Project Plan for Participation Gap Analysis Among Residential Energy Efficiency Programs in California

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I. **OVERVIEW**

The increasing occurrence of droughts and devastating fires in California illustrates the local effects of climate change. One of the critical resources available to combat climate change is energy efficiency, which reduces the need to generate energy and thus results in the reduction of greenhouse gases that contribute to global warming.

EnergySage.com defines energy efficiency as the "method of reducing energy consumption by using less energy to attain the same amount of useful output" (EnergySage, 2020). When consumers are able to utilize energy more efficiently, the overall demand for energy decreases. Over time, as utility companies reduce their production of energy to meet lower demand, less greenhouse gases will be released into the atmosphere.

The Natural Resource Defense Council (NRDC) "works to increase energy efficiency everywhere and has an interest in encouraging utilities to embrace energy efficiency for customers" (NRDC, 2020). As a policy advocacy organization, the NRDC also plays a key role in working with state agencies to influence more equitable environmental policies and programs. The NRDC has partnered with the California Public Utilities Commission (CPUC) in its efforts to assist California in meeting goals set out in the Clean Energy and Pollution Reduction Act (SB 350).

To meet specific targets mandated by SB 350, increased participation in energy efficiency programs is required. With this project, the NRDC aims to help the CPUC to better understand whether energy efficiency (EE) program benefits are implemented equitably so that the savings potential is maximized across all sectors and communities.

II. **OBJECTIVES OF PROJECT PLAN**

This research study will find whether participation gaps exist in residential energy efficiency programs funded by California's major investor-owned utilities (IOUs). In other words, do certain socio-demographic and geographic groups benefit more or less from existing programs? We will analyze present gaps in participation with the expectation that relevant findings will help inform future decisions regarding program design; to improve program reach and participation, and to ensure more equitable distribution of program benefits.

The following two questions will examine the gaps in program participation:

1. *Are there gaps in program delivery by geographic areas?*
2. *Do residential energy efficiency programs reach or not reach certain socio-demographic groups?*

A determination of whether existing programs favor specific customers and geographic gaps in delivery will provide a basis for policy change and program re-design to ensure an equitable distribution of program benefits.

III. **BACKGROUND AND CONTEXT**

ENERGY BURDEN AND LIVING WAGE BLIND SPOT

While all customers may experience similar rate structures, the impact of paying energy bills varies based on household size and income level. As illustrated in Figure 1, there is a significant disparity between the level of high energy burden among low-income and non-low-income households (Drehobl & Ross, 2016).

Figure 1: Landscape of Income Type, Utility, & Energy Burden

TABLE ES1. Median income, utility bill, energy burden, and unit size for households based on income type, building type, building ownership, and household race for groups across all metro areas

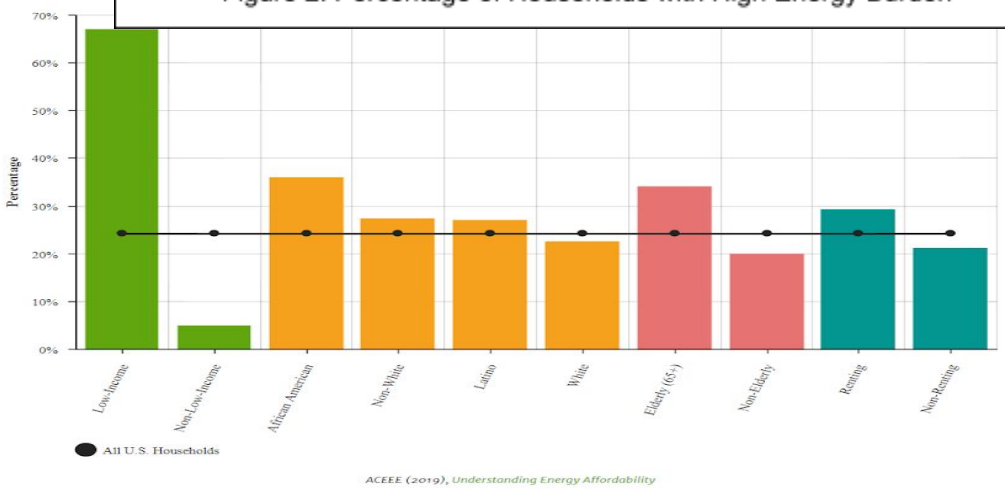
	Household type	Median annual income	Median size of unit (square feet)	Median annual utility spending	Median annual utility costs per square foot	Median energy burden[1]
Income type	Low-income[2] (≤80% AMI)[3]	$24,998	1,200	$1,692	$1.41	7.2%
	Non-low-income	$90,000	1,800	$2,112	$1.17	2.3%
	Low-income multifamily (≤80% AMI)	$21,996	800	$1,032	$1.29	5.0%
	Non-low-income multifamily	$71,982	950	$1,104	$1.16	1.5%
Building ownership	Renters	$34,972	1,000	$1,404	$1.40	4.0%
	Owners	$68,000	1,850	$2,172	$1.17	3.3%
Head of household race	White	$58,000	1,600	$1,956	$1.22	3.3%
	African-American	$34,494	1,290	$1,920	$1.49	5.4%
	Latino	$39,994	1,200	$1,704	$1.42	4.1%
All households	N/A	$53,988	1,573	$1,932	$1.23	3.5%

[1] Energy burden is the percentage of household income that is spent on energy bills. To calculate median energy burden, we calculated energy burden for all households and then took the median. This value differs from the median energy burden that is calculated using median annual utility spending and income.
[2] Low-income includes both single- and multifamily households. [3] Area median income (AMI) is the median dollar amount that divides the population into two equal parts.
Source: American Housing Survey (Census Bureau 2011 and 2013a).

(Drehobl & Ross, 2016)

Customers who earn less than the living wage may be underserved. Living wage in California is a minimum of $48,422 per year for a 2-person family ("Living Wage calculator", 2019). Whereas the maximum low-income threshold for a 2-person family is $33, 820 — which represents a 69% income gap, the EE programs are not designed to serve this demographic .

Figure 2: Percentage of Households with High Energy Burden



("Energy Savings Assistance Program", 2020)

Customers who make too much to qualify for low-income programs may also earn less than the living wage and therefore cannot take advantage of other program benefits because they cannot afford to make energy efficient home improvements or upgrades.

INVESTOR OWNED UTILITIES

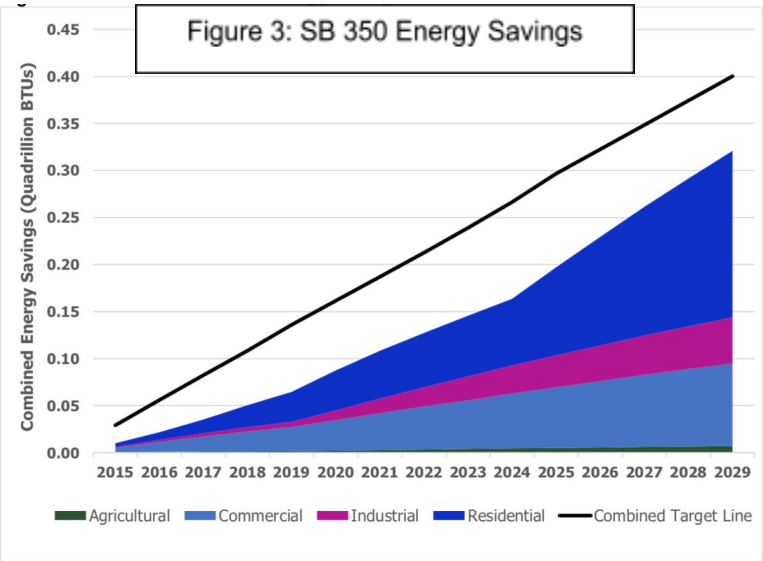
There are four major IOUs that provide an array of residential energy efficiency programs that are available to approximately 75% of California households. (California Energy Commission). Southern California Regional Energy Network and Bay Regional Energy Network administer EE programs for hard to reach customers served by the major IOUs. For the purpose of this study we will be focusing on residential EE programs administered for utility customers who reside within the jurisdiction of the CPUC.

Various circumstances or barriers may influence a customer's behavior and decisions to participate in EE programs. These barriers include low home-ownership rates, complex customer needs, insufficient access to capital, building age, and remote or underserved communities (Barriers Study, 2016). Additional barriers exist and will be explored in our research. It is also possible that barriers related to geographic location or internet access, separate from the level of income, may affect participation rates. Alternatively, various motivations related to personal ideologies or preferences can influence an individual to participate in an EE program (Lazar & Colburn, 2013). We seek to understand the exact motivations behind driving consumer behavior, to improve equity in the distribution of program benefits while reducing the drivers of climate change.

SB350 DOUBLING ENERGY SAVINGS CHALLENGE

In 2015, California set an ambitious goal to achieve a statewide cumulative doubling of energy efficiency savings and demand reductions in electricity and natural gas by 2030.

The same year, Senate Bill 350 codified that goal and directed the California Energy Commission (CEC) to set annual targets to achieve that goal. However, based on 2017 estimates, current energy saving projections in 2030 are projected to be lower in all sectors by 17% as depicted in Figure 3. Energy savings are driven mostly by residential and commercial sector programs (Kenny et al, 2019). Therefore, in the 2019 California Energy Efficiency Action Plan, the CEC recommended greater program participation in both residential and commercial sectors, along with introducing more EE programs to the market.



In terms of program participation, NRDC hypothesizes that the majority of program benefits are not reaching hard-to-reach customers like lower-income residents, those who do not speak English as their primary language, and those in rural locations. Additional studies (e.g., Cluett et al, 2016; Wilson et al, 2019) have found that low-income households tend to have similar energy-saving potential as higher-income households, so increasing participation by these demographic groups would both improve the equity impacts of existing EE programs and also help the state meet its energy savings goals.

IV. **DATA SOURCES**

The following is an outline of the various data sources that will be used to determine if geographic or socio-economic gaps exist among energy efficiency participants. Specific criteria are listed in Table 1 of the Appendix.

1. We will use the American Community Survey (ACS) from the US Census Bureau for most demographic data. ACS is an estimated survey done every year, providing a more real-time, local communities-based datasets, that can be used by local government, commercial leaders, and planners to get a better understanding of the local socio-economic situation. We will choose ACS profiles at ZCTAs (zip code tabulation areas) level. We will combine multiple datasets to gain a more comprehensive view of the demographic characteristics of the selected study areas.

2. We will use the Energy Data Request and Release Process (EDRP), established by CEC and IOUs, to access the energy usage and usage-related data within IOUs territories. The data downloaded from energy data request datasets are provided quarterly by zip codes.

3. We will use the California Energy Data and Reporting System, a database run by CPUC, to find out more details about the programs, which are residential energy efficiency programs.

4. We will use the *California Electric Utility Service Areas* (as well as another dataset called *natural gas service areas)* from CEC. The data represents the boundary of the IOU's service territory.

5. We will use *Census Zip Code Tabulation Areas, California, 2010* created by California's Office of Statewide Health Planning and Development and held by Stanford University. This polygon shapefile represents zip code tabulation areas for the state of California.

6. California Energy Efficiency Statistics provides rolling portfolios from 2016 Q1 to 2017 Q1, containing data about energy savings and demand reduction. The sources of data are quarterly standardized program tracking data submitted by IOUs and regional energy authorities. The rolling portfolio only tracks the non-low-income programs.

7. Additional data and information may include participation rates in EE programs. We will look into CALMAC where IOUs report their program evaluations and ask for that data directly from IOUs. Limitation in participation rate can be hard to find and mostly hidden because of customer confidentiality.

V. **RESEARCH & ANALYSIS STRATEGIES**

This study will use statistical, quantitative, qualitative, and spatial analysis to determine participation gaps in residential energy efficiency programs funded by the IOUs in California. The team will examine secondary data from the U.S. Census Bureau and energy-related consumer datasets from various sources such as the IOUs, CEDARS, and CEC. By analyzing the relationships that exist between the participants' demographic and geographic information, vis-à-vis the energy efficiency programs, we can determine where gaps in participation exist.

We will use a geographic information system (GIS) to analyze spatial patterns and organize layers of demographic information of program participants into a map. Table 2 below is a matrix of the research and analysis strategies. It includes the indicators and measurements to be used to answer the research questions, along with the data sources and data analysis methods to be employed.

Table 2: *Research and Analysis Strategies*

Research Question	Indicator	Measurement	Data Sources	Data Analysis
Are there gaps in program delivery by geographic areas?	Access	Number of participants by neighborhood	The Census Bureau ACS 5-estimatesTiger/ Line Shapefiles	GIS Spatial Analysis
Do the residential energy efficiency programs reach or not reach certain socio-demographic groups?	Access	Number of participants by income type, ethnicity, primary language spoken	IOU, CEC, NRDC, Census Bureau	GIS Spatial Analysis
	Investment	Energy savings kWh/therms saved per household	IOU, CEC Energy Data Request and Release process	

Interviews with industry and academic experts, along with stakeholders, may also be employed to inform the analysis team.

The *two main questions* of this study will drive the research strategy in analyzing the participation gaps. The three indicators of energy equity identified by CEC are access, investment, and resilience, they will be adapted to measure the gaps.

1. *To answer the first question*: "Are there gaps in program delivery by geographic areas?" The number of participants by neighborhood will be used as an indicator of access to programs.

The secondary data from the Census Bureau and Tiger/Line Shapefiles will be processed and analyzed using GIS.

2. *To answer the second question*: "Do residential energy efficiency programs reach or not reach certain socio-demographic groups?". The number of participants by income type, ethnicity of the head of household, primary language spoken will be used as an indicator of access to programs. While the energy savings per household will be used as an indicator of investment in the programs. The secondary data will be processed and analyzed using GIS.

This study will make use of concepts from the intersectionality literature, which "recognizes that to address complex inequities, a one-size-fits-all approach [to defining individual identity] does not work" (Olena, H. 2011, p. 218). Intersectionality policy analysis seeks to pin-point and tackle "the way specific acts and policies address the inequalities experienced by various social groups" (Bishwakarma, Hunt, and Zajicek 2007, p. 9).

A stakeholder analysis will help us to better understand the situation and determine the most relevant research topics. Energy customers/ subscribers and property owners have high stakes in the subject matter. We include various levels of government, which have high interests and influence on various issues regarding climate, equity, energy burden, and public safety policies. We also consider how other organizations like EE advocacy groups, community leaders, architects, engineers, and energy contractors may be impacted.

VI. **DELIVERABLES**

Project deliverables will include a visualization of participation among residential utility customers who reside within the jurisdiction of the CPUC and are participating in a specific EE program. Similar visualizations may be developed for additional EE programs. We will also create a final report that documents our methods and assumptions, and provide a summary slide deck.

The final report will include: 1) Executive Summary; 2) Methodology; 3) Data; 4) Findings; 5) Conclusion.

VII. **SCHEDULE**

DUE	PROJECT MILESTONE	CLIENT FEEDBACK	TECHNOLOGY USED
May 26	Initial Meet	No	E-mail
June 4 - June 11	Project Plan Presentation + Work Plan Timeline	Yes	Zoom/Email
June 18 - June 25	Define Problem & Preliminary Research	Yes	Zoom/Email
June 26 - July 3	Establish Deliverables	Yes	Zoom/Email
July 6 - July 10	Complete Research & Data Analysis	No	N/A
July 13 - July 20	Develop Findings + Draft Report	Yes	Zoom/Email
July 21 - July 29	Report Findings	Yes	Zoom/Email
July 30 - Aug 6	Finalize Report	No	N/A
Aug 6 - Aug 11	Deliver Final Report to Client	No	N/A

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APPENDIX

Table 1: *Data Sources*

Geographic	GEOid, Track number Zip code Geo location Utility service area boundary
Demographic (it will depend on what variables/parameters we will use to indicate low income/ disadvantaged communities)	Population employed Median Household Income ($) Average household size Language spoken at home -- English only, Language other than English ...
Housing	Occupied housing units Units in structure Year structure built Housing tenure -- owner-occupied, renter-occupied Housing heating fuel -- electricity ...
Energy	Total customer Total electricity used (kWh) Total natural gas used (therms) *Participation rate (limited)* *Energy saving (have not found)*
Energy Efficiency Programs	Residential EE programs portfolio

1) The Selected Economic Characteristics ACS 5-year estimates profile. It contains a mix of numeric and text data; we will focus on:
   - Track number: census track can be combined with zip codes, which are used for energy usage by IOUs
   - Population employed (value/percent)
   - Median Household Income ($)

2) The Selected Social Characteristics ACS 5-year estimates profile. This dataset provides various variables related to social demographic characteristics. we will focus on:
   - Track number
   - Average household size
   - Language spoken at home -- English only, Language other than English

3) The Selected Housing Characteristics ACS 5-year estimates profile. This profile provides housing-related data in California by census track. We will focus on:
    - Track number
    - Occupied housing units
    - Units in structure
    - Year structure built
    - Housing tenure -- owner-occupied, renter-occupied
    - Housing heating fuel -- electricity

4) Energy Data and Release Process. We will focus on:
    - Year
    - Zip codes
    - Total customer
    - Total electricity used (kWh)
    - Total natural gas used (therms)