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Measured Savings Program for Summer Reliability

Measurement and Verification Plan

Subsection of Program Management Plan

Updated: August 12, 2024

# Definitions

**Advanced Metering Infrastructure (AMI) Data:** Meter interval data used for baselining and performance tracking. AMI data is provided in an hourly intervals for electric and daily intervals for gas.

**Aggregator Portal:** Password-protected website providing Aggregators program resources and links to tools, including application checklists, eligibility tools, project value estimator tool, and application platform, once available.

**Automated Application Portal:** Implementer’s centralized, cloud-based portal for Aggregators to submit and track project application materials.

**Avoided Costs:** Avoided costs refers to the incremental costs avoided by the investor-owned utility when it purchases power from qualifying facilities, implements demand-side management, such as EE or demand-response programs, or otherwise defers or avoids generation from existing/new utility supply-side investments or energy purchases in the market. Avoided costs also encompass the deferral or avoidance of transmission and distribution-related costs. (D.08-01-006)

**Behavioral, Retro-commissioning, and Operational (BRO) Measures:** The BRO category includes measures that either restore or improve EE and can be reasonably expected to produce multi-year savings. BRO measures include information or educational programs that influence energy-related practices (behavioral), activities and installations that restore equipment performance to its nominal efficiency (i.e., rated, intended, or original efficiency (retro-commissioning)) but do not enhance the measure’s nominal efficiency, and measures that improve the efficient operation of installed equipment (operational). (Statewide Deemed Workpaper Rulebook 2019)

**Cohort:** For Population-based projects, a group of projects that started M&V during the same year and quarter. As each quarterly cohort completes M&V, the AESC Team will true up each quarterly cohort at the end of that cohort’s performance period.

**Community Choice Aggregators (“CCAs”):** Organizations created by local governments pursuant to Assembly Bill 117 for procuring power and administering energy efficiency programs on behalf of local citizens.

**Cost Effectiveness:** An indicator of the relative performance or economic attractiveness of any EE investment or practice when compared to the costs of energy produced and delivered in the absence of such an investment.

**Customer:** Any person or entity that pays an electric and/or gas bill to PG&E and that is the ultimate consumer of goods and services including energy efficiency products, services, or practices.

**Customer Incentive:** Financial or non-financial support (e.g. price reductions, monetary incentives, financing options such as low interest or zero interest loans) provided to a customer to motivate the customers to install energy efficient measures, adopt energy efficiency practices or undertake energy efficiency projects.

**Customer Participation Information:** Information that is collected by the Program in support of the customer participating in the Program.

**Customer Sector:** Residential, Commercial, Industrial, Agricultural, and Public.

**Customer Segment/Sub-segment:** Grouping of like customers within an individual customer sector based on the North American Industry Classification System (“NAICS”) code.

**Customer Site Eligibility Tool (CSET):** Implementer’sToolused to identify if a site meets program requirements including CV(RMSE), data sufficiency, and lack of program double dip.

**Day**: Unless otherwise specified, reference to a “day” means a calendar day.

**Demand Response (“DR”):** Demand Response is short-term changes in electricity usage by end-use customers from their normal consumption patterns. Demand response may be in response to:

* changes in the price of electricity; or
* participation in programs or services designed to modify electricity use; or
* in response to wholesale market prices, or
* when system reliability is jeopardized.

**Disadvantaged Communities (DAC)[[1]](#footnote-2):** Pursuant to Section 39711 of the Health and Safety Code, the California Environmental Protection Agency (“CalEPA”) developed a means for identifying disadvantaged communities, which may include, but are not limited to 1) Areas disproportionately affected by environmental pollution and other hazards that can lead to negative public health effects, exposure, or environmental degradation, and/or 2) Areas with concentrations of people that are of low income, high unemployment, low levels of homeownership, high rent burden, sensitive populations, or low levels of educational attainment. Specific DAC criteria is as follows:

* Census tracts with the highest 25% of overall scores in CalEnviroScreen 4.0, or
* Census tracts with the highest 5% of pollution burden indicator scores in CalEnviroScreen 4.0 and that also do not have an overall score, or
* Census tracts designated as DACs by CalEPA in 2017 using CalEnviroScreen 3.0, or
* Lands under federally recognized tribes

**Double Dipping:** This term is applied when a customer receives financial incentives from multiple CPUC-funded energy efficiency programs and the corresponding energy savings and/or TSB are reported multiple times to the CPUC for the same activity.

**Effective Useful Life (“EUL”):** An estimate of the median number of years that the measures installed under the program are still in place and operable. For MSSR, Project TSB will be based on weighted EUL, which is the average of EUL of all measures installed at the site weighted by Energy Savings for each of the measures.

**Energy Efficiency (“EE”):** Activities or programs that stimulate customers to reduce customer energy use by making investments in more efficient equipment or controls that reduce energy use while maintaining a comparable level of service as perceived by the customer.

**Energy Insight (“EI”):** PG&E’s customized Customer Relationship Manager (“CRM”) platform used for documentation of energy efficiency projects, documenting customer interactions and workflow for customer service resolution.

**Energy Savings:** The level of reduced energy use (or savings) resulting from the installation of an energy efficiency measure or the adoption of an energy efficiency practice, subject to the condition that the level of service after the investment is made is comparable to the baseline level of service. The level of service may be expressed in such ways as the volume of a refrigerator, temperature levels, production output of a manufacturing facility, or lighting level per square foot.

**Enrolled Aggregator (**interchangeable with **“Aggregator”** through PMP**)** – Trade professional, contractor, or project developer who has signed an agreement with MSSR to identify and enroll customers to implement energy efficiency projects that will be measured in the MSSR. Enrolled Aggregators receive incentive payments for the customers’ projects.

**Evaluation, Measurement and Verification (“EM&V”):** Activities that evaluate, monitor, measure and verify performance or other aspects of EE programs or their market environment.

**Ex-Ante Savings:** Estimated savings values calculated based on assumptions prior to the evaluation of the portfolio cycle. These savings reflect the IOU reported savings, which are trued up with final evaluation.

**Fuel Substitution:** Fuel substitution measures involve projects where all or a portion of the existing energy use is converted from one CPUC-regulated fuel to another CPUC-regulated fuel (e.g., conversion from a natural gas appliance to an electric appliance).

**Gross Savings:** Gross savings count the energy savings from installed energy efficiency measures irrespective of whether or not those savings are from free riders, i.e., those customers who would have installed the measure(s) even without the financial incentives offered under the program. Gross savings are adjusted by a net-to-gross ratio to produce net savings, that is, to remove the savings associated with free riders.

**Implementation Plan (“IP”):** A detailed description of a program that includes program theory and design, goals and budgets, logic models, planned processes, program activities and EM&V, and program performance metrics, developed by Program Administrators and stakeholders to detail program and implementation strategies required by the CPUC.

**Install or Installation:** The activities necessary to effectuate a Project, which may include development, construction, installation, implementation, or other activity necessary to effectuate a Measure, and may include removal of or reconfiguration of a facility or of certain existing equipment.

**Integrated Demand Side Management (“IDSM”):** Energy efficiency, energy conservation, demand response, advanced metering, and distributed generation technologies are offered as elements of an integrated solution that supports energy and carbon reduction goals immediately, and eventually water and other resource conservation goals in the future.

**Investor-Owned Utilities (“IOUs”):** Refers to either of the following entities - Pacific Gas and Electric Company, Southern California Edison Company, Southern California Gas Company, and San Diego Gas & Electric Company.

**Lifecycle Summer Peak kW:** EUL\* Summer Peak kW, where Summer Peak kW is during the summer peak period of 4 p.m. to 9 p.m., June 1 and September 30.

**Market Barrier:** Any characteristic of the market for an energy-related product, service, or practice that helps to explain the gap between the actual level of investment in, or practice of, energy efficiency and an increased level that would appear to be cost-beneficial.

**Measure:** An energy using appliance, equipment, control system, or practice whose installation or implementation results in reduced energy use (purchased from the distribution utility) which maintaining a comparable or higher level of energy service as perceived by the customer. In all cases energy efficiency measures decrease the amount of energy used to provide a specific service or to accomplish a specific amount of work (e.g., kWh per cubic foot of a refrigerator held at a specific temperature, therms per gallon of hot water at a specific temperature, etc.). For the purpose of these Rules, solar-powered, non-generating technologies are eligible energy efficiency measures (Decision 09-12-022, OP 1).

**Measure Package:** Documentation prepared by the program administrators or program implementers that documents the data, methodologies, and rationale used to develop ex-ante estimates that are not already fully contained in the Electronic Technical Reference Manual (eTRM).

**Measurement & Verification (“M&V”):** Data collection, monitoring and analysis activities associated with the calculation of gross energy and peak demand savings from individual customer sites or projects.

**Meter-based:** A platform/ruleset that quantifies energy savings and/or TSB through analysis of a site’s normalized metered energy consumption and can be substantiated to a specific time and geographic location.

**Net Savings:** Program savings exclusive of free ridership savings. Net savings is calculated by multiplying gross savings by the net to gross ratio.

**Net-to-Gross Ratio**: The savings attributable to a program realized when free ridership is accounted for. The savings are calculated by multiplying the gross savings by the net to gross ratio.

**Non-Routine Event (NRE)**: Non-program related material change in energy usage (e.g. permanent or extensive building occupancy change, added cooling or heating loads, changes in building size)

**Normalized Metered Energy Consumption (“NMEC”):** A method of calculating savings using statistical analyses of actual pre- and post-installation energy usage data, rather than engineering analyses of forecasted savings or application of prescriptive (deemed) values.

**On-Bill Financing (“OBF”):** A financing opportunity offered by PG&E that provides zero percent (0%) interest loans to qualified customers toward the purchase and installation of new energy efficient measures or equipment at the customer’s premises.

**Participating Aggregator:** Installers who, at a minimum, meet the Program’s Installer Agreement requirements defined in the Program Implementation Agreement.  **Portfolio:** Portfolio consists of all the projects that the AESC team delivers to the program. Aggregator Portfolio includes the subset of projects that the Aggregator delivers to MSSR.

**Praxis M&V Tool:** Implementer’s tool to track savings and TSB estimation, perform project and portfolio M&V, calculates and enables approval of EULs, kW, kWh, and therms savings, and track incentive payments.

**Program Logic Model:** The graphical representation of the program theory showing the flow between activities, their outputs, and subsequent short-term, intermediate, and long-term outcomes. Often the logic model is displayed with these elements in boxes and the assumed causal relationship is shown by arrows connecting the boxes.

**Program Policies and Procedures (P&P) Manual:** A user guide developed by the program Implementer detailing the principles, policies, procedures, rules and requirements of its EE Program.

**Program Net Lifecycle Energy Savings:** At the measure level, the term “lifecycle savings” refers to the savings over the measure life, not only a single year. Net savings are the portion of the full (or “gross”) energy savings a participant sees after installing an EE measure that would not have happened in the absence of the program. A program’s lifecycle net energy savings comprise the sum of the lifecycle savings of all installed.

**Project:** A customer project that is implemented by the Program.

**Program Year(s):** The calendar year(s) during which the program operates.

**Service Area/Territory:** The geographical area served by the Program.

**Statewide Program (“SW”)**: Program delivered uniformly through the four investor-owned utility (IOU) territories, overseen by a single lead program administrator, and designed and delivered by one or more EE program implementers.

**Subcontracted Aggregator:** Installers who, at a minimum, meet AESC’s subcontractor agreement that includes AESC’s contractual flow downs.

**Total Resource Cost Test (“TRC”):** The TRC test measures the net resource benefits from the perspective of all ratepayers by combining the net benefits of the program to participants and non-participants. The benefits are the avoided costs of the supply-side resources avoided or deferred. The TRC costs encompass the cost of the measures/equipment installed and the costs incurred by the program administrator.

**Total Resource Cost Ratio No Admin (“TRCRatioNoAdmin”):** The TRCRatioNoAdmin is calculated by dividing avoided cost benefits (Electric Benefits + Gas Benefits + Avoided Gas Infrastructure Costs + Refrigerant Leakage Benefits) by TRCCostNoAdmin. The TRCCostNoAdmin is the TRC Cost excluding all program costs (e.g., admin, marketing, and direct implementation non-incentive). The TRCRatioNoAdmin metric is used for measuring the program and project Cost Effectiveness Performance.

**Total System Benefit (“TSB”)**: The sum of the benefit, in dollars, of the lifecycle energy, capacity, and GHG benefits of energy efficiency, expressed on an annual basis.

**Value Estimation Tool (VET):** Implementer’s tool used to calculate the estimated weighted EUL, TSB, and TRCRatioNoAdmin and incentive for entered projects.

# Measurement and Verification (M&V) Plan

The Measured Savings Program for Summer Reliability (MSSR) Measurement and Verification Plan (M&V) Plan covers requirements for both Site-level and Population-level Projects. As Site- and Population-level projects have similar requirements, the Plan gives requirements for both and specifically calls out differences where they exist.

## Permissible Project Types

MSSR will include several Aggregators targeting a range of commercial[[2]](#footnote-3) building types[[3]](#footnote-4) throughout PG&E service territory. For any given Aggregator, participating customers are reasonably expected to have similar types of equipment and drivers in energy consumption. During the qualification process, Aggregators will ensure that factors impacting consumption and energy savings will be relatively similar across the population for Population-level NMEC projects.

For projects that don’t meet the requirements for Population-level NMEC, such as projects with unique building type, baseline energy consumption, energy drivers, data needs, and/or baseline non-routine adjustments, the Program will consider approving a Site-level NMEC pathway. The Program may approve Site-level projects on a case-by-case basis, based on factors that may include, but are not limited to, TSB and cost-effectiveness.

## Qualifying Measures

As a meter-based Program, the Program will measure savings at the whole-building level. Thus, any measure that reduces energy use is qualified for the program, including to-code, Industry Standard Practice, PG&E expired measures, custom measures (accelerated replacement, add-on equipment, weatherization, behavioral, retrocommissioning (RCx), and operational (BRO)), and deemed measures. New construction and added load measures are not allowable.

The Program can support electrification and load shifting strategies under certain guidelines to comply with cost-effectiveness and modeling requirements of the Program:

* For **electrification (fuel substitution)** measures to participate in the Program, they must:
  + contribute cost-effective electric benefits to the portfolio and save electricity (kWh) at the meter (e.g., high efficiency packaged heat pump units in warmer CZs).
  + pass the Fuel Substitution Test implemented by Decision 19-08-009, using the most recent Fuel Substitution Calculator[[4]](#footnote-5). The Fuel Substitution Test has two requirements:
    - The measure shall not harm the environment
    - The measure must not increase source energy or CO2 emissions compared to the baseline technology.
* **Load-shifting measures** (e.g., battery energy storage, existing EV charge management, other controls) will be allowed when they are bundled with accompanying EE measures and result in an overall reduction in energy consumption at the meter.

Targeted projects include comprehensive retrofits, HVAC, refrigeration, RCx, lighting, and load shifting when paired with EE. Solar PV and other electricity generation are not eligible for incentives from the MSSR.

## Data Collection and Management

The availability and quality of AMI consumption data for proper baselines is fundamental to identifying NMEC program participants and quantifying impacts accurately. MSSR relies on CalTRACK Methods[[5]](#footnote-6) to determine data quality and sufficiency requirements for establishing appropriate baselines.

MSSR will work with PG&E to maintain quality data management and monitoring throughout the program life to ensure the reporting period results generate an accurate representation of the savings impacts. The AESC Team will provide fully auditable and verifiable records to track each meter that is modeled and its fate over the course of the program. PG&E will oversee QA/QC processes to verify measure installation.

MSSR and PG&E will oversee inventory of participant site and meter information required for proper weather station matching, and the project start and end dates needed to classify the blackout period between the baseline and the implementation (reporting) periods as required. Other required data elements, including participant contact details and location, meter IDs, dates of energy efficiency (EE) measure installation, energy efficiency measures installed, and project costs are the responsibility of PG&E. These data elements may be required for customer cohort tracking and management, program attribution, and evaluation studies.

### Data Security

Data security and customer privacy are paramount for effective, trustworthy customer programs. Data tools and systems used by AESC are built on modern industry standards and have undergone the auditing process to achieve SOC 2 compliance, which ensures best in class security and data management practices that meet the required “trust service principles” as defined by the American Institute of Certified Public Accountants (AICPA). Security agreements with PG&E and Aggregators are available to the CPUC upon request.

AESC receives customer data of customers enrolled in their program and non-participant data directly from PG&E, and as required by PG&E, maintains an annual IT data security assessment (Third-Party Security Review (TSR)).

### Data Collection

PG&E provides the AESC Team with program data according to the Program Data Plan specified in Section 5 of this Program Management Plan.

### Monitoring and Documentation QA/QC Over the Reporting Period

The MSSR relies on CalTRACK Methods for quality assurance and quality control procedures.

CalTRACK Methods are built into Praxis to automatically screen and provide notification for missing AMI and weather data.

The AESC Team will maintain quality data management and monitoring throughout the program life to ensure the reporting period results generate an accurate representation of the savings impacts that is repeatable. As part of this M&V Plan, The AESC Team will provide a fully auditable and verifiable record to track each meter that is modeled and its fate over the course of the program.

## Assessing Savings Uncertainty of Projects and Project Portfolios

Measuring the change in energy consumption at the building level is challenging due to the number of factors that influence energy use. Some factors are out of the modeler’s control (such as the uncertainty of human behavior and the volatility of the premise load), but others can be accounted for in the energy models. Population NMEC controls for the two observable factors demonstrated to drive energy use in buildings: outside temperature and occupancy patterns. Other factors that affect savings uncertainty are diminished when energy efficiency interventions are more effective at reducing energy use and when larger numbers of similar projects are aggregated into a portfolio.

*Effect size* influences the ability to measure energy savings accurately. It can be understood as the percent change in energy use following the intervention. Larger impacts will be easier to detect.

*Sample size* is another key factor. The influence of errors on the estimates of the average effect of premise interventions within a portfolio that are introduced from outlier sites is reduced as the size of a portfolio grows. The larger the numbers of projects aggregated into a portfolio, the more confidence we can have in the average estimates of savings of the portfolio because the impact of the energy use of individual buildings in the portfolio (and the customer behavior patterns that, in part, drive it) is diminished, assuming that random estimation errors are normally distributed.

*Load volatility.* The greater the unexplained volatility (variation) in premise loads, the greater the challenge in detecting changes in energy use resulting from the interventions. When portfolios are comprised of buildings that share common characteristics and installed measures are similar across projects, the inherent volatility on aggregated premise loads will decrease.

The key metrics for uncertainty for MSSR are:

* The Coefficient of Variation of the Root Mean Square Error [CV(RMSE)].
* Interval data sufficiency
* Fractional Savings Uncertainty (FSU)
* Minimum number of projects required to comprise a MSSR portfolio.

### Coefficient of Variation of the Root Mean Square Error [CV(RMSE)]

Coefficient of Variation of the Root Mean Square Error, or CV(RMSE), provides an indication of the quality of model fit, where a lower CV(RMSE) equates to better fit. In other words, the CV(RMSE) statistic provides an indication of how well one can model a building’s energy use, provided that you have its interval data and its associated temperature data. The NMEC Rulebook has not established threshold criterion for CV(RMSE) for meters to qualify for inclusion into Population-Level NMEC programs. At this time, PG&E’s MSSR requires a CV(RMSE) less than one [CV(RMSE) < 1.0] to be eligible to participate in the program.[[6]](#footnote-7)

There are a number of ways to compute CV(RMSE). More rigorous methods use out-of-sample testing and backcasting. In this case, the CV(RMSE) is used to determine whether customer meter data is sufficient to allow eligibility in the program. For this program, CV(RMSE) is defined as follows:

Where:

is the total energy use during period P.

is the predicted energy use during period p.

is the mean energy use during the baseline period.

is the total number of periods.

is the number of explanatory variables in the model.

### Interval Data and Temperature Data Baselines and Coverage

MSSR relies on CalTRACK Methods for interval data and temperature baselines and coverage requirements. The CalTRACK Methods Technical Appendix, “the baseline period for hourly methods is not set according to a particular time period – one year, for example – but is instead defined as sufficient when the full range of independent variables are observed. This is referred to as “data coverage” in Hourly Methods Documentation.”[[7]](#footnote-8) For fitting baseline models using hourly methods, consumption data must be available for over 90% of hours for every month for both the baseline and intervention periods. The number of days in the 365-day baseline period with data missing (zero / null readings) should not exceed 37 days (10%).[[8]](#footnote-9)

For fitting baseline models using hourly methods, temperature data may not be missing for more than six consecutive hours.[[9]](#footnote-10)

#### Interpolation of Missing Data

When recording interval data, the meter will infrequently return a null value for a single or multiple intervals due to the temperature or observed meter read being missing. The average percentage of null values for a given meter tends to be around 2-3%, which can be impactful to savings calculations and payment claims. As a result, MSSR will use the following methods to interpolate missing data.

* **Missing Temperature Data** -- Missing temperature values will be filled in with the average of the adjacent non-missing values, where for each missing value, one non-missing value before and after the missing value date will be averaged to fill in the missing value.  For example, if two consecutive hours are missing, then two hours before and two hours after the missing period will be averaged to fill in the two missing hours. When there are more than six consecutive hours of missing temperature data, the missing temperature data will not be filled in, and will be considered null.
* **Counterfactual Usage --** If temperature data is missing and unable to be interpolated, then counterfactual usage for those hours will not be calculated or interpolated.
* **Meter Data --** Avoided energy use is not calculated for hours when consumption data is missing. Meter data will not be interpolated. If performance meter data sufficiency degrades and does not meet the data sufficiency requirements (>90% values per month), AESC reserves the right to apply the Assigned Savings method to the missing data period or the entire M&V period.

### Minimum Number of Projects Required for a MSSR Portfolio

A key assumption of the Population-Level NMEC methodology is that when a sufficient number of projects are installed, any errors associated with measuring savings at the site level are offset by the aggregation of the population across all sites in a portfolio. Aggregation in turn leads to reduced measurement uncertainty, as population size is a key driver of uncertainty.[[10]](#footnote-11) The NMEC Rulebook does not establish a minimum number of projects required to constitute a portfolio and MSSR does not have a set minimum number of projects to be included in a portfolio.

### Fractional Savings Uncertainty (FSU)

Fractional Savings Uncertainty (FSU) is an error metric that can be used to express the uncertainty of a project’s savings estimate on a relative basis. FSU also can be used to express a portfolio’s (aggregated) savings estimate, that is based on the statistics from the projects’ energy models that produce it. Portfolio savings uncertainty as expressed by FSU diminishes as the number of projects included in a program increases and the average project energy savings (as a percentage of premise energy use) increases.

Ideally, MSSR Aggregators will target projects with a forecasted savings potential of 10% or more by including a diverse range of energy efficiency measures that include lighting, HVAC, water heating, refrigeration, and building envelope measures. A greater range of EE measures, and measures that result in deeper savings, typically represent greater financial commitments on the part of Customers, longer sales cycles, and a lower percentage of completed engagements. To mitigate risk, the AESC Tean will scrutinize early projects proposed by Aggregators and evaluate the reasonableness of savings projections.

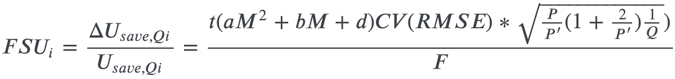
#### Population-Level NMEC

MSSR portfolio should be designed to meet the Fractional Savings Uncertainty (FSU) criteria established for the Population NMEC methodology established by ASHRAE Guideline 14 that is cited in the NMEC Rulebook of at least 90% confidence / 25% range.[[11]](#footnote-12)

#### Site-Level NMEC

Site-level projects will be screened to ensure projects have sufficient baseline model fit and meet the requirements of the PG&E M&V Requirements for Site-Level NMEC[[12]](#footnote-13). A cost effectiveness screening will also help determine project eligibility. Savings will be distinguishable from normal variations in consumption because projects will be required to meet CV(RMSE) of less than 0.25 and an FSU that is less than 50% at 90% confidence.

FSU at an individual site level is defined by the following equation:



Where:

t is the t-statistic and a, b, and d, are empirical coefficients described further in the online CalTRACK documentation.

M is the number of months in the reporting period.

P is the number of periods in the baseline

P’ is the number of periods in the baseline adjusted for autocorrelation

Q is the number of periods in the reporting period (days or billing periods for example)

F is the savings fraction defined as the savings divided by the counterfactual baseline usage.

Fractional savings uncertainty at an aggregated (portfolio) level is calculated via the following equation:

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N is the number of projects

Aggregating results to a portfolio mitigates issues related to model noise and increases confidence in savings estimates.

FSU is calculated based on the project’s daily model due to the inaccuracy of FSU equation when used on hourly models because hourly models have a high degree of autocorrelation. Gas models use an hourly form, and only electric models require an additional daily model for the FSU calculation. The model form used in a project’s daily model will match the model form selected for the hourly model based on the best candidate model.

Assuming that MSSR achieves a minimum of 100 annual installations of a diverse range of EE measures and achieves forecasted average savings of 8% of total participant consumption, PG&E forecasts that fractional savings uncertainty will fall within the bounds of the NMEC Rulebook requirements of FSU of +/- 25% at the 90% confidence level.

## Estimating and Measuring Savings

MSSR is designed for the eligible Customers within PG&E’s service area. Targeted building types, including consumption trends, existing equipment, and likely impact of the interventions, will be reasonably consistent for each Aggregator within the program.

The Program will perform targeted outreach to raise visibility and prompt enrollment from Customers and projects that may provide the most summer peak reduction and most valuable total system benefit.

* **Locational Targeting:** While MSSR is available to qualified Customers in all PG&E territories, the Program will prioritize targeting CZ 12, 13, 3 and 4 where summer peak is driven by addressable loads.
* **Market Segment Targeting:** The Program will prioritize targeting market segments with high summer usage, such as retail, real estate, grocery, convenience, restaurant, lodging, medical, warehouses, and refrigerated warehouse and public sector facilities including police, fire, jails, libraries, recreation, and emergency operations.
* **Targeted Measures:** Recommended measure bundles for targeted segments will be incorporated into Aggregator training and resources.

While all qualified PG&E customers and projects are welcome in the Program, this subset will be actively sought by the AESC Team. Aside from such targeted outreach, the crux of customer outreach and engagement will be performed by Enrolled Aggregators.

Initial Aggregator savings estimates will be reviewed and validated by Implementer. An Aggregator pre-payment is based on forecasted energy savings and trued up based on metered impacts following a 12-month Performance Period. Project reviews will be performed to ensure estimates are reasonable and based on industry best practice. The project review process will help ensure Customers receive reliable estimates of savings potential and that PG&E can have confidence in forecasted impacts and effectively manage performance payment budgets.

### Approaches for Ex-Ante Estimates of Project Savings

Energy savings calculations will be required to support the forecasted savings estimates used for initial prepayment incentive calculation and forecasted savings claims.

Aggregators are required to submit measure savings calculations to support each measure input in AESC’s Value Estimator Tool. Calculations must be non-proprietary, open and reviewable so reviewers can easily trace all calculation inputs to outputs and replicate savings values.

#### Population-Level NMEC

All calculation inputs and assumptions should be supported by documentation (e.g., equipment nameplate photos, trend data, spot measurements, design documents, equipment specifications, and/or technical workpapers, etc.). The calculation and documentation rigor

should match the level of savings (e.g. higher savings should be supported with more detailed savings calculations).

Table 8 describes the project documentation required from the Aggregator depending on the savings approach utilized. Other approaches may be considered, following review by AESC Team and PG&E approval.

Table 8 Pre-Installation Verification of Savings Estimation Options

|  |  |
| --- | --- |
| **Approach** | **Project Documentation from Aggregator** |
| Actuarial  Meter-based past performance | Past evaluation report, third-party evaluation or engineering assessment of a similar projects’ past performance utilizing whole building IPMVP Option C methods (e.g., CalTRACK, TOWT) |
| Modeled  Building simulation projection | Results of a building simulation model like Energy Plus, eQuest, or other similar IPMVP Option D modeling tool. Models calibrated with actual usage data are preferred. |
| Deemed  Pre-approved standardized measure-specific savings | Citation of a CPUC-approved or archived workpaper, or other DEER value. Measure-specific savings estimates from CalTF via the eTRM may also be appropriate but should be calibrated for to and through code performance. |
| Bottom-Up  Multiple approved and standardized measure-specific savings | Citation of a suite of deemed values (see above) combined to estimate the whole impacts of a project. Interactions between measures should be considered in the estimate. |

The AESC Team will review Aggregator savings estimates to confirm reasonableness of method (e.g., industry best practices, assumptions) and results pre- and post-installation. Aggregators may provide industry-accepted calculations, such as Praxis models, Excel workbooks, EnergyPlus, eQuest, or deemed values. Calculation methodology is dependent on the type of project; for example, Site-Level projects with multiple measures may require more complex Praxis or whole building-simulation calculations, while a simpler lighting project may utilize line-by-line excel calculations. The AESC Team will apply engineering best practices to ensure forecasted savings are reliable and realistic.

Energy savings review will focus on ensuring reasonableness of calculations and results to reduce the possibility of large swings between projected savings and actual measured savings. In addition, QC reviewers will apply learnings about each installer as newer projects are reviewed.

The Program may perform either pre- and/or post-installation inspections, via onsite visit, video-enabled virtual visits, or through photographs, as deemed necessary and appropriate.

#### Site-level NMEC

Site-level NMEC projects will require a Project Feasibility Study (PFS) and site-level M&V plan that fully detail the scope of work and energy calculations. Project application packages must adhere to all requirements of the PG&E Site-level NMEC pathway including requirements detailed in the most updated versions of the CPUC NMEC Rulebook, PG&E Resource Savings Rulebook, and PG&E M&V Requirements for Site-Level NMEC. Site-level projects will be reviewed and approved by the Program and PG&E’s Quality Control and Communications (QC&C) Team before project installation can begin. Site-level NMEC projects may be selected for additional CPUC staff review at any stage of the project; however, the CPUC review does not restrict or delay project development.

### Savings Calculator Used as the Basis for Aggregator Incentive Compensation

Aggregator Incentive Compensation is issued as two payments:

1. Initial Payment to be paid upon project installation based on the full ex-ante estimates
2. Final True-up Payment to be paid upon completion of the 12-month M&V period based on performance and net of the Initial payment.

The Aggregator incentive payments are based on the TSB of the Aggregator’s quarterly cohort. Payments are based on the incentive rates ($/TSB) and incentive caps by project type as outlined in Section 4.3.7.

The initial and final payment are calculated using the TSB as calculated by California Energy Data and Reporting System (CEDARS), Cost Effectiveness Tool (CET), using the Avoided Cost Calculator Vintage “2022/E-5228.”

Payable energy savings used in the final true-up payment are calculated using AESC’s Praxis based on the measured savings calculation for 12 months (365 days) of post-installation meter-based performance, adjusted by the matched granular profile to control for exogenous factors. Final payable savings and savings reported to the CPUC will be calculated as Avoided Energy Use for Pop-NMEC projects, and Normalized Savings for Site-Level NMEC projects. Normalized savings will use long-term weather based upon the most up-to-date weather files (e.g., CZ2022[[13]](#footnote-14)).

### Calculations of Savings and Peak Impacts

Measured energy savings and peak impacts for input into the CEDARS CET will be calculated by Praxis usings the Avoided Energy Use[[14]](#footnote-15) (energy savings) using multiple regression methods that are consistent with industry guidelines established by The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE Guideline 14)[[15]](#footnote-16), CalTRACK Methods[[16]](#footnote-17), and meet International Performance Measurement and Verification Protocol (IPMVP Option C)[[17]](#footnote-18) requirements.

The steps for calculating measured savings and peak impacts are as follows:

1. Establishing the baseline model by normalizing for weather and occupancy
2. Compute avoided energy use
3. Establish granular profile baseline model by normalizing for weather an occupancy
4. Compute granular profile avoided energy use
5. Adjust gross avoided energy use for exogenous impacts using granular profile savings and the differences-in-differences methodology

Baseline models are established using 365 days of pre-installation meter data. Savings are reported after 365 days of post-installation M&V.

Electric models use hourly AMI data and report hourly kWh results. Gas models use daily AMI data and report daily therm results. The sum of the 365 days of M&V avoided energy use will be reported as the annual energy use to be used in the CET for the TSB and incentive calculation.

In D.21-12-011, the Commission specifically defined peak as 4:00 p.m. to 9:00 p.m. from June to September. Forecasted peak impacts will be reported using for the peak period using the same methodology as the PG&E approved “SEM-NMEC Demand Savings Calculator Using CET Loadshapes.xlsx” which gives the fraction of on-peak kW savings per annual kWh savings by E3MeaElecEndUseShape. The tool gives the on-peak fraction per E3MeaElecEndUseShape which is then multiplied by annual energy savings to calculate on-peak kW savings. Measured peak impacts will be reported utilizing hourly performance data. The traditional energy efficiency program definition which estimates the peak impacts achieved by the program during the peak periods defined in the October 11, 2019, DEER Resolution will not be used.[[18]](#footnote-19) Peak impacts will be calculated and reported as Lifecycle Summer Peak kW. Lifecyle Summer Peak kW is equal to the project weighted EUL\* Summer Peak kW, where Summer Peak kW is during the summer peak period of 4 p.m. to 9 p.m., June 1 and September 30.

#### Population-Level NMEC

Baseline candidate regression models will be selected using an automatic model selection algorithm. Praxis will analyze and assess multiple model forms and select the best possible baseline candidate model, the model with the lowest CV(RMSE). Hundreds of candidate models will be evaluated for each project meter(s) using the following model forms:

* Simple Linear Regression
* Three-Parameter
* Four-Parameter
* Five-Parameter
* CalTRACK
* Gradient Boosting Machine Learning Model (XGBoost)

#### Site-level NMEC

Similar to Population-level NMEC, an automatic model selection algorithm will be utilized, but the Site-Level NMEC pathway will allow engineering input and discretion for model form and independent variable selection in order to customize the model to the customer’s primary energy drivers. Simple linear regression and machine learning models will allow engineers to specify up to ten custom independent variables. Site-Level NMEC will allow custom NRE adjustments to the baseline and performance periods when they are detected. Custom NRE adjustments will be reviewed during project approval quality assurance and quality control (QA/QC). Site-Level M&V plans will be provided with project submission according to the requirements of the CPUC NMEC Rulebook and PG&E M&V Requirements for Site-Level NMEC. Praxis can be used to generate the Site-Level M&V plan template with baseline model development/predictability analysis based on Praxis generated information. The template will align with “PG&E M&V Requirements for Site-Level NMEC: Measurement and Verification Plan Template”.

### Normalization for Independent Variables

The primary independent variable that influences whole building energy consumption for commercial buildings is usually outdoor air temperature (dry-bulb). Therefore, all baseline candidate models tested by Praxis attempt to normalize energy use to temperature, or some derivation of it (e.g. heating/cooling degree days, or temperature change points).

The Three-, Four-, and Five-Parameter models test for temperature normalization. The Simple Linear Regression, CalTRACK, and XGBoost candidate models test for temperature and additional variables such as time-based variables like hour of the day, hour of the week, month, and season. The CalTRACK model includes an additional occupancy proxy variable.

Simple Linear Regression, Three-, Four-, and Five-Parameter models are implemented in Praxis as outlined in ASHRAE Guideline 14-2023: Measurement of Energy, Demand and Water Savings[[19]](#footnote-20).

CalTRACK is implemented in Praxis through EEmeter[[20]](#footnote-21)

XGBoost is implemented in Praxis through the XGBoost python package[[21]](#footnote-22)

Praxis utilizes EEweather[[22]](#footnote-23) service for weather station matching and retrieving temperature data from the National Climatic Data Center (NCDC)[[23]](#footnote-24) database.

All data, code, and scripts needed to replicate model predictions and counterfactuals will be made available to 3rd Party reviewers through each site’s model download file, a csv that contains all model data, variables, statistics, and other parameters.

### Adjustments to Gross Savings for Participants in Demand Response Programs

One of the intents of MSSR is to encourage dual participation with PG&E Demand Response Programs. However, in order to avoid double-counting of savings between the two programs, the following adjustments will be made for sites dually participating in the program. For sites participating in demand response (DR) events, MSSR intends to exclude DR response days from the baseline period and set savings for DR days to zero in the reporting period. The entire DR day will be “blacked out” to exclude the full DR response which typically includes load increases prior to the event, such as pre-cooling or pre-charging. This approach will simplify savings estimation and will avoid double counting of load reductions. Event data for sites participating in DR programs must be provided as outlined in the “Demand Response Participation” section. The AESC Team and PG&E will explore other ways to address and improve dual participation going forward.

### Adjustments to Gross Savings to Control for Exogenous Factors

Population NMEC controls for one observable exogenous factor (i.e., outside temperature) that affects energy use, but not others (e.g., economic factors, natural adoption of commercial equipment). Many consumption data analyses compare changes in energy use observed in the treatment group to a carefully constructed group of similar eligible customers that didn’t participate in the program over the same time period to adjust savings estimates for exogenous changes. Typically, comparison groups are constructed after the characteristics of program participants are understood and, when energy change in such groups is compared to the change observed in program participants, provide a means to estimate the impact of exogenous change, with program free ridership being an important exception.[[24]](#footnote-25)

To control for exogenous forces that may have affected energy use on program participants and non-participants alike, the calculations of energy savings produced by Population NMEC of the effect of the intervention (treatment) can be compared to changes in energy use during the same period to a comparison group using a Difference-in-Differences (DiD) methodology. Non-participating customers are matched to customers participating in the program within industry sector (NAICs codes) and climate zone based on similarities in interval data. Pre-post differences of energy use of the treatment group are compared to pre-post differences of energy use of the control group to estimate the treatment effect as is illustrated in the figure below.[[25]](#footnote-26)

Figure 3 Pre-Installation Verification of Savings Estimation Options

A diagram of a graph

Description automatically generated with medium confidence

The same savings model selected by automatic model selection algorithm as described in Section 6.5.3: “Calculation of Savings and Peak Impacts”, including method and software, will be applied to understand participant and comparison group changes in energy consumption. The calculated incremental impact of the program over the non-participant population will adjust both performance payments and claimable savings for the portfolio reported to the Program Administrator. Adjustments to gross savings[[26]](#footnote-27) for exogenous effects will be made using the DiD methodology, calculated on a percentage basis and then applied to the treatment group counterfactual.

#### Use of Granular Profiles in Place of Comparison Groups Using the Difference-in-Differences (DiD) Approach

In place of a comparison group comprised of actual non-participant customer data, PG&E will provide the AESC Team with *granular profiles[[27]](#footnote-28),* which are load profiles that characterize the energy consumption of specific segments of the non-participant customer population over the time of the baseline and intervention periods. The granular profiles are generated from interval data (hourly for electric, daily for gas) from non-participant non-residential and residential customers. As such, the profiles characterize the energy use of unique customer strata that are not being treated by the AESC Team.[[28]](#footnote-29) The profiles are defined by business type (NAICS codes), size (defined by energy use), and climate region. For sites lacking a matched granular profile, or for which the meter is not impacted by typical external or market factors (e.g., exterior lighting on its own meter), the AESC Team may choose to use a different methodology.

The AESC Team will match each participant to its appropriate profile according to business type, size and climate region. Using a DiD method, the AESC Team will adjust site-level gross savings estimates. The segmentation approach for defining the granular profiles is being refined so that it incorporates learnings from the original research conducted for PG&E on granular profiles and will be supplied when available.

#### Alternative Method in Case of Outlier Buildings

There are rare instances in which granular profiles do not provide accurate adjustments in highly unique buildings. In these instances, PG&E will do the following:

* Assess the accuracy of the synthetic controls at the site level. If the site-level out-of-sample CV(RMSE) is above 0.75, PG&E will identify a matched control for the participating customer.
* If site-level out-of-sample CV(RMSE) is higher for the matched control group DiD, then PG&E will use the matched control to calculate savings and payments for the identified site.

For sites lacking a matched granular profile or for which the meter is not impacted by typical external or market factors (e.g., exterior lighting on its own meter), the AESC Team reserves the right to calculate claimable and payable savings without a granular profile adjustment. Other scenarios can be justified by the AESC Team with PG&E approval.

#### Application of the Default Net-to-Gross Ratio

In addition to the DiD adjustment using granular profiles, PG&E will apply the 0.95 default net to gross ratio adopted for Commercial NMEC programs as specified in the October 12, 2019, DEER Resolution to account for free ridership.[[29]](#footnote-30) This adjustment will be applied on top of the comparison group adjustment that also adjusts for free ridership and thereby provides a more conservative estimate of net savings.

## Outlier Site and Site-Specific Non-Routine Event Identification

Outlier site and site-specific non-routine event identification is specific to the type of NMEC project. Population-level NMEC projects do not allow for calculated adjustments specific to the project site and instead use “pre-set methods” that are “applied uniformly to all sites in the program” as required by the CPUC NMEC Rulebook. Site-level NMEC projects allow for site specific adjustments when described in the project’s site-level M&V plan.

A non-routine event (NRE) is an event that changes the energy consumption within the measurement boundary (project meter(s)) that is unrelated to the project’s installed energy efficiency measures’ scope. NREs may include change in building load (add/remove equipment, add/remove IT load), change of occupancy, renovation/construction, change of building use, change in setpoints, etc.

### Population Level NMEC

#### Pre-Screening

In the process of customer acquisition, Aggregators will verify with customers that they do not plan to install major new load additions or subtractions, solar PV, or EV charging in the reporting year (post-program implementation). In addition, the AESC Team will work with PG&E to determine if customers are already participating in other energy efficiency programs, have installed an EV charging system, or solar PV or battery storage within the baseline year. In these instances, the AESC Team will determine if the baseline can be adjusted to account for those interventions. Program participation will be at the AESC Team’s discretion, with PG&E approval. Aggregators will also identify if customers are participating in a demand response program in order to comply with conditions specified in the “Demand Response Participation” section. Finally, PG&E will ensure that savings claims will not be duplicated by cross-referencing known participants in other programs. PG&E will be responsible for providing this data to the AESC Team on a monthly basis to ensure accurate monthly program forecasting and reporting, per reporting CPUC requirements. If data is not provided in a timely fashion and sites are enrolled that have participated within the previous year, project reservations, tracking, and payments to Aggregators will be maintained.

#### Baseline Data

Customers who experience a baseline, site-specific NRE (such as a wholesale change to equipment operating at the site, or a significant change in building hours or operations, or erratic energy consumption that cannot be normalized well to temperature during the baseline period) may be excluded from the program. Some scenarios in which they may remain include:

* Affected metered energy consumption can be excluded from the analysis without violating minimum data sufficiency standards.
* The site-specific NRE does not materially affect the project and population savings.
* Other situations with AESC Team and PG&E approval.

#### Performance

The AESC Team will not make site-specific NRE adjustments. Projects will be regularly and systematically screened in Praxis for possible site-specific NRE according to the following procedure:

* **Excess Savings:** Calculate the GP adjusted savings compared to GP adjusted counterfactual for each project on a quarterly basis. Any projects with quarterly savings that exceed 50% will be flagged as an NRE. Justification can be given to override the NRE flag. For example, if the project savings estimate exceeded the threshold.
* **Deterioration of Model Fit:** After 12 months of M&V, a regression model will be fit to the post-install consumption data and if the CV(RMSE) is greater than 0.75, then the project will be flagged as a site-specific NRE. The regression model form for this test will match the form used to define the baseline model.

A project may be classified as having an NRE if the savings are determined to be invalid and unrelated to the approved/installed project measure.

### Non-Routine Event Treatment – Forecasted Savings Method

Projects that are flagged as having one or more NRE in the Performance period, or when savings are no longer valid, will transition to assigned savings where the project savings will be estimated using a consistent adjustment applied uniformly to all NRE projects, called the “NRE Treatment – Forecasted Savings Method.” Projects will be clearly marked as NRE throughout the software. Projects marked with NRE will have payable and claimable savings based on forecasted savings (according to the assigned default load shape) and the Aggregator’s realization rate. Realization rates will be calculated based on the Aggregator’s portfolio performance (excluding NRE sites), as the ratio of realized savings to forecasted savings. The Forecasted Savings Method process is detailed below.

1. Measured savings will be cleared from the project and replaced with the forecasted annual savings, distributed hourly (daily for gas) according to project’s primary measure’s load shape, and adjusted by the Aggregator’s realization rate.
2. An interim realization rate will be established based on the Aggregator’s portfolio of non-NRE treated sites and include all performance available at the time the project is marked as NRE Treatment. The interim realization rate will be used to report monthly and quarterly savings for the project while the project is still in the M&V period.
3. Once the NRE treated site has completed the full 12-month M&V period, a new realization rate will be calculated using the Aggregator’s portfolio of non-NRE Treated Sites and all performance data up to that date. The new realization rate will replace the project’s interim realization rate, and forecasted savings will be recalculated for the entire M&V period.
4. The project will receive a final true-up payment based on the recalculated results.

## Demand Response Participation

Customer sites may participate in both the MSSR and a separate Demand Response (DR) program. To qualify for Dual Enrollment, the following conditions must be met:

1. MSSR Aggregators agree that the site may participate in DR events during the energy efficiency measurement period.
2. MSSR Aggregators must disclose any separate Demand Response program participation during enrollment for each site.
3. Participation in the MSSR does not hinder or violate the Aggregator’s obligations to deliver DR resources in other markets (programs, CAISO, contracts, etc.).

Dual participation requires timely information about called events and reliable transfer of this data. The Aggregator of a site or sites enrolled in both MSSR and a DR program will be subject to different requirements depending on which party provides the data. The two types of Aggregator requirements are listed below:

* **Type 1: Dual Participation in PG&E DR Programs in which PG&E has Agreed to Transfer Event Data** -- For PG&E DR programs, PG&E may elect to send event data for certain programs each month, in which case event data would no longer be required from Aggregators for these programs. Aggregators will be notified if this occurs.
* **Type 2: Dual Participation in a DR or CAISO Program for Which Data is Not Provided by PG&E** -- For scenarios in which AESC is not receiving event data from PG&E, Aggregators must complete the onboarding process before enrollment and comply with the following additional requirements:

1. MSSR Aggregator completes the onboarding process for event data submittal, demonstrating ability to provide the program with event data required in the specified format. This must be completed before any Dually Participating site is enrolled.
2. MSSR Aggregator provides all participating event data, timestamped, and in the specified format for each site within 15 days following the end of the previous month. If no events have occurred, Aggregator must submit the same event data template, confirming that there have been no events.
3. MSSR Aggregator attests to the accuracy and completeness of the submitted event data. The event data may be audited in the future.

Failure to provide this information accurately, in the specified format, or in the timeframe specified may result in delay of payment until the following payment period and suspension from the MSSR Program.

By default, event days from separate Demand Response programs will be blacked out from M&V and MSSR payment. As the MSSR matures, disaggregation to separate EE and DR impacts during event hours may be used to increase potential for Aggregator payment from MSSR. Possible demand response disaggregation methods are described in the following Demand Response Disaggregation section.

## Payments, Measures, and Cost Effectiveness

### Customer Payments

There are no predetermined direct-to-customer payments or incentives. Incentives will be paid solely to Enrolled Aggregators. Customers will acknowledge and accept that the incentives will be used to buy down the cost of the project and will be paid directly to the Enrolled Aggregator, through an agreement that the incentive payment is assigned to the Aggregator. Enrolled Aggregators will acknowledge that the incentives must be used to buy-down the cost of the project and are responsible for designing a market approach that supports this buy-down.

The customer-assigned incentive will be based on the estimated and delivered TSB generated by their projects based on the incentive rates outlined in Section 4.3.7.2 “Aggregator Incentive Payments”. The incentive is limited to 100% of the project cost, to buy down the cost of the project. In addition to receiving the customer’s incentive to buy-down the cost of the customer’s project, Enrolled Aggregators are eligible to receive an additional project payment up to 10% of the project cost, or 120% of the TSB minus the paid customer incentive, whichever is less.

MSSR uses the following payment terms:

* 120% of the project’s estimated incentive payments are reserved at project approval; and capped at 110% of the project costs.
* The Program will pay incentives in two installments:

1. Once the project is installed, inspected (if applicable), and post-installation project documentation is approved by the AESC Team and PG&E, the Payment Performance Notification Letter (PPNL) will be issued. Once the PPNL is issued, 45% of the forecasted incentive will be issued.
2. Final Payment after 12-months of measurement and verification and submittal of all supporting project documentation is approved by MSSR and PG&E. The remaining incentive will be issued based on the measured savings multiplied by the incentive rate, net the prepayment.

Any project with a total forecasted incentive value above $500,000 requires additional PG&E written approval before the project is committed.

These payment terms are designed in accordance with guidance provided in the NMEC Rulebook and all known Commission directives related to terms and conditions.

### Calculation Total System Benefit

Aggregator incentive payments are designed to compensate Aggregators directly on the Total System Benefit of delivered metered net savings achieved by their cohorts.

Total System Benefit (TSB) is defined as an expression, in dollar value at a discounted rate, of “lifecycle energy, ancillary services, generation capacity, transmission and distribution capacity, and GHG benefits of energy efficiency activities, on an annual basis.”[[30]](#footnote-31) More generally, TSB represents the total benefits or “avoided costs,” that a measure (or project) provides the electric and natural gas systems. The definition accounts for increased supply cost as a reduction in benefits when electricity increases[[31]](#footnote-32). The metric encourages interventions to target “high value” load reduction and longer-duration energy savings while being fuel agnostic.[[32]](#footnote-33)

* *Total System Benefit = Sum of All Net Benefits – Sum of All Net Increased Supply Costs*
  + *Sum of All Net Benefits = (Net Electric Benefits + Net Gas Benefits + Net Other Benefits)*
  + *Sum of All Net Increased Supply Costs = (Net Electric Supply Costs + Net Gas Supply Costs + Net Other Costs)*

MSSR will rely on the official TSB as calculated by California Energy Data and Reporting System (CEDARS), Cost Effectiveness Tool (CET), using the Avoided Cost Calculator Vintage “2022/E-5228.” A project’s weighted EUL assigned savings load shape, and annual energy savings, will be the primary inputs.

Aggregators can maximize TSB and incentive payments by promoting projects with high energy savings, long EULs, and measures that target summer peak savings.

Incremental refrigerant benefits can be included in the TSB and incentive calculation (as Net Other Benefits in the above calculation) for refrigerant measures that reduce lifecycle GHGs through changes in refrigerant to natural or ultra-low Global Warming Potential refrigerants, such as self-contained unit upgrades, refrigeration system replacements, and gas swaps. The “2022 ACC Refrigerant Calculator v1b.xlsx” is required to claim refrigerant benefits.

If a project with solar is accepted, Payments for projects involving solar in the baseline or reporting year will be adjusted based on non-IOU fuel source analysis, and may be paid annually rather than quarterly, per the AESC Team’s discretion.

## Effective Useful Life (EUL)

MSSR may include, but is not limited to, the following interventions: lighting, HVAC, water heating, building envelope, refrigeration, and controls-based technologies. The measures listed in Tables A through D are utilized by the AESC Team to calculate weighted EUL values for each project as applicable. The EULs listed, combined with the default savings load shapes, are used to calculate TSB for submitted interventions and for savings claims. The Program is technology-agnostic, and a wide array of measures may be installed to meet the savings and demand impact targets. Load shapes and EULs used by MSSR are based on best available research from eTRM measure packages and customer load shapes. New load shapes may be added at the AESC Team’s discretion.

In calculating TSB and savings claims, MSSR will combine measure attributes in accordance with the CPUC’s guidance on “Weighted Average Expected Useful Life/Net to Gross Method[[33]](#footnote-34),”

which simply calculates the weighted EUL as the total lifecycle savings divided by the total annual savings of the project measure package by fuel type.

Table 9 Electric Retrofit Measure EULs

|  |  |  |
| --- | --- | --- |
| **Technology/Intervention** | **EUL** | **Load Shape (E3 Measure End Use Shape)** |
| Lighting | 12 | DEER: NonRes\_Indoor\_Non\_CFL\_Ltg |
| Lighting – Exterior | 12 | 2 = Commercial Outdoor Lighting[[34]](#footnote-35) |
| Lighting – 24/7 Operation | 12 | DEER: NonRes\_Indoor\_Non\_CFL\_Ltg |
| HVAC Retrofit | 15 | DEER: NonRes\_HVAC\_Split\_Package\_AC |
| Heat Pump Retrofit | 15 | DEER: NonRes\_HVAC\_Split\_Package\_HP |
| Chiller | 20 | DEER:NonRes\_HVAC\_Chillers |
| Refrigeration | 12 | DEER:NonRes\_HVAC\_Chillers |
| Refrigeration - Compressors/Condensers/Display Case | 15 | DEER:NonRes\_HVAC\_Chillers |
| Building Envelope | 20 | DEER:NonRes\_HVAC\_Split\_Package\_AC |
| Process – Pumps/Motors | 15 | DEER: NonRes\_Indoor\_Non\_CFL\_Ltg |
| Storage Water Heaters | 15 | DEER: NonRes\_Indoor\_Non\_CFL\_Ltg |
| Heat Pump Water Heater | 10 | DEER: NonRes\_Indoor\_Non\_CFL\_Ltg |
| Appliances – Cooking Equipment | 12 | DEER: NonRes\_Indoor\_Non\_CFL\_Ltg |
| Appliances – Dishwasher | 15 | DEER: NonRes\_Indoor\_Non\_CFL\_Ltg |
| Food Services – Equipment | 10 | DEER: NonRes\_Indoor\_Non\_CFL\_Ltg |
| Refrigeration – Rapid Close Doors for Refrigerated Storage Areas | 8 | DEER:NonRes\_HVAC\_Chillers |

Table 10 Gas Retrofit Measures

|  |  |  |
| --- | --- | --- |
| **Technology/Intervention** | **EUL** | **Load Shape (E3 Measure End Use Shape)** |
| Boiler | 20 | Annual |
| Tankless Water Heater | 20 |
| Appliances - Cooking Equipment | 12 |
| Appliances - Dishwasher | 15 |
| Building Envelope | 20 |
| Food Service - Equipment | 10 |
| Heat Pump Retrofit | 15 |
| Heat Pump Water Heater | 10 |
| HVAC Retrofit | 15 |
| Storage Water Heater | 15 |

Table 11 Electric and Gas BRO Measure EULs

|  |  |  |
| --- | --- | --- |
| **Technology/Intervention** | **EUL** | **Load Shape (E3 Measure End Use Shape)** |
| HVAC – Maintenance & Optimization | 1 | DEER: NonRes\_HVAC\_Split\_Package\_HP |
| Refrigeration – Maintenance & Optimization | 1 | DEER:NonRes\_HVAC\_Chillers |
| Behavioral Interventions | 1 | DEER: NonRes\_Indoor\_Non\_CFL\_Ltg |
| HVAC – Maintenance & Optimization with Maintenance Plan | 3 | DEER: NonRes\_HVAC\_Split\_Package\_HP |
| Refrigeration – Maintenance & Optimization with Maintenance Plan | 3 | DEER:NonRes\_HVAC\_Chillers |
| Behavioral Interventions with Maintenance Plan | 2 | DEER: NonRes\_Indoor\_Non\_CFL\_Ltg |

## Add-On Measure EUL

The Aggregators shall use the guidance provided in Resolutions E-4818 and E-5152 when determining the EUL of add-on equipment measures. Add-on equipment not installed directly on the host equipment, and thus described as ‘permanent’, will have EULs that are independent of the remaining useful life of the underlying host equipment. Add-on equipment measures installed directly on the existing equipment will have an EUL that is “equal to the lower of the RUL of the modified parent system or equipment or the EUL of the add-on component.”[[35]](#footnote-36) In such cases, the AESC Team will apply the ⅓ rule for the EUL of the parent system as described in the EE policy manual.[[36]](#footnote-37) The program will require Aggregators to attest if their measure is an add-on installed directly on an existing system and will work to provide consistent messaging on which measures are likely to be considered permanent or temporary add-ons.

Supporting documentation will be required to document any add-on equipment measure that will be installed permanently (not installed attached to the underlying equipment) and that will not be replaced if the underlying equipment is replaced. The installation of the add-on equipment will be verified at the post-installation phase. If the verified installation does not align with the proposed installation (permanent or temporary) then the savings calculations will be re-evaluated with the correct measure/EUL to determine the estimated incentive.

Eligible add-on measures for this program (including but not limited to Table 9 of E-4952) are listed in Table 12.

Table 12 List of Add-On Measure EULs

|  |  |  |  |
| --- | --- | --- | --- |
| **Technology/Intervention** | **EUL** | **RUL** | **Load Shape (E3 Measure End Use Shape)** |
| Pipe Insulation | 11 | 5 | DEER:NonRes\_Indoor\_CFL\_Ltg |
| Duct Insulation | 20 | 5 | DEER:NonRes\_HVAC\_Split\_Package\_AC |
| Floor Insulation | 20 | 10 | DEER:NonRes\_HVAC\_Split\_Package\_AC |
| Roof/Ceiling Insulation | 20 | 10 | DEER:NonRes\_HVAC\_Split\_Package\_AC |
| Water Heater Tank Wrap | 7 | 5 | DEER:NonRes\_Indoor\_CFL\_Ltg |
| Compressor Heat Recovery | 14 | 5 | DEER:NonRes\_HVAC\_Split\_Package\_AC |
| VFD/VSD Measures | 15 | 5 | DEER:NonRes\_HVAC\_Split\_Package\_AC |
| Add Economizer | 10 | 5 | DEER:NonRes\_HVAC\_Split\_Package\_AC |
| Evaporative Pre-Cooler System | 15 | 5 | DEER:NonRes\_HVAC\_Split\_Package\_AC |
| Building Envelope - Cool Roof | 15 | 6 | DEER:NonRes\_HVAC\_Chillers |
| Building Envelope - Window Film | 10 | 6 | DEER:NonRes\_HVAC\_Chillers |
| Evaporative PreCooler System | 15 | 5 | DEER:NonRes\_HVAC\_Split\_Package\_AC |
| HVAC - New Controls | 15 | 5 | DEER:NonRes\_HVAC\_Split\_Package\_AC |
| Lighting – Controls | 12 | 4 | DEER:NonRes\_Indoor\_Non\_CFL\_Ltg |
| Plug Load - Controls | 12 | 4 | DEER:NonRes\_Indoor\_Non\_CFL\_Ltg |
| Process - VFD/VSD | 15 | 5 | DEER:NonRes\_Indoor\_Non\_CFL\_Ltg |
| Process Cooling - Controls | 15 | 5 | DEER:NonRes\_Indoor\_Non\_CFL\_Ltg |
| Refrigeration - Controls | 15 | 5 | DEER:NonRes\_HVAC\_Chillers |
| Refrigeration - Insulation | 15 | 5 | DEER:NonRes\_HVAC\_Chillers |

## Risk Mitigation

The program is very low risk as the actual energy savings are measured based on NMEC methods and incentive payments are based on measured savings. Program spending is limited by the TSB achieved as calculated by the CET. All of the incentive to the Aggregator is based on the annual net savings achieved at the meter.

## To Code Savings Compliance

The M&V Plan described herein will quantify the savings achieved compared to an existing conditions baseline as authorized in AB802, SB350, and detailed in the methods sections of this M&V plan.

Compliance with OP 2 of D.17-11-006 is met in this section by responding to the ordering questions below.

**Question:** Where does the to-code savings potential reside?

**Answer:** Since the MSSR measures and claims savings at the meter, capturing to-code savings may be part of any given MSSR project. MSSR is not specifically targeting to-code measures, but MSSR does allow for and incent projects that bring equipment/buildings up to code and does expect to realize to-code savings. Typically, these savings will be bundled with above-code savings.

**Question:** What equipment types, building types, geographical locations, and/or customer segments promise cost-effective to-code savings?

**Answer:** Though MSSR has proposed targets for the full program, MSSR is not targeting a specific technology or PG&E territory location in the commercial customer segment for to-code savings. However, since population-level NMEC and the related performance-based payments approach does not discriminate between measures or to-/above-code all to-code savings are realized for any project.

**Question:** What kinds of barriers are preventing code-compliant equipment replacements?

**Answer:** High capital equipment costs present financial barriers that delay equipment upgrades. Thus, equipment is often not brought up to code. Customers without program intervention and financial incentives will continue to operate equipment to the effective useful life of the equipment, and in some cases, beyond.

**Question:** Why is natural turnover not occurring within certain markets or for certain technologies?

**Answer:** Equipment is replaced when there is a compelling business reason – such as failure, attractive terms, or business needs. Equipment is not typically changed simply due to new code requirements. Thus, despite code updates, old equipment will remain in place until there is a compelling business reason to change it.

**Question:** What program interventions would effectively accelerate equipment turnover?

**Answer:** MSSR’s NMEC structure naturally lends itself to accelerating equipment turnover and overall adoption of to-code solutions.  By using existing condition NMEC savings to accelerate equipment turnover, the incentives will be based on all savings, not just to-code or above-code savings, which help make projects cost effective for the customer.

## Tools, Methods, Analytical Approaches and Software Criteria

The AESC Team will use the following tools to check eligibility, calculate benefits and incentives, perform M&V, and track projects and incentives.

* Customer Site Eligibility Tool: Automatically identifies if a site meets program requirements including CV(RMSE), data sufficiency, and lack of program double dip.
* Value Estimation Tool: Calculates the weighted EUL, TSB, and incentive for entered projects.
* Praxis M&V Tool: Tracks savings, performs project and portfolio M&V, calculates and enables approval of EULs, kW, kWh, and therm savings, and tracks incentive payments.
* Praxis Measure Calculators: Whole Building/HVAC and Lighting calculators estimate project kWh, kW, GHG, and customer utility cost savings based on existing conditions baselines and customer CZ and utility tariff. This optional tool may be used by Aggregators to estimate project savings.
* Automated Application Portal: Centralized, cloud-based portal for Aggregators to submit and track project application materials.
* Aggregator Portal: Password-protected website providing Aggregators program resources and links to tools, including application checklists.
* Salesforce: Customer Relationship Management (CRM) software that tracks all Enrolled Aggregators, Customers, and Projects (status, savings, costs, etc.) and can easily pass data to PG&E’s CRM, Energy Insight.

Compliance with Rulebook for Programs and Projects Based on Normalized Metered Energy Consumption (v2.0) is given below for each category.

**Savings Calculation:** All analytical methods, tools, algorithms and software used in the savings and incentive or compensation payment calculations, will be made available to commission staff and its consultants upon request.

**Measurement Period:** savings determinations are made by comparing at least 12 months (365 days) of post-intervention energy consumption to at least 12 months (365 days) of pre-intervention consumption. The comparison uses the Avoided Energy Use method of calculating savings.

**Transparency, Documentation and Replicability, Ex-post Evaluation:** The methods used to calculate savings for the program are documented in this M&V plan sufficiently such that savings calculations are able to be replicated by the PAs, Commission, and its impact evaluators. All NMEC Projects and project data will be collected as a whole and stored to be made available to the parties upon request.

**Consistent, Pre-set Methods:** For the Population-level projects, the measurement method and calculation software is pre-set and applied uniformly to all sites in the program.

**Proprietary Methods and Software:**

* 1. Although Praxis core codebase is proprietary, Praxis utilizes savings measurement methods that are publicly available, widely used, and supported by industry documentation (ASHRAE, LBNL, CalTRACK) that are referenced in this M&V plan. All data, code, and scripts needed to replicate results will be made available to commission staff and its consultants upon request. The code and data will be updated and maintained so a 3rd party reviewer can replicate results seamlessly without discrepancy.
  2. The program-level M&V plan herein describes the appropriateness of the methods and software, in Section 6.5.

1. https://calepa.ca.gov/wp-content/uploads/sites/6/2022/05/Updated-Disadvantaged-Communities-Designation-DAC-May-2022-Eng.a.hp\_-1.pdf [↑](#footnote-ref-2)
2. A Residential sub-program may launch after the launch of the Commercial sub-program. Updates the M&V Plan will be made to address any applicable changes or additions necessitated by the Residential sub-program. [↑](#footnote-ref-3)
3. The Program can serve commercial facilities with NAICS codes that begin with the following two digits: 11, 21, 22, 23, 31, 32, 33, 42, 44, 45, 48, 49, 51, 52, 53, 54, 55, 56, 61, 62, 71, 72, 81, and 92. The following NAICS codes 92 include agricultural and industrial meters and need to be screened on a case by case basis: 11, 21, 22, 23, 31, 32, 33, 42, 48, 49, 56, 81. Additional NAICS codes may be considered with AESC Team and PG&E approval. [↑](#footnote-ref-4)
4. https://www.cpuc.ca.gov/about-cpuc/divisions/energy-division/building-decarbonization/fuel-substitution-in-energy-efficiency [↑](#footnote-ref-5)
5. CalTRACK Technical Appendix, Section 2.2., available at <http://docs.caltrack.org/en/latest/methods.html>. [↑](#footnote-ref-6)
6. Note that the CV(RMSE) must be less than 1.00 for the eligibility screening but must be less than 0.75 during the measurement period. If CV(RMSE) is greater than 0.75 during measurement, the project will be flagged for non-routine event analysis. [↑](#footnote-ref-7)
7. CalTRACK Methods Technical Appendix, Section 2.2.1.2. [↑](#footnote-ref-8)
8. CalTRACK Technical Appendix, Section 2.2.1.2, available at <http://docs.caltrack.org/en/latest/methods.html>. [↑](#footnote-ref-9)
9. CalTRACK Technical Appendix, Section 2.2.4.1, available at <http://docs.caltrack.org/en/latest/methods.html>. [↑](#footnote-ref-10)
10. Uncertainty diminishes as 1/sqrt(n), where n=population size. For daily models, CV(RMSE) = 1.0, 10% savings, FSU can be ~77% (for an individual project), but with a project population of 10, FSU would decrease uncertainty to be 10 sites to diminish uncertainty to FSU < 25%. [↑](#footnote-ref-11)
11. NMEC Rulebook 2.0, Section II.2.C, p. 12. [↑](#footnote-ref-12)
12. PG&E M&V Requirements for Site-Level NMEC, available at https://www.pge.com/assets/pge/docs/save-energy-and-money/energy-savings-programs/pge-site-nmec-mv-requirements.pdf [↑](#footnote-ref-13)
13. Typical Weather Files of long-term average weather are available at http://calmac.org/weather.asp [↑](#footnote-ref-14)
14. Avoided Energy Use is determined by adjusting the baseline period energy to the reporting period conditions by using routine adjustments and non-routine adjustments. [↑](#footnote-ref-15)
15. ASHRAE Guideline 14-2023 –Published guideline. Supersedes ASHRAE Guideline 14-2014. Measurement of Energy, Demand and Water Savings <https://www.ashrae.org/technical-resources/standards-and-guidelines/titles-purposes-and-scopes>. [↑](#footnote-ref-16)
16. CalTRACK Methods https://docs.caltrack.org/en/latest/methods.html [↑](#footnote-ref-17)
17. International Performance Measurement & Verification Protocol: Concepts and Options for Determining Energy and Water Savings, Volume I, Revised March 2002 DOE/GO-102002-1554, International Performance Measurement & Verification Protocol Committee <https://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp>. [↑](#footnote-ref-18)
18. <http://docs.cpuc.ca.gov/publisheddocs/published/g000/m232/k459/232459122.pdf>. [↑](#footnote-ref-19)
19. ASHRAE Guideline 14-2023 available at <https://webstore.ansi.org/standards/ashrae/ashraeguideline142023> [↑](#footnote-ref-20)
20. EEmeter is available at <https://github.com/openeemeter/eemeter> where methods are fully explained at <https://docs.caltrack.org/en/latest/methods.html> [↑](#footnote-ref-21)
21. XGBoost documentation available at <https://xgboost.readthedocs.io/en/stable/python/>. [↑](#footnote-ref-22)
22. EEweather documentation available at https://eeweather.readthedocs.io/en/latest/ [↑](#footnote-ref-23)
23. https://www.ncei.noaa.gov/cdo-web/ [↑](#footnote-ref-24)
24. U.S. Department of Energy, National Renewable Energy Laboratory, November 2017, *Whole-Building Retrofit with Consumption Data Analysis Evaluation Protocol*. The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures. Section 3.2. [↑](#footnote-ref-25)
25. Source: <https://www.publichealth.columbia.edu/research/population-health-methods/difference-difference-estimation> [↑](#footnote-ref-26)
26. "Adjusted gross" is, in this context, net of other activity on the grid, whereas the final "net" adjustment is considering free ridership alone. [↑](#footnote-ref-27)
27. Granular profiles are provided directly by PG&E or available publicly at https://www.calmac.org/customer\_load\_shapes\_pge.asp [↑](#footnote-ref-28)
28. Granular profiles were tested using two groups of randomly selected Commercial PG&E customers: one group that had recently participated in PG&E’s energy efficiency programs, and another that had not. See: Population NMEC Control Group Accuracy Assessment (2/16/2022, Demand Side Analytics) available at <https://www.calmac.org/publications/PGE0476.01.pdf>. Subsequent to that research, new granular profiles were created to incorporate a broader set of Commercial customers. [↑](#footnote-ref-29)
29. <http://docs.cpuc.ca.gov/publisheddocs/published/g000/m232/k459/232459122.pdf>. [↑](#footnote-ref-30)
30. Assessment of Energy Efficiency Potential and Goals and Modification of Portfolio Approval and Oversight Process (2021) Decision (D.) 21-05-031, p. 9. [↑](#footnote-ref-31)
31. Increased supply costs are typical for electrification projects and not included in Praxis’ TSB calculation. Increased energy as negative electric savings will be calculated the same was positive energy savings but have a negative TSB impact. [↑](#footnote-ref-32)
32. D.21.05-031, May 20, 2021, p. 9. [↑](#footnote-ref-33)
33. Rolling Portfolio Program Guidance; Weighted Average Expected Useful Life/Net to Gross Method. Excel Spreadsheet titled “Combining\_Measures\_Claims-DRAFT”. The spreadsheet calculator has not been updated to reflect new DEER values so it can be used only with respect to the proposed method. <https://www.cpuc.ca.gov/General.aspx?id=6442456320>. [↑](#footnote-ref-34)
34. “2 = Commercial Outdoor Lighting” is a time-of-use load shape and for the purpose of this program has been converter to hourly and adjusted to produce TSB similar to the CET calculation. [↑](#footnote-ref-35)
35. https://www.caetrm.com/media/reference-documents/CPUC\_Resolution\_E-4807\_December\_2016.PDF [↑](#footnote-ref-36)
36. https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/e/6442465683-eepolicymanualrevised-march-20-2020-b.pdf. [↑](#footnote-ref-37)