

Enhancing California’s NMEC Programs;

Technical Reviewer’s Perspective

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ABSTRACT

In 2015, Assembly Bill 802 allowed use of normalized metered data to estimate claimable energy savings in California. Since then, the investor-owned utilities, Community Choice Aggregators, Regional Energy Networks, and third-party implementers funded by the Public Purpose Program surcharges have designed and launched more than thirty emerging meter-based programs throughout the state of California to bring deep energy retrofits to their customers in all sectors and harvest meter-based energy savings and peak demand reduction.

In this study, authors share their experience and perspective on how to improve the review process and minimize the turnaround time of site-level Normalized Metered Energy Consumption (NMEC) projects. The current study, which is based on review of implemented site-specific NMEC projects in PG&E territory between 2020 and 2022 for various non-residential building types and sizes, presents lessons learned from policy and technical review of program implementation plans, project M&V plans, analytical models, savings estimates, cost estimates, estimated useful life analysis, and performance reports. This study also lists common items in advisory dispositions issued by California Public Utilities Commission (CPUC) reviewers along with recommendations to avoid pitfalls in future projects. A review of common analytical tools for meter-based savings calculations supplements the study to support implementers in their modeling process. In addition, authors discuss COVID19 impact as a non-routine event and review non-routine adjustment methods of data analytics to isolate and exclude COVID19’s impact from the savings claim. Finally, the study outlines several recommendations to expedite the technical review process, reduce the turn-around time, and reduce the gap between the submitted and approved energy savings.

Introduction

Assembly Bill 802 (AB-802) required that the CPUC shall, by September 1, 2016, authorize electrical corporations or gas corporations to provide financial incentives, rebates, technical assistance, and support to their customers to increase the energy efficiency of existing buildings based on all estimated energy savings and energy usage reductions, taking into consideration the overall reduction in normalized metered energy consumption (NMEC) as a measure of energy savings (Assembly Bill No. 802 2015). Authors believe that normalization, referenced in AB-802, is a statistically valid method to adjust pre- and post- project energy use to a common set of conditions, so that savings can be accurately calculated. In typical “existing buildings”, especially commercial buildings, energy use is normalized based on weather data and occasionally other variables such as occupancy and time of week, shown to influence energy consumption.

Since 1985, scientists and researchers have been investigating analytical methods to normalize the energy data with respect to meteorological parameters and quantify the impact of

energy efficiency measures (EEMs) on building energy use. One of the earliest methods was Princeton Scorekeeping Method (PRISM), which is a statistical procedure that processes a year of monthly billing data from a house or building to produce a weather-adjusted Normalized Annual Consumption index, along with other physically meaningful parameters and extensive reliability statistics (Fels, Energy conservation scorekeeping: The prism method 1985). Some exemplary works with PRISM are (Fels, Hurvich and Reynolds, PRISM Research: Yesterday, Today, and Tomorrow 1986), (Burnett and Lesser 1986), and (Hwang 1989).

With evolution of Advanced Metering Infrastructure (AMI) in electric meters, utility companies now have direct access to whole building electricity use at a granular scale. AMI introduced the challenge of analyzing energy savings using AMI meter data with whole building energy use rather than at end-use level. The challenge was that utility companies could only analyze an energy efficiency program where sufficient data exists and that data is of sufficient quality. As an example of using utility AMI data for evaluating energy conservation programs, Richard Raustad et al. described the energy use evaluation and analysis method used for utility company programs (Raustad, et al. 2020).

While researchers have published the outcome of their work on the analytical methods of energy savings calculations using AMI data and how AMI data has improved the accuracy of realized energy savings calculations, there have not been studies on the review process of site-level NMEC projects. This paper aims to introduce the most common analytical methods in energy savings calculation and bring light to current challenges in the review process of NMEC projects based on empirical data. By providing assessment recommendation for each of the challenges, authors intend to help other program administrators (PAs) throughout California and beyond in their process improvement activities in NMEC programs and increase their customer satisfaction.

Evolution of NMEC programs

NMEC Predecessors

California energy efficiency has seen explosive growth in NMEC and other meter-based programs in the past several years. Early versions of NMEC programs were offered to the public sector as early as 2004 in the form of the Monitoring Based Commissioning Program (MBCx) through the UC/CSU/IOU Energy Efficiency Partnership in California, with third party MBCx and RCx programs based on the findings from the Public Sector began proliferating across California in 2009 (Meiman, Anderson and Brown 2012). While many of these incentive programs were eventually sunset due to regulatory and cost effectiveness concerns, they allowed hundreds of IOU customers to save significant energy with a meter-based approach and set the stage for future NMEC programs. Figure 1 illustrates the timeline of regulatory progress for NMEC.

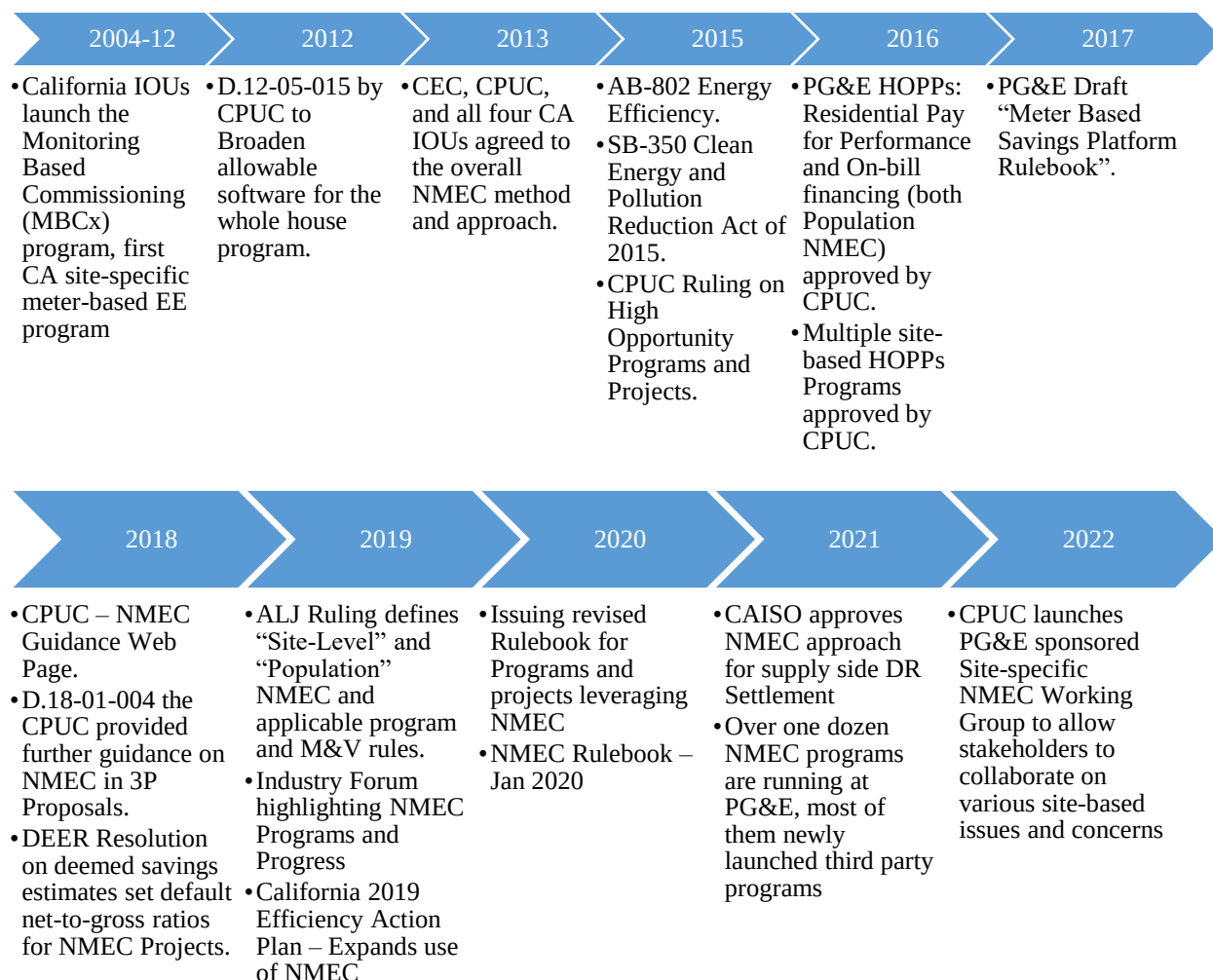


Figure 1. NMEC Regulatory Progress Timeline

AB-802 and the Advent of NMEC

In 2015, the State of California passed Assembly Bill 802 (Assembly Bill No. 802 2015), which allowed Energy Efficiency Programs to use NMEC savings from existing conditions beginning the following year. AB-802 authorized IOUs to provide financial incentives, rebates, technical assistance, and support to their customers to increase the energy efficiency of existing buildings based on all estimated energy savings and energy usage reductions, taking into consideration the overall reduction in normalized metered energy consumption as a measure of energy savings. AB-802 further authorized high opportunity projects and programs (HOPPs). Shortly after the passage of AB-802, Senate Bill No. 350 Clean Energy and Pollution Reduction Act of 2015, authorized utilities to use NMEC methods with an existing conditions baseline: "The energy efficiency savings and demand reduction reported ... shall be measured taking into consideration the overall reduction in normalized metered electricity and natural gas consumption where these measurement techniques are feasible and cost effective" (SB-350 Clean Energy and Pollution Reduction Act of 2015).

The HOPPs ruling released at the end of 2015 established the framework for the first set of today's California NMEC programs, by setting standards around how AB-802 would be

interpreted and how these new NMEC projects and programs would be measured, verified, and evaluated (Rulemaking 13-11-005 2015). Several IOUs leveraged the HOPPs framework to establish both site-specific and population NMEC programs operating under HOPPs rules. In 2020, the CPUC issued a ruling implementing the NMEC Rulebook 2.0 which summarizes CPUC requirements for NMEC Programs where energy savings are based on normalized metered energy consumption (NMEC) (Rulemaking 13-11-005 2020). The purpose is to provide a list of the directives and policies that have been established by the Commission for the administration and implementation of such programs.

As of March 2022, there were a total of 34 energy efficiency programs in the State of California to help people and communities to reduce energy consumption and claim it based on the savings observed on the meter. These programs include site-level NMEC, population-based, and hybrid programs and are administered by one of the following PAs: Pacific Gas and Electric Co (PG&E), SoCal Gas, San Diego Gas and Electric, Southern California Edison, Marin Clean Energy (MCE), Bay Area Regional Energy Network (BayREN), and Southern California Regional Energy Network (SoCalREN). Among all these PAs, PG&E which serves the second largest number of customers in the US, runs the greatest number of meter-based energy efficiency programs. The table below outlines the existing meter-based programs administered by PG&E:

Table 1. Meter-based Programs administered by PG&E

Program Name	Sector(s)	Program Implementer
Advanced Energy Program for High Tech and Biotech (AEP)	Third Party	Commercial
Agricultural Energy Savings Action Plan (AESAP)	Third Party	Agriculture
Commercial & Public Sector Whole Building Performance-Based Retrofit Program	PG&E	Commercial, Public
Continuous Energy Feedback Program	Third Party	Residential
CoolSave Energy Smart Grocer	Third Party	Commercial
Government And K-12 Comprehensive Program	Third Party	Public
Government And K-12 Program	Third Party	Public
Healthcare Energy Fitness	Third Party	Commercial
Hospitality Program	Third Party	Commercial
Industrial Systems Optimization Program (ISOP)	Third Party	Industrial
NetOne Commercial Efficiency Program	Third Party	Commercial
On-Bill Financing Alternative Pathway	PG&E	Commercial, Public
Residential Pay-for-Performance Pilot	Third Party	Residential
Smart Labs Laboratory Technical Assistance Retrofit	Third Party	Commercial
Strategic Energy Management - Food Processing	Third Party	Industrial
Market Access Program	Third Party	Commercial

NMEC Calculation Tools

The NMEC programs listed above are allowed to utilize any calculation tools to carry out NMEC calculations as long as these tools meet CPUC's requirements listed in NMEC Rulebook 2.0. The Rulebook states that "all analytical methods, including tools, algorithms and software used in savings and incentive or compensation payment calculations, must be made available to Commission staff and its consultants upon request." PG&E instituted additional requirements in the PG&E Resource Savings Rulebook, which requires savings claims and implementer performance payments to be based on measurement methods and calculation software or tools that are publicly available; sufficiently documented that their results can be replicated, reviewed, and understood; and approved by PG&E prior to program launch (PG&E Platform Team 2020).

Therefore, some of the proprietary cloud-based platforms for building portfolio management that include an IPMVP Option C or NMEC savings calculations would not be approved tools for savings claims, however they may be used in payments between the implementer and customer. In contrast, there are some great open-source NMEC tools for desktop analysis that meet the CPUC requirements and can be used by Project Developers (PDs) to calculate the normalized energy savings. Moreover, the Commission has supported the development of public, open-source processes to develop NMEC methods (e.g. CALTRACK) and encourages stakeholders to engage in these open-source initiatives.

There are some publicly available studies, such as (Fette and Endurthy 2021), that focus on all available NMEC tools with comprehensive reviews of associated pros and cons. In this paper, we focus on review of two of these tools that are most used in NMEC projects to calculate the normalized savings:

ECAM

ECAM is a Visual Basic for Applications (VBA) based add-in within MS Excel. This tool is a transparent and easy-to-use tool for measurement and verification (M&V) of energy savings in buildings. ECAM segments the data based on the user's choice of categorical variables to group data points, and the user can apply a different model in each segment, independent from other segments. It also has utilities for generating new fields in the time series data for these category variables. In addition to generating fields based on the timestamp like month, day-of-week, hour-of-day, and other attributes of time and date, it has user dialogs for preparing lists of holiday dates, and setting occupancy schedules, which are mapped into new fields that can be used for grouping and segmentation. Users can also add custom variables such as occupancy. ECAM can create the following models for loads as a function of temperature: Mean, Linear, and a variety of 3P, 4P, and 5P models.

To the extent of author's knowledge and based on the ExAnte CPR feedbacks provided until 2022, NMEC projects has been reviewed and evaluated by CPUC reviewers using ECAM.

nmecr

nmecr was developed in 2019 to bring together simple linear regression with outside air temperature, the change point models, and the Time-of-Week and Temperature model and builds enhancements upon these by accurately predicting the energy use profiles of facilities with

multiple operating modes (Sharma, Jump and Johnson 2021). This R-based model has been extensively used in PG&E's site-level NMEC projects and it is capable of developing Time-of-Week (TOW), Time-Of-Week and Temperature (TOWT), Simple Linear Regression (SLR), 3P Cooling, 3P Heating, 4P Change, 5P Change, Heating Degree Days (HDD), Cooling Degree Days (CDD), and HDD-CDD models¹. In addition to model metrics, nmecr has functions to check the normality of residuals, homogeneity of variance of residuals², and correlation and linearity of residuals. These are important quality checks that can warn the user if a building load cannot be adequately described by the independent variables in the model. nmecr offers a function to calculate coverage factor when applying a model to a new set of weather conditions. This is an important quality check, which is required in data analysis, to make sure the model is not extrapolating too far beyond the training dataset.

Technical Review of NMEC Projects

Program Administrators in California are tasked with ensuring the quality and compliance of the energy efficiency projects they administer and claim to CPUC. To ensure the quality of NMEC projects and their compliance with regulatory requirements, these projects undergo multiple technical review processes during their lifetime. The Technical Review of site-level NMEC projects is more sophisticated and challenging compared to Custom projects³ due to the following reasons:

1. Technical review of NMEC projects happens more frequently compared to Custom projects as they are reviewed at pre-install, post-install, mid-term performance, and twelve-month performance stage. Frequent review of these projects adds admin costs on the PA side as well as operational costs on the implementation side.
2. At the pre-install stage, the project packages come with two sets of calculations at least: energy savings estimates and predictability analysis (also known as baseline analysis).
3. The technical review process of NMEC projects is relatively new and is fast developing compared to technical review of Custom project. Technical reviewers are expected keep up with the latest updates from CPUC as well as lessons learned from most recent SDRs and dispositions.
4. Although all NMEC projects are expected to use IPMVP option C in their Monitoring and Verification (M&V) process, they are allowed to use any publicly available, open-to-review analytical tool to calculate and normalize the energy savings. Technical reviewers are expected to be well-versed in using and reviewing the models developed in a variety of tools, some of which were introduced earlier in this paper.
5. IPMVP Application Guide on Non-Routine Events and Adjustments offers six analytical approaches to detect non-routine events (NRE) and more than ten methods to make non-routine event adjustments (NRA). Finding the best NRE detection method and offering the most suitable NRA based on the nature of the NRE and data logging capabilities at the site is a complicated task as part of the technical review.

¹ For more information about these methods, please refer to [CalTRACK Methods](#).

² In statistical models, a residual is the difference between the observed value and the mean value that the model predicts for that observation.

³ For more information about the Custom projects, please refer to [Custom Projects Review Guidance Documents](#).

6. Data quality is important. To calculate the impact of an energy efficiency project, analysts would like to make sure the energy savings is only attributed to the implemented EEMs, rather than other changes at the site. However, non-routine changes, such as a change in building ownership, operational controls, or renovations can alter the magnitude of energy usage. Visual review of graphical representation of the AMI data before and after the project implementation could be the first step, but it would not be sufficient.

CPUC Supplemental Data Requests (SDRs) and Dispositions

Between August 2020 and March 2022, PG&E uploaded fifteen site-level NMEC projects to Custom Measure and Project Archive (CMPA) for CPUC to review. For these projects, CPUC issued twelve SDRs and eleven dispositions. A summary of the comments we received in CPUC dispositions is outlined in the table below:

Table 2. Summary of issues in CPUC dispositions

Issue Area	Action Categories	Summary of CPUC Staff Required Action by the PA:	Percent of Total
Issues Related to Gross Savings Impacts	Analysis assumptions	9	11%
	Calculation method	10	12%
	M&V plan	10	12%
	Other - discrepancy in project savings	2	2%
	Subtotals	31	37%
Process, Policy, Program Rules	Baseline	1	1%
	Eligibility	11	13%
	EUL/RUL	4	5%
	Other - simple payback	1	1%
	Self-generation	2	2%
	Subtotals	19	23%
Documentation Issues	Missing required information	13	16%
	Other - documentation discrepancy	1	1%
	Project scope unclear	3	4%
	Program influence	4	5%
	Subtotals	21	26%
Issues Related to Net Impacts	Other - advisory review	3	4%
	Continue Document Upload	9	11%
	Subtotals	12	14%
	Grand Total	83	100%

By reviewing the items included in the SDRs and dispositions, and their frequency, authors have sought options for process improvements and reduction in turnaround time (TAT). This effort has resulted in a decrease in the quantity of the items per disposition from August 2020 to July 2022. After reviewing and analyzing these SDRs and dispositions, authors list the most frequent SDR/disposition comments and recommended process improvements to mitigate in future projects.

Calculation Methods and Analysis Assumptions

Around 23% of the items in the issued dispositions were concerning calculation methods and analysis assumptions. This included both metered energy use, such as regression modeling and goodness of fit (GOF) as well as energy savings estimates. Some of these comments were concerning either electricity demand or natural gas regression model not meeting the GOF criteria. The recommended approach is using engineering calculations. In addition, California PAs are currently funding a study titled “Gas Model Acceptance Criteria” to enhance the eligibility review of natural gas models in site-level NMEC projects. The results are expected to be published later this year.

Another issue related to energy use regression models was NREs that were detected during parallel review using ECAM models. In the project development and technical review processes, NREs are detected either visually, by customer, or by “+/- 3 x standard deviation” test. After reviewing the dispositions, PG&E technical reviewers have increased the review scrutiny by adding time series analysis of residuals to their NRE detection procedures.

In addition, technical reviewers and PDs were asked to include HVAC interactions even from electricity-only measures, such as lighting, in the total gas savings calculations. For projects with a failed natural gas regression model, an engineering approach is being used to estimate and report the interactive effects on the natural gas usage.

Eligibility and Estimated Useful Life (EUL)/Remaining Useful Life (RUL)

In PG&E, we observed that 15% of the parallel review comments were about EUL/RUL of the projects and how it may impact their eligibility. Per Statewide Custom Project Guidance Document V1.4, projects’ EUL must be greater than the Simple Payback Period (CPUC Staff 2021). In some parallel-reviewed projects, the EUL recommended by reviewer was different compared with the EUL in the project package. Using a different EUL has caused an eligibility issue in some cases where simple payback was becoming longer than weighted average EUL of the project.

To alleviate this issue and reduce the number of SDR/dispositions, technical reviewers requested PDs to cite a reference, such as Database for Energy Efficiency Resources (DEER), for their proposed EUL for each individual measure. In addition, PG&E and other PAs are currently considering an overarching EUL for site-level NMEC projects. This activity is still in-progress and will be proposed to the CPUC for final ruling.

Missing Required Information

In 16% of the received comments in NMEC dispositions, CPUC reviewer asked for missing information, such as non-IOU fuel availability and required analysis, measure application type (MAT) for each individual measure, model or GOF statistics missing, and more.

To minimize the SDR and dispositions about missing information, PG&E technical reviewers have developed and utilized a checklist that lives and progresses throughout the life of a project. This checklist is detailed enough to certify all required documents in the NMEC Rulebook are provided and included in the project package. In addition, quality control process of CMPA upload has improved to bear more scrutiny and ensure none of the documents cited in the project feasibility study (PFS), M&V plan, and technical review are missing in the final submission.

M&V Plan

Per NMEC Rulebook, project-level M&V Plans must detail methods for tracking feasibility of the NMEC approach and how NMEC failure will be addressed. For instance, when one of the energy use models fail to meet the GOF criteria, the M&V plan should explain how the energy savings should be calculated. If a PD is planning to use engineering calculations in lieu of the failed models, the M&V plan describes the data logging plan, including data logging parameters and intervals, and period.

Comments on M&V plans were 12% of the overall comments in site-level NMEC dispositions. After reviewing the dispositions and SDRs, PDs are required to dedicate a section in the project-level M&V plans to discuss the data logging and calculation methods for verification of the installed measures and energy savings calculations of the failed models.

In addition to what was discussed above, CPR comments infrequently covered a few other topics such as unclear project scope and project baseline. PG&E technical reviewers have diligently worked on process improvements to minimize the project TAT and maximize the customer satisfaction.

Technical Review Process Improvements

PG&E strives to make sure everyone and everything is always safe, and our work shall create prosperity for all customers and investors. This includes the effort to minimize the risk of investment in energy efficiency for the customers and help them promote a healthy environment and carbon-neutral energy system for all Californians. As such, technical reviewers should focus on providing a safe and smooth process for customers to invest on energy efficiency projects and reliably observe the difference on their energy meters. Based on review of implemented site-specific NMEC projects in PG&E territory, the following items are recommended to enhance the technical review process:

Transparency on Project Documents

Technical reviewers should share a list of minimum requirements for project packages with the project developers. The pre-install package of NMEC projects should at least include the following items or otherwise will be marked as incomplete:

- Project application
- M&V plan
- Evidence of payment to Public Purpose Programs
- Project feasibility study
- Support document for influence narrative
- Unlocked savings calculations
- Unlocked energy models for baseline usage
- Manufacturer's specification sheets of proposed equipment
- Weighted average EUL calculations and supporting documents
- Measure cost justification
- Pre-install photos to show existing equipment and operation
- Meter IDs and boundary of the project

Other items, such as a Non-IOU fuel analysis and a three-year maintenance plan, can be added to this list depending on the nature of facilities and type of proposed measures.

Using A Detailed Technical Review Checklist

Although using a checklist and filling it during the review may seem to be an additional step, it provides benefits that outweigh the added time. It expedites the process and enhances communications with project stakeholders. In addition, it allows the reviewers to be more specific and be more confident at each step of the review. PG&E technical reviewers have developed a detailed spreadsheet checklist with workbooks dedicated to each step of the review during lifecycle of a project. This checklist, which is shared with project developers (PDs) along with technical review comments at the pre-install stage, provides more information to PDs about the checks that were performed. Since this checklist stay among the project files, it will keep a record of project history and helps project stakeholders to create a complete project package at each step. A copy of this checklist is available upon request.

Adequate Level of Rigor for Savings Estimates

In NMEC projects, initial savings estimates will not be used to determine final claimable energy savings or incentive payments. Initial energy savings estimates may be based either on approved deemed measure workpapers or may be calculated using engineering calculations. Initial savings estimates are used in expected useful life (EUL) calculations, gross realization rate (GRR) and net-to-gross (NTG) adjustments.

It is important to note that predictability analysis, pre- and post-install energy use regression models, and normalized savings calculations are needed in NMEC projects. If the level of rigor in savings estimates is set too high, it will put a heavy burden on PDs and drive the project development costs so high that may negatively impact the quantity of projects and discourage customers from program participation. Considering the importance of the normalized energy savings compared to the energy savings estimates, technical reviewers should focus mainly on review and validation of meter-level energy analysis and normalization process and verify the accuracy of energy savings estimates to the level needed for EUL calculations, GRR and NTG adjustments.

The recent CPUC NMEC Working Group surfaced several stakeholder concerns about calculation rigor and the impact on project development and project review teams. It was further surfaced that PAs and Project Implementers interpret existing language in the NMEC Rulebook Version 2.0 in different ways, resulting in different levels of calculation rigor across the state. These variances contributed significantly to a large difference in review times and rigor levels across the state (Common Spark Consulting 2022). Subsequent meetings of the Working Group will be convened to attempt to create calculation rigor guidance to be used by PDs and PAs in the future.

Adequate Documentation About Regressions Models

As explained earlier, PDs on NMEC projects are allowed to use any analytical tool, such as ECAM and nmecr, to develop the regression models of the project if these tools meet the requirement of being publicly available. From the technical review perspective, it is not practical to have expertise and access to all these tools. At each stage of the project, PDs are expected to provide documentation and information, such as raw data, model coefficients, and modeled energy usage. This, in conjunction with model development methodology narrative, should be detailed enough to let the reviewer replicate the modeled energy usage and generate Goodness of Fit (GOF) metrics.

Technical Review of Submetering Projects

Per NMEC Rulebook 2.0, submetering is permissible for all NMEC projects, although the mandated level of accuracy is far beyond the industry standard practice. The Rulebook outlines minimum requirements for submetering equipment accuracy. This minimum requirement, specially having a solid-state Btu meter, is well beyond standard practice of most customer-owned chilled, hot water, and steam meters, such as community colleges, state and private universities, University of California, and other buildings served by central plants. It is far more common that data from individual water flow meters and unpaired temperature sensors are used to monitor their chilled and hot water energy use. Steam energy use is commonly measured from the condensate tank return, not on the inlet side with vortex shedding flow meters. Therefore, PG&E submitted an Early Opinion (EO) request (EO) to discuss this issue with CPUC.

In response to PG&E's EO in 2021, CPUC and their consultants, offered three options to address non-compliance with submetering requirement in NMEC Rulebook 2.0:

- Option 1: Submit documentation of sensor accuracy and calibration requirements along with evidence that required calibration activities were completed. Temperature sensors must meet minimum accuracy requirements of +/- 0.2 F in accordance with ASHRAE Guideline 14 Appendix A. Flow meters must meet minimum accuracy requirements of +/- 2% in accordance with ASHRAE Guideline 14 Appendix A (ASHRAE 2014).
- Option 2: The LBNL M&V Plan Guidance calls for a "coverage factor" of 90%. Coverage of the measured flowrates and temperatures during parallel metering should include 90% of the expected values (Granderson, et al. 2019).
- Option 3: Use of condensate return metering should be limited to buildings where "once through" steam loads are not present or are negligible.

Under all these circumstances technical review approval will be granted on a case-by-case basis until NMEC Rulebook is updated.

NMEC Savings for Projects Impacted by COVID19

In October 2021, California energy efficiency program administrators shared a proposal with CPUC to elaborate on the energy savings reporting of COVID-19 pandemic affected projects. The intent was to avoid penalizing customers for COVID impacts. For site-level NMEC projects multiple approaches were proposed based on the IPMVP Application Guide for Non-Routine Events and Adjustments published in October 2020 and the Efficiency Valuation Organization White Paper on COVID-19 impacts on meter-based methods. The choice of these methods, that are in descending order of preference in the IPMVP document, should be justified by implementers in the site-level M&V plan:

Table 2. Proposed NRA methods to address the COVID19 impact

Project installation timeline with respect to the pandemic	Proposed Methods
Category 1: Onset of the shelter-in-place episode impacts both the baseline and the performance period.	NRA Method 1 - Omit data NRA Method 3 - Redefine Model Using New Variables NRA Method 5 - Create a (NRE) Adjustment Model NRA Method 6 - Use Mini Models NRA Method 7 - Develop a Pre-Post NRE Model NRA Method 9 - Use Calibrated Simulations NRA Method 10 - Use Engineering Calculations
Category 2: Onset of the shelter-in-place episode impacts only the performance period.	

In this proposal, projects are categorized depending on when a project installation occurs with respect to the pandemic. Although the same NRA methods are proposed to adjust the models and the energy savings, the methods should be implemented differently. In the Category 1 projects, the NRA methods apply to both baseline and proposed periods, in the Category 2 projects, the NRA methods only apply to the performance period.

If none of these approaches are viable, then the PAs proposed that the 18-month maximum timeframe between baseline and reporting periods required by the NMEC Rulebook v2.0 should be temporarily suspended. Although this last resort improves the savings accuracy while other options are not technically viable, this may yield unknown timeframe for project close-out, hence customer dissatisfaction.

By applying COVID as a non-routine event, this proposal adds flexibility to using technique best suited for each project based on the project condition and impact scenario. The proposed NRA methods to address the COVID impact not only improves the savings accuracy in projects implemented during the pandemic period, but also improves the customer satisfaction since these methods are meant to negate the COVID penalty on claimable energy savings.

Conclusion

This paper aims to lay the groundwork for streamlining and improving the technical review process of meter-based projects. In this paper, authors provided insight to the evolution of meter-based energy efficiency programs in California along with most up-to-date information on current meter-based programs throughout the state and specifically in PG&E territory. Authors also provided a brief description about the most common analytical tools used in current meter-based EE programs in PG&E which would direct the project implementers to choose the right tools for their project. With several years of providing technical review for meter-based projects, this paper took a deep dive into supplemental data requests and dispositions issued by CPUC with an approach to alleviate the issues, minimize the projects' turnaround time, and maximize the customer satisfaction. The authors provided practical recommendations to address the issues observed in calculation methods, analysis assumptions, project eligibility, M&V plan, and more. This paper equips the meter-based programs stakeholders, such as project developers and technical reviewers with essential tools they need, such as technical review checklist, list of required documents, discussions around level of rigor for savings estimates. Finally, authors bring light to current challenges in meter-based projects including eligibility and requirements for submetering projects and savings calculations for projects impacted by COVID19. It is important to note that the recommendation list is not an exhaustive list and is limited to the findings of projects subject to this study. Although the discussions provided in this study focus on California's meter-based program, it can offer valuable insight to decision makers and managers of meter-based programs in other states and countries.

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