sup> topics or audiences related to high potential areas for energy savings.
- Market penetration<sup>55</sup> (number of participants, or reach, in targeted professions /number of potential participants in profession, percentage)

<sup>54</sup> “High energy savings” topics and audiences will be determined through a review of the EE potential study, as well as collaboration with other PAs and input from stakeholders and will change on an annual basis. Key considerations may include specific technologies, training needs in technology/sector area, potential impact of a given job classification, as well as potential energy savings.

<sup>55</sup> For market penetration, PG&E is expecting to use the categories currently used to classify participants. This indicator will help to understand how many are reached to inform the direction of the program.

- Outcomes such as increase in knowledge gain and changing workplace practices, i.e., course participants used the knowledge and skills as part of their work on a daily or occasional basis. PG&E anticipates that these will be self-reported and later measured at the program level through post-course surveys and EM&V studies, as budgets allow.<sup>56</sup>

At the program-level, WE&T will also monitor participant satisfaction and the quality of the trainings and other efforts through process evaluation efforts, where funding allows.

As part of its long-term integrated planning efforts, WE&T will also collaborate and share information with industry partners and stakeholders. Specifically, in the short-term, WE&T will:

- Foster collaboration with industry partners (education, government agencies, CBOs) via a minimum of 2 stakeholder engagement sessions or WE&T CAEECC subcommittee meetings per year
- Share energy efficiency/program administrator data to drive WE&T efforts by hosting an annual summit for education providers, and by reporting sector and program data

These discussions will be used to share information with stakeholders, but will also inform the objectives of the WE&T program and the type of information collected to monitor the program.

**Table 9.11** captures the primary metric and indicators that we expect to track for this program.

<sup>56</sup> PG&E anticipates that these will initially be self-reported, and later measured at the program level through post-course surveys and EM&V studies, as budgets allow.

**Table 9.11**  
PG&E WE&T Metrics<sup>a</sup>

GOAL: A workforce capable of meeting state energy goals						
Intervention Strategies	Metric	Baseline	Metric Source	Short-Term Target (1-3 years)	Mid-Term Target (4-6 years)	Long-Term Target (7-9 years)
All	Percent of offerings that align with high energy savings topics or audiences related to high potential areas for energy savings	None (will start to track as determined by program targets)	<ul style="list-style-type: none"> <li>PG&amp;E classes database, tool loansdatabase, consultations database, etc.</li> <li>Data provided by vendors and collaborating organizations</li> </ul>	<ul style="list-style-type: none"> <li>Determine topics and audiences</li> <li>Set up systems to track offerings by “high energy savings” topics and audiences</li> <li>Identify data needs with vendors and collaborating organizations</li> </ul>	TBD	TBD
<b>Potential Indicators</b>						
<ul style="list-style-type: none"> <li>Number and percent of offerings focused on “high energy savings” topics</li> <li>Number and percent of offerings targeting “high energy savings” audiences</li> </ul>						
<b>Notes</b>						
<p>“High energy savings” topics and audiences will be determined through a review of the potential study, as well as collaboration with other PAs and input from stakeholders and will change on an annual basis. Example considerations include technology, training needs in technology/sector area, potential energy savings, potential impact of a given job classification.</p>						

*Note: **Metrics** have baselines and targets, will be tracked, and when updated will compare the current value to the baseline and target. **Indicators** will be tracked but have no targets and may or may not have baselines. Indicators provide useful context for the metric.*

## M. EM&V Research Needs and Considerations

Evaluation, Measurement and Verification (EM&V) conducts research studies with the guidance of the CPUC Framework<sup>57</sup> and Protocols.<sup>58</sup> The main source of planned research will be the annual EM&V Research Plan<sup>59</sup> put together jointly by the CPUC and the PAs. This ongoing process enables stakeholders to understand and comment on research. The research for WE&T will be contingent upon the needs of the portfolio as a whole and the annual sector-specific research budget.

WE&T has past studies, including the “2006-2008 Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program Report” and the “Impact Evaluation of the California Statewide Building Operator Certification Program” showing the impact of its program offerings. Such studies have concluded that students not only had a gain in knowledge about energy efficiency, but also that they are implementing energy efficiency knowledge and skills back at the office and back on the job site.

The IOUs are interested in updating these studies to better understand how the material or course impacted, or were relevant to, jobs following WE&T coursework, and aligning the results with ongoing program development. Knowing if students are applying the skills and/or using the information they received would be very useful in assessing the course content and in designing or redesigning future courses. Furthermore, PG&E would benefit from EM&V studies that captured workforce market data focused on energy efficiency. These will be used to inform program designs, reduce uncertainties and minimize the costs of energy savings to the IOUs and ratepayers.

The IOUs will consider the WE&T program direction as outlined in the business plans in conjunction with the 2013-2014 WE&T Statewide Program Theory and Logic Model Study to provide insight into the design of this study. Multiple other potentially-relevant studies<sup>60</sup> will serve as resources for the development of the specific direction and potential key questions for this study.

<sup>57</sup> California Public Utilities Commission and the Project Advisory Group. The California Evaluation Framework. June 2004. [http://www.calmac.org/publications/California\\_Evaluation\\_Framework\\_June\\_2004.pdf](http://www.calmac.org/publications/California_Evaluation_Framework_June_2004.pdf).

<sup>58</sup> California Public Utilities Commission. California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals. April 2006.

<sup>59</sup> The most recent EM&V Evaluation Plan is here: <http://www.energydataweb.com/cpuc/search.aspx#>.

<sup>60</sup> The studies which will help inform the research include the SCE 2006-2008 Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program, the 2009-2010 Education and Training and Outreach M&E study, the 2000 PG&E Report on the Market Effects of the Energy Training Center Stockton, and some of the more recent 2013-2015 WE&T EM&V studies.

# Appendices

## Workforce Education and Training Appendices

### Appendix A: Compliance Checklist

	Cross Cutting Sector	
BP Page Number	Business Plan Guidance	PG&E Notes
	<b>A. Market Characterization</b>	
	a. Customer landscape (who they are, what are their needs)	WE&T Sector Overview, pp. 10-12
	b. Trends	Trends and Challenges, pp. 12-16
	c. Gaps/Barriers	Trends and Challenges, pp. 12-16
	<b>B. Value</b>	
	a. Discussion of roles for cross-cutting sector	Value: WE&T Supports PG&E's Energy Efficiency Portfolio, pp. 30-32
	b. How does it support portfolio	Value: WE&T Supports PG&E's Energy Efficiency Portfolio, pp. 30-32
	c. How does it benefit customers	WE&T Snapshot, Appendix D
	d. External impacts and benefits (community/economic benefits)	WE&T Snapshot, Appendix D
	<b>C. Vision</b>	
	a. Discussion of opportunities	PG&E's WE&T Vision, pp. 1-2
	b. Whether items are near-, mid-, long-term strategic initiatives	PG&E's Approach to Achieving Goals, pp. 18-29
	<b>D. Metrics</b>	
	a. One metric or more as appropriate for each intervention strategy	Metrics, pp. 36-39
	<b>E. Program/PA Coordination: Description of which and how strategies are coordinated regionally among PAs and/or other demand-side options.</b>	PG&E's Partners and Commitment to Coordination, pp. 32-34
	<b>F. EM&amp;V Considerations: Statement of evaluation needs "preparedness" (i.e., data collection strategies and internal performance analysis)</b>	EM&V Research Needs and Considerations, p. 40

## Appendix B: References

- AEE Institute. 2016. *Advanced Energy Jobs in California: Results of the 2016 California Advanced Energy Employment Survey*. Prepared by BW Research Partnership. <http://info.aee.net/advanced-energy-jobs-in-california-2016>
- California Energy Commission. June 29, 2016. *2015 Integrated Energy Policy Report (IEPR)*. Docket # 15-IEPR-01, CEC-100-2015-001-CMF. [http://www.energy.ca.gov/2015\\_energypolicy/](http://www.energy.ca.gov/2015_energypolicy/)
- California Energy Commission. March 2015. *California's Existing Buildings Energy Efficiency Action Plan*. <http://www.energy.ca.gov/2015publications/CEC-400-2015-013/CEC-400-2015-013-D.pdf>
- Employment Development Department (EDD); State of California. *Top 100 Fastest-Growing Occupations in California, 2014–2024*. [www.labormarketinfo.edd.ca.gov/OccGuides/FastGrowingOcc.aspx](http://www.labormarketinfo.edd.ca.gov/OccGuides/FastGrowingOcc.aspx)
- ERIC Institute of Educational Sciences. 1980. *Adult Learning Principles and Their Application to Program Planning*. Brundage, Donald H.; MacKeracher, Dorothy. <http://eric.ed.gov/?id=ED181292>
- ICF International. June 29, 2016. *Survey of Inclusion Workforce Landscape*. <http://www.energydataweb.com/cpucFiles/pdaDocs/1615/Final%20Report%206%2029%2016.pdf>
- Opinion Dynamics Corporation. 2014. *Impact Evaluation of the California Statewide Building Operator Certification Program*. Prepared for California Public Utilities Commission. [http://theboc.info/pdf/Eval\\_Impact\\_California\\_BOC\\_Program\\_Feb\\_2014.pdf](http://theboc.info/pdf/Eval_Impact_California_BOC_Program_Feb_2014.pdf)
- Opinion Dynamics Corporation. 2010. *Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program Report*. Prepared for California Public Utilities Commission. [www.calmac.org/publications/06-08\\_Statewide\\_Education\\_and\\_Training\\_Impact\\_Eval\\_Vol\\_I\\_FINAL.pdf](http://www.calmac.org/publications/06-08_Statewide_Education_and_Training_Impact_Eval_Vol_I_FINAL.pdf)
- Opinion Dynamics. February 2016. *PY2013-2014 California Statewide Workforce Education and Training Program, Contractor Training Market Characterization*. Prepared for California Public Utilities Commission, Energy Division. [http://media.wix.com/ugd/0c9650\\_a3002caa6e00488e94e3b8bcaa204674.pdf](http://media.wix.com/ugd/0c9650_a3002caa6e00488e94e3b8bcaa204674.pdf)
- Opinion Dynamics. June 2014. *2013-2014 Statewide WE&T Program, Program Theory and Logic Model Update; Centergies Data Needs; And Critical WE&T Data Needs*. [http://www.calmac.org/warn\\_dload.asp?e=0&id=3024](http://www.calmac.org/warn_dload.asp?e=0&id=3024)
- Opinion Dynamics Corporation and Lisa McLain ID Consulting. December 2012. *2010-2012 WE&T Process Evaluation Volume II: Connections*. [http://www.calmac.org/publications/2010-2012\\_WE%26T\\_Connections\\_Process\\_Eval\\_Report\\_FINAL-volume\\_II.pdf](http://www.calmac.org/publications/2010-2012_WE%26T_Connections_Process_Eval_Report_FINAL-volume_II.pdf)
- Perrin, Burt. September 1998. *Effective Use and Misuse of Performance Measurement*. *American Journal of Evaluation* 1998:19(3);367-379. [https://www.researchgate.net/publication/238224436\\_Effective\\_Use\\_and\\_Misuse\\_of\\_Performance\\_Measurement](https://www.researchgate.net/publication/238224436_Effective_Use_and_Misuse_of_Performance_Measurement)



UC Berkeley Labor Center, Don Vial Center on the Green Economy. 2011. *California Workforce Education & Training Needs Assessment for Energy Efficiency, Distributed Generation, and Demand Response*. [http://laborcenter.berkeley.edu/pdf/2011/WET\\_Part1.pdf](http://laborcenter.berkeley.edu/pdf/2011/WET_Part1.pdf)

Wirtshafter Associates, Inc. June 2005. *Evaluation of the 2003 Statewide Education and Training Services Program Final Report*. [www.calmac.org/warn\\_dload.asp?e=0&id=2345](http://www.calmac.org/warn_dload.asp?e=0&id=2345)Content

## Appendix C: Proposed WE&T Program Structure

The statewide WE&T program is structured into three primary components represented in Table 13.

- Career Connections
- Career & Workforce Readiness (CWR)
- Core (Post-Secondary) Energy Education Collaboration\*
- Technical Upskill\*

\* Core Energy Education and Technical Upskill are parts of Integrated Energy Education and Training (IEET), and are most closely aligned to the former “Centergies” Sub-program. See page 4 of the WE&T Business Plan for descriptions of each WE&T component.

**Table C.1: Proposed WE&T Program Structure**

Program Component	Career Connections: Career Awareness/ Exploration & Energy/ Sustainability Fundamentals	Career & Workforce Readiness (CWR): Job and Career Readiness	Integrated Energy Education & Training (IEET)	
			Core (Post-Secondary) Energy Education Collaboration	Technical Upskill
<b>Primary Audience</b>	People needing energy and sustainability fundamentals resources, and energy jobs and career awareness: <ul style="list-style-type: none"> <li>- K-12 students</li> <li>- K-12 instructors</li> <li>- Energy job/career seekers</li> <li>- Job/career transitioners</li> </ul>	People not prepared to enter a traditional energy job/career higher education path: <ul style="list-style-type: none"> <li>- Disadvantaged communities</li> <li>- Disadvantaged workers</li> </ul>	People on a chosen post-secondary educational track toward an energy job/career <ul style="list-style-type: none"> <li>- Students</li> <li>- Apprentices</li> </ul>	People in a job/career seeking energy-focused upskilling: <ul style="list-style-type: none"> <li>- Engineering &amp; design professionals</li> <li>- Technical trades / journeymen</li> </ul>
<b>Possible Offerings and Resources</b>	<ul style="list-style-type: none"> <li>- Career awareness and exploration resources</li> <li>- Energy and sustainability teaching materials</li> <li>- Teacher training</li> </ul>	<ul style="list-style-type: none"> <li>- Curriculum materials</li> <li>- Technical training and advice</li> <li>- Train-the-Trainer</li> <li>- Tools and Resources</li> <li>- Career prep/job readiness services (via partnerships)</li> <li>- Job placement (via partnerships)</li> </ul>	<ul style="list-style-type: none"> <li>- Technical education and training</li> <li>- Support for curriculum materials development</li> <li>- Train-the-Trainer</li> <li>- “Kick-Start / early stage” initiatives support</li> <li>- Building performance measurement tools</li> </ul>	<ul style="list-style-type: none"> <li>- Technical training and advice</li> <li>- Energy tools and resources</li> <li>- Certification program support</li> </ul>
<b>Primary Organizations for Strategic Partnerships</b>	<ul style="list-style-type: none"> <li>- K-12 schools</li> <li>- WIBs, CBOs</li> </ul>	<ul style="list-style-type: none"> <li>- Workforce Investment Boards</li> <li>- Workforce Development Agencies</li> <li>- Community-based organizations</li> <li>- Job-training organizations</li> </ul>	<ul style="list-style-type: none"> <li>- Community colleges</li> <li>- 4-year Colleges</li> <li>- Job-training organizations</li> <li>- Vocational Schools</li> <li>- Labor/Unions</li> <li>- Trade Associations</li> <li>- Apprenticeship &amp; Pre-apprenticeship</li> <li>- Community-based organizations</li> </ul>	<ul style="list-style-type: none"> <li>- University Extension Programs</li> <li>- Certification agencies &amp; programs</li> <li>- Professional and Trade Associations and Agencies</li> </ul>

## Appendix D: Additional WE&T Statistics

### Market Actors Reached by Industry Area

Table D.1 provides an estimate of the percent of industry actors that WE&T reached in 2006-2008 based on an EM&V study.<sup>1</sup>

**Table D.1: Market Actors Reached**

Industry Area	Market Actors (Statewide)	Estimated Reach by (IOU Energy) Centers	Percent Reached (Statewide)
HVAC and Refrigeration	19,700	9,427	44%
Government Agency / Regulatory / Inspector	12,500	3,263	26%
Engineering / Architectural Design	58,200	15,053	22%
Lighting	68,300	8,339	12%
Construction	161,200	9,064	6%
Boilers / Water Heating Sales	56,000	3,263	6%
Other	55,800	2,901	5%
Motors	49,400	2,538	5%
Facility Operations & Maintenance	163,000	3,263	2%
Energy Technology Research / Consulting	n/a	5,801	n/a
Pumping / Hydraulic Equipment	n/a	2,175	n/a
Renewables	n/a	5,076	n/a

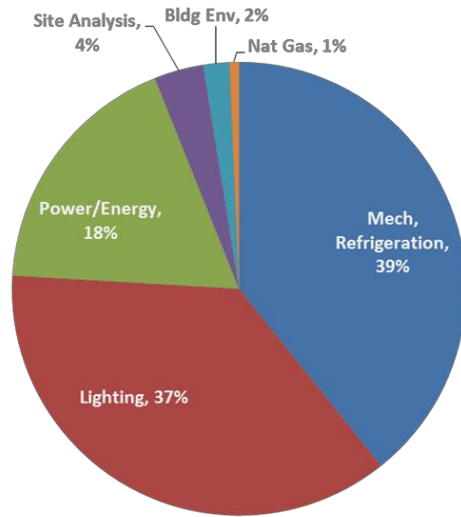
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<sup>1</sup> Opinion Dynamics Corporation, "Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program. Volume I of IV: Final Report;" March 2010; p. 58.

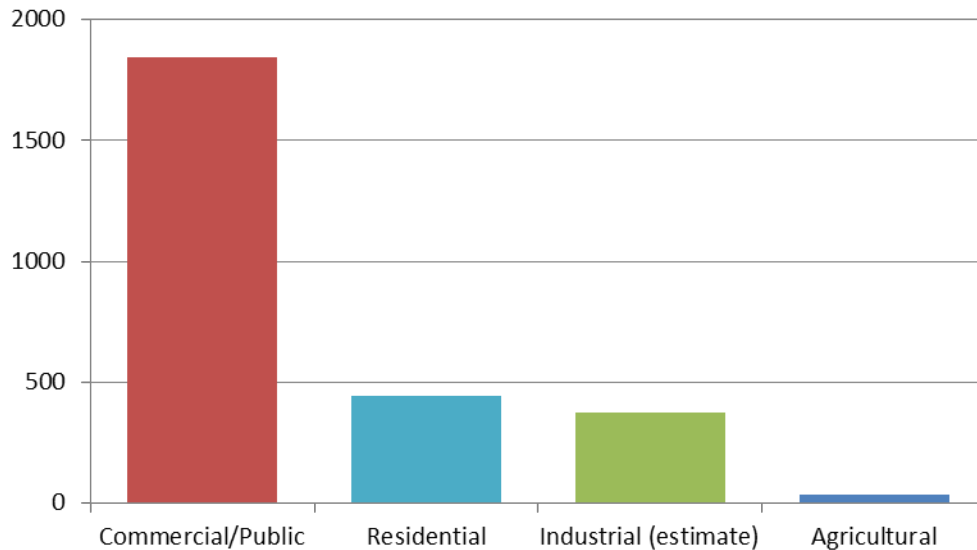
## WE&T Classes and Tool Loans Data

Figure D.1 and Figure D.2 are sourced from PG&E's student registration and Tool Lending Library databases for 2013-2015. They illustrate the diversity of tool lending library project types and ways in which the classes and Tool Lending Library have supported the five core market sectors.

**Figure D.1: PG&E Tool Loans by Project Type (2013-2015)**



**Figure D.2: PG&E Total Loans by Sector (2013-2015)**



## Appendix E: More EM&V Research Learnings of California’s WE&T and Energy Efficiency Programs

Over the past 13 years, several EM&V studies, process evaluations, and impact evaluations have informed and shaped PG&E’s WE&T strategy for 2018 and beyond. Below are high-level summaries of these key studies:

- **The IOUs’ Energy Centers are successful in achieving energy savings and promoting greater energy efficiency knowledge.** The 2006-2008 *Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program Report* concluded that the IOUs Energy Centers provide an additional 5% of energy savings to the IOUs program portfolio.<sup>2</sup> The study estimated that the Energy Centers combined yearly gross impact was approximately 700 GWh with a net impact of 544 GWh. The Centers are responsible for annual gas savings of approximately 6 million net therms. These electric and gas savings equate to approximately 267,000 and 30,000 metric tons of avoided carbon dioxide (CO<sub>2</sub>) emissions.<sup>3</sup> This study also found that over 95% of training participants self-reported gains in knowledge that moved them closer to implementing efforts to save energy. The vast majority of participants (over 87%) cited a moderate or large increase in knowledge across all market segments (residential, commercial and market actor).<sup>4</sup>
- **The 2014 Impact Evaluation of the California Statewide Building Operator Certification Program study identified successes of the Building Operator Certification (BOC) Program.** The study found that more than half (58%) of BOC program participants took some energy-saving action post-program, which resulted in an average per-student net savings of 32 MWh/year, 4.5 kW/year, and 525 therms/year. The most frequent actions taken included lighting measures, HVAC equipment scheduling, and fan optimization/air distribution actions.<sup>5</sup>
- **The Tool Lending Library (TLL) is a unique offering with high potential for energy savings.** This research included a case study, which investigated the TLL to estimate the amount of energy saved by borrowers. The study showed that TLL users implemented projects that saved \$18 million/year (with 90% confidence intervals at \$2.2 million and \$34.8 million) and 185 million kWh/year.<sup>6</sup> This topic will be further explored in the upcoming CPUC Energy Division EM&V-funded *Tool Lending Library Impact Study*, which will quantify the savings from 1-3 specific tools or sets of tools and their associated protocols that have the most energy savings potential from one PG&E Pacific Energy Center. This study is expected to be completed in 2017.

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<sup>2</sup> Opinion Dynamics Corporation, “Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program Report” 2010, p. 2.

[www.calmac.org/publications/06-08\\_Statewide\\_Education\\_and\\_Training\\_Impact\\_Eval\\_Vol\\_I\\_FINAL.pdf](http://www.calmac.org/publications/06-08_Statewide_Education_and_Training_Impact_Eval_Vol_I_FINAL.pdf)

<sup>3</sup> Opinion Dynamics Corporation, “Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program Report” 2010, p. 2.

[www.calmac.org/publications/06-08\\_Statewide\\_Education\\_and\\_Training\\_Impact\\_Eval\\_Vol\\_I\\_FINAL.pdf](http://www.calmac.org/publications/06-08_Statewide_Education_and_Training_Impact_Eval_Vol_I_FINAL.pdf)

<sup>4</sup> Opinion Dynamics Corporation, “Indirect Impact Evaluation of the Statewide Energy Efficiency Education and Training Program Report” 2010, p. 1.

[www.calmac.org/publications/06-08\\_Statewide\\_Education\\_and\\_Training\\_Impact\\_Eval\\_Vol\\_I\\_FINAL.pdf](http://www.calmac.org/publications/06-08_Statewide_Education_and_Training_Impact_Eval_Vol_I_FINAL.pdf)

<sup>5</sup> Opinion Dynamics Corporation, “Impact Evaluation of the California Statewide Building Operator Certification Program”, June 2014, p. 1.

[www.calmac.org/publications/BOC\\_10-12\\_Impact\\_Evaluation\\_Report\\_FINAL.pdf](http://www.calmac.org/publications/BOC_10-12_Impact_Evaluation_Report_FINAL.pdf)

<sup>6</sup> Wirtshafter Associates, Inc. 2005. “Evaluation of the 2003 Statewide Education and Training Services Program Final Report,” June 2005, p. E-5.

[www.calmac.org/warn\\_dload.asp?e=0&id=2345](http://www.calmac.org/warn_dload.asp?e=0&id=2345)

- **In response to a study recommendation, the IOUs are moving toward outcome-based Program Performance Metrics (PPMs) to more effectively gauge and monitor program performance.**<sup>7</sup> The PPMs being explored by the IOUs include knowledge gain, changes to workplace practice, use of WE&T knowledge/skills on-the-job, and helping to enhance/expand energy efficiency content in other organizations' curricula. This ODC study recommended that WE&T program PPMs should go beyond tracking the number of courses offered as this is limiting and provides minimal insight into impact of activities.
- **In response to study recommendations, the Energy Centers have improved data tracking and collection efforts in order to have more consistency across IOUs in support of WE&T program theory and logic.**<sup>8</sup> The study recommendations for improving data tracking included revising and enhancing the registration data collection, revising and enhancing the Energy Center course tracking databases, and revising and enhancing the course feedback surveys. The IOUs have incorporated some of these recommendations into the WE&T program by developing a core set of questions in the student post-course survey instrument. Also, all IOUs now use the same registration system and collect aligned demographics (e.g., same job classifications, same job sectors).
- **A past study has confirmed that there is sufficient availability and variety of training to support contractors, but the barrier remains in terms of contractor awareness of these training options.** This contractor training market characterization study found that the wide variety of trainings available in the state for the Residential Energy Upgrade California (EUC) Home Upgrade Program, the Residential HVAC Program, and the Non-residential Lighting Program sufficiently meets the training needs of contractors and technicians. Awareness of trainings is a greater obstacle than the number and availability of trainings.<sup>9</sup>
- **In response to a study recommendation, the IOUs have incorporated Adult Learning Principles<sup>10</sup> into their Energy Center course design, where relevant, and can continuously improve by incorporating future learnings and developments.** According to a 2005 Wirtshafter Associates, Inc. study,<sup>11</sup> Adult Learning Principles help to ensure that the focus of the classes moves beyond one that is only a transfer of information from knowledgeable instructor to attendees, to one that empowers attendees to take specific actions.

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<sup>7</sup> Opinion Dynamics Corporation, "2013-2014 Statewide WE&T Program, Program Theory and Logic Model Update; Centergies Data Needs; And Critical WE&T Data Needs", June 2014, p. 2.

[http://www.calmac.org/warn\\_dload.asp?e=0&id=3024](http://www.calmac.org/warn_dload.asp?e=0&id=3024)

<sup>8</sup> Opinion Dynamics Corporation, "2013-2014 Statewide WE&T Program, Program Theory and Logic Model Update; Centergies Data Needs; And Critical WE&T Data Needs;" June 2014; p. 2.

[http://www.calmac.org/warn\\_dload.asp?e=0&id=3024](http://www.calmac.org/warn_dload.asp?e=0&id=3024)

<sup>9</sup> Opinion Dynamics Corporation, "PY2013-2014 California Statewide Workforce Education and Training Program, Contractor Training Market Characterization;" June 2016; p. 7.

[www.energydataweb.com/cpucFiles/pdaDocs/1631/CPUC%20WET%20Contractor%20Training%20Market%20Characterization\\_FINAL\\_V5.docx](http://www.energydataweb.com/cpucFiles/pdaDocs/1631/CPUC%20WET%20Contractor%20Training%20Market%20Characterization_FINAL_V5.docx)

<sup>10</sup> ERIC Institute of Educational Sciences. 1980. Adult Learning Principles and Their Application to Program Planning. Brundage, Donald H.; MacKeracher, Dorothy. <http://eric.ed.gov/?id=ED181292>

<sup>11</sup> Wirtshafter Associates, Inc., "Evaluation of the 2003 Statewide Education and Training Services Program Final Report," June 2005, p. E-4. [www.calmac.org/warn\\_dload.asp?e=0&id=2345](http://www.calmac.org/warn_dload.asp?e=0&id=2345)

**A 2012 process evaluation study revealed that all of the Connections K-12 programs brought new energy saving concepts into schools and classrooms.** 57% of the schools or districts touched by the program self-report that they had not provided education on energy efficiency or energy conservation outside of the program. 43% of teachers had not taught students about energy efficiency or conservation outside of the program.<sup>12</sup>

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<sup>12</sup> Opinion Dynamics Corporation and Lisa McLain ID Consulting, "2010-2012 WE&T Process Evaluation Volume II: Connections;" December 2012; p. 6.

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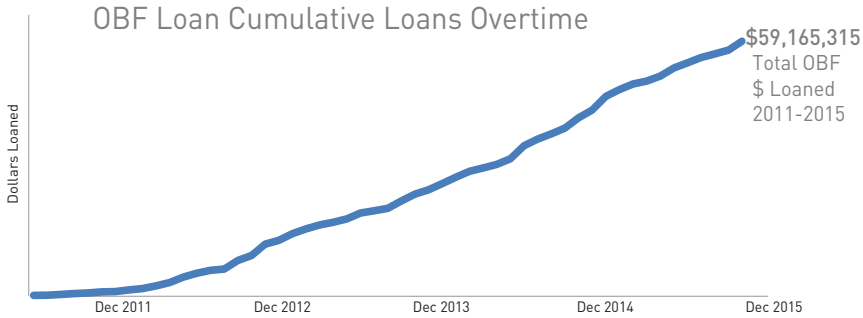
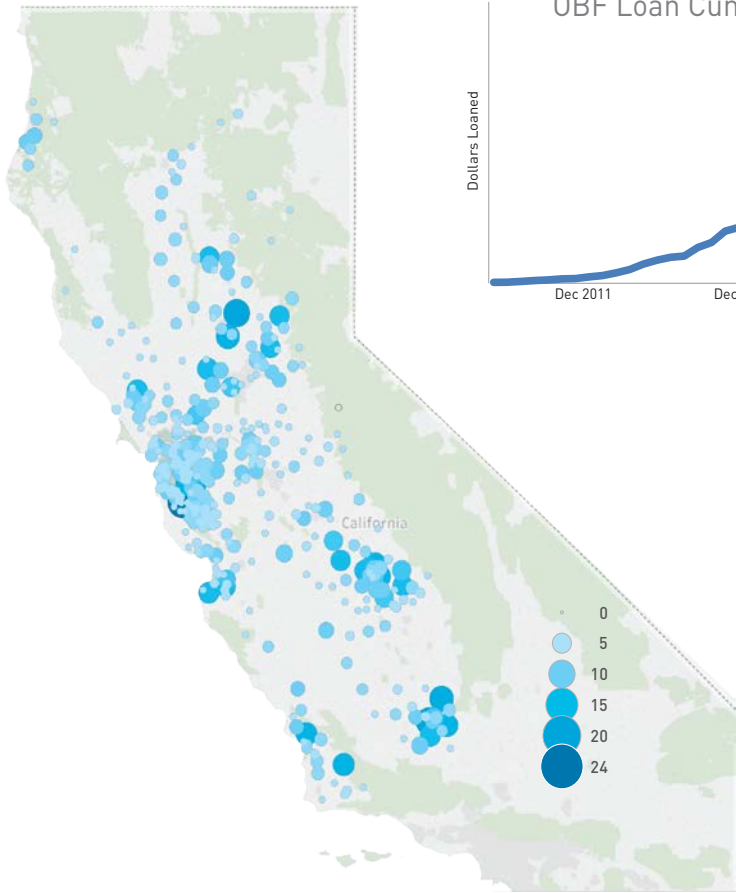


CROSS-CUTTING SEGMENT

# FINANCE

CHAPTER 10

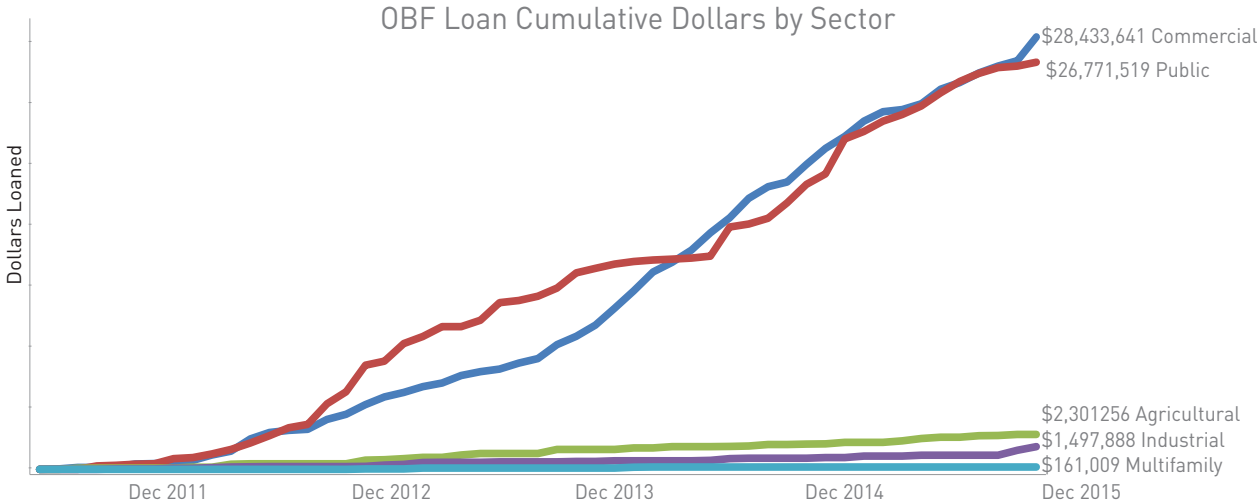
# PG&E Finance Snapshot



**0.08%** Default Rate on OBF Loans

**71%** of volume of loans to Small & Medium Businesses (SMB)

Average loan size: **\$44,219** All Participants **\$26,378** SMB **\$132,906** Government



Source: PG&E OBF Loan lending Data

## A. PG&E's Energy Efficiency Finance Vision

PG&E uses a variety of financing options, or “transaction services,” to enable customers across PG&E’s portfolio to overcome barriers related to making demand side energy investments. Offerings like On-Bill Financing (OBF) have, for the past few years, provided an initial path to new financing options. Over the next decade, PG&E aims to support the availability of new financing structures that can spur greater investment in energy efficiency and ease customers’ decision-making processes. Further, PG&E aims to support an expanded supply of, and access to, affordable funding by making investments in energy efficiency attractive for investors.

PG&E has identified two primary goals:

- Increase the supply of and access to affordable capital for energy efficiency investments.
- Facilitate investment in more and deeper projects through strategies to overcome transaction barriers for customers and lenders.

Greater detail on the intervention strategies supporting these goals can be found in *Section F: PG&E's Approach to Achieving Goals*.<sup>1</sup>

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<sup>1</sup> Email communication from Administrative Law Judge Julie Fitch, on November 15, 2016 clarified program administrators’ Business Plan timeline. “Because D.14-10-046 only authorizes funding through the end of 2025, it is my expectation that this would be the timeframe for the Business Plans as well, covering calendar years 2018-2025.” However, PG&E has built its Business Plan around a ten year vision, and has identified short (1-3 years), medium (4-7 years) and long-term (8-10 years) time periods used to indicate when strategies and tactics will be deployed, and targets will be met. PG&E believes this structure is in line with the intent of the rolling portfolio concept.

## B. PG&E's Energy Efficiency Finance Proposal Compared to Past Program Cycles

PG&E will build on the success of current offerings, such as OBF, while also looking to develop new offerings in the future. Strategies to realize the vision include:

**Build customer interest and confidence in energy efficiency investment:** While offerings like OBF have attracted customers in the past, OBF has been narrow in its focus with limits on loan amounts and the energy efficiency measures available for investment. PG&E plans to employ new tactics to spur customer investment including third-party certification of OBF-Alternative Pathway<sup>2</sup> loans, and integrating financing options at the point of sale.

**Test new financing structures:** Traditional financing structures can present challenges to energy efficiency financing.<sup>3</sup> Split incentives for landlords and tenants, commercial loan structures that require approval to add new debt, and the complex and lengthy process involved in obtaining a loan, all act as deterrents.<sup>4</sup> On-Bill Repayment (OBR) through

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<sup>2</sup> Advice Letter 3697-G /4812-E, 3697-G-A/4812-E-A, “PG&E’s On Bill Financing Alternative Pathway Program,” p. 2, <[http://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS\\_3697-G.pdf](http://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS_3697-G.pdf)> (October 18, 2016).

<sup>3</sup> Freehling, Joel and Brian Stickles, “Energy Efficiency Finance: A Market Reassessment,” ACEEE White Paper, February 2016, p. 6, <<http://aceee.org/sites/default/files/market-reassessment-0216.pdf>> (October 18, 2016).

<sup>4</sup> Ibid.

a central servicer is a new financing structure being tested by PG&E and the other California IOUs through the California Hub for Energy Efficiency Financing (CHEEF) in both residential and non-residential sectors.<sup>5</sup> PG&E aims to supplement OBR with Residential OBR for low value transactions. Additionally, PG&E plans to assess alternative financing structures such as metered energy efficiency, and tariffed financing.

**Increase supply of, and access to, affordable capital for energy efficiency investments:** Many customers lack access to affordable capital with which to finance energy efficiency measures.<sup>6</sup> Small commercial enterprises often have difficulty securing loans through traditional lenders, and public agencies often face barriers raising sufficient capital to finance large scale measures.<sup>7</sup> Tactics to expand the availability of affordable capital include:

- Credit enhancement pilots offered in partnership with California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA).
- Raising caps and other parameters for OBF loans.
- Replenishing the pool of OBF funds with third-party capital, facilitating larger transactions.
- Offering loan loss reserves to financial institutions to help them offer loans to underserved customers.

### Key Learnings from Recent EM&V Reports of California's Finance Programs

Over the last decade, governments, utilities, and other entities have begun to offer programs to finance energy efficiency projects. The popularity of these programs is growing because the up-front cost of energy efficiency improvements can present a barrier to their adoption.<sup>8,9</sup> Financing programs present a way to overcome that barrier.

<sup>5</sup> The regulatory name for single family residential OBR is Energy Finance Line Item Charge (EFLIC).

<sup>6</sup> Ibid., p. 10.

<sup>7</sup> See Public Sector chapter for a more detailed explanation of public agencies' financing hurdles, Public sector Section F. Trends and Challenges.

<sup>8</sup> Kan, Cynthia, Carol Mulholland, Linda Dethman, James "Pat" McGuckin, Ryan Fox, and Allie Marshall. "California 2010-2012 On-Bill Financing Process Evaluation and Market Assessment." Portland, OR: The Cadmus Group, March 2012, p. 3.

<sup>9</sup> Opinion Dynamics and Dunsy Energy Consulting. "PY 2014 Finance Residential Market Baseline Study Report, Volume I." Oakland, CA, March 2016, p. 1, <[http://calmac.org/publications/PY2014\\_Residential\\_Finance\\_Market\\_Baseline\\_Volume\\_1\\_FINAL.pdf](http://calmac.org/publications/PY2014_Residential_Finance_Market_Baseline_Volume_1_FINAL.pdf)> (December 16, 2016).

PG&E began offering OBF to non-residential customers in 2010,<sup>10</sup> following direction from the CPUC.<sup>11</sup> In subsequent years, funding for financing programs has grown and offerings have expanded. All IOUs, including PG&E, plan to initiate pilots that will target a range of specific types of customers (e.g., multifamily housing).<sup>12</sup>

#### 1. Key Learnings: importance of marketing, education, and outreach

- **Many customers—residential and non-residential—are not familiar with energy efficiency financing programs.**<sup>13,14</sup>
- **Vendors/contractors play an important role in financing programs, but training and oversight are important.** Because they have face-to-face contact with customers, contractors play an important role in "selling" energy efficiency financing programs.<sup>15</sup> Likewise, many vendors say OBF is important in enabling them to sell energy efficiency projects to customers who otherwise would not be able to afford them.<sup>16</sup> However, some contractors who are aware of energy efficiency financing options fail to promote them to customers, either because they do not see it as a dimension of their business or because they do not think customers need it.<sup>17</sup>
- **Quality assurance and quality control are important in the IOU-contractor relationship.** Customers may hesitate to trust contractors as information sources about loan products.<sup>18</sup> However, they may more readily accept financing options once they know they are associated with

<sup>10</sup> Sempra began their program in 2006, SCE in 2009.

<sup>11</sup> CPUC Decision D.09-09-047, p.285.

<sup>12</sup> See the following website for more information: <http://www.treasurer.ca.gov/caeatfa/cheef/>.

<sup>13</sup> Opinion Dynamics and Dunsy Energy Consulting, "PY 2014 Finance Residential Market Baseline Study Report," Oakland, CA, March 2016, p. 1.

<sup>14</sup> Mulholland, Carol, Linda Dethman, Allie Marshall, and Cynthia Kan, "Energy-Efficiency Financing Customer Research Focus Group Findings," Boston, MA: The Cadmus Group, June 2013, pp. 3, 7, 10, 14.

<sup>15</sup> James, Laura, Pat McGuckin, Althea Koburger, and Carol Mulholland, "California Joint Utilities Financing Research: Existing Programs Review," Boston, MA: The Cadmus Group, April 2014, p. 5.

<sup>16</sup> Horkitz, Karen, Pat McGuckin, Laura James, Christopher Frye, and Hugh Ratcliffe, "HERO Program Profile: Final Report," Boston, MA: The Cadmus Group, October 2016, p. 2, <[http://calmac.org/publications/HERO\\_Program\\_Study\\_Final\\_Report.pdf](http://calmac.org/publications/HERO_Program_Study_Final_Report.pdf)> (October 18, 2016).

<sup>17</sup> Opinion Dynamics, 2016, pp. 27-29.

<sup>18</sup> Mulholland et al. 2013., pp. 3, 7, 10, 14.

a utility.<sup>19,20</sup> Other California OBF programs have faced issues with vendors who misled customers that OBF is “free” and not a loan or installing low quality projects that did not produce energy savings benefits for them.<sup>21</sup>

## 2. Key Learnings: potential for financing programs to expand uptake of energy efficiency measures

### • Financing programs address a clear need.

Residential customers report that high up-front costs present a significant barrier to the uptake of residential energy efficiency measures, and homeowners say that energy efficiency financing could help overcome this barrier.<sup>22</sup> A strong majority of non-residential OBF customers (three-quarters of 76 customers surveyed in 2011-2012) reported that they would not have implemented their energy efficiency projects without OBF,<sup>23</sup> and an equivalent majority of residential customers (three-quarters of 115 homeowners surveyed in 2015) said financing enabled them to do larger projects or purchase higher-quality equipment than they otherwise would have.<sup>24</sup>

### • Default rates for OBF programs are low.<sup>25,26</sup>

This implies that despite availability of loans to customers who may otherwise find affordable financing difficult to obtain, the risk to ratepayers from offering these programs is low.

### • Loan Loss Reserves (LLRs) and other credit enhancement measures may be effective market transformation tools. Credit enhancement attracts lenders to energy efficiency financing programs, but program administrators may be able to reduce or eliminate credit enhancement over time, once lenders are engaged.<sup>27</sup>

## 3. Key Learnings: program design and operations

### • Streamlining the process of applying for and obtaining financing is important, for customers and contractors.<sup>28</sup>

Home Energy Renovation Opportunity (HERO) program’s simple application process and flexibility on the measures it can pay for have been key factors in its growth.<sup>29</sup>

### • IOUs believe increased energy efficiency adoption results from offering both financing and rebates together, rather than either alone.<sup>30</sup>

### • Reaching mid- to low-income customers may be difficult. Many residential customers with low income or credit scores feel it would be difficult to obtain a loan.<sup>31</sup> Even programs structured to serve customers with financial challenges may primarily serve others. Several programs structured to serve customers with less-robust credit histories in fact served customers with high average credit scores.<sup>32</sup>

### • Customers report that interest rates are important decision-making criteria for single family homeowners.<sup>33</sup> Their expectations may be based on subsidized or secured loans, which offer lower interest rates.<sup>34</sup> However, the HERO program, which offers market-based interest rates of around 7% to 8%, has grown rapidly.<sup>35</sup>

<sup>19</sup> Ibid., pp. 27, 41.

<sup>20</sup> Kan et al. 2012, pp. 36, 51.

<sup>21</sup> Ibid., pp. 3, 50.

<sup>22</sup> Opinion Dynamics, 2016, p. 1.

<sup>23</sup> Kan et al., 2012, p. 36.

<sup>24</sup> Opinion Dynamics, 2016, p. 22.

<sup>25</sup> James et al., 2014, p. 5.

<sup>26</sup> CPUC 2015, p. 117.

<sup>27</sup> James et al., 2014., p. 4.

<sup>28</sup> Ibid., p. 6.

<sup>29</sup> Horkitz, et al., 2016, p. 7.

<sup>30</sup> James, et al., 2014, p. 4.

<sup>31</sup> Opinion Dynamics, 2016, p. 7.

<sup>32</sup> James et al., 2014, p. 5.

<sup>33</sup> Mulholland et al., 2013, p. 10.

<sup>34</sup> Ibid.

<sup>35</sup> Horkitz et al., 2014, p. 4.

## C. Sector Level Budget

PG&E's Business Plan budget provides general information on the expected levels of annual spending for 2018-2025. As Business Plans were envisioned as "a comprehensive vision outlining long-term strategic initiatives and intervention

strategies,"<sup>36</sup> PG&E provides its budget forecast that represents its best estimates to realize its portfolio vision, while retaining flexibility to accommodate potential market or regulatory changes. Each year, PG&E will file a Tier 2 advice letter (AL) that provides a detailed budget for the Commission's review and approval.<sup>37</sup> See **Table 10.1**.

**Table 10.1**  
PG&E Finance Sector Budget Summary

Cost Category	2016	2017	2018	2019	2020-2025 Annual Budget <sup>a</sup>
<b>Administration</b>	\$831,166	\$582,979	\$507,502	\$432,025	\$385,599
<b>Marketing</b>	\$1,127,360	\$1,828,167	\$1,369,628	\$1,271,089	\$1,172,549
<b>Implementation</b>	\$3,610,187	\$2,346,743	\$2,329,096	\$2,311,449	\$2,293,802
<b>Incentive</b>	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<b>Loan Pool</b>	\$10,000,000	\$13,500,000	\$13,500,000	\$13,500,000	\$5,000,000
<b>Total</b>	<b>\$15,568,713</b>	<b>\$18,257,889</b>	<b>\$17,706,226</b>	<b>\$17,513,563</b>	<b>\$8,851,950</b>

<sup>a</sup> The Annual Budget from 2020 through 2025 will remain the same.

<sup>36</sup> D.15-10-028, p.48.

<sup>37</sup> D.15-10-028, OP 4.

## D. Market Overview

All market sectors can enjoy a diverse array of financing opportunities to stimulate energy efficiency investments.

### Residential Sector

The need for financing energy-related projects in the near future is significant. High up-front project costs present a significant barrier to the uptake of residential energy efficiency measures, and homeowners say that energy efficiency financing could help overcome this barrier.<sup>38</sup> 40% of homeowners said that they are likely to make an energy-related upgrade in the next two years, and 27% are at least somewhat likely to use financing. Over half of homeowners surveyed (54%) agreed that high up-front cost is why they might not make an energy-related upgrade, and a third of homeowners stated that a loan could help overcome the costs.

The market for energy efficiency financing in the residential sector has undergone significant change in recent years with over \$1.2 billion of PACE loans being funded since 2014.<sup>39</sup> PACE's popularity appears to be reaching those customers who previously found difficulty obtaining financing. Many residential customers with low income or credit scores feel it would be difficult to obtain a loan.<sup>40</sup>

Multifamily buildings offer great energy efficiency potential.<sup>41</sup> However, split incentives present a barrier to both owners and tenants from investing in energy efficiency measures.

### Commercial, Industrial and Agricultural Sectors

Large commercial, industrial and agricultural customers are not necessarily constrained by lack of financing, but rather by the lack of a compelling value proposition for energy efficiency measures. Energy costs typically represent only 2-4% of an operating budget and commercial enterprises generally prefer to reserve the use of debt (access to which is limited by the strength of the balance sheet) to initiatives that support the core business (e.g., manufacturing widgets and providing a service).<sup>42</sup>

The size of an operation generally has a much bigger impact on financing opportunities available to it than the sector in which it falls. Small customers often face high levels of debt, repayment concerns among lenders, elevated transaction costs, and risk-averse owners when considering financing options for energy efficiency upgrades.<sup>43</sup>

### Public Sector

Public sector customers face different incentives in the budgeting process than those in the commercial and residential sectors, creating unique challenges. During the budgeting process, it is often easier to acquire funds to pay higher bills than seek capital expenditures for major improvements.<sup>44</sup> Once a public-sector property owner has received approval to pursue capital improvements, complex procurement procedures create a disincentive to develop projects.<sup>45</sup>

<sup>38</sup> California Energy Commission, "Existing Buildings Energy Efficiency Action Plan Draft 2016 Plan Update," 2016, p. 62.

<sup>39</sup> Ibid.

<sup>40</sup> Opinion Dynamics, 2016, p. 29.

<sup>41</sup> Hynek, Don et al., "Follow the Money: Overcoming the Split Incentive for Effective Energy Efficiency Program Design in Multi-family Buildings," ACEEE Summer Study 2012, p. 3, <<http://aceee.org/files/proceedings/2012/data/papers/0193-000192.pdf>> [October 18, 2016].

<sup>42</sup> Harcourt, Brown & Carey, Inc., "Energy Efficiency Financing in California Needs and Gaps Preliminary Assessment and Recommendations," Presented to The California Public Utilities Commission, Energy Division, July 8, 2011, p. 41, <[http://www.harcourtbrown.com/wp-content/uploads/CPUC\\_FinancingReport\\_HBC\\_Jul8v2.pdf](http://www.harcourtbrown.com/wp-content/uploads/CPUC_FinancingReport_HBC_Jul8v2.pdf)> [October 18, 2016].

<sup>43</sup> Freehling et al., 2016, p.2.

<sup>44</sup> Harcourt, Brown & Carey, Inc., 2011, p. 34.

<sup>45</sup> Ibid., p. 4.

## E. Trends and Challenges

For some customers, while interest in energy efficiency and other distributed energy resources (DERs) investments exists, financial barriers restrict their ability to proceed with desired projects. Barriers include, but are not limited to:

- **Lenders and customers lack confidence in energy efficiency savings:** While potential lenders are willing to invest in energy efficiency in principle, lenders generally identified “energy savings not materializing” as their greatest risk and welcomed more data to consider during underwriting.<sup>46</sup>
- **Customers lack interest in financing offerings:** Many energy efficiency financing programs have failed to generate significant customer project volume, often because the primary barrier to energy efficiency adoption is low customer demand, not access to attractive capital.<sup>47</sup>
- **Capital allocation procedures in non-residential and multifamily sector are difficult.** This can manifest itself in the public sector with restrictions on processes for taking on new debt, and in the commercial sector where competing priorities often make obtaining internal sources of funding challenging.
- **Building capital structures are complicated across multiple sectors:** Many lending agreements require consent of the existing lenders before new debt can be taken on. Primary lenders will rarely allow new financing since they cannot be certain that the new debt will not undermine payment of their loans. Even if lenders are open to additional financing, it can be time consuming and costly to obtain the agreements. Additionally, while lenders may be open to projects, small equity holders may not. Securing agreements from numerous parties drives up costs of transactions and makes deals unprofitable and unpopular for all involved.<sup>48</sup>
- **Split incentives in tenanted properties (commercial/residential multifamily) present a challenge:** The split incentive manifests itself when tenants pay the utility bills (directly or indirectly), but have no control over capital investments that affect energy consumption. Those few investments that a tenant might make that could impact their utility bill tend not to be completed, as the tenant will be unable to take the improvement with them when they move.<sup>49</sup>
- **Funding is not available for low value projects:** Lending for low cost projects is challenging as lenders need to cover the underwriting and administration of loans, resulting in relatively high financing costs. As such, market solutions have focused on larger cost projects.<sup>50</sup>
- **Small business credit is an issue:** The small commercial market faces high levels of debt, repayment concerns among lenders, elevated transaction costs, and risk-averse owners.<sup>51</sup>

PG&E describes financial barriers specific to each market sector (Residential, Commercial, Agricultural, Industrial and Public) in each of the market sector chapters.

<sup>46</sup> Kolstad, Leonard, “Energy Efficiency Finance For Commercial Buildings: Insights From Lenders,” Institute for Market Transformation, March 2016, p. 5. <<http://www.imt.org/resources/detail/energy-efficiency-finance-for-commercial-buildings-insights-from-lenders>> [October 18, 2016].

<sup>47</sup> SEE Action Network Financing Solutions Working Group, “Energy Efficiency Financing Program Implementation Primer,” January 2014, p.11. <[https://www4.eere.energy.gov/seeaction/system/files/documents/financing\\_primer\\_0.pdf](https://www4.eere.energy.gov/seeaction/system/files/documents/financing_primer_0.pdf)> [October 18, 2016].

<sup>48</sup> Freehling et al., 2016, p. 7.

<sup>49</sup> Hynek, Don et al., 2012, p. 2.

<sup>50</sup> Horkitz et al., 2016, p. 4.

<sup>51</sup> Freehling et al., 2016, p.7.



## F. PG&E's Approach to Achieving Goals

To achieve the two goals identified in PG&E's energy efficiency financing vision, PG&E has identified three primary strategies.

- Build customer and investor interest and confidence in energy efficiency investment.
- Implement new financing structures.
- Increase the supply of, and access to, affordable capital for energy efficiency investments.

The next section provides further detail on the selected intervention strategies and exploratory tactics.

### Intervention 1 – Build customer and investor interest and confidence in energy efficiency investment

Many energy efficiency financing programs have failed to generate significant customer project volume, often because the primary barrier to energy efficiency adoption is low customer demand, not access to attractive capital.<sup>52</sup> Exacerbating this problem is the lack of confidence, on the part of both customers and potential lenders, in whether energy savings will materialize once an investment has been made.<sup>53</sup> PG&E has adopted a variety of tactics to build both customer and investor interest and confidence in energy efficiency investments.

Building confidence in projected energy savings is critical when customers are asked to consider paying for an energy efficiency investment over time through a financing mechanism. It requires providing the customer with trusted tools and resources that enables them to clearly understand their investment decision. For example, the Environmental Defense Fund's (EDF) Investor Confidence Project (ICP)<sup>54</sup>, certifies energy efficiency projects by examining a project's baseline, savings calculations and EM&V plan. PG&E is adapting the ICP Commercial Protocol as one pathway to loans under OBF – Alternative Pathway.<sup>55</sup> For other new financing tools and programs that leverage third-party capital, PG&E intends to use the framework developed under the OBF-Alternative Pathway.

Customers are interested in energy efficiency measures, not taking out a loan. Building customer interest is dependent on connecting customers to appropriate financing opportunities at the point of sale/rebate. PG&E will support the statewide financing pilots marketing and outreach plan to recruit and inform project developers and contractors about options for customer energy efficiency financing.<sup>56</sup> Further, PG&E will continue providing developers and contractors with tools that can help the customer with their investment decision.

<sup>52</sup> SEE Action Network, 2014, p. 11.

<sup>53</sup> Kolstad, 2016, p.5.

<sup>54</sup> Investor Confidence Project, <<http://www.eepformance.org/>> (October 13, 2016).

<sup>55</sup> Advice Letter 3697-G /4812-E, 3697-G-A/4812-E-A, "PG&E's On Bill Financing Alternative Pathway Program," p. 2, <[http://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS\\_3697-G.pdf](http://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS_3697-G.pdf)> (October 18, 2016).

<sup>56</sup> California Hub for Energy Efficiency Financing (CHEEF) Pilot Programs, <<http://www.treasurer.ca.gov/caeatfa/cheef/>> (October 13, 2016).

**Table 10.2** provides: a summary of the barriers addressed by this intervention strategy; the tactics that will be pursued; whether tactics are existing, modified, or new; the timing for tactic implementation; and the partners that will be engaged.

A 2015 survey of approximately 1,300 California homeowners found that about one-third of homeowners were aware of some form of energy efficiency financing.<sup>57</sup> Focus groups conducted in 2013 with medium-to-large business customers, small business customers, and residential customers in PG&E's service territory also found that all three groups had limited awareness and knowledge of energy efficiency financing.<sup>58</sup>

**Table 10.2**  
Intervention 1: Build customer and investor interest in investment

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Build customer and investor interest and confidence in energy efficiency investment</b>	<b>Overcome Transaction Barriers to Investment</b> <ul style="list-style-type: none"> <li>• Customers and lenders lack confidence in energy savings</li> <li>• Customers lack interest in financing offerings</li> </ul>	Connect customers to financing options at point of sale	E	S
		Outreach strategy for financing programs focused on contractors to inform them of financing opportunities	N	S
		Certify offerings from an investor perspective through ICP based protocols (e.g., OBF-Alternative Pathway loans)	N	S
		Outreach to building owners and operators to inform them of financing opportunities	N	S
		Provide alternative, trusted tools and resources to clearly understand investment decision	N	S

**Partners:** CAEATFA, IOUs, Financial Institutions (FI), EDF ICP.

<sup>57</sup> Opinion Dynamics, 2016, p. 1.

<sup>58</sup> Mulholland et al., 2013, p. 4.

Contractors, project developers and PG&E representatives are critical to connecting customers to energy efficiency financing they might otherwise be unaware of. A 2014 assessment of 15 energy efficiency financing programs across the U.S. and in several other countries found that program managers believed contractors were a critical sales channel.<sup>59</sup> Despite this, a 2015 survey of 156 residential retrofit contractors in California found that the vast majority (85%) did not promote financing programs to their customers, most often because they did not think their customers needed them or did not think they had capacity to promote them.<sup>60</sup> Most contractors who did promote financing programs were larger companies with developed sales capacities,<sup>61</sup> and even when contractors were aware of multiple financing programs, they often presented only one option at a time to individual customers.<sup>62</sup>

## Intervention 2 – Implement new financing structures

Energy efficiency investment opportunities can be difficult for building owners and operators to fund, simply due to the complexity and lengthy processes necessary to acquire capital. The funding terms of many commercial properties require approval to add additional debt, and property owners may not qualify for the additional loans necessary to complete an energy efficiency project.<sup>63</sup> Split incentives, in which landlords may not be inclined to make energy efficiency upgrades to building services when the benefits associated with the resulting energy savings accrue to the tenant, are another potential barrier to energy efficiency investment.

New financing structures may offer an opportunity for customers to access financing, navigate or avoid their own capital investment decision-making processes, and solve barriers such as the split

incentive. OBR, in which loans provided by non-utility lenders are repaid through a customer's energy bill, has the potential to overcome some of these barriers by providing investors with a secure cash flow stream collected by the utility, and by providing customers the convenience of repaying the loan as part of their utility bill. Under the statewide financing pilots, the IOUs will test OBR's ability to overcome these barriers to energy efficiency investments by utilizing a consistent statewide process and a single entity as the intermediary between the IOUs and financial institutions.

Additionally, new alternative financing structures exist that could provide a benefit in specific sectors where energy investments have historically been difficult to make, such as tenanted properties. Financing energy efficiency investments by billing utility owners for the metered efficiency yield of an installed measure (e.g., Distributed Energy Resources Billing Initiative (DERBI)) is one example.<sup>64</sup> Tariffed financing opportunities, in which investments in distributed energy resources are repaid through a tariff on the customer's bill (differentiated from OBF as the tariff is a service linked to a meter rather than a customer, allowing the obligation to transfer to subsequent owners or renters), offers a solution to split incentives between owners and renters.<sup>65</sup> PG&E will study the feasibility and opportunity that these structures offer, and whether PG&E can play a role in facilitating their adoption.

PG&E is also working with national partners to help attract lower cost funds from capital markets for energy efficiency investments. These include work on a pilot to stimulate the market for Green Bonds and evaluating opportunities to work with government-sponsored entities to update home mortgages to encourage energy efficiency investments.<sup>66</sup>

<sup>59</sup> James et al., 2014, p. 5.

<sup>60</sup> Opinion Dynamics, 2016, p. 4.

<sup>61</sup> Ibid.

<sup>62</sup> Horkitz et al., 2016, p. 4.

<sup>63</sup> Harcourt, Brown & Carey, Inc., 2011, p. 33.

<sup>64</sup> See for example "MEETS" in Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, "Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings," 2016, p.11.

<sup>65</sup> California Energy Commission, 2016, p. 64.

<sup>66</sup> KPMG International, "Sustainable Insight: Gearing Up for Green Bonds," 2015, p. 2.

**Table 10.3** provides: a summary of the barriers addressed by this intervention strategy; the tactics that will be pursued; whether tactics are existing, modified, or new; the timing for tactic implementation; and the partners that will be engaged.

Financing energy efficiency improvements in rental properties and extending an attractive financial product to individuals that do not plan to stay in their homes very long is difficult. Tariffed offerings link the investment and its repayment to the unit's meter, and offer a resolution to this problem.<sup>67</sup>

**Table 10.3**  
Intervention 2: Implement new financing structures

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>New Financing structures</b>	<ul style="list-style-type: none"> <li>• Capital allocation procedures are difficult</li> <li>• Building capital structures are complicated</li> </ul>	Implement OBR	M	S
		Evaluate new transaction structure offerings focused on billing utility owners for the metered efficiency yield of an installed measure (e.g. MEETs), and tariffed financing options in specific sectors	N	M
		Transform capital markets through Green Bonds pilot and mortgage work with Freddie Mac/Fannie Mae	N	L

**Partners:** OBR lenders, Fannie Mac/Freddie Mae.

<sup>67</sup> Nadel, Steve et al., "On-Bill Financing for Energy Efficiency Improvements: A Review of Current Program Challenges, Opportunities and Best Practices," ACEEE Report Number E118, December 2011, p. 4, <[http://www.puc.state.pa.us/Electric/pdf/Act129/OBF-ACEEE\\_OBF\\_EE\\_Improvements.pdf](http://www.puc.state.pa.us/Electric/pdf/Act129/OBF-ACEEE_OBF_EE_Improvements.pdf)> (October 18, 2016).

### Intervention 3 – Increase the supply of, and access to, affordable capital for energy efficiency investments

Many customers who otherwise might be positioned to implement energy efficiency measures are unable to access financing on terms they find attractive. This might be due to a lack of credit for many small businesses,<sup>68</sup> or to the high cost of energy efficiency measures for a given customer's measures. For example, many K-12 and higher education customers face high costs when managing projects in a multiple building, campus setting.

As a primary lender, PG&E offers OBF to non-residential customers to increase access to affordable capital for energy efficiency investments. OBF is a popular resource for PG&E customers, with more than \$71 million loaned out since program implementation.

PG&E will continue to evaluate opportunities to improve OBF to align with customer needs and California's energy efficiency goals. Changes could include expanding loan parameters in customer segments which are identified as underserved, and expanding the available pool of funds by replenishing it with third-party capital. According to the California Energy Commission (CEC),<sup>69</sup> "With the SB 350 mandate to set targets to double statewide efficiency savings, financing needs will be larger yet."

In addition to areas in which PG&E can act as the primary lender, new financing structures that can attract new capital are another potential area where the supply of capital can be expanded. PG&E is currently working with the CAEATFA to test a suite of new financing pilots across all customer classes. These programs aim to offer credit enhancements in the form of loan loss reserves, and offer OBR of third-party loans through a central servicer, in order to attract new lenders and new financing products to the market. OBR may be a particularly valuable opportunity to fund low value loans as some of the administrative costs of lending can be removed.

<sup>68</sup> Freehling et al., 2016, p. 2.

<sup>69</sup> California Energy Commission, 2016, p. 61.

**Table 10.4** provides: a summary of the barriers addressed by this intervention strategy; the tactics that will be pursued; whether tactics are

existing, modified, or new; the timing for tactic implementation; and the partners that will be engaged.

**Table 10.4**

Intervention 3: Increase supply and access to affordable capital

Intervention Strategy	Barriers	Example Tactics	Existing, New, or Modified	Short, Mid, or Long-term
<b>Increase the supply of, and access to, affordable capital for energy efficiency investments</b>	<ul style="list-style-type: none"> <li>• High administrative cost of low-value lending</li> <li>• Lack of credit for small business and agricultural customers</li> <li>• Difficulty in accessing affordable capital for residential customers with poor credit history</li> </ul>	Expand parameters for OBF loans	M	S
		Evaluate replenishing OBF funds with third-party capital	M	M
		Tariffed financing option targeted at customers in need of access to additional sources of capital	N	M
		Implement financing pilots to offer credit enhancements in partnership with CAEATFA. (e.g., Residential Energy Efficiency Loans (REEL))	N	S
		OBR for low-value loans	N	M

**Partners:** CAEATFA, OBR lenders, third-party investors.

A strong majority of non-residential OBF customers (three-quarters of 76 customers surveyed in 2011-12) reported that they would not have implemented their energy efficiency projects without OBF.<sup>70</sup>

15 US and international OBF programs surveyed in 2014 were consistently reported with a default rate of 1% or less.<sup>71</sup> Among California IOUs, San Diego Gas & Electric has the largest and longest-running OBF program. Its default rate between 2006 and 2012 was less than 1%.<sup>72</sup>

Evaluation of energy efficiency financing programs has indicated that a key element for continued growth is ensuring that efficiency is better integrated into capitalization allocation processes (e.g., during initial construction or at recapitalization).<sup>73</sup> Strategies to increase the supply of capital to these customers make the process of integrating capitalization easier.

### Statewide Finance Pilots

D.13-09-044, approved by the CPUC in 2013, implemented statewide finance pilot programs which address the need for financing to overcome first cost barriers to new energy efficiency projects. The pilots are administered by the California Hub for Energy Efficiency Financing (CHEEF), which coordinates the various participants and manages funds and data, and which in turn is administered by the CAEATFA.

For more information on the pilots, see *Section I: Financing Pilots Overview*.

## G. PG&E's Partners and Commitment to Coordination

PG&E's success in financing will rely on a broad range of program administrators, regulators, government agencies, financial institutions, non-profits, market actors, and stakeholders. Particularly important for the success of PG&E's transaction services are the relationships it builds with financial institutions. The following list of organizations and stakeholders will help PG&E achieve its finance sector goals. This list is representative, and not intended to be all-inclusive.

- **Financial institutions (FI):** PG&E seeks to attract financing institutions to participate in the financing programs. PG&E needs to work with financing institutions in the design and implementation of programs to ensure that the programs can successfully leverage ratepayer dollars with private capital.
- **FI servicing organizations:** PG&E will need to work with intermediaries to perform functions like OBR. Servicing organizations have a crucial role to play in connecting lenders with the PG&E billing system.
- **Non-profit organizations such as the Environmental Defense Fund (EDF), Green Building Certification Institute (GBCI) and Natural Resources Defense Council (NRDC):** Non-profit organizations have developed trusted processes through which to certify energy efficiency investments. For example, the Environmental Defense Fund's Investor Confidence Project certifies energy efficiency projects by examining a project's baseline, savings calculations and EM&V plan. PG&E is adapting the ICP Commercial Protocol as one pathway to loans under OBF – Alternative Pathway.

<sup>70</sup> Kan et al., 2012, p. 10.

<sup>71</sup> James et al., 2014, p. 5.

<sup>72</sup> California Energy Commission, 2015, p. 62.

<sup>73</sup> Ibid., p 61.

- **Energy Efficiency Product Manufacturers/ Distributors:** Product manufacturers have a crucial role to play in driving participation from both lenders and customers. Integrating financing into their marketing strategy can increase adoption of their product.
- **Government agencies such as CAEATFA, CPUC, local governments:** CAEATFA is the implementer of the CHEEF, which is administering loan loss reserve programs and OBR on behalf of the other IOUs.
- **Third-Party Implementers:** PG&E will make the financing tools available to third-party implementers to incorporate into their programs. PG&E believes that third-party implementers are well positioned to drive participation in the financing programs, and to drive energy savings by using financing tools.
- **Trade Professionals:** PG&E educates its network of trade professionals about the financing tools and provides training on how to use the financing tools to support sales of energy efficiency measures.
- **Other IOUs, and other Program Administrators:** PG&E seeks coordination with the other IOUs in the implementation of statewide financing programs, and the coordination amongst program administrators to integrate financing into energy efficiency programs.

## H. Statewide Administration and Transition Timeline

D.16-08-019 modifies the program administration structure for all upstream and midstream programs, market transformation efforts, and select downstream programs, such that these programs become “statewide.” D.16-08-019 defines statewide programs as being delivered uniformly throughout the IOU service territories and overseen by a single lead program administrator.<sup>74</sup> Statewide efforts are required to comprise at least 25% of each IOU’s portfolio budget.<sup>75</sup>

Please refer to *Statewide Administration Chapter 11* for program administrators’ proposals for statewide programs and/or subprograms.

<sup>74</sup> D.16-08-019, p. 51.

<sup>75</sup> D.16-08-019, p. 65.

## I. Financing Pilots Overview

With the use of ratepayer supported credit enhancements and IOU OBR, the CPUC has authorized the IOUs to launch new financing pilots. The financing pilots use loan loss reserves to leverage private capital from third party lenders to expand the access of attractive financing through innovative financing programs. Key pilot design elements include:

- **OBR:** Allows customers to repay third-party energy loans and leases on the utility bill.
- **Credit enhancements:** Minimize risk of capital losses for third-party lenders, thereby resulting in increased consumer access to enhanced financing terms.

In September 2013, the CPUC approved D.13-09-044 to implement statewide residential and non-residential finance pilot programs to address the first cost barrier to support energy efficiency improvement projects. These pilots are intended to serve multiple segments including single family, multifamily, small business, and other non-residential sectors.

The pilots are administered by the CHEEF, which coordinates the various participants and manages funds and data, and which in turn is administered by CAEATFA. Each pilot is expected to run for 24-months starting from the time the first loan is enrolled in the program.

**Table 10.5** provides a list of the program types with a brief description. The Residential Energy Efficiency Loan Assistance Program (REEL) launched in the third quarter of 2016. The IOUs and CAEATFA will focus on the launch of the remaining pilots, including the OBR feature.



**Table 10.5**  
Financing Pilots

Program Type	Description
Residential Energy Efficiency Loan (REEL)	Single family residential loan program without on-bill repayment feature
Energy Efficiency Line Item Charge (EFLIC)	On-bill repayment sub-program of REEL (PG&E only)
Master-metered Multifamily	Available for property owners of affordable housing buildings with 20 or more units with on-bill repayment feature
Small Business Loan	On-bill loan program for small businesses as defined by the United States Small Business Administration (SBA)
Small Business Lease	On-bill and off-bill lease program for small business as defined by SBA
Non-residential without Credit Enhancement	On-bill repayment program for all non-residential customers. Distributed generation is allowed

### Pilot Objectives

1. Develop scalable, leveraged, financing products that can be used to obtain cost effective energy savings.
2. Expand access to financing instruments, particularly segments of energy users underserved by current EE financing.
3. To engage customers in deeper, more comprehensive EE projects than available through current programs.

For more information on the statewide solicitation strategy and transition timeline, please see the Business Plan chapter on Statewide Administration.

## J. Metrics and EM&V Considerations

PG&E and the other program administrators understand the importance of ensuring that all metrics provide value to the CPUC, program administrators, or other stakeholders. We also recognize that listed metrics can have powerful and unintended effects.<sup>76</sup>

All of the metrics that we propose are consistent with the agreed-upon statewide guiding principles for the metrics that was shared with the Energy Division on August 16, 2016.

### Metrics should...

- Be used and useful by PAs to manage portfolio
- Be timely
- Rely on data used in program implementation
- Be simple to understand and clear of any subjectivity
- Have longevity

<sup>76</sup> Perrin, in an article in the American Journal of Evaluation, discussed certain known limitations of performance metrics. Among these limitations, he described varying interpretation of the “same” term and concepts, goal displacement, use of meaningless and irrelevant measures, and cost-savings vs. cost-shifting. (Perrin, Burt. 1998. *Effective Use and Misuse of Performance Measurement*. American Journal of Evaluation 1998:19;367.)

As Finance is a program rather than a sector, in this section we present information on program-level metrics and indicators. These will be explored more in the development of the implementation plan for Finance.

PG&E's cross-cutting programs are intended to support statewide policy objectives such as the doubling of energy efficiency by 2030 and efforts to work towards zero net energy (ZNE) buildings by supporting all sectors within PG&E's energy efficiency portfolio.

Finance supports the State's policy goals by working to:

- Increase the supply of and access to affordable capital for energy efficiency investments.
- Facilitate investment in more and deeper projects through strategies to overcome transaction barriers for customers and lenders.

To support state policy goals, the finance program is in the process of developing metrics and indicators that will be tracked by PG&E. Note that these are program-level metrics and indicators. As such, these will be developed as the program matures and budgets are allocated across the various strategies.

In the short-term, PG&E expects that all data will be collected as indicators (not metrics) to track progress. That is, no short-term targets will be set. The rationale for this is that finance is a program that is anticipated to support all five sectors, and as such, much of the data that we are proposing to collect in this area (e.g., energy savings, projects, operational efficiency) will be collected as part of the metrics and indicators identified in the five key market sectors.

In the mid-term, as finance programs become more established, PG&E will revisit all indicators to set clear targets where stand-alone metrics for finance make sense. The current indicators proposed for finance include:

### **1. Increase the supply of and access to affordable capital for energy efficiency investments:**

- Total amount of loans, and amount of incremental capital made available for energy efficiency (i.e., through a financing tool that would otherwise not be available to the customer).
  - These will be tracked by the five sectors: Residential (SF/MF), Commercial (S/M/L), Public, Agricultural, Industrial.
- As sub-programs continue to develop, additional indicators to measure this goal may include:

private capital committed to the programs, number of financial institutions participating in the programs, cost-effectiveness of the interventions, and the impact on loans terms and conditions.

### **2. Help customers complete more and deeper projects through strategies to overcome barriers to investment:**

- Number of participants and number of projects
  - Where programs target previously underserved market segments (e.g., multi-family, tenanted commercial, low income residential), customer participation and number of projects will be tracked by targeted group.
- Participation in EE programs in previously underserved sectors (e.g. multi-family, tenanted commercial, low income residential)
- Energy savings for finance in total [MWh, MW, Therms]
  - This will be tracked by the five sectors: Residential (SF/MF), Commercial (S/M/L), Public, Agricultural, Industrial.
- Energy savings for finance-only projects (no rebates) [MWh, MW, Therms]
  - This will be tracked by the five sectors: Residential (SF/MF), Commercial (S/M/L), Public, Agricultural, Industrial.
- Cost of delivering energy savings
- Depth of savings indicators
  - Initially, indicators such as average savings per project by sector, average cost of project per sector, and average number of measures per project by sector and project size will be tracked.
  - These could be compared to similar measurements in the residential and commercial sectors.
  - Over time, there may be the ability to adjust this to a better measure, such as the DORCE measure that the CPUC is currently exploring; however, the DORCE metric is still under development.
- Additional indicators to measure this goal among the targeted markets may include: financing awareness in the targeted market, customer participation in energy efficiency financing programs in the targeted market, contractor participation, or project size.

## K. EM&V Research Needs

In the future, PG&E will begin claiming energy savings from transaction services programs. Thus, in the near term, EM&V efforts for the financing sector will focus in large part on collecting data and developing methods to claim savings for these programs.

PG&E's financing programs are also expanding—both in terms of the number of customers they reach and the range of offerings available. As these programs evolve, EM&V needs will focus on assessing the market potential for new programs, conducting process evaluations of programs as they are launched, and understanding how financing can drive energy efficiency savings in conjunction with incentive programs.

Notably, one EM&V challenge is the need to work with FIs and servicing organizations, which maintain a high degree of information security, to obtain data about loans. This factor can be particularly challenging for market studies, as it is difficult to estimate the availability or baseline uptake of loans.

In the longer-term, EM&V is expected to measure market changes as a result of the finance program (and sub-programs). The CPUC recently completed a baseline study for finance within the residential sector, and they are currently working on a similar study to collect baseline metrics for small and medium businesses.<sup>77</sup> The potential for measuring change in baseline measures explored in these reports will be revisited after the relevant financing offerings have reached a steady state of implementation.

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<sup>77</sup> Opinion Dynamics, 2016, p. 38.

# Appendices

## Finance Appendices

### Appendix A: Compliance Checklist

	Cross Cutting Sector	
BP Page Number	Business Plan Guidance	PG&E Notes
	<b>A. Market Characterization</b>	
	a. Customer landscape (who they are, what are their needs)	Finance Sector Overview, p. 5
	b. Trends	Trends and Challenges, pp. 6
	c. Gaps/Barriers	Trends and Challenges, pp. 6
	<b>B. Value</b>	
	a. Discussion of roles for cross-cutting sector	PG&E's Finance Sector Vision, p. 1
	b. How does it support portfolio	Finance Sector Overview, p. 5
	c. How does it benefit customers	Finance Sector Overview, p. 5
	d. External impacts and benefits (community/economic benefits)	Finance Sector Overview, p. 5
	<b>C. Vision</b>	
	a. Discussion of opportunities	PG&E's Approach to Achieving Goals, pp. 7-13
	b. Whether items are near-, mid-, long-term strategic initiatives	PG&E's Approach to Achieving Goals, pp. 7-13
	<b>D. Metrics</b>	
	a. One metric or more as appropriate for each intervention strategy	Metrics and EM&V Considerations, pp. 15-16
	<b>E. Program/PA Coordination: Description of which and how strategies are coordinated regionally among PAs and/or other demand- side options.</b>	PG&E's Partners and Commitment to Coordination, pp. 13-14
	<b>F. EM&amp;V Considerations: Statement of evaluation needs "preparedness" (i.e., data collection strategies and internal performance analysis)</b>	Metrics and EM&V Considerations, pp. 15-16

## Appendix B: References

Advice Letter 3697-G /4812-E, 3697-G-A/4812-E-A , “PG&E’s On Bill Financing Alternative Pathway Program,” p. 2, <[http://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS\\_3697-G.pdf](http://www.pge.com/notes/rates/tariffs/tm2/pdf/GAS_3697-G.pdf)>. Accessed October 18, 2016.

Berkeley Law, Center for Law, Energy & the Environment and the Emmett Institute on Climate Change and the Environment, UCLA, “Powering the Savings: How California Can Tap the Energy Efficiency Potential in Existing Commercial Buildings,” 2016

California Energy Commission, “California Existing Buildings Energy Efficiency Action Plan,” 2015

California Energy Commission, “Existing Buildings Energy Efficiency Action Plan Draft 2016 Plan Update,” 2016

California Hub for Energy Efficiency Financing (CHEEF) Pilot Programs, <<http://www.treasurer.ca.gov/caeatfa/cheef/>>. Accessed October 13, 2016.

CPUC Decision D.09-09-047

Freehling, Joel and Brian Stickles, “Energy Efficiency Finance: A Market Reassessment,” ACEEE White Paper, February 2016 <<http://aceee.org/sites/default/files/market-reassessment-0216.pdf>> . Accessed October 18, 2016.

Harcourt, Brown & Carey, Inc., “Energy Efficiency Financing in California Needs and Gaps Preliminary Assessment and Recommendations,” Presented to The California Public Utilities Commission, Energy Division, July 8, 2011, <[http://www.harcourtbrown.com/wp-content/uploads/CPUC\\_FinancingReport\\_HBC\\_Jul8v2.pdf](http://www.harcourtbrown.com/wp-content/uploads/CPUC_FinancingReport_HBC_Jul8v2.pdf)> . Accessed October 18, 2016.

Horkitz, Karen, Pat McGuckin, Laura James, Christopher Frye, and Hugh Ratcliffe, “HERO Program Profile: Draft Final Report,” Boston, MA: The Cadmus Group, August 2016, <[http://www.energydataweb.com/cpucFiles/pdaDocs/1625/HERO%20Program%20Profile\\_DRAFT%20Final%20Report.pdf](http://www.energydataweb.com/cpucFiles/pdaDocs/1625/HERO%20Program%20Profile_DRAFT%20Final%20Report.pdf)>. Accessed October 18, 2016.

Hynek, Don et al., “Follow the Money: Overcoming the Split Incentive for Effective Energy Efficiency Program Design in Multi-family Buildings,” ACEEE Summer Study 2012, <<http://aceee.org/files/proceedings/2012/data/papers/0193-000192.pdf>>. Accessed October 18, 2016.

Investor Confidence Project, <<http://www.eepformance.org/>> (October 13, 2016).

James, Laura, Pat McGuckin, Althea Koburger, and Carol Mulholland, “California Joint Utilities Financing Research: Existing Programs Review,” Boston, MA: The Cadmus Group, April 2014,

Kan, Cynthia, Carol Mulholland, Linda Dethman, James “Pat” McGuckin, Ryan Fox, and Allie Marshall, “California 2010-2012 On-Bill Financing Process Evaluation and Market Assessment,” Portland, OR: The Cadmus Group, March 2012,

Kolstad, Leonard, "Energy Efficiency Finance For Commercial Buildings: Insights From Lenders," Institute for Market Transformation, March 2016, <<http://www.imt.org/resources/detail/energy-efficiency-finance-for-commercial-buildings-insights-from-lenders>>. Accessed October 18, 2016.

KPMG International, "Sustainable Insight: Gearing Up for Green Bonds," 2015,

Mulholland, Carol, Linda Dethman, Allie Marshall, and Cynthia Kan, "Energy-Efficiency Financing Customer Research Focus Group Findings," Boston, MA: The Cadmus Group, June 2013

Nadel, Steve et al., "On-Bill Financing for Energy Efficiency Improvements: A Review of Current Program Challenges, Opportunities and Best Practices," ACEEE Report Number E118, December 2011<[http://www.puc.state.pa.us/Electric/pdf/Act129/OBF-ACEEE\\_OBF\\_EE\\_Improvements.pdf](http://www.puc.state.pa.us/Electric/pdf/Act129/OBF-ACEEE_OBF_EE_Improvements.pdf)> (October 18, 2016).

Opinion Dynamics and Dunsky Energy Consulting, "PY 2014 Finance Residential Market Baseline Study Report," Oakland, CA, March 2016  
<<http://www.energydataweb.com/cpucFiles/pdaDocs/1499/PY2014%20Residential%20Finance%20Market%20Baseline%20Volume%201%20FINAL.pdf> > Accessed October 18, 2016

SEE Action Network Financing Solutions Working Group, "Energy Efficiency Financing Program Implementation Primer," January 2014  
<[https://www4.eere.energy.gov/seeaction/system/files/documents/financing\\_primer\\_0.pdf](https://www4.eere.energy.gov/seeaction/system/files/documents/financing_primer_0.pdf)>. Accessed October 18, 2016.

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# STATEWIDE ADMINISTRATION

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# **STATEWIDE ADMINISTRATION**

CHAPTER 11



## Statewide Programs

The rolling portfolio structure<sup>1</sup> requires all upstream, midstream, and market transformation programs be delivered “uniformly” throughout the four IOU territories, led by a single statewide administrator, and for the most part, a single statewide implementer.<sup>2</sup> Statewide efforts are required to comprise at least 25% of each IOU’s portfolio budget.<sup>3</sup>

In keeping with our plan to evolve our energy efficiency portfolio to meet or exceed energy savings<sup>4</sup> and cost-effectiveness targets by offering programs that drive value and innovation for our customers, PG&E will seek to transform markets via the new statewide model.

This new approach extends the reach and increases the buying power of California ratepayer investments beyond individual IOU-specific transactions. PG&E will encourage statewide program administrators to better leverage statewide (and/or regional) buying power and regional/national partnerships for energy efficiency equipment and technologies in a centralized, coordinated and strategic way.

## PG&E-Led Statewide Programs

In D.16-08-019, the Commission identified a list of programs to be administered statewide and requested that program administrators identify at least four downstream programs to pilot statewide.<sup>5</sup>

The new paradigm of statewide program administration<sup>6</sup> entrusts lead administrators with pursuing all cost-effective energy savings throughout the state, while maintaining the utmost in customer satisfaction, and regulatory compliance. Through the collaboration of IOUs and other program administrators at the California Energy Efficiency Coordinating Committee (CAEECC), PG&E has been chosen as the statewide administrator for six statewide subprograms (see **Table 11.1**). The list of statewide programs reflects the current program and portfolio construct of the eligible program administrators, and may be revisited and revised once Business Plans are approved and implemented.

In accordance with D.16-08-019,<sup>7</sup> PG&E presents a framework for each statewide program that we intend to administer. For descriptions of the other IOU statewide programs, and their respective solicitation strategies and transition timelines, please refer to each of the IOU Business Plans. Each statewide program description includes the following items:

- Program Overview
- Program Objectives
- Solicitation Strategy
- Transition Timeline
- Metrics

D.16-08-019 states, “the business plans should include specific metrics by which progress towards objectives may be assessed, and a schedule for reviewing results against performance indicators on a regular recurring basis, for statewide programs.”<sup>8</sup> All PG&E-led statewide programs put forth specific metrics, to be finalized after implementation plans

<sup>1</sup> D. 16-08-019.

<sup>2</sup> D.16-08-019, Ordering Paragraph 5, p. 110.

<sup>3</sup> D.16-08-019, Ordering Paragraph 6, p. 110.

<sup>4</sup> PG&E relies on the Commission’s Potential Goals Study (PGS) to identify the market potential achievable in its service territory. The Commission last adopted the PGS in D.15-10-028. PG&E anticipates the Commission adopting an updated PGS in 2017 to reflect new energy efficiency targets from SB 350.

<sup>5</sup> D.16-08-019, OP 8 and 9.

<sup>6</sup> The rolling portfolio transforms statewide programs. All upstream and midstream programs, market transformation programs, and select downstream programs move to a model wherein lead program implementer(s) are under contract to a single lead program administrator. D.16-08-019, p.51.

<sup>7</sup> D.16-08-019 COL 41 and 55, OP 12-14.

<sup>8</sup> D.16-08-019, COL 55.

**Table 11.1**  
Statewide Program IOU Assignments

The four IOUs and other program administrators, with significant input from stakeholder via CAEECC, have agreed to the following lead assignments for the programs identified as statewide in the Decision<sup>a</sup>

Lead IOU	Statewide Program Assignments
<b>Pacific Gas and Electric Company</b>	<i>Public:</i> Institutional Government Partnerships — State of California and Department of Corrections
	<i>Financing:</i> New Financing Offerings
	<i>Codes and Standards:</i> Building Codes Advocacy and Appliance Standards Advocacy Program
	<i>Workforce Education and Training:</i> K-12 Connections Program
	<i>Workforce Education and Training:</i> Career & Workforce Readiness (downstream pilot)
	<i>Agricultural:</i> Indoor Agricultural Program (downstream pilot)
<b>Southern California Edison Company</b>	<i>Emerging Technologies:</i> Electric Emerging Technologies Program
	<i>Lighting:</i> Primary Lighting, Lighting Innovation and Lighting Market Transformation
	<i>Commercial:</i> Savings by Design
	<i>Public:</i> Institutional Government Partnerships — University of California and California State University
	<i>Public:</i> Water/Wastewater Pumping Program (downstream pilot)
<b>Southern California Gas Company</b>	<i>Residential:</i> New Construction
	<i>Emerging Technologies:</i> Gas Emerging Technologies Program
<b>San Diego Gas and Electric Company</b>	<i>Residential and Commercial:</i> Upstream Heating, Ventilation, and Air Conditioning (HVAC)
	<i>Residential:</i> Midstream Plug Load Appliance (PLA)
	<i>Residential:</i> HVAC Quality Installation/Quality Maintenance (QI/QM) (downstream pilot)

<sup>a</sup> D.16-08-019, COL 52, OP 8-9, OP 12-14.

have been vetted with CAEECC. PG&E will develop a schedule for reviewing metrics and performance indicators at that time, as these may vary by program.

## Proposed Statewide Program Descriptions

### Statewide Codes and Standards (C&S)

#### Program Overview

The scope of the statewide Codes and Standards (C&S) program covered under the single program administrator governance structure focuses on the state building codes advocacy and appliance standards advocacy subprograms, per D.16-08-019.<sup>9</sup>

#### Program Objectives

C&S Advocacy (C&S) has two specific objectives:

- Maximize customer energy savings through new or amended building codes and appliance standards.
- Support California's role as a leader on energy efficiency, clean energy policy and climate change issues.

#### Solicitation Strategy

As statewide administrator, PG&E will conduct a statewide solicitation for the appropriate number of implementers<sup>10</sup> to support the further development of California's Building Energy Efficiency Standards (Title 24, Part 6 and Part 11) and Appliance Standards (Title 20). PG&E anticipates that multiple implementers will be needed to support building codes and appliance standards rulemakings. The scope of work will be determined in collaboration with the California Energy Commission (Energy Commission), informed by historical knowledge of what is required to complete these analyses, and developed with input from statewide IOU peers. PG&E may recommend that implementers subcontract certain areas of work, if the lead implementers need support beyond their expertise to produce robust, high-quality deliverables. PG&E may contract directly

with experts to provide additional technical oversight. Statewide implementers will be recruited through established procurement processes (i.e., competitive bid, existing master service agreements (MSAs), etc.). This may require various contracting options. The statewide C&S program also intends to use in-house technical support staff and test labs. Please see PG&E's Portfolio Overview chapter, Section I "Solicitation Strategies and Transition Timeline" for more information on PG&E's plan for utility staff supporting C&S.

#### Transition Timeline

**Building Codes (Title 24, Part 6 and Part 11)** — PG&E expects to commence statewide implementation for the first available code cycle, which takes effect on January 1, 2022.<sup>11</sup> Research for 2022 will begin in early 2018. The determination of scope and contracting is expected to occur during the second half of 2017.

**Appliance Standards (Title 20)** — PG&E expects to commence statewide implementation in 2018 for new areas of work identified by the Energy Commission.<sup>12</sup> The determination of scope and contracting must occur during the last half of 2017. PG&E anticipates budget discussions between the IOUs to understand the size of the contracting budgets for these two subprograms. In addition, the statewide administrator will provide an overview of the solicitation, including draft scopes of work and solicitations, to the other IOUs for review and discussion.

<sup>9</sup> Compliance Improvement, Reach Codes and Planning and Coordination are C&S subprograms that are administered individually by each IOU, but are closely coordinated amongst all IOUs.

<sup>10</sup> D.16-08-019, COL 39, allows for flexibility in the number of statewide implementers selected for statewide programs.

<sup>11</sup> Work to support the 2019 code cycle commenced in early 2015, including research followed by stakeholder meetings. Maintaining existing contractual relationships will ensure continuous support to the Energy Commission and avoid costs associated with restarting projects.

<sup>12</sup> Similar to building codes, maintaining continuity on existing projects is important. Multiple IOUs are leading existing work.

## Metrics

PG&E is considering the following metrics to support the subprograms' objectives. Metrics will be chosen that inform the sector level metrics as well as program metrics. This list is intended to be illustrative and will be finalized with the selected implementer(s).

- Annual greenhouse gas emission reductions.
- Number of analyses (e.g., Codes and Standards Enhancement (CASE) reports and appliance standards studies).
- Number of cost effective measures adopted into building codes or appliance standards by state agencies.

Once metrics are finalized, PG&E will develop a schedule for reviewing metrics and performance indicators, based on feedback from CAEECC.

## State of California Partnerships Program

### Program Overview

D.16-08-019 names the State of California and the Department of Corrections and Rehabilitation (CDCR) as two separate subprograms, in keeping with the past portfolio construct. Moving into the new statewide framework, PG&E merged the two subprograms into a single subprogram called the State of California Partnerships Program that serves all state agencies. This aligns with PG&E's vision of a streamlined portfolio, making participation easier for customers and market actors.

PG&E's long-term vision for the state government segment is to provide the State of California with the expertise and tools needed to efficiently manage its energy use, with a focus on aging and below-code facilities as well as new facilities. PG&E will encourage strategies that promote investment in energy efficiency through comprehensive resource support and internal capacity-building while encouraging the development of ideal conditions that help energy efficiency thrive in state government facilities. Although the IOUs' existing partnerships with the State of California have made progress over the years, significant energy savings opportunities remain within State facilities.

Close interaction with the State of California's diverse branches of government will be crucial to meeting California's ambitious energy goals. With Governor Brown's Executive Order B-18-12 requiring state agencies to reduce grid-based electricity purchases

by at least 20% by 2018 compared to a 2010 baseline, and aggressive ZNE goals consisting of 50% of all new facilities beginning design after 2020 and 50% of existing facilities by 2025, the State is well positioned to make significant progress towards reducing energy usage and the overall carbon footprint of its facilities and infrastructure.<sup>13</sup> As a national leader in energy policy and climate change mitigation, the State can help drive increased energy efficiency adoption within California communities and beyond.

### Program Objectives

Primary objectives of the State of California Partnerships Program are to:

- Assist the State of California with meeting the Governor's Executive Order B-18-12 and other energy efficiency regulatory and legislative mandates.
- Deliver immediate and long-term, persistent, energy savings and demand reduction results cost-effectively through integrated partnership activities.
- Overcome barriers to energy efficiency project execution by targeting high-opportunity facilities and addressing the lengthy public procurement process.
- Build upon, and strengthen, IOUs' existing relationships with State of California agencies, departments and commissions, such as CDCR, Department of General Services (DGS), and Judicial Council of California.
- Support the State of California in its role as a national leader on climate change mitigation and leading by example through reducing the energy-related carbon footprint of state facilities.

Secondary objectives are to:

- Provide a platform to test emerging demand side management (DSM) technology to determine the success or failure of novel concepts.
- Facilitate energy efficiency best practice sharing, through documentation and other educational and workshop opportunities to encourage broad energy efficiency adoption.

<sup>13</sup> Executive Order B-18-12 is available at <https://www.gov.ca.gov/news.php?id=17508>



## Solicitation Strategy

PG&E will conduct the statewide solicitation for the State of California Partnerships Program. This effort will require participation by all four IOUs, and will call upon insights from relevant stakeholders, specifically State of California partners, participating in the Request for Proposal (RFP) solicitation process. The RFP will seek proposals to address the key objectives outlined above. Through the solicitation process, the IOUs intend to select one or more implementers to design and develop a single program that meets the diverse needs of the State of California's agencies, departments and commissions. The IOUs will encourage collaboration between the implementers to deliver a more comprehensive and integrated suite of solutions to support new and innovative design, development, implementation and execution of DSM programs. Please refer to PG&E's Portfolio Overview chapter, Section I "Solicitation Strategies and Transition Timeline," for more information.

## Transition Timeline

The RFP process will begin once PG&E's Business Plans are approved by the Commission. PG&E anticipates issuing the RFP in Q3 2018. Upon selection of the winning implementer, the draft implementation plan will be presented at CAEECC to gather stakeholder feedback. PG&E anticipates implementation plan and program implementation to commence within one year of RFP issuance.

The transition of program oversight from Southern California Edison (SCE) to PG&E will begin after the Commission approves the Business Plan.

## Metrics

Metrics will be chosen that inform the sector level metrics as well as program metrics. The following metrics are illustrative and will be finalized with the selected implementer(s).

- Achievement of annual and multi-year kW, kWh and Therm goals.
- Percentage increase in annual energy savings achieved.
- Percentage reduction in average energy use intensity (kWh/sq ft) for State facilities and infrastructure.
- Percentage of State facilities that have completed an energy efficiency retrofit.
- Percentage of agencies that have made measurable progress toward meeting Governor's Executive Order B-18-12.
- Comprehensiveness of energy savings measures installed (e.g., diversity in measure mix).

Once metrics are finalized, PG&E will develop a schedule for reviewing metrics and performance indicators, based on feedback from CAEECC.

## Financing Programs

### Program Overview

D.13-09-044, approved by the CPUC in 2013, implemented statewide finance pilot programs that address the need for financing to overcome first cost barriers to new energy efficiency projects. The pilots are administered by the California Hub for Energy Efficiency Financing (CHEEF), which coordinates the various participants and manages funds and data, and which in turn is administered by the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA).

### Program Objectives

Pilots are anticipated to run for two years from the time the first loan is enrolled in the program. Pilot objectives are to:

- Develop scalable, leveraged, financing products that can be used to obtain cost effective energy savings.
- Expand access to financing instruments, particularly segments of energy users underserved by current energy efficiency financing.
- Engage customers in deeper, more comprehensive energy efficiency projects than available through energy efficiency programs.

### Solicitation Strategy

CAEATFA was assigned responsibility to implement the energy efficiency financing pilots in D.13-09-044, following a public process. PG&E does not intend to seek a new implementer.

### Transition Timeline

As agreed to by the other IOUs and program administrators, PG&E will be the statewide program administrator for the New Financing Offerings following the approval of this Business Plan. PG&E will work with Southern California Gas Company (SCG) to transition the role of the statewide program administrator to PG&E in a way that creates the least disruption to the energy financing pilots.

### Metrics

Metrics will be chosen that inform the sector level metrics as well as program metrics. The following metrics are illustrative and will be finalized based on the Commission's determinations in Phase 3 of the Energy Efficiency Rulemaking, R.13-11-005.<sup>14</sup>

- Develop scalable, leveraged financing products.
  - Capital committed to the program from private lenders
  - The ratio of private capital committed relative to ratepayer funds for loans
  - Number of participating customers in the programs
- Implement deeper, more comprehensive retrofits.
  - Average cost of project
  - Number of measures installed per project
  - Energy savings achieved per project (through ex-post evaluation)
- Achieve cost-effective energy savings.
  - Energy savings achieved (through ex-post evaluation)
  - Cost of incentivizing the energy savings (financial incentive cost + administration cost)
- Expand access to financing instruments, particularly segments of energy users underserved by current EE financing.
  - Incremental capital made available for energy efficiency financing (i.e., to customers who currently cannot use an equivalent financing tool)

Once metrics are finalized, PG&E will develop a schedule for reviewing metrics and performance indicators, based on feedback from CAEECC.

<sup>14</sup> The Joint Ruling of the Assigned Commissioner and Administrative Law Judge on Financing Pilots and Associated Marketing, Education, and Outreach Activities, dated November 22, 2016, indicated that the goals and metrics for the Financing Pilots might be revised following the receipt of public comments at the "mid-point review" of the Financing Pilot program.

## WE&T Career Connections

### Program Overview

Part of the energy efficiency workforce that will contribute to meeting California's long-term energy efficiency goals is currently in Kindergarten through grade 12 (K-12). Educating these students on energy and sustainability fundamentals — making them aware of and helping them explore energy education and career paths — is an important part of “priming the pump” for our future energy workforce. The California Long-term Energy Efficiency Strategic Plan (CEESP) calls for WE&T to support all levels of education.<sup>15</sup>

Career Connections is a statewide program administered by PG&E in collaboration with the other IOUs, under one or more implementers. Career Connections focuses on two key audiences—K-12 students and teachers, and career-seeking adults. As noted in a 2010–2012 evaluation, “the WE&T Connections program contributes to the Strategic Plan’s WE&T goal of establishing energy efficiency education and training at all levels of California’s educational systems.”<sup>16</sup> Career Connections provides two key elements to participants:

1. Energy and sustainability fundamentals teaching materials and resources, and
2. Green career awareness and exploration.

Past studies have highlighted the value and importance of subjects such as K-12 Science, Technology, Engineering, and Mathematics (STEM) education and career readiness: “... too few of our high school graduates are ready for college coursework or careers in STEM....the reasons are many, including: lack of authentic learning activities in STEM subjects, little time for science in elementary school, inadequate K-12 teacher preparation in math and science content, poor alignment of K-12 and college curricula, and insufficient collaboration between K-12 and higher education institutions to smooth student transitions from high school to college.”<sup>17</sup>

<sup>15</sup> CPUC California Energy Efficiency Strategic Plan (January 2011 Update), Section 9, p. 70, [www.energy.ca.gov/ab758/documents/CAEnergyEfficiencyStrategicPlan\\_Jan2011.pdf](http://www.energy.ca.gov/ab758/documents/CAEnergyEfficiencyStrategicPlan_Jan2011.pdf).

<sup>16</sup> Ibid.

<sup>17</sup> STEM Smart Brief; STEM Smart: Lessons Learned from Successful Schools- “Preparing Students for College and Careers in STEM.”

The Career Connections program intends to minimize gaps and misalignments between general education and the understanding needed to provide energy efficiency, and energy and resource conservation. The Program will provide support and resources to Title 1<sup>18</sup> K-12 schools as a way of supporting disadvantaged communities. Consistent with the 2011 California WE&T Needs Assessment, “the purpose of K-12 career development programs is to inform students about the careers available to them and provide them with the necessary occupational skills and/or knowledge for entering into these careers, and/or moving into a post-secondary education on a selected career track.”<sup>19</sup>

### Program Objectives

Career Connections’ primary objectives are to:

- Educate K-12 students on energy and sustainability fundamentals.
- Increase awareness of energy and sustainability career pathways for high school students and career-seeking adults.
- Support Title 1<sup>20</sup> K-12 schools as a way of supporting disadvantaged communities.

### Solicitation Strategy

PG&E will lead the statewide RFP effort for Career Connections. This effort will require participation by all participating IOUs, and will call upon relevant stakeholders to contribute their insight. The RFP will call for proposals to address the primary objectives outlined above and other factors including the program becoming self-sustaining over a specified number of years. The IOUs will consider implementation options, including a scenario where one or more implementers work statewide, or one in which multiple implementers operate regionally and collaborate with one another. Please refer to PG&E’s Portfolio Overview chapter, Section I “Solicitation Strategies and Transition Timeline” for more information.

<sup>18</sup> <http://www2.ed.gov/programs/titleiparta/index.html>.

<sup>19</sup> 2011 California WE&T Needs Assessment, p. 229, [http://laborcenter.berkeley.edu/pdf/2011/WET\\_Part2.pdf](http://laborcenter.berkeley.edu/pdf/2011/WET_Part2.pdf).

<sup>20</sup> Title 1 schools are defined as schools in which children from low-income families make up at least 40 percent of enrollment. U.S. Department of Education, <http://www2.ed.gov/programs/titleiparta/index.html>.

### Transition Timeline

The RFP process will begin once PG&E's Business Plans are approved by the Commission. PG&E anticipates releasing an RFP in Q3 2017. Upon selection of the winning implementer(s), the draft implementation plan will be presented at CAEECC to gather stakeholder feedback. PG&E anticipates program implementation commencing within one year of issuance of the RFP.

### Metrics

Metrics will be chosen that inform the sector level metrics as well as program metrics. Possible metrics and outcomes will depend on level of resources required to assess the metric, and may include, but may not be limited to:

- Market penetration based on a to-be-determined baseline.
- IOU-initiated program(s) becomes self-sustaining over a period of approximately 3 years.
- Energy efficient student behavior at school or at home.
- Ongoing (as opposed to one-year) of use of education materials provided to teachers.
- Student awareness and exploration of green education and career pathways where information can be collected.
- Percent of Title 1 schools served vs. total Title 1 schools.

Once metrics are finalized, PG&E will develop a schedule for reviewing metrics and performance indicators, based on feedback from CAEECC.

## Statewide Downstream Pilot Programs

### WE&T Career and Workforce Readiness

#### Program Overview

The Career and Workforce Readiness (CWR) program serves the overall goal of developing a workforce capable of meeting State energy goals. CWR helps to prepare disadvantaged workers<sup>21</sup> to enter the energy workforce by leveraging career support services provided by workforce development organizations, training trainers of career training organizations, developing curriculum and providing tools and resources to career training organizations. CWR will provide its primary target audience with energy education and workforce development resources through collaborations with organizations whose missions support disadvantaged workers and communities. Such organizations include workforce investment boards, community-based organizations, building-related job training programs, and workforce development agencies.

CWR's secondary target audience is the current energy workforce and those seeking to change careers. For the underemployed and/or seeking to move into the energy sector, CWR will integrate existing workforce development organizations' services and resources (case management, soft skills training, job placement, etc.) with technical energy education and training resources.

Ultimately, the goal of CWR is to facilitate entry of people from disadvantaged communities to the energy education pathways in California, and provide them with relevant energy training through existing agencies and organizations that already serve disadvantaged workers. Specifically, CWR will:

- Support the integration of energy efficiency content into existing workforce development training programs whose primary audience is disadvantaged communities and workers.

<sup>21</sup> In late 2015, with input from stakeholders, the IOUs arrived at a definition of a disadvantaged worker as an individual who meets at least one of the following three criteria: 1) lives in a high unemployment zip code where unemployment rate is at least 150% of the median unemployment rate for the county or for the state; or 2) lives in a low-income zip code where the average household income is 50% below Area Median Income (AMI); or 3) has a referral from a collaborating community-based organization (CBO), state agency, or workforce investment board.

- Support trainers of programs supporting disadvantaged workers and communities in support of overarching energy efficiency portfolio objectives.
- Provide energy and green career awareness resources to workforce development organizations serving disadvantaged workers and communities.
- Provide energy and resource conservation education materials and resources to organizations who train disadvantaged workers.

CWR funds will be used for energy and resource efficiency education and training, and will not be used to fund energy efficiency education and training activities that are already occurring. Also, CWR funds shall not be used to fund activities that workforce development agencies and organizations currently are funded to do (i.e., case management, job placement, etc).

### Program Objectives

CWR's overarching objectives are as follows:

- Build upon existing efforts of community-based organizations, workforce development organizations, and workforce investment boards with a focus on energy and resource efficiency, to help disadvantaged workers enter core education or job/career pathways.
- Increase awareness among disadvantaged workers about green career pathways.
- Increase disadvantaged worker's knowledge of energy and resource efficiency concepts, technologies, and systems.

### Solicitation Strategy

PG&E will lead the statewide RFP effort for Career and Workforce Readiness. The IOUs will seek proposals to meet the objectives outlined above. Given the diversity of workforce development organizations and agencies, the IOUs will consider several implementation options during the solicitation process, including:

- One implementer that can work statewide across several workforce development organizations,
- One implementer that can work statewide across several community based workforce development organizations
- Multiple implementers that can work regionally to collaborate across several community based workforce development organizations
- Matching funds from other non-IOU organizations
- IOU-initiated program(s) become(s) self-sustaining

Funded organizations should provide soft skills, job development, workforce training and potentially job placement offerings, which currently fall outside the scope of IOU and/or other program administrator energy efficiency funding and training. Collaborating organizations should identify in their bid what energy efficiency educational/skills gap their program is intending to fill. It is expected that successful bidders will have existing programs and a mission to support disadvantaged communities and workforce development. Please refer to PG&E's Portfolio Overview chapter, Section I "Solicitation Strategies and Transition Timeline" for more information.

### Transition Timeline

The RFP process will begin once PG&E's Business Plans are approved by the Commission. PG&E anticipates issuing the RFP in Q1 2018. Upon selection of the winning implementer(s), the draft implementation plan will be presented at CAEECC to gather stakeholder feedback. PG&E anticipates program implementation commencing within one year of issuance of the RFP.

## Metrics

The following metrics are illustrative and will be finalized with the selected implementer(s). Metrics will be chosen that inform the sector level metrics as well as program metrics. They may include, but will not be limited to:

- Curriculum enhanced or expanded with energy efficiency for organizations that serve disadvantaged workers and that have training programs in high impact energy efficiency careers or jobs.
- Achievement of workforce development organization's funded goals around job placement.
- Achievement of workforce development organization's goals related to disadvantaged communities.
- Student participation in program.

All WE&T programs, including CWR will be subject to the global WE&T metric of focusing on high potential market actors and high energy efficiency potential sectors and topics.

Once metrics are finalized, PG&E will develop a schedule for reviewing metrics and performance indicators, based on feedback from CAEECC.

## Indoor Agriculture Program

### Program Overview

The Indoor Agriculture (IA) Program is a new downstream pilot that will target commercial indoor growing facilities with primarily lighting and heating, ventilation and air conditioning (HVAC) solutions to reduce energy usage.

As technologies mature for indoor growing, more and more producers are realizing the benefits of closely-controlled soil, air and light conditions.<sup>22</sup> Farms "that grow other high-value but thirsty crops like pistachios, walnuts and grapes, are at the leading edge of this type of precision agriculture, known as 'smart farming'."<sup>23</sup> A farmer that can successfully manage variables such as pest-control, nutrient content and competition to crops from weeds can produce high-yield, maximize profit and efficiently manage resources such as water and energy. To attempt to understand the potential energy use from the largest end-use in indoor agriculture, lighting, it is useful to narrow the view to one crop.

In November 2016, California passed Proposition 64, legalizing the growth of cannabis for personal use and the commercial production of cannabis, gearing up for the retail market in the coming years.<sup>24</sup> When Washington State legalized marijuana in 2013, the State commissioned a report to produce a long-term load forecast to take into account emerging market drivers, including indoor agriculture production.<sup>25</sup> At the time, approximately 90% of cannabis production in California was indoors. The study showed that cannabis production in the State of Washington could grow electricity demand between 60 MW to 160 MW over the next 20 years.

A number of benefits exist to the utility to engage with these customers and enroll them in energy efficiency programs, beyond the potential to reduce electricity demand onsite. Proposition 64 presents an opportunity for customers to legally connect to

<sup>22</sup> "14 High Tech Farms Where Veggies Grow Indoors", June 17, 2013, <http://gizmodo.com/this-is-the-future-14-high-tech-farms-where-veggies-gr-513129450>.

<sup>23</sup> "The Future of Agriculture: Factory Fresh", June 9, 2016, <http://www.economist.com/technology-quarterly/2016-06-09/factory-fresh>.

<sup>24</sup> "Legalization Ballot Initiatives", <http://norml.org/election-2016>.

<sup>25</sup> "Electrical load impacts of indoor commercial cannabis production", Northwest Power and Conservation Council, September 3, 2014, <http://www.nwccouncil.org/media/7130334/p7.pdf>.

the grid. PG&E can support these customers by matching them with the right rate per their usage profile. By becoming legal operations, PG&E can also support their facilities in ensuring the safe operation of high-volume lighting and HVAC.

The IA Program will target all commercial production facilities (e.g., warehouses, greenhouses) of indoor crops (e.g., vegetables, flowers, and cannabis). The IA Program will achieve GWh, MW and MM Therm savings in lighting and HVAC end uses.

### Program Objectives

The IA program's overarching objectives are to:

- Support growers in managing resources wisely (e.g., energy).
- Reduce electricity costs for agriculture customers.
- Increase awareness among agriculture customer about behavioral opportunities to reduce energy use.

### Solicitation Strategy

PG&E will lead the statewide RFP effort for the IA program. The IOUs will seek proposals to meet the objectives outlined above. PG&E will determine whether or not one implementer can meet the stated objectives or whether multiple implementers working regionally will be the preferred path during the solicitation process. Please refer to PG&E's Portfolio Overview chapter, Section I "Solicitation Strategies and Transition Timeline" for more information.

### Transition Timeline

The RFP process will begin once PG&E's Business Plans are approved by the Commission. PG&E anticipates issuing the RFP in Q3 2017. Upon selection of the winning implementer(s), the draft implementation plan will be presented at CAEECC to gather stakeholder feedback. PG&E anticipates program implementation commencing within one year of issuance of the RFP.

### Metrics

The following metrics are illustrative and will be finalized with the selected implementer(s). Metrics will be chosen that inform the sector level metrics as well as program metrics. They may include, but will not be limited to:

- Savings by segment (warehouses, greenhouses), crop type, end use (lighting, HVAC), and geographical location (Bay Area, Coastal, Central Valley, Mountain, Other).
- Levelized cost of savings (Net values, PAC basis).
- Number of customers participating in program (by fuel type).
- Number of customers using any state-supported tools to understand energy within their organization.

Once metrics are finalized, PG&E will develop a schedule for reviewing metrics and performance indicators, based on feedback from CAEECC.



## Rationale for PG&E's Statewide Lead Program Administrator Assignments

The Commission left it to the program administrators to propose the lead program administrator for each statewide program from among themselves, only specifying that a program administrator's capacity to manage a program be considered. During the course of Business Plan development, the IOUs considered what a lead program administrator must do to achieve the efficiencies of a statewide program while making sure that programs are relevant to local communities. The IOUs agreed that the lead program administrator must coordinate closely with each program administrator to maximize energy saving opportunities. The IOUs evaluated potential lead program administrators using six program administration criteria: 1) natural program bundling (e.g., Residential and Commercial HVAC); 2) cost-effectiveness; 3) capacity; 4) expertise; 5) relationships; and 6) stakeholder feedback. PG&E explains why it has been selected as the statewide lead for certain programs in the following section. More details on the IOUs' approach to proposing lead program administrators is provided in Appendix A.

### State Government Partnerships (State of California and Dept. of Corrections)

Following the principle of natural bundling, the IOUs believe that combining the two State partnerships under one lead would result in economies of scale and increased efficiencies. PG&E is presently the statewide lead for these partnerships. PG&E believes that engaging public customers through strategic partnerships enables customers to take action while demonstrating leadership that inspires their constituents to pursue their own energy efficiency projects. As such, PG&E will continue to rely on ready access to state agency leadership due to geographic proximity to help facilitate effective management of these partnerships. As PG&E's Public Business Plan chapter explains, PG&E sees a great opportunity to engage more state agencies, including the Judicial Council, through expanded and new partnerships to share technical expertise and to achieve greater participation in energy efficiency programs and drive deeper savings achievement.

### Financing (New Finance Offerings)

PG&E believes that investments in finance programs will allow program administrators to more cost-effectively achieve energy efficiency savings, which aligns with the state's vision for energy efficiency financing. PG&E's finance team has professional financing expertise and experience in implementing energy efficiency financing programs both in and outside of California. PG&E has demonstrated statewide leadership in the realm of finance programs for the last four years, particularly in the development of the statewide on bill repayment (OBR) pilots. Not only has PG&E collaborated well with its IOU partners, it has built strong working relationships with the Commission and the California Alternative Energy and Advanced Transportation Financing Authority (CAETFA) to help shape the future of energy efficiency financing in California.

As the lead administrator, PG&E will continue to work closely with CAETFA to build the finance pilots that work best for California. Further, PG&E has dedicated itself to continuous improvement of the on-bill financing (OBF) program by integrating it into our programs and focusing on making the program easy for contractor participation. PG&E has seen a steady growth in its financing loan pool since 2012 and is on track to continue that growth through 2019. PG&E now has the largest loan pool among the IOUs, and has thus far only experienced minimal defaults. PG&E has demonstrated its leadership by implementing a non-rebate OBF pathway for customers – the OBF Alternative Pathway. PG&E believes that its new process for OBF has potential to increase participation in energy efficiency from customers who have previously chosen not to participate in IOU programs. This Alternative Pathway should become a statewide model for energy efficiency financing investments and will create a model for other financing programs beyond OBF.

In PG&E's Finance Business Plan chapter, PG&E has shown a commitment to continuing to innovate and test new financing structures that can have an incremental impact on our customer's ability to fund their energy efficiency investment. PG&E understands what drives customers to undertake energy efficiency investments, which has led to exploring financing structures that will overcome specific barriers customers face to investing in



energy efficiency. PG&E has shown a commitment to financing as a strategy for residential energy efficiency adoption through its on-bill loan repayment program for this sector. As detailed in the Finance chapter of this Business Plan, the goals for statewide financing include overcoming customer transaction barriers to investment and increasing the supply and access to affordable capital.

### **Codes and Standards (Building Codes Advocacy and Appliance Standards Advocacy)**

Codes and Standards (C&S) represent an extremely cost-effective way to help meet the State's ambitious goal to double energy efficiency by 2030 and reduce greenhouse gas emissions. PG&E has demonstrated leadership in C&S for over 10 years at both the state and federal level. PG&E has the engineering expertise and strategic resources available to successfully lead the statewide C&S advocacy subprograms to meet the California Energy Commission (CEC) and CPUC's goals for the C&S program.

PG&E has developed strong relationships with the statewide program administrators, CEC, Department of Energy, efficiency advocates, industry stakeholders, and CPUC staff. These relationships allow PG&E to navigate upcoming Title 24 and Title 20 rulemakings successfully. These relationships have allowed PG&E to work on agreements with industry to gain their support for the CEC's proposals and achieve additional energy savings.

PG&E has managed codes and standards enhancement (CASE) studies through careful planning and execution while maintaining quality. The resulting CASE studies have provided the basis for considerable cost-effective energy savings for California. A strong CASE study increases the likelihood and the speed that the CEC will begin a rulemaking since it provides a solid foundation for their work. PG&E has experience directing primary data collection to support CASE topics so that supporting data is timely, statistically relevant and comprehensive. As statewide lead, PG&E will continue to partner with the IOUs, CEC, and CPUC, and shape the next generation of codes and standards 2.0.

### **Workforce Education and Training (K-12 Connections)**

As the current statewide lead for K-12 Connections, PG&E brings the expertise required to effectively engage the broader educational communities (e.g., schools, colleges, professional organizations) for a successful K-12 Workforce, Education and Training (WE&T) initiative. PG&E's WE&T team includes trained, professional educators who bring the right expertise to lead evaluation efforts on program design proposals. PG&E's experience in working directly with disadvantaged communities and organizations that serve disadvantaged workers sets PG&E up for success as the IOUs respond to SB 350 and look for ways to broaden outreach and engagement of these communities in energy efficiency programs.

For over 25 years, PG&E has supported the kindergarten through sixth-grade (K-6) group within the education sector with a cost-effective education program which serves elementary school students at an average cost of \$3.30 per student. Furthermore, PG&E's existing online career awareness portal for high school students can serve a broader audience than residents within the PG&E service territory. PG&E has conducted a variety of education programs that have served K-12 schools. For example, Energenius incorporates the latest curriculum standards and has reached about half of all K-8 schools across PG&E's diverse service territory while receiving above 90% satisfaction ratings. PG&E has leveraged programs and experts across organizations to offer comprehensive K-12 resources to serve its service territory (e.g., working with the low income programs CARE and Energy Savings Assistance (ESA) to incorporate energy, conservation and environmental education in the Out of School program delivered to low income students and their families).

As statewide lead, PG&E plans to leverage internal and external partnerships to cost-effectively deliver resources to the K-12 marketplace, such as the IOUs' Local Government Partnerships and Energy Savings Assistance program implementers, the California Student Aid Commission, the California Apprenticeship Coordinators Association, and several UC/CSU campuses. PG&E has also used marketing efforts of organizations such as the California Department Education and the California Teachers Association. As the Business Plan explains, PG&E

envisions a workforce capable of meeting California's energy savings goals and implementing its utility programs. This includes the current workforce and the next generation of the workforce. PG&E believes firmly that its role as statewide lead for K-12 Connections and Career Workforce Readiness will help meet this vision.

### **WE&T Career Workforce Readiness (CWR) Program**

As statewide lead administrator for the CWR program, PG&E brings the expertise required to effectively engage the broad array of workforce and community partners, stakeholders and other interested parties for a successful career and workforce readiness initiative. PG&E has experience working with disadvantaged workers and with organizations that serve disadvantaged workers and disadvantaged communities. Our experience in working with disadvantaged communities sets us up for success as the IOUs respond to SB 350, exploring ways to broaden outreach and engagement of these communities in our energy efficiency programs.

As our Business Plan explains, PG&E envisions a workforce capable of meeting California's energy savings goals and implementing its utility demand-side management programs. We believe firmly that our role as statewide administrator for CWR will help us meet this vision.

### **Indoor Agriculture (IA) Program**

PG&E will dedicate its decades of experience serving California's agricultural community to being the statewide lead administrator for the IA program, PG&E has provided agricultural customers a variety of energy efficiency solutions from technical assistance to rebates and low/no interest loans. PG&E understands that energy is a key resource for farmers, and that smart energy management can be a powerful tool in addressing rising energy costs, regulatory standards, and safety issues. Leveraging our years of knowledge of agricultural customers, and what motivates them to make energy efficiency investments positions PG&E well as statewide administrator for this new downstream program.

# Appendices

# **Appendix A**

## **Statewide Administration Approach**

**January 17, 2017**

**By**

**Pacific Gas and Electric Company**

**Southern California Edison Company**

**Southern California Gas Company**

**San Diego Gas and Electric Company**

# STATEWIDE ADMINISTRATION APPROACH

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## **I. INTRODUCTION**

Decision (D.) 16-08-019 modifies the energy efficiency program administrative structure by requiring that all upstream and midstream programs, market transformation efforts, and at least four pilot downstream programs be delivered uniformly throughout the four large Investor-Owned Utility (IOU) service territories, and overseen by a single lead Program Administrator (PA). In requiring these programs to be administered on a statewide basis, the California Public Utilities Commission (CPUC or Commission) wants to prioritize ease of program access to customers, and in part, lower transaction costs for PAs and implementers.<sup>1</sup>

This document presents the IOUs assignments for Lead Administration of statewide programs, along with the rationale for said assignments. Ultimately, a PA is responsible for managing their program portfolio, and is accountable for achieving savings goals in their territory.<sup>2</sup> Statewide programs contribute to the PA’s goal achievement; effective administration and implementation of these programs is paramount to achieving these goals. In this document,

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<sup>1</sup> D.16-08-019, pg. 51.

<sup>2</sup> D.16-08-019 p. 71, “We wish to continue to push the utilities to focus more on their role as determiners of “need” and portfolio design.”

the IOUs also describe a governance process that represents a joint collaborative commitment to the success of the statewide model.

## **II. DIRECTION**

D.16-08-019 directs statewide programs to be administered by one Lead PA, with the capacity to handle statewide programs. The Commission left the Lead PA assignments for each statewide program to be determined by current program administrators and put forth the designations in the business plans to be filed on January 17, 2017.<sup>3</sup> With the exception of capacity, the Commission did not prescribe qualifications for Lead PAs. The Decision expected that “natural leads with the capacity to handle the statewide programs will either volunteer or be nominated by their peers, with a consensus approach brought forward to the Commission for [their] consideration.”<sup>4</sup> At this point, the four IOUs have taken lead roles in administering the statewide programs.

Once a Lead PA is determined for the statewide programs, the Commission recognizes that the remaining PAs still play an important role in the administration of statewide programs.<sup>5</sup> The Commission calls for a consultative and collaborative relationship between the Lead PA and other administrators on key aspects of the portfolio,<sup>6</sup> and states that they “are deliberately not specifying in this decision the exact form such collaboration should take.”<sup>7</sup> With this direction, the IOUs describe a governance process that presents the consultative and collaborative relationship in the statewide administration model.

## **III. APPROACH**

To improve program delivery and efficiency, the IOUs holistically evaluated potential Lead PAs using six program administration criteria. The six criteria used in determining Lead PA assignments are described below.

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<sup>3</sup> D.16-08-019 p. 53

<sup>4</sup> D.16-08-019 p. 54

<sup>5</sup> The seven current PAs are: Pacific Gas and Electric, Southern California Edison, Southern California Gas Company, San Diego Gas and Electric, Bay Area Regional Energy Network, Southern California Regional Energy Network, and Marin Clean Energy.

<sup>6</sup> D.16-08-019 p. 54

<sup>7</sup> *Id.*

1. **Portfolio Approach and Natural Bundling:** The IOUs considered an overall portfolio approach and grouped programs to support a cohesive program strategy and an emphasis on increasing the effectiveness of energy efficiency, improving cost-effectiveness, balancing localized considerations, and providing the most value for our customers. As an example, the same lead was assigned to both the Residential and Commercial HVAC Programs so that the Lead PA can determine if these programs can be consolidated to gain efficiencies. In addition, through the bundling of interdependent programs, such as Electric Emerging Technologies and the Savings By Design (SBD) programs as well as the grouping of the Gas Emerging Technologies and Residential New Construction programs, the IOUs will achieve greater continuity for oversight and focus on zero net energy (ZNE) policy goals, along with increasing energy efficiency.

The IOUs also considered specific factors in the marketplace such as regional, climate, and locational resource constraints which could have a bearing on the relationship with major customers, vendors, and suppliers. For example, different end uses or technologies require different skillsets, a different set of manufacturers, trade organizations, and distributors to engage. This is particularly true in the area of lighting and HVAC where the suppliers and experts in each area are vastly different. The Lead PA assignments consider these unique factors and bundle programs accordingly.

2. **Cost-effectiveness:** The IOUs reviewed program administrators' ability to deliver energy savings in the most cost-effective manner. For each of the Lead PA assignments listed below, the Lead PA chosen was typically the lowest in administering a program on a \$/kWh or \$/therm basis, or has the highest Total Resource Cost (TRC) ratio for the program.
3. **Capacity:** Each IOU's capacity to administer a given program at the statewide level was considered, with the understanding that establishing this new structure and process may require shifting significant work across administrators. Given the requirement to begin the transition to this structure, all IOUs will need to participate and take the lead in key areas. No single PA can or should lead all statewide programs, and these assignments consider balancing administrative burden and responsibilities with diversity in experience. We anticipate that the structure of the statewide portfolio and lead

assignments may evolve over time as we gain experience with the new statewide model. There may also be staffing impacts due to the transformative changes being undertaken that will likely unfold over time as we continue to execute and prove the success of this new model.

In addition, the IOUs reviewed each of the statewide programs and used historical information and experience to help estimate the capacity each IOU has to administer statewide programs. Examples of information used are: total savings for each program for the past 6 years, total savings for 2015, and knowledge of the support infrastructure necessary to effectively administer and support delivery of programs and services to customers.

4. **Expertise:** Expertise, experience, and knowledge are important factors to consider regarding statewide program administration, both from a technical and an administrative perspective. Understanding that implementers will be designing and delivering these programs, expertise in administration will be required to ensure proper program oversight, achievement of program goals, strategic portfolio management, and a full understanding of Commission rules. From a technical perspective, in an effort to ensure speed to market, agility, and program management discipline, the IOUs qualitatively reviewed and evaluated the relative expertise each IOU had for a given program to assist in the assignment process. For example, the technical expertise available to support the Emerging Technologies Program (ETP) for both gas and electric technologies was considered, including how such expertise may be used to support other important efforts such as the development of the grid of the future. Of particular importance with ETP is the close connection to fuel-specific expertise, which resulted in the decision to create two distinct electric and gas ETPs. Knowledge of the characteristics and needs of key strategic customers and partners was also considered, such as with the Institutional Partnership programs.
5. **Relationships:** Inter-utility (including publicly-owned utilities) and external industry relationships are also an important factor to consider regarding statewide program administration. The IOUs qualitatively reviewed and evaluated the relationships each had with key stakeholders for a given program to assist in the assignment process.



Relationships each IOU had with key upstream vendors, emerging technology organizations, and State entities were considered. The relationships held by each IOU are important to ensure the new statewide programs launch quickly, and with minimal disruption to the market or customers.

- 6. Feedback from Stakeholders:** Through the California Energy Efficiency Coordinating Committee (CAEECC) process, stakeholders have provided input to the IOUs on proposed lead assignments.<sup>8</sup> This input includes bundling similar programs, recognition of prior leadership, and leveraging demonstrated expertise. The IOUs have considered stakeholder recommendations, and have made adjustments to proposed Lead Assignments, as appropriate.

#### IV. GUIDING PRINCIPLES

The following Guiding Principles represent the shared commitments of IOU PAs in the delivery of statewide-administered energy efficiency programs.

- 1. Support the State's energy efficiency policy goals.** Orient portfolio design around State and Regulatory objectives and act in the best interests of all customers.
- 2. Do no harm.** Make decisions that preserve our collective ability to meet energy savings goals, achieve cost-effectiveness goals, and minimize impacts to existing local and downstream programs.
- 3. Advocate for all PAs.** Recognize that the whole is greater than the sum of its parts. Be willing to collaborate with other PAs in planning and decision-making efforts.
- 4. Assume best intentions.** In an environment of shared goals and shared directives, be humble in the approach and ambitious for the broader group's success.
- 5. Be good listeners.** Take responsibility for the environment by which decisions are made such that all participants have the opportunity to participate.
- 6. Take a stand for customers.** Take into consideration the customer experience and strive for simplicity, clarity, and ease.
- 7. Wisely pursue change.** Demonstrate open-mindedness to changes in design, delivery and administration.

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<sup>8</sup> IOUs presented proposed Lead Assignments to the CAEECC on September 21, 2016, October 19, 2016, and again on November 16, 2016.

**V. LEAD ASSIGNMENTS**

The final Lead Assignments, by IOU, are put forth as follows:

<b>Pacific Gas and Electric Company</b>	Institutional Government Partnerships: State of California and Department of Corrections
	Financing: New Financing Offerings
	Codes and Standards: Building Codes Advocacy and Appliance Standards Advocacy Programs
	Workforce Education and Training: Centergies K-12 Connections Programs
	Workforce Education and Training: Career & Workforce Readiness ( <i>downstream pilot</i> )
	Indoor Agriculture Program ( <i>downstream pilot</i> )
<b>Southern California Edison Company</b>	Electric Emerging Technologies Program
	Lighting: Primary Lighting, Lighting Innovation and Lighting Market Transformation
	Commercial New Construction: Savings by Design
	Institutional Government Partnership: University of California and California State University
	Water/Wastewater Pumping Program for non- residential Public sector ( <i>downstream pilot</i> )

<b>Southern California Gas Company</b>	Residential New Constructions
	Gas Emerging Technologies Program
	Foodservice Point-of-Sale (POS) Program
	Midstream Commercial Water Heating
<b>San Diego Gas and Electric Company</b>	Upstream Heating, Ventilation, and Air Conditioning (HVAC)
	Midstream Plug Load Appliance (PLA)
	Residential HVAC Quality Installation/Quality Maintenance (QI/QM) ( <i>downstream pilot</i> )

What follows is a brief discussion on the rationale behind these choices.

**Pacific Gas & Electric (PG&E)**

**1. State Government Partnerships (State of California and Dept. of Corrections)**

Following the principle of natural bundling, the IOUs believe that combining the two State partnerships under one lead would result in economies of scale and increased efficiencies. PG&E believes that engaging public customers through strategic partnerships enables customers to take action while demonstrating leadership that inspires their constituents to pursue their own energy efficiency projects. PG&E is presently the statewide lead for these partnerships and PG&E benefits from ready access to state agency leadership due to geographic proximity. PG&E will rely on its proximity to help facilitate effective management of these partnerships. As PG&E’s business plan explains, PG&E sees a great opportunity to engage more state agencies, including the Judicial Council through expanded and new partnerships to share technical expertise and to achieve greater participation in energy efficiency programs and drive deeper savings achievement.

**2. Financing (New Finance Offerings)**

PG&E believes that investments in finance programs will allow program administrators to more cost-effectively achieve energy efficiency savings, which aligns with the state's vision for energy efficiency financing. PG&E's finance team has professional financing expertise and experience in implementing energy efficiency financing programs both in and outside of California. PG&E has demonstrated statewide leadership in the realm of finance programs for the last four years, particularly in the development of the statewide on bill repayment (OBR) pilots. Not only has PG&E collaborated well with its IOU partners, it has built strong working relationships with the Commission and the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) to help shape the future of energy efficiency financing in California.

As the Lead PA, PG&E will continue to work closely with CAETFA to build the finance pilots that work best for California. PG&E has seen growth in the On-Bill Financing (OBF) program. PG&E has dedicated itself to continuous improvement of the OBF program by integrating it into our programs, and focusing on making the program easy for contractor participation. PG&E has seen a steady growth in its financing loan pool since 2012 and is on track to continue that growth through 2016. PG&E now has the largest loan pool amongst the IOUs, and has thus far only experienced minimal defaults. PG&E has demonstrated its leadership by implementing a non-rebate OBF pathway for customers – the OBF Alternative Pathway. PG&E believes that its new process for OBF has potential to increase participation in energy efficiency from customers who have previously chosen not to participate in IOU programs. This Alternative Pathway should become a model for energy efficiency financing investments statewide, and a model for other financing programs beyond OBF.

In PG&E's finance business plan chapter, PG&E has shown a commitment to continuing to innovate and test new financing structures that can have an incremental impact on our customer's ability to fund their energy efficiency investment. PG&E understands what drives customers to undertake energy efficiency investments, which has led to exploring financing structures that will overcome specific barriers customers face to investing in energy efficiency. PG&E has shown a commitment to financing as a strategy for residential energy efficiency adoption through its on-bill loan program for this sector. As detailed in its Business Plan, the goals for statewide financing include overcoming customer transaction barriers to investment and increasing the supply and access to affordable capital.

### **3. Codes and Standards (Building Codes Advocacy and Appliance Standards Advocacy)**

Codes and Standards (C&S) represent an extremely cost-effective way to help meet the State's ambitious goal to double energy efficiency by 2030 and reduce greenhouse gas emissions. PG&E has demonstrated leadership in C&S for over 10 years at both the state and federal level. PG&E has the engineering and strategic resources available to successfully lead the statewide C&S advocacy sub-programs. PG&E has the expertise to lead and direct the program to meet the California Energy Commission (CEC) and CPUC's goals for the C&S program. PG&E has developed strong relationships with the statewide PAs, CEC, Department of Energy, efficiency advocates, industry stakeholders, and CPUC staff. These relationships allow PG&E staff, in conjunction with the other IOUs, to navigate upcoming Title 24 and Title 20 rulemakings successfully. These relationships have allowed PG&E to work on agreements with industry to gain their support for the CEC's proposals and achieve additional energy savings.

PG&E has managed CASE studies through careful planning and execution while maintaining quality. The resulting CASE studies have provided the basis for considerable cost-effective energy savings for California. A strong CASE study increases the likelihood and the speed that the CEC will begin a rulemaking since it provides a solid foundation for their work. PG&E has experience directing primary data collection to support CASE topics so that supporting data is timely, statistically relevant and comprehensive. As statewide lead, PG&E will continue to partner with the IOUs, CEC, and CPUC, and shape the next generation of codes and standards 2.0, which the statewide C&S business plan details.

### **4. Workforce Education and Training (K-12 Connections)**

As the current statewide lead for K-12 Connections, PG&E brings the expertise required to effectively engage the broader educational communities (schools, colleges, professional organizations) for a successful K-12 WE&T initiative. PG&E's WE&T staff include trained, professional educators who bring the right expertise to lead evaluation efforts on program design proposals. PG&E's experience in working directly with disadvantaged communities and organizations that serve disadvantaged workers sets PG&E up for success as the IOUs respond to

Senate Bill (SB) 350 and look for ways to broaden outreach and engagement of these communities in energy efficiency programs.

PG&E is currently the statewide lead for the Connections subprogram. For over 25 years, PG&E has supported the K-6 sector with a cost-effective education program which serves elementary school students at an average cost of \$3.30 per student. Furthermore, PG&E's existing online career awareness portal for high school students can serve a broader audience than the PG&E service territory. PG&E has conducted a variety of education programs that have served K-12 schools. For example, Energenius has evolved to incorporate the latest curriculum standards. Energenius has reached about half of all K-8 schools across PG&E's diverse service territory while receiving above 90% satisfaction ratings. PG&E has leveraged programs and experts across organizations to offer comprehensive K-12 resources to serve its diverse service territory (e.g., working with the low income programs CARE and Energy Savings Assistance (ESA) to incorporate energy, conservation and environmental education in the Out of School program delivered to low income students and their families).

As statewide lead, PG&E plans to leverage internal and external partnerships to cost-effectively deliver resources to the K-12 marketplace, such as the IOUs' Local Government Partnerships and Energy Savings Assistance program implementers, the California Student Aid Commission, the California Apprenticeship Coordinators Association, and several UC/CSU campuses. PG&E has also used marketing efforts of organizations such as the California Department Education and the California Teachers Association. As the Business Plan explains, PG&E envisions a workforce capable of meeting California's energy savings goals and implementing its utility programs. This includes the current workforce and the next generation of the workforce. PG&E believes firmly that its role as statewide lead for K-12 Connections and Career Workforce Readiness will help meet this vision.

#### **5. WE&T Career Workforce Readiness (CWR) Program**

As statewide lead administrator for the CWR program, PG&E brings the expertise required to effectively engage the broad array of workforce and community partners, stakeholders and other interested parties for a successful career and workforce readiness initiative. PG&E has experience working with disadvantaged workers and with organizations that serve disadvantaged workers and disadvantaged communities. Our experience in working

with disadvantaged communities sets us up for success as the IOUs respond to SB 350, exploring ways to broaden outreach and engagement of these communities in our energy efficiency programs. As our Business Plan explains, PG&E envisions a workforce capable of meeting California's energy savings goals and implementing its utility demand-side management programs. We believe firmly that our role as statewide administrator for CWR will help us meet this vision.

## **6. Indoor Agriculture (IA) Program**

PG&E will dedicate its decades of experience serving California's agricultural community to being the statewide lead administrator for the IA program, PG&E has provided agricultural customers a variety of energy efficiency solutions from technical assistance to rebates and low/no interest loans. PG&E understands that energy is a key resource for farmers, and that smart energy management can be a powerful tool in addressing rising energy costs, regulatory standards, and safety issues. Leveraging our years of knowledge of agricultural customers, and what motivates them to make energy efficiency investments positions PG&E well as statewide administrator for this new downstream program.

## **Southern California Edison (SCE)**

### **1. Electric Emerging Technologies Program**

The IOUs propose to divide the ETP by fuel source to account for the specialized knowledge and skills that are associated with each fuel type and distribution system. Because it is ETP's role to support the resource program portfolios with new innovations, fuel-specific subject matter experts (SMEs) will be critical to providing strategic planning and quality assurance functions. The two functions are central so that policy and technology are developed into measures. SCE and the Southern California Gas Company (SoCalGas) have unique fuel-centric expertise that will be leveraged for these critical functions that the implementers will not provide under the new administrative model for ETP. The expertise in administration is necessary to ensure proper program oversight, achievement of program goals, strategic portfolio management, and a full understanding of Commission rules. Fuel-specific SMEs at SCE and SoCalGas will bring an understanding of the implementers' roles in designing and delivering

these programs as they relate to both electric or gas measures. Collaboration between electric and gas statewide program administrators, as well as other PAs, are essential to the success of this model, which ETP has over 12 years of experience through the Emerging Technologies Coordinating Council (ETCC).

The IOUs assign SCE as the statewide PA for the Electric ETP. SCE has been the statewide lead for over 10 years providing leadership in program design, planning, implementation, policy input, and program evaluation for the statewide program. Under SCE's leadership, the ETP has been successfully restructured<sup>9</sup> to meet the evolving policy needs of California (SB 350, Assembly Bill 802) and the Commission while maintaining cohesive and collaborative working relationships with other IOUs and CPUC staff. In addition, SCE has had consistent commitment to ETP in terms of expertise, resources, and budget allocation and has successfully met or exceeded all program goals since the program's inception over 10 years ago.<sup>10</sup>

SCE has led efforts with innovation-focused organizations such as the Los Angeles Cleantech Incubator (LACI), CEC grant programs (CalSEED and Regional Clusters), and CleanTech Open. SCE has also helped foster innovation through outreach activities such as the Technology Resource Innovation Outreach (TRIO) initiative and through collaboration with the Department of Energy's early stage technology completion effort (First Look West – FloW) and the newly formed Rocket Fund; both managed by CalTech. In addition, SCE has reviewed over 500 ideas and launched over 100 new measures or technologies and various pilots through its ideation process, many of which were funneled into the process or reviewed with the support of SCE's ETP.

SCE also has a team of technical experts within ETP to review potential products and services for SCE's demand-side management (DSM) programs. SCE's team of DSM technical

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<sup>9</sup> The PY2013-2014 ETP Targeted Effectiveness Evaluation (Calmac ID# CPU0112.01 ) concludes "ETP consistently exceeds PIP objectives. Moreover, the ETP exceeded some objectives by significant amounts....Objectives were achieved within allocated budget,...[and] projects align with CEESP end-use areas." " p. 41-42.

<sup>10</sup> "PY2013-2014 ETP Targeted Effectiveness Evaluation", CPUC, 2015 (Calmac ID #CPU0112.01); "PY 2010-2012 California Statewide Emerging Technologies Program Phase I", CPUC, 2013 (Calmac ID #CPU0066.01); "PY 2010-2012 California Statewide Emerging Technologies Program Phase II", CPUC, 2013 (Calmac ID #CPU0066.03); "Evaluation of the California Statewide Emerging Technologies Program [PY2006-2008], CPUC, 2010 (Calmac ID #CPU0031.01)".



experts brings the expertise required to effectively engage with ETP's collaborators and peers. SCE's staff includes trained, professional engineers who have the necessary skills and proficiency to oversee technology projects. SCE's Lead Program Manager has over seven years of leadership as the statewide ETP lead, over 10 years at SCE, and over 15 years in technology development within the utility and DSM context. SCE's team also includes a full-time staff that brings a combined 75 years of expertise to administrating the statewide ETP. In addition, SCE's DSM technical experts also collaborate closely with other experts across SCE to coordinate projects and to help determine how new technologies will impact the grid. This is vital to help California build the grid of the future that supports customer choice, the two-way flow of electricity, and the ever-expanding adoption of distributed energy resources — energy efficient equipment, rooftop solar, onsite energy storage, electric vehicles, and energy management systems — to achieve cost savings, cleaner energy, conservation, and enhanced reliability. SCE will continue to leverage this expertise through its Electric Emerging Technology Program to support the IOUs and the State of California so that the plug-and-play-grid-of-the-future reaches its potential. SCE looks forward to continuing and building upon its effective leadership of ETP<sup>11</sup> as it transitions to administering the statewide Electric ETP in 2018.

## **2. Lighting (Primary Lighting, Lighting Innovation and Lighting Market Transformation)**

The IOUs recommend that SCE be the statewide PA for the Lighting programs. SCE leads the state in energy savings claimed through the statewide primarily lighting programs<sup>12</sup> and is the low-cost leader compared to the other IOUs on a \$/kWh basis.<sup>13</sup> In addition, SCE's upstream lighting approach concept has been replicated in other states.

SCE has also been the historical lead for the Lighting Market Transformation (LMT) and Lighting Innovation (LI) programs, which have contributed to SCE's effective Primary Lighting program in the past. Through these programs, SCE has embarked on various pilots that have provided valuable data related to future program design and implementation. Sample successes

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<sup>11</sup> SCE has demonstrated strong statewide leadership in the realm of Emerging Technologies. Not only has SCE collaborated well with its IOU partners, it has built strong working relationships with Energy Division, CEC-PIER, SMUD, LADWP, BPA, NEEA, NYSERDA, DOE, and industry leaders across the U.S.

<sup>12</sup> SCE's claims 75% of all energy savings claimed through the statewide primary lighting program.

<sup>13</sup> SCE Advice 3465-E Southern California Edison Company's 2017 Annual Energy Efficiency Program and Portfolio Budget Request.

include the development of a midstream delivery channel for lighting technologies that continues to expand into other technology categories today. This and other pilots conducted by SCE have focused on customer engagement and partnering with large organizations established at a nationwide level. SCE has the expertise in lighting to continue developing and researching energy efficiency lighting products that will aid towards future initiatives.

In its 2017 budget Advice Letter, SCE planned to defund both LMT and LI as stand-alone program areas, noting that some aspects of the programs could be integrated into the Emerging Technologies program. In the immediate term, SCE sees no need for this strategy to change, and funding is already set aside to complete its remaining pilots; however, SCE may also leverage third-party solicitations to garner new program ideas in this space as long as overall portfolio cost-effectiveness can be maintained.

### **3. Commercial New Construction – Savings by Design (SBD)**

The IOUs recommend that SCE be the statewide lead for the Commercial New Construction – SBD Program.

Coupling of SBD and the Electric ETP under SCE will help California reach ZNE in the commercial sector by 2030 as we endeavor for the two programs to work together to shepherd nascent technologies from ETP into SBD. In addition, the grouping of Electric Emerging Technologies, all Lighting program areas, and SBD programs under SCE will provide California with an end-to-end focus on lighting that begins with the evaluation of new lighting technologies and ends with code readiness through nonresidential new construction. This combined programmatic approach will also be an important factor in SCE's pursuit of achieving ZNE on behalf of our customers and for California given that lighting is one of the primary end-use measures in both the commercial and the residential markets.

However, SCE's approach to SBD will be much more holistic. We will also focus on supporting a Whole Building Approach to project opportunities. This will be done by streamlining the design and implementation activities with customers, design teams, and partner trade associations, all with the common goal of developing and constructing the most energy-efficient buildings and communities possible, with a focus on preparing the industry for zero net energy buildings.

In addition, SCE has over 18 years' experience in administering the SBD Program and has stimulated whole-building energy modeling & ZNE building designs by supporting the development of more advanced modeling programs. SCE is a top-two performer in terms of cost on a \$/kWh basis and also has the capacity to administer the program on a statewide basis.<sup>14</sup> SCE also has a long-standing partnership with SoCalGas for program delivery, in which SCE provides recommendations, pays the customer incentives, and processes the Therm savings on the behalf of SoCalGas. Some examples of these programs are the SBD Program and PLA Program. This partnership demonstrates SCE's ability to partner with other PAs to administer programs.

To strengthen SBD moving forward, SCE will issue a competitive Request for Proposal (RFP) to enhance resources in the areas of program design, implementation, and processing, as appropriate.

#### **4. Government Institutional Partnerships – UC/CSU and CA Community Colleges**

The IOUs recommend that SCE be the statewide lead for the Government Institutional Partnerships – UC/CSU and CA Community Colleges program. SCE is the current statewide lead for the UC/CSU Partnership. SCE has deep knowledge of the customer base and has dedicated resources committed to helping the UC/CSU system and other higher-education partners meet our shared DSM, ZNE, and environmental goals. SCE's Program and Account Management team has the institutional knowledge and the relationships with this customer base to provide guidance and to help meet evolving energy and environmental goals, which are unique for the higher-education customer segment.

SCE has been successful in meeting its goals in a cost-effective manner and is the low-cost leader in administering the UC/CSU Program and a leader in administering the CCC Program on a \$/kWh basis.<sup>15</sup> In addition, SCE also has the information technology systems infrastructure necessary to support program administration at the statewide level, including unique online application capabilities.

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<sup>14</sup> SCE Advice 3465-E Southern California Edison Company's 2017 Annual Energy Efficiency Program and Portfolio Budget Request.

<sup>15</sup> (<http://eestats.cpuc.ca.gov/views/EEDataPortal.aspx>, 2013-15)

SCE is driving innovation in the higher-education segment and has submitted a high opportunity project or program (HOPPs) proposal to the Commission for the Public sector with a UC/CSU focus to help drive deeper savings.<sup>16</sup> SCE has also helped UC/CSU partners meet their DSM, ZNE, and environmental goals through SCE's ETP, for which SCE is also the proposed statewide lead, thus ensuring a continued synergy between the Electric ETP and the Institutional Partnership programs.

### **1. Water Infrastructure Systems Efficiency Program (WISE)**

WISE is a DSM program designed to provide EE solutions to water production, distribution, and treatment systems. The program serves water agencies, special districts, and local governments with a focus on water treatment, wastewater treatment, and pumping facilities and systems. The WISE program was originally launched out of SCE's IDEEA 365 solicitation, was a pilot for approximately 18 months, and is now transitioning to a mainstream third party-implemented program. SCE's extensive experience with the WISE pilot will be useful for conducting the program on a statewide basis as a downstream pilot.

### **Southern California Gas Company (SoCalGas)**

#### **2. Residential New Construction**

SoCalGas is committed to administering dual-fuel energy efficiency program offerings on behalf of all PAs and many publicly-owned utilities in its shared service territories. SoCalGas has demonstrated that it has been the most cost-effective administrator of the Residential New Construction program, on a \$/therm basis. SoCal Gas' demonstrated experience of successfully managing dual-fuel energy efficiency programs to customers, coupled with the discipline on cost-effective implementation, well-positions SoCalGas to assume statewide leadership of the Residential New Construction program.

SoCalGas has the infrastructure, systems, and discipline in place to manage complex, multi-dimensional energy efficiency programs across multiple service territories. For example, SoCalGas has 28 joint programs with municipal electric utilities and water agencies, such as Los

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<sup>16</sup> SCE Advice 3460-E.

Angeles Department of Water and Power (LADWP), including the Residential New Construction Program. SoCalGas also has long-standing partnerships with PG&E, San Diego Gas and Electric (SDG&E), and SCE in delivering joint gas and electric programs throughout the shared service territory. Since 2013, SoCalGas' California Advanced Homes Program has enrolled more than 25,000 new home units in its shared service area with combined builder project incentives of over \$15 million – the most in California.

In addition to partnerships with other utilities, SoCalGas has strong relationships with manufacturers, distributors, and builders to deliver the Residential New Construction program. SoCalGas works together with all its market actor partners to help the building industry design and develop more environmentally-friendly communities and support California's efforts for new single family homes to reach ZNE by 2020. SoCalGas seeks to leverage its learning from active partnerships with Metropolitan Water District and LADWP's Water Conservation teams to increase the speed to market as water conservation becomes an increasingly important component of the Residential New Construction equation throughout California. SoCalGas intends to administer a program with a crosscutting focus on sustainable design and construction, green building practices, energy efficiency, and emerging technologies. SoCalGas' experience in delivering dual-fuel programs by bringing all market actors together in an engaged partnership, positions it to implement this vision.

### **3. Gas Emerging Technologies Program (ETP)**

As a gas-only utility, SoCalGas is focused on developing efficient new natural gas technologies to fit the needs of California customers. The statewide ETP initiative has been successful in bringing new and underutilized technologies into the utility energy efficiency portfolios based on the strong, collaborative network (the ETCC) formed among the ETP staff at the four IOUs, as well as Sacramento Municipal Utility District and LADWP. These relationships will not disappear in the new statewide Administration model, but rather will be enhanced under SoCalGas' administrative leadership. As described for the Residential New Construction program, SoCalGas has a strong reputation for collaborative leadership among a wide range of market actors and key ET information and policy organizations, such as the American Council for an Energy-Efficient Economy (ACEEE), Consortium for Energy

Efficiency (CEE), and Energy Solutions Center (ESC). This leadership will extend to Gas Emerging Technologies.

Creating two distinct gas and electric Emerging Technologies Programs will allow for greater focus on a wider range of energy-specific new technologies. SoCalGas is a recognized leader in bringing new efficient gas technologies to market. Gas ETP will build on the existing statewide program framework, such as using the ETCC collaboration structure, in-house and external testing facilities, and the experience of more than a hundred heating technology assessments delivered in the past five years. SoCalGas has close relationships with the CEC natural gas Public Interest Energy Research programs and the Gas Technology Institute, to bring new, energy-efficient gas technologies into the portfolio. As the statewide ET program currently operates, natural gas technologies can often be a secondary focus to electric technologies given the higher portion of electric energy efficiency budgets among the IOUs. However, SoCalGas' ET efforts have ensured that progress in gas technologies continues to reap the significant energy saving sought by the state. With two distinct electric and gas ETPs, the programs can laser focus on the development, assessment, and introduction of more new and underutilized technologies, without regard to fuel prioritization. It will also enable a more relevant engagement with stakeholder organizations, given the manufacturers, distributors, trade allies, and member organizations associated with natural gas technologies are significantly different than the electric counterparts. For technologies with dual benefits, such as energy management systems, SoCalGas and SCE will closely partner, as they often do already, to efficiently use program resources. They will also collaborate to ensure that program administration, strategy and product and process quality controls are set at high levels, enforced and cost-efficient. SoCalGas looks forward to continuing its successful program administration and collaboration as it transitions to administering the statewide Gas ETP.

#### **4. Foodservice POS Rebate and Midstream Water Heating Programs**

Ordering Paragraph 8 of D.16-08-019 requires that all upstream and midstream programs in the existing portfolio, including but not limited to those listed in the decision, plus new programs proposed in business plans that are market transformation, upstream, or midstream, shall be delivered statewide. SoCalGas currently offers two midstream programs: Foodservice POS Rebate and Midstream Water Heating, which SoCalGas intends to continue to offer as part

of the rolling portfolio. In this new paradigm, these programs will be delivered statewide, led by SoCalGas.

The Foodservice POS Rebate program seeks to increase the sales of high efficiency commercial foodservice equipment by engaging midstream market actors to stock and actively market high efficiency equipment. The Midstream Water Heating program's objective is to push higher efficiency water heaters into the non-residential market by leveraging the distributor and contractor communities. SoCalGas will leverage its experience in administering these programs to expand their delivery statewide.

### **San Diego Gas & Electric (SDG&E)**

SDG&E is a lean, efficient program administrator. Even though SDG&E's territory has key factors that work against cost-effectiveness (limited Industrial sector and a relatively small portfolio – \$116.5M), SDG&E has been able to create a portfolio with a TRC greater than 1.5 as well as creating a competitive lifecycle cost for energy efficiency measures. Building upon this platform for success, SDG&E's statewide lead assignments are based on its vision for the future of these statewide program offerings.

#### **1. Upstream Heating, Ventilation, and Air Conditioning (HVAC)**

SDG&E has proven leadership in HVAC innovation. As the residential HVAC lead for almost four years, SDG&E's proven statewide leadership has identified opportunities to synergize customer offerings with complete cradle to grave innovative through our upstream, midstream and downstream HVAC programs. SDG&E has collaborated with HVAC industry stakeholders to increase and optimize the performance of the HVAC programs to increase customer comfort, improve air quality, reduce operating costs, and save energy for all customer segments. As the HVAC marketplace evolves, SDG&E has incorporated Pay-for-Performance contracts, customer-centric design, cost reductions, increased energy savings, Advanced Meter Infrastructure data analytics, Integrated Demand Side Management solutions, whole building integration, and cutting edge advanced technologies to meet the demands of the changing landscape of California's Legislation (e.g. AB 758, SB 793, SB 1414, SB 350, AB 802).

#### **2. Midstream Plug Load and Appliances (PLA)**

SDG&E's innovative approach will accelerate market-based energy-efficient purchases. A strong drive to identify process improvements, reduce costs and resources to implement effective programs while improving the customer experience requires a core team of creative, thoughtful innovators. In early 2016, SDG&E overhauled and redesigned the water and energy-savings kit program, part of the Plug Load and Appliance program. SDG&E leveraged our team's extensive experience with sourcing, fact-based negotiating and contracting to secure volume discount pricing and streamline processes resulting in a 50% reduction in the cost of water and energy-savings kit administration. Additionally, SDG&E reduced customer order fulfillment to less than 10 days improving the customer experience.

SDG&E will be leveraging the team's strengths and experience from the other IOUs to realize significant results on a statewide scale. SDG&E believes that the statewide administration of the midstream PLA Program can elevate access of efficient end-use products while facilitating emerging energy management technologies.

As the statewide lead for the midstream PLA Program, SDG&E will partner with manufacturers, distributors, retailers and other influential market participants to develop comprehensive and innovative initiatives that reduce energy usage across technologies with high savings potential. SDG&E intends to consider multiple intervention strategies for program delivery including, but not limited to Retail Products Platform, Point of Sale or a hybrid approach. Additionally, upstream and midstream partnerships will be leveraged to increase the visibility and eventually decrease the cost of energy management technology. SDG&E also intends to collaborate with those key market actors to increase demand for national connectivity standards and protocols, which will ultimately improve adoption and customer experience for those technologies. Finally, SDG&E recognizes that an energy management hub, be it physical or virtual, will be an integral part of a home owner's energy management. Through this home network, customers will have unprecedented access to information and control of their homes.

### **3. Residential QI/QM (Downstream Pilot)**

The rapid growth of air conditioning in California homes has made it one of the state's largest energy consuming end-uses and the single largest contributor to peak demand. Activities designed to improve HVAC efficiency, therefore, provide a significant opportunity to improve energy efficiency and reduce peak power demand. Historically, programs that have targeted maintenance and installation aspects of the HVAC market have been plagued with poor cost



effectiveness, low realization rates, and minimal market participation. This has resulted in mixed opinions and interest from the HVAC industry.

In alignment with the California Long Term EE Strategic Plan<sup>17</sup>, SDG&E will seek to overcome the barriers that have caused program performance issues in the past. This strategy will employ a five point approach:

- a. Improve HVAC system performance to generate greater savings for customers;
- b. Enhance requirements to insure that only qualified contractors can participate;
- c. Simplify the assessment and measurement approach to optimize cost effectiveness;
- d. Employ a pay for performance approach to align incentives with savings; and
- e. Create value propositions that address and overcome the “run to fail” mentality for equipment maintenance and installation.

In addition to the changes described above, these efforts will result in customers increasingly valuing the improved health and safety and lower maintenance or replacement costs better HVAC systems can provide.

## **VI. GOVERNANCE**

To ensure success of this new statewide administration model, the IOUs are working to develop a statewide program governance structure for a number of administration elements, such as program budgets and customer satisfaction. The PAs will attempt in good faith to resolve any dispute or concern arising out of or in relation to the statewide administration of energy efficiency programs through negotiations between an authorized representative of each of the PAs with authority to settle the relevant dispute via Regular Meetings. When agreement cannot be reached via these meetings, any PA can trigger the formal Commission dispute resolution process. The following is a discussion of how IOUs intend to address certain topics that may benefit from governance. The governance process must be flexible in order to allow PAs to adjust as they gain experience with statewide program administration.

### ***Communication***

To promote statewide program collaboration, all PAs will participate in periodic meetings to review key issues including program performance, implementer performance (key

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<sup>17</sup> California Energy Efficiency Strategic Plan, Section 1 located at [http://www.energy.ca.gov/ab758/documents/CAEnergyEfficiencyStrategicPlan\\_Jan2011.pdf](http://www.energy.ca.gov/ab758/documents/CAEnergyEfficiencyStrategicPlan_Jan2011.pdf).

performance indicators) and program direction. The Lead PA is responsible for hosting these meetings. All PAs will file regulatory documents and provide periodic reporting. The Lead PA will file on behalf of the overall statewide programs and the other PAs will report on local impacts (savings and budget). All PAs are responsible for regular and ongoing communications, above and beyond compliance filings and regulatory reporting requirements, for program elements specific to their own service territory.

### ***Contract and Fiscal Management***

The Lead PA is responsible for program monitoring and oversight, including but not limited to savings, budget, key performance indicators and other contract terms. The Lead PA is not authorized to unilaterally make budget decisions without explicit approval from affected PAs. Upon which time, the Lead PA is responsible for following the regulatory compliance process should said change trigger an Advice Letter or update to the Implementation Plan.

### ***Downstream Programs: Custom Project Support***

For downstream statewide programs, the Implementer, in coordination with the Lead PA, is responsible for consistently applying regulatory requirements for custom projects. Custom projects may be additionally supported by local account representatives that can help the customer and Implementer with project development.

### ***New Programs, Material Scope Changes, Program Closures***

In the event that a PA identifies a need for a new upstream or midstream program, this proposal should be presented to all PAs for consideration within their portfolios. If all PAs agree that the new program meets a market need in a cost-effective manner that leads to market transformation, the program will be put forth as a statewide program through an Advice Letter to the Commission. No one PA can unilaterally launch a statewide program without the broad support, including budget and energy savings commitments, from the other PAs. Additionally, the PA that proposes the program is not the presumptive lead and the determination for Lead PA for the new program is to be addressed among all PAs. If consensus cannot be reached for a proposed new upstream or midstream program, a non-statewide approach can be brought to the Commission for consideration with sufficient justification from the proposing PA.

Changes to existing program scope and budget must be discussed among all PAs as there may be a material impact should one PA assert a material change to their budget commitments. Proposals to close a program must have agreement among all PAs before filing an Advice Letter to advise the Commission of intent to close a program.

### **Statewide Program Council**

A Program Council will be formed for each statewide program, to serve as an oversight body to support the PAs in decision-making and strategic direction. The Program Council is comprised of authorized representatives of participating PAs. All participants must be invested in the chosen outcome and a consensus approach is preferred to prevent those in the minority feeling marginalized or left out of the decision-making process.

#### ***Program Council Responsibilities to Include:***

- Informed Decision-making: review materials, provide feedback and ask questions, as necessary to make an informed decision on the matter-at-hand.
- Active Participation: Attend meetings, share opinions and experience, ask questions and designate a delegate when necessary.

### **Dispute Resolution**

In the event of a dispute between the PAs concerning the design, implementation or performance of any statewide-administered energy efficiency program, such matter or matters in dispute shall be finally settled in a meeting of the Program Council or, if necessary, by the Commission.

## **VII. ROLES AND RESPONSIBILITIES IN STATEWIDE PROGRAM ADMINISTRATION**

In D.16-08-019, the Commission laid the foundation for the relationship between a Lead Administrator and the other Program Administrators, expecting “a consultative and collaborative process with the other administrators, either via the CAEECC or via separate sector and/or program-level coordination venues created and hosted by the lead administrators and involving all other relevant administrators.”<sup>18</sup> In a collaborative and inclusive process, identification of key program administrator responsibilities and the corresponding roles between the Lead

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<sup>18</sup> D.16-08-019 p. 54

Program Administrator, Non-Lead Program Administrators (herein referred to as Other Program Administrators), and Statewide Implementer(s) are essential in the successful management of statewide programs. It is expected that the assigned duties will vary among upstream, midstream, and downstream programs. However, the Commission notes that maintaining the connectivity between the IOUs and their customers is considered critical for success.<sup>19</sup> Customers will largely continue to engage in energy efficiency programs through the local utility websites, use of local marketing campaigns, local outreach efforts, and call centers, and potential engagement from local account representatives.

For each statewide program, the IOUs will detail specific roles and responsibilities in the distinct implementation plans, to be developed following Business Plans filings. Following are some key principles governing the relationship between the Lead and Other Program Administrators:

- The Lead PA has lead responsibility for program design and delivery, procurement, contract administration (including co-funding agreements where appropriate), invoicing, and contract payments. Final decisions regarding program design and delivery, in collaboration with Implementer(s), shall be agreed upon by all IOU administrators with guidance from the Program Council as necessary.
- The Lead PA is responsible for overseeing Implementer performance, including the achievement of contract goals, meeting energy savings and cost-effectiveness goals, and achieving customer satisfaction service levels in all IOU service territories.
- The Lead PA should consider, support, and where feasible, facilitate all local HOPPs and program partnerships, including those with publicly-owned utilities and public agencies, which address local issues or locational constraints.
- The Lead PA (or Implementer) shall provide regular reports including energy savings accomplishments, energy savings forecasts, incurred costs, forecasted costs, and other relevant metrics to Other PAs.

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<sup>19</sup> D.16-08-019, Conclusion of Law 61: “Utilities have an ongoing ability and responsibility to determine the needs to serve their customers.”

- The PAs will work together to grant relevant and appropriate data access and/or operations system access to selected Implementer(s), and ensure Implementer complies with Commission data security and privacy requirements.
- The Lead PA is not authorized to exceed approved IOU service territory budgets without written consent of all IOU administrators through the Program Council, as necessary.
- All IOUs may propose changes in program funding, or propose cancelation of program activity, based on local concerns or portfolio needs, including fund shifting. Changes should be approved by the impacted IOU administrators through the Program Council.

Statewide administration will require the coordination and collaboration of the statewide Lead PA, other PAs funding the statewide program, and Implementer(s) chosen to design and deliver the statewide programs. Clear roles and responsibilities for each party should result in efficiencies by minimizing duplication of effort. The IOUs envision four high-level functional areas:

- Solicitation Management
- Program Management
- Program Support
- Evaluation, Measurement, and Verification (EM&V)

A high-level overview of the various roles and responsibilities by function and task are provided below. While the categories will remain consistent, roles and responsibilities for the various tasks may differ across types of programs and market interventions and updates will be made as necessary. As statewide administration is a new concept, roles and responsibilities may evolve over time to ensure we achieve the objectives for statewide administration, as set forth by the Commission in D.16-08-019.

**Category 1: Solicitation Management**

<b>Request for Proposal (RFP) Design</b>	
<b>Lead PA</b>	(1) Host RFP design meeting to gather input on the general vision and direction of the program and determine applicable intervention strategies to be addressed by RFP.
	(2) Develop appropriate metrics for each strategy including budget, savings and cost-effectiveness targets, target sectors / subsectors, key performance indicators, etc.

<b>Request for Proposal (RFP) Design</b>	
<b>Other PA</b>	(1) Provide input on the general RFP design and vision for the program.
	(2) Provide input regarding appropriate metrics for each strategy including budget, savings and cost-effectiveness targets, target sectors / subsectors, key performance indicators, etc.
<b>Implementer</b>	Not yet engaged.

<b>RFP Management</b>	
<b>Lead PA</b>	(1) Issue RFP.
	(2) Host PRG meetings in accordance with RFP process.
<b>Other PA</b>	(1) Participate in PRG meetings.
<b>Implementer</b>	Not yet engaged.

### **Category 2: Program Management**

<b>Program Design (as reflected in IP)</b>	
<b>Lead PA</b>	(1) Provide input to Implementer on program design once bids are solicited.
<b>Other PA</b>	(1) Provide input to Lead PA on program design once bids are solicited.
<b>Implementer</b>	(1) Design program approach based on intervention strategies; budget, energy savings, and cost-effectiveness targets; other key performance indicators; and target sectors / subsectors.
	(2) Incorporate stakeholder input into final program design as collected via the CAEECC process.

<b>Implementation Plans</b>	
<b>Lead PA</b>	(1) Upon selection, Lead PA and Implementer will refine program scope, as needed.
<b>Other PA</b>	(1) Participate in CAEECC to provide input on Implementation Plans.
<b>Implementer</b>	(1) Upon selection, Lead PA and Implementer will refine program scope, as needed.
	(2) Implementer will act as primary author of Implementation Plan, to be approved of initially by Lead PA before presented to CAEECC for stakeholder input.
	(3) Present Implementation Plan at CAEECC to solicit input on Implementation Plan.

<b>Key Performance Indicators</b>	
<b>Lead PA</b>	(1) Upon contract award, and as a part of post-award refinement, Lead PA and Implementer finalize Key Performance Indicators.
	(2) Gather data on a monthly basis and review Implementer performance along with program performance on a quarterly basis.
	(3) Lead PA is the sole determiner of rewards or corrective action based on Implementer performance.

<b>Key Performance Indicators</b>	
<b>Other PA</b>	(1) Other PA is kept informed of Key Performance Indicators.
	(2) Provide feedback to Lead PA and/or Implementer based on Key Performance Indicators, and any concerns or comments on efforts/results in own territory.
<b>Implementer</b>	(1) Implementer gathers data for Key Performance Indicators on a rolling or monthly basis (as relevant).

<b>Program Delivery</b>	
<b>Lead PA</b>	(1) Provides support to Implementer, including use of local utility website, local marketing campaigns, local outreach efforts, call centers, and engagement from account representatives.
<b>Other PA</b>	(1) Provides support to Implementer, including use of local utility website, local marketing campaigns, local outreach efforts, call centers, and engagement from account representatives.
<b>Implementer</b>	(1) Independently deliver program to target sectors / subsectors. Implementer(s) may collaborate with local account representatives as relevant.
	(2) Monitor performance to ensure program meets budget, energy savings, and cost-effectiveness targets as well as other key performance indicators.
	(3) Continuously improve program delivery based on evaluation of program performances.

Program Support and EM&V needs for statewide programs will be determined after Implementation Plans are developed.