# Attachment D - Measurement and Verification Plan

The purpose of this Measurement and Verification (M&V) Plan (Plan) is to describe how energy savings will be quantified for the Business Energy Pro P4P Pilot and subsequently how performance-based payments will be calculated. Additionally, the Plan outlines the process for the reporting and detection of Non-Routine Events (NREs) and how associated Non-Routine Adjustments (NRAs) will be calculated.

The Plan is adapted from the Investor Confidence Project's M&V Plan Template: Option C - Measurement and Verification, IPMVP Option C, Whole Facility.

CalTRACK 2.0[1], which provides transparent and peer-reviewed protocols for Option C implementation, is also incorporated. The CalTRACK methods were developed in an open and transparent stakeholder process that used empirical testing to define replicable methods for calculating normalized metered energy consumption using either monthly or interval data from an existing condition baseline.

## Baseline Period Energy and Conditions

The P4P Pilot adopts an existing condition baseline. The baseline period for each Project consists of the 12 months immediately before implementation of the initial Intervention (energy efficiency work).

Savings are the avoided energy use calculated during the Performance Period (the 3-year period during which Portfolio Managers will be compensated for calculated energy savings). An avoided energy use value will be calculated using the following equation:

**Equation 1**

Avoided Energy Use (or Savings) = (Counterfactual Baseline Energy – Performance Period[2] Energy)

Counterfactual Baseline Energy represents what energy consumption was calculated to have been during the Performance Period if an energy efficiency Intervention had not occurred. This is determined by modeling the relationship between baseline energy consumption and baseline weather conditions, then using Performance Period weather conditions to predict energy consumption. The Avoided Energy Use calculation will also be adjusted using data from a comparison group, as described in the "Adjustments for COVID19" section below.

To calculate energy savings, a customer's utility account number is required to match a Project with a customer's energy consumption data. It shall be the responsibility of the Portfolio Manager to provide utility account numbers to the Advanced M&V (AMV) Solution Provider via their Customer Relationship Management (CRM) system or a similar database. If a Portfolio Manager fails to submit the correct customer utility account number associated with a Project site's utility meters, energy savings cannot be calculated for that Project, and the Project will not be included in a Portfolio Manager's performance payment. The Project will not be eligible for any form of performance payment until the Portfolio Manager provides the correct eligible utility account number.

If a Project does not have a utility account number that matches to utility consumption records, or if the Project record is missing other data fields required for savings calculation, the Project will be listed under "Disqualified Meters". Portfolio Managers will be responsible for monitoring the list of disqualified meters in their Portfolio via their instance of the AMV Platform.

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[1] http://www.caltrack.org/
[2] For additional information, see: http://docs.caltrack.org/en/latest/methods.html#

## Responsibilities

**Table 1. M&V Roles and Responsibilities**

| Role | Responsibilities |
|---|---|
| Advanced M&V (AMV) Solution Provider | • Pull utility data transmissions, Portfolio Manager Project data, and weather data required for savings calculations into the AMV Platform.<br>• Calculate and track energy savings and Basis-of-Payment for Portfolio Payment Recommendation.<br>• Detect potential NREs and report flagged Projects to the Evaluation Contractor.<br>• Apply approved NRAs.<br>• Conduct analysis of eligible customers and provide customer acquisition targeting metrics. This includes calculating R2 and CVRMSE as part of the baseline goodness of fit model. |
| Evaluation Contractor[3] | • Review reported and detected NREs and approve NRAs.<br>• If necessary, perform interviews and site visits as appropriate to confirm the presence of NREs.<br>• Document NRA decision and explanation for Portfolio Manager(s)' reference.<br>• Provide input to NYSERDA regarding M&V-related issues. |
| NYSERDA | • Oversee and approve adjustments and improvements to the AMV Platform, including the use of updates made to the CalTRACK methodology, and the Pilot's M&V processes.<br>• Review and approve Payment Recommendation provided by AMV Solution Provider. |
| Utility Administrator | • Manage contracts with Portfolio Managers.<br>• Provide utility data to AMV Solution Provider.<br>• Review and approve Payment Recommendation approved by NYSERDA and execute recommended payment to Portfolio Manager.<br>• Detect NREs that specifically arise from customers that participate in National Grid energy efficiency projects after their P4P intervention is completed |

## Analysis Procedures

Separate regression models shall be constructed for electricity and natural gas consumption for each Project by the AMV Solution Provider. Consumption data from each account shall be modeled as base load, heating load, and cooling load. Heating load and cooling load are assumed to have a linear relationship with heating and cooling demand, as approximated by heating and cooling degrees[4].

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[3] In addition to these responsibilities, an Evaluation Contractor will be responsible for conducting customer process surveys, project data verification site inspections, and in-depth interviews with pilot stakeholders.

[4] The balance point temperatures selected for counting heating and cooling degrees will be determined for each fuel type, based on the average daily temperatures which yield the highest R-squared across a range of candidate balance points in a set of regression calculations.

## Data Quality Control

Data quality procedures will be administered by the AMV Solution Provider and conform to CalTRACK Compliance specifications, as they relate to daily estimation methods and as published at http://docs.caltrack.org/en/latest/methods.html.

## Detection of Non-Routine Events (NREs)

Non-Routine Events (NREs) are changes in building energy use that are not attributable to changes in the independent variables used in the baseline model, primarily outdoor air temperature, nor to the Intervention that occurred at the Project site. In the case of an NRE, the savings calculation, Equation 1 may have to be adjusted.[5] While COVID19 and its associated impacts may be considered an NRE, the section "Adjustments for COVID19" describes how energy impacts related to COVID19 will be accounted for.

### Step One: Baseline Period NREs

The Utility Administrator will periodically screen its Customers and provide contracted Portfolio Manager(s) with a list of eligible Customers that may participate in the P4P Pilot. Eligible customers must have:

- Sufficient baseline energy consumption data for all meters serving the site/utility account[6]
- A baseline model that meets goodness-of-fit criteria, defined as model CV(RMSE) of less than 1.0[7]
- Not participated in a National Grid energy efficiency program during the baseline period

### Step Two: Performance Period NRE Reporting

Portfolio Managers may flag that an NRE has occurred at a Project site by indicating, at minimum, the following in either their database or CRM:

- A Boolean flag indicating an NRE has occurred
- A timestamp representing when (exact or approximate) the NRE occurred
- An indicator of what type of NRE has occurred (as categorized in Table 3 below)
- A link to documentation of the NRE

The AMV Solution Provider will collect this information on a nightly basis along with all other Project data. The AMV Solution Provider will remove Projects with reported NREs from a Portfolio Manager's main Portfolio. If an NRA for a project is approved, payment will be calculated for the Project separately from the main Portfolio. This payment will be processed in the Performance Quarter in which the Project's next Annual Adjusted Payment would have been processed. This payment will represent an annualized value and will be paid out as regularly scheduled for the duration of the Project's performance period. After this payment, the Project will be considered closed, and no further payments will result from this Project. NRE documentation may be stored using any secure means agreed to by the Portfolio Manager and NYSERDA, provided it allows documentation to be linked to a project and is easily accessible to NYSERDA staff on an ongoing basis. Solutions may range from keeping the documentation in cloud storage to a file transfer via SFTP to NYSERDA on a monthly basis.

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[5] Granderson, Jessica, Paula Gruendling, Peter C. Jacobs, Christina Torok (2018). *Guidance for Pilot Level M&V Plans: Normalized Metered Energy Consumption Savings Estimation in Commercial Buildings, DRAFT*, Prepared for California Public Utilities Commission Energy Division by Lawrence Berkeley National Laboratory

[6] Refer to requirements as specified in the CalTRACK Methods.

[7] While all sites with a baseline model CV(RMSE) of less than 1.0 will be eligible for participation, Portfolio Managers will be able to view the calculated CV(RMSE) of each eligible site and make informed targeting decisions based on the available data.

Table 3 below provides the NREs that the Portfolio Manager or Utility Administrator may report and the acceptable forms of verification that may be used to demonstrate their occurrence. As part of the contracting process, each Portfolio Manager and Utility Administrator will formally agree to a list of claimable NREs and method of documentation. Without one of the forms of verification listed below, a Project with the relevant NRE will not be approved for an NRA. Acceptable forms of verification will be documented, defined, and updated on an as-needed basis throughout the course of the P4P Pilot through the mutual agreement of NYSERDA, the Utility Administrator, and the Portfolio Manager.

**Table 3. Reportable NREs and Acceptable Forms of Verification[8]**

| NRE ID | NRE Description | Load Increase or Decrease | Forms of Verification |
|---|---|---|---|
| *NRE001 Example* | *Addition or removal of major energy using equipment* | *Increase or Decrease* | *Invoices for equipment, customer Q&A* |
| *NRE002 Example* | *Change in Occupancy* | *Increase or Decrease* | *Customer Verification* |
| *NRE003 Example* | *Change in square footage* | *Increase or Decrease* | *Building Permit, customer Q&A, secondary data from third-party database* |
| *NRE004 Example* | *Customer rescinds data access permission* | *N/A* | *Customer correspondence revoking authorization* |

## Step Three: Performance Period NRE Detection

During a Project's Performance Period, the AMV Solution Provider shall screen for NREs as follows:

- On an ongoing basis:
  - **Interruptions in utility consumption data.** If the AMV Solution Provider is no longer able to pull utility account data because of account closure or revocation of authorization to view and leverage account data, a Project will be flagged.
  - **Indications of net metering.** If utility account data indicates previously unnoted net metering, the Project will be flagged.
- On an annual basis:
  - **Savings relative to baseline consumption.** Recalculate savings as a percentage of baseline consumption for all Projects. Flag Projects with savings greater than plus or minus fifty percent (±50%) of the baseline consumption.
  - **Deterioration in normalization model goodness of fit.** Fit normalization model to the Year 1 post-retrofit consumption data and recalculate CV(RMSE) at the end of Year 1. If the Year 1 model has a CV(RMSE) of greater than .75, then the Project will be flagged for a potential NRE. If an NRE is not detected during Year 1, the model from Year 1 will then be fit using consumption data from Year 2 at the end of Year 2. If the Year 2 CV(RMSE) is greater than .75, then the Project will be flagged for a potential NRE. The Year 2 process will be followed for subsequent years as necessary.

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[8] Table 3 currently contains examples provided for clarification purposes only; they are not intended to represent ideal, desired, or representative reportable NREs or ways in which to verify NREs. As part of the contracting process, each Portfolio Manager and Utility Administrator will formally agree to a concrete list of claimable NREs and methods of documentation. The acceptable forms of verification will be documented, defined, and updated on an as-needed basis in the M&V Plan. The Portfolio Manager will propose forms of verification for NYSERDA/Utilities acceptance.

During a Project's Performance Period, National Grid shall screen for NREs that specifically arise from customers that participate in National Grid energy efficiency projects after their P4P intervention is completed.

NYSERDA may adjust thresholds for flagging possible NREs as needed. If such an adjustment were to be made, 30-day notice would be provided to all Portfolio Managers.

If an NRE is detected, the Project will be flagged under "disqualified meters". Portfolio Managers will be responsible for monitoring the list of disqualified meters in their Portfolio via their instance of the AMV Platform.

## Step Four: NRA Approval

The AMV Solution Provider will supply the Evaluation Contractor with a list of all Projects that have reported or detected NREs. The Evaluation Contractor will then perform the following tasks on a monthly basis:

- Review NREs reported by Portfolio Managers to ensure proper documentation has been included as contractually required.
    - If the Project is not approved for an NRA, the Evaluation Contractor will notify the Portfolio Manager, and the Portfolio Manager will have the opportunity to resubmit the NRE with the appropriate documentation.
- Investigate possible detected NREs through follow-up phone interviews with Portfolio Managers and utility account holders, secondary data resource review, and/or site visits, as appropriate. Portfolio Managers shall act in good faith to assist the Evaluation Contractor in investigating possible NREs. The Utility Administrator may also be solicited for information regarding Customer account status and concurrent participation in other energy efficiency programs.

Projects with NREs may then receive NRAs per the protocols specified in Step 6. Suspicious patterns of NREs may trigger investigation by the Evaluation Contractor.

## Step Five: Preparing Projects for Non-Routine Adjustments

Once the Evaluation Contractor approves the NRA to be applied, they will document and share approvals with the AMV Solution Provider. If a Project was approved, the AMV Solution Provider will ensure that the Project is flagged to receive an assigned value resulting from an NRA. If the NRA for a Project is denied, the AMV Solution Provider will move the Project back into the Portfolio Manager's main Portfolio, where savings calculations and payments will continue as normal. If this for some reason is not possible (i.e. saving cannot be calculated for this Project), the Project will continue to be listed under the disqualified meter's, and no performance payment will be made in association with that Project until the issue resulting in the disqualification is otherwise resolved.

## Step Six: Calculating Non-Routine Adjustments

NRA methodologies are defined below and binding for contracted Portfolio Managers. NRAs will be calculated and tracked by the AMV Solution Provider in the AMV Platform.

The adjustment mechanism is one of the following:

1. For Projects with more than one year of Performance Period meter data prior to the NRE, calculate first-year normalized metered energy consumption savings and set it to be the projected annual savings value for the Year 2 and/or Year 3 Annual Adjusted Payments. This savings value will then be multiplied by the Payment/Energy Unit value to calculate the performance payment.

2. For Projects with less than one year of Performance Period meter data prior to the NRE, the portfolio actual savings divided by the predicted portfolio savings multiplied by 100 multiplied by the Project's predicted savings value will be used as the foundation of the assigned value.

The following function will be used to calculate assigned values:

Assigned Value =
n_years_elapsed * cents_per_kwh * (
   (ms_elec_pred_annual * (ms_elec_y1_portfolio / ms_elec_pred_ann_portfolio)) * I_y1
   + (ms_elec_y1) * I_y2
   + ((ms_elec_y1 + ms_elec_y2) / 2) * Max(I_y3, I_complete)
)
+ n_years_elapsed + cents_per_therm * (
   (ms_gas_pred_annual * (ms_gas_y1_portfolio / ms_gas_pred_ann_portfolio)) * I_y1
   + (ms_gas_y1) * I_y2
   + ((ms_gas_y1 + ms_gas_y2) / 2) * Max(I_y3, I_complete))
)

Where:

- n_years_elapsed (units: none), The number of *complete* years elapsed since the project intervention active date
- cents_per_kwh (units: MMBTU/kWh), Base pricing in cents per unit kWh
- cents_per_therm (units: MMBTU/therm), Base pricing in cents per unit Therm
- ms_elec_pred_annual (units: kWh), Prediction of electricity metered savings in the first year of reporting for this meter
- ms_gas_pred_annual (units: therm), Prediction of gas metered savings in the first year of reporting for this meter
- ms_elec_yN_portfolio (units: kWh), Sum of electricity metered savings in Nth first reporting year for all meters in portfolio without NREs and meeting data sufficiency requirements of first reporting year electricity savings
- ms_gas_yN_portfolio (units: therm), Sum of gas metered savings in Nth reporting year for all meters in portfolio without NREs, meeting data sufficiency requirements, and with a valid prediction of first reporting year gas savings
- ms_elec_yN (units: kWh) Electricity metered savings in reporting year N; value is 0 if meter reports gas usage or until N complete years of sufficient data are available following the intervention period.
- ms_gas_yN (units: therms) Gas metered savings in reporting year N; value is 0 if meter reports electricity usage or until N complete years of sufficient data are available following the intervention period.
- ms_gas_yN_jan_to_feb (units: therms) Gas metered savings from calendar months January and February in reporting year N; value is 0 if meter reports electricity usage or until N complete years of sufficient data are available following the intervention period.
- ms_elec_pred_ann_portfolio (units: kWh), Sum of electricity metered savings predictions for all meters in portfolio without NREs, meeting data sufficiency requirements, and with a valid prediction of first reporting year electricity savings
- ms_gas_pred_ann_portfolio (units: kWh), Sum of gas metered savings predictions for all meters in portfolio without NREs, meeting data sufficiency requirements, and with a valid prediction of first reporting year gas savings
- I_yN (units: none), in indicator for active year N with a value of 1 when year N-1 data is available but complete data for year N is not yet available, 0 otherwise
- I_complete: indicator with a value of 1 when data extends through full contract term length of three years from project intervention, 0 otherwise

- Max function: returns the maximum value encountered in the list. For instance, Max(0, 1, 0) == 1, and Max(0, 0, 0) == 0

Each Project approved for an NRA will receive an Assigned Value using the function above. NRAs will be calculated and applied to performance payments in the place of measured savings by the AMV Solution Provider.

## Force Majeure

In rare instances, a Project site may be impacted by a catastrophic occurrence (i.e. fire, flooding, etc.). Provided the Portfolio Manager furnishes appropriate documentation demonstrating that such an instance has occurred, an NRA will be applied for the impacted Project site as detailed above.

## M&V Protocols to Detect Malicious Intent

Portfolio Managers will be subject to the below protocols if they are found to be engaging in either of the following: (a) intentionally inflating the incidence of NREs in a manner that would be financially favorable to the Portfolio Manager; or (b) disguising the impact of NREs to resemble expected energy savings. Examples include, but are not limited to, Customer recruitment focusing on Customers that expect future reductions in baseload energy consumption; installation of secondary heating sources or power generation fueled by non-metered fuels; and fraudulent reporting.

The following requirements shall apply:

1. Portfolio Managers shall not systematically target, recruit, or enroll Customers who expect to experience a decline in energy consumption due to non-routine events within the coming twelve months.
2. Portfolio Managers shall not misrepresent the scope of energy efficiency improvements in such a way as to disguise non-routine changes to energy consumption baselines as true energy savings.

While it is anticipated that Portfolio Managers will participate in the pilot in good faith, these requirements will ensure the accurate evaluation of a framework designed to open new market opportunities for energy efficiency service providers and benefit NY utility customers.

## Methodology for Detecting NRE Patterns Prohibition 1

If the frequency of consumption reducing NREs cannot be explained by random occurrence within a Portfolio (i.e. a pattern of NREs triggers concern), the Portfolio will be examined by the Evaluation Contractor to assess whether the NREs are statistically indicative.

## Methodology for Detecting Fraudulent Reporting Prohibition 2

NYSERDA or a representative will randomly inspect Participating Customers' Projects to verify that installed measures reported by Portfolio Manager(s) have been installed. Project data verification site inspection failure(s) will trigger required corrective action(s) to the job. These corrections will be made by the Portfolio Manager at the expense of the Portfolio Manager. Additional penalties may include dropping Projects from the Portfolio and/or suspending the Portfolio Manager's participation in the pilot. More severe penalties may be enacted by the Utility Administrator, depending on the severity of the fraudulent activity.

## Adjustments for COVID19

To account for the impacts of COVID19 on energy consumption, a routine adjustment to gross savings will be used to ensure Portfolio Managers are not underpaid/overpaid for achieved savings. This adjustment will utilize a comparison group of non-participating customers from the pilot territories that meet all eligibility requirements for the pilot. Comparison group customers will be selected randomly and will be stratified using characteristics such as location (i.e. county), observed COVID19 impacts, and

energy consumption (high vs low). This stratification will be based off the Portfolio Manager's anticipated target customers as reported by the Portfolio Manager at the start of the pilot. The Comparison Group will be evaluated on a quarterly basis to ensure that it is reflective of the acquired portfolio. If the Comparison Group is no longer reflective of the treatment group (e.g. energy consumption patterns are no longer statistically similar), the Comparison Group may need to be resampled. To the extent possible, Portfolio Managers will be informed of the process for selecting comparison group customers in advance of pilot launch and performance payments being issued.

The CalTRACK 2.0 methodology will be applied in an identical fashion to both the treatment and the comparison group. The 12-month baseline period and 36-month performance period will be set to occur over the same time period for both participants (treatment group customers) and the comparison group customers. Then the change in energy consumption for each comparison group customer will be calculated as avoided energy use in accordance with the information in this document and external CalTRACK 2.0 documentation. Performance payments will be calculated as the difference in differences between the treatment group customers' avoided energy use and the comparison group customers' avoided energy use.

The details of the process used to select comparison groups will be informed by the Department of Energy-funded comparison group working group led by Recurve Analytics, Inc. The working group will facilitate open discussion via bi-weekly meetings and a public GitHub forum in which all parties (National Grid, Portfolio Managers, and NYSERDA) may participate in an open and equitable manner. An amendment to this M&V Plan will be made to document specifics, including any potential deviations from the recommendations of the Comparison Group Working Group, and links to appropriate public documentation as necessary.

Portfolio Managers will be provided with the explicit comparison group selection criteria used to create the comparison group. Portfolio Managers may provide suggestions to Recurve to improve comparison group construction methodology. Recurve will consider Portfolio Manager suggestions, but Recurve alone will have sole discretion over the comparison group construction methodology.