SITE-LEVEL NMEC EVALUABILITY STUDY, PROGRAM YEARS 2020-2021

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California Public Utilities Commission

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Glossary of key terms and acronyms[1]

Baseline period – The baseline period is the 12-month period leading up to the energy efficiency intervention or retrofit.

Calculated savings – The calculated savings for NMEC projects is a sum of the initial claimed savings and true-up savings found in CEDARS. Calculated savings is expected to equal normalized savings.

California Database for Energy Efficiency Resources (DEER) – Refers to the Database for Energy Efficient Resources. This database contains information on energy efficient technologies and measures. DEER provides estimates of the energy-savings potential for these technologies in residential and non-residential applications. DEER is used by California Energy Efficiency (EE) Program Administrators (PAs), private sector implementers, and the EE industry across the country to develop and design energy efficiency programs.[2]

California Energy Data and Reporting System (CEDARS) – Refers to the database that securely manages California Energy Efficiency Program data reported to the Commission by Investor-Owned Utilities, Regional Energy Networks (RENs), and certain Community Choice Aggregators (CCAs).[3]

Coefficient of determination (R^2) – Refers to a model goodness-of-fit statistic that gives the proportion of the variation in the dependent variable (energy consumption) explained by the regression model. The higher the R^2, the better the model explains variation in the dependent variable.

Coefficient of variation of the root mean square error (CV(RMSE)) – Refers to a model goodness-of-fit statistic that is a measure of variability (of savings) relative to the average value of the variable (average energy consumption) used to determine how well the model predicting the variable (baseline consumption) fits the data. The lower the CVRMSE, the better the model fit.

Custom project review (CPR) – Refers to the process of selecting custom projects, submitted biweekly by the program administrators, for review of all forecasted savings parameters and documents of selected projects.

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.

F**orecasted savings** – Engineering-based savings estimate derived before installation.

Fractional savings – Refers to the percent of annual energy usage saved through program participation. For NMEC projects, the rulebook recommends that projects have a forecasted fractional savings of at least 10%.

Fractional savings uncertainty (FSU) – FSU combines CV(RMSE) and percent savings. It is similar to relative precision in that it measures the uncertainty around the expected savings. As the value FSU decreases, confidence in the estimated savings level increases.

Gross realization rate (GRR) – Refers to the ratio of achieved energy savings to predicted energy savings; as a multiplier on Unit Energy Savings, the GRR considers the likelihood that not all CPUC approved projects undertaken by IOUs will come to fruition.

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[1] Please refer to the Energy Efficiency Policy Manual for additional terms and definitions: https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/e/6442465683-eepolicymanualrevised-march-20-2020-b.pdf

[2] Public utilities commission of California, Resolution E-5152, August 5, 2021. http://www.deeresources.com/files/DEER2023/Resolution%20E-5152%20DEER2023%20Complete.pdf

[3] California Energy Data and Reporting System (CEDARS), "Welcome to CEDARS," cedars.sound-data.com, https://cedars.sound-data.com/

Gross savings – Gross savings count the energy savings from installed energy efficiency measures irrespective of whether 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.

Initial claimed savings – For NMEC projects, the savings claimed in CEDARS following project implementation.

International Performance Measurement and Verification Protocol (IPMVP)[4] – Protocol that facilities a common approach to measuring and verifying energy efficiency investments. IPMVP incorporates M&V best practices in a non-prescriptive framework that allows it to be applied flexibly based on a measure's application and the information available.

Lifecycle savings – Refers to the savings associated with the lifetime of an efficiency measure undertaken by a program participant. Equipment replaced early in its useful life might receive reduced savings for a portion of its lifetime.

Measure – Specific customer action that reduces or otherwise modifies energy end use patterns. A product whose installation and operation at a customer's premises reduces the customer's on-site energy use, compared to what would have happened otherwise.

Measure application type (MAT) – Refers to the installation basis for each claim. There are seven approved measure application types: Add-on Equipment, Accelerated Replacement, BRO-Behavioral, BRO-Operational, BRO-Retro-commissioning (RCx), New Construction, and Normal Replacement.

Net savings – The savings realized when free-ridership is accounted for. Savings are calculated by multiplying the gross savings by the net-to-gross ratio.

Net-to-gross ratio (NTGR) – A ratio or percentage of net program savings divided by gross or total impacts. Net-to-gross ratios are used to estimate and describe the free-ridership that may be occurring within energy efficiency programs.

Non-routine adjustment (NRA) – Non-routine adjustments are used to account for the effects of non-routine events, where the changes affected by the NRE are not suitable to the baseline or reporting period adjustment models. Non-routine adjustments occur separately from the routine adjustments made using independent variables in the adjustment model. Non-routine adjustments are developed using methods including but not limited to engineering analysis, sub-metering, or other analyses using the metered energy use data

Non-routine event (NRE) – A non-routine event is an externally-driven (i.e., not related to the energy efficiency intervention) significant change affecting energy use in the baseline or the reporting period and therefore must be accounted for in savings estimations. Typical NREs include changes in facility size, changes in facility activity not affected by the energy efficiency measures (such as addition or removal of a data center) or other modifications to the facility or its operation that alter energy consumption patterns and are unrelated to the program intervention

Normalized mean bias error (NMBE) – Refers to a statistical model goodness-of-fit statistic that can indicate whether a model is over or under estimating energy use.

Normalized metered energy consumption (NMEC) – Refers to high opportunity programs or projects that provide incentives based on metered energy consumption. This initiative fulfills the directive for utilities to quickly identify high energy-efficiency savings opportunities in existing buildings using a program and project approach where incentive payment and claimed savings are based on NMEC and include only approved NMEC building programs.

[4] IPMVP - Efficiency Valuation Organization (EVO), evo-world.org, https://evo-world.org/en/

Normalized savings – Savings calculated as the difference between the weather normalized baseline and performance period statistical models.

Program administrator (PA) – An entity tasked with the functions of portfolio management of energy efficiency programs and program choice (i.e., Marin Clean Energy (MCE),[5] Pacific Gas & Electric (PG&E), Southern California Edison (SCE), Southern California Gas (SCG), San Diego Gas & Electric (SDG&E)).

Peak demand – Refers to the average demand impact, for installed or implemented measures, as would be applied to the electric grid. CPUC Resolution E-4952 approved the Database for Energy-Efficient Resources (DEER) for 2020. Additionally, this resolution revised the DEER Peak Period definition from 2:00 p.m. to 5:00 p.m. to 4:00 p.m. to 9:00 p.m. effective January 1, 2020. In accordance with the CPUC memo issued on 03/21/19, operationalizing the 2020 DEER Peak Period change, effective January 1, 2020, per CPUC Res E-4952 for custom projects shall follow the Statewide Custom Project Guidance Document, Version 1.4.

Relative precision – A ratio of the error bound divided by the value of the measurement itself. This provides the error on a relative basis that is frequently used to show uncertainty as a fraction of a quantity. In this report, all relative precisions are provided at the 90% confidence interval, which means that in repeated sampling 90 times out of 100 the true value will fall within the lower and upper bounds of the estimate.

Savings delta – The difference between normalized savings and forecasted savings.

True-up savings – The savings claimed in CEDARS following the end of the performance period. This value is expected to be the difference between initial claimed savings and the normalized savings.

[5] MCE is a not-for-profit public agency that MCE provides electricity service to more than 1 million residents and businesses in 37 member communities across four Bay Area counties: Contra Costa, Marin, Napa, and Solano.

1 EXECUTIVE SUMMARY

1.1 Introduction

This report presents key findings of the site-level normalized metered energy consumption (NMEC) evaluability study on behalf of the California Public Utilities Commission (CPUC). NMEC projects use a meter-based approach to measure whole-building energy use reductions. This evaluation focuses on site-level NMEC projects where savings efforts are unique to each site in contrast to a population NMEC approach that applies a consistent savings approach to many sites. The CPUC approved an evaluability study separate from the evaluations that will follow because tracking data irregularities made it difficult to identify an initial scope for the evaluations without extensive preliminary research. The NMEC pathway is relatively new, and the Program Administrators (PAs) are still figuring out how to work with California Energy Data and Reporting System (CEDARS) to provide the more complicated NMEC reporting needed. As a result, considerable effort was required to identify the population of site-level NMEC projects. The evaluability study provided the opportunity to identify the site-level NMEC population for the subsequent evaluations and provide an overarching characterization of projects to better understand the current population of site-level NMEC projects.

The evaluability study and the impact evaluation studies that will follow are the first comprehensive site-level NMEC evaluations since the NMEC pathway expanded beyond the pilot phase. The only other evaluation that has partially touched on site-level NMEC to date was "PY2018–2019 California Statewide On-Bill Financing Impact Evaluation" published in 2022. That report focused only on the On-Bill Financing (OBF) Program, which was primarily a population NMEC vehicle, but did have some projects that were assessed via site-level NMEC. DNV considered the findings in that report as we assessed the wider site-level NMEC programs. The evaluability research efforts are guided by the NMEC evaluation workplan dated November 30, 2022.[6]

1.1.1 Site-level NMEC

Site-level NMEC projects use statistical modeling of meter-based consumption data to measure energy use reductions after improvements designed to save energy are made. This performance-based approach to implementing and rewarding energy efficiency efforts is designed to limit ratepayer risk while facilitating additional energy efficiency activity that would not otherwise occur in the existing program structure. In particular, NMEC was identified as a way to address the issue of stranded savings, buildings and systems that remain below code despite the opportunities presented by existing energy efficiency programs.

1.1.2 Evaluability study objectives

The objective of the evaluability study is to identify and characterize the Program Year (PY) 2020 and PY2021 site-level NMEC projects, determine whether the projects are ready to be evaluated, and make recommendations for how to improve project documentation and timeliness for future years to improve program evaluability. This report addresses the following key research questions:

[6] California Public Utilities Commission, "California Energy Efficiency Energy Contracts-Program Year 2020-2021 Commercial, Industrial, and Agriculture Custom (CIAC) Projects Evaluation Work Plan-Final," pda.energydataweb.com, 4/28/23., https://pda.energydataweb.com/#!/documents/2629/view.

Key research questions
What are the key characteristics of site-level NMEC projects?
What is the typical site-level NMEC project timeline from project initiation through true-up claim?
Why are some projects not trued up in the year following the initial claim?
How do project characteristics correlate with claimed savings, evaluated savings, and realization rate[7]?

1.2 Evaluability study approach

The evaluability study methodology comprised three data collection activities focused on understanding how NMEC projects are tracked and documented. These data collection activities are summarized in Table 1-1. The Tracking data prep activity involved investigating the types of NMEC projects and energy savings claims submitted by the Program Administrators. The "Documentation review" step involved collecting and reviewing all application and supporting materials for selected NMEC projects. The "PA and implementer interviews were comprised of in-depth interviews (IDIs) designed to provide further context for what was found in both the tracking data prep and documentation review efforts.

Table 1-1. Methodology

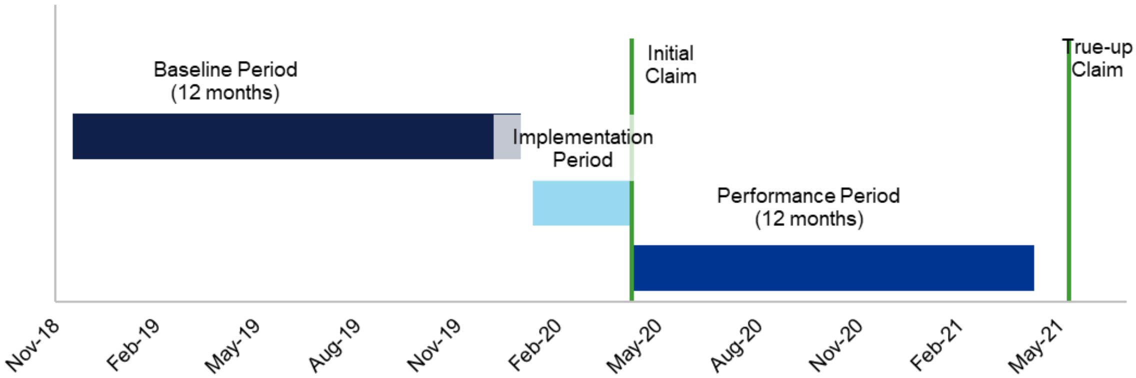
Tracking data prep	Documentation review	PA and implementer interviews
Identify NMEC claims. The site-level NMEC pathway is part of multiple different programs. DNV identified claims based on the tracking database field - measure impact type. **Classify claim type.** Each NMEC project has an initial claim following project installation using engineering-based forecasted savings and a true-up claim following the 12-month performance period after installation.	**Documentation request.** DNV requested project documentation for all 51 site-level NMEC projects with initial claims in PY2020-21. **Documentation review.** DNV collected information unavailable in the tracking data and investigated why some projects have not yet been trued up. DNV gathered information about 759 energy efficiency technologies and practices (measures) and 177 statistical models.	**Program Administrator (PA) IDIs.** DNV conducted 90-minute interviews via Teams with PG&E, SCE, SCG, SDG&E, and SoCalREN. The PAs included members of their policy, reporting, and technical teams. **Implementer IDIs.** DNV also conducted two, hour-long interviews with NMEC implementers via Teams.

1.3 PY2020 and PY2021 NMEC projects

The evaluability study reviewed projects with initial claims occurring in either PY2020 or PY2021. Figure 1-1 shows the generalized expected project timeline. Initial claims are expected to occur in the year the project installation is completed, and true-up claims are expected to occur a year later to allow for completion of the 12-month performance period after installation during which savings are assessed. However, some PY2020 claims were not trued-up in PY2021 while some projects with initial claims in PY2021 were trued-up in PY2021 (less than 12 months after the initial claim).

[7] The proportion of evaluated savings to claimed savings.

Figure 1-1. Expected site-level NMEC project timeline



Each site-level NMEC project is expected to have an initial claim[8] and a true-up claim[9] in the tracking data. Identifying initial claim and true-up claim pairings is important for the evaluation, as the sum of the savings for the two claims is expected to represent the total meter-based savings claim for each project. If a project is not trued-up yet, it is not ready for evaluation because savings will not be performance-based.[10] One of the goals of the evaluability study is to determine which projects can be evaluated. Some projects may have a Post M&V report completed with final weather-normalized savings estimates that have not yet been used to true-up the tracking data. These savings estimates can be considered performance-based and final despite not yet being officially entered into the tracking data and may be included in the evaluation in the interest of deriving as much insight as possible from this evaluation. Table 1-2 presents the site-level NMEC projects included in the evaluability study grouped by the initial claim program year and true-up status.

Table 1-2. PY2020 and PY2021 NMEC projects

Group	Number of projects				Total
	PG&E	SCE	SCG	SoCalREN	
Trued-up 2020 claims	0	14	0	1	**15**
Trued-up 2021 claims	21	0	0	0	**21**
2020 claimed and not trued-up	0	1	2	2	**5**
2021 claimed and not trued-up	3	0	0	7	**10**
Total	**24**	**15**	**3**	**10**	**51**

1.4 Key findings and recommendations

The current population of NMEC projects is dominated by two customers who in combination represent 65% of projects and 50% of claimed electric savings.

Although this study conducted a census of PY2020 and PY2021 projects, the characteristics of this population are unlikely to be representative of future NMEC populations. Table 1-3 shows the number of projects and corresponding energy savings broken out by customer groups. In addition to making up a large share of the overall projects, the large tech company and school district make up 92% of the trued-up projects (projects with final claims in the tracking data). To partially combat this, DNV plans to incorporate additional projects into the impact evaluation that have final measurement and verification (M&V)

[8] Initial claims are expected to occur after the installation of the project and are based on the engineering-based forecasted savings.

[9] True-up claims occur at least a year after the installation of the project and are a positive or negative savings differences that adjusts the initial claim up or down so that it is aligned with the meter-based normalized savings.

[10] All of the projects included should have been trued up by the time this report was written. Why some projects remained not trued-up was a question this report attempted to answer.

reports and final weather-normalized model results but that have not yet had those results officially included in the tracking data via the true-up process.

Table 1-3. Project counts and savings for large customer groups

Customer group	Project count		Initial savings			True-up savings		
	Initial	True-up	kWh	kW	Therms	kWh	kW	Therms
Large tech company	19	19	4,026,134	0.0	0	519,091	-10.0	-632
School district	14	14	859,030	0.0	0	407,205	0.0	0
Other	18	3	4,936,760	382.8	98,877	21,675	5.5	0
Overall	**51**	**36**	**9,821,925**	**382.8**	**98,877**	**947,971**	**-4.6**	**-632**

PY2020 and 2021 NMEC projects were almost universally impacted by the COVID pandemic.

The PY2020 and PY2021 projects all overlapped with shutdowns that occurred in 2020 either during the 12-month baseline period prior to making energy efficient changes or in the 12-month performance period. Depending on building type and project scope, the severity and duration of COVID impacts on projects varied. Some building types such as schools or libraries were shut down for extended periods, while others such as parking structures were less impacted by shutdowns and occupancy changes.

Model impacts: A performance-based savings measurement approach is uniquely sensitive to non-program related changes in consumption that can affect savings calculations. Non-routine events (NREs) are a recognized challenge for NMEC projects and have historically been the result of other shorter-term or localized changes such as maintenance activities. COVID represented an NRE of unprecedented magnitude and complexity.

COVID caused delays and motivated multiple updated models and approach adjustments to address the associated challenges. Most commonly, the PAs added occupancy-related variables to the model so that occupancy could be normalized across the baseline period and the performance period. Moving forward, it is possible that use of occupancy variables will be less common because occupancy over time will be more stable. Additionally, model updates and NRE adjustments are expected to be less common in future NMEC projects as COVID impacts decrease. COVID put incredible stress on the NMEC measurement approach, but the projects and approach were able to adapt. The methods used to address COVID impacts, even if less commonly used in the future, provide useful information for how NREs can be addressed.

Timeline impacts: In addition to the modeling challenges that created delays, COVID and the related supply chain impacts resulted in installation delays. During interviews with the PAs and implementers, respondents indicated that installation times had increased from 3-10 months to more than 2 years for some complicated projects encountering COVID-related delays.

NMEC programs and projects are evolving.

The in-depth interviews with PAs attempted to better clarify NMEC project management practices in place during PY2020 and PY2021 and better understand the on-going practices and any pending changes planned in the future.

Implementation team structure: The structure of the teams implementing NMEC programs varies across PA and has also changed since PY2020-PY2021. Some PAs have partially or entirely moved to a third-party implementer model for NMEC while other PAs have moved more implementation in house. Some programs have many different organizations involved with each project including a third-party implementer, sub-contractors who may be responsible for the NMEC models or engineering aspects, and a PA or sub-contractor technical review team.

Installation timing: In some cases, projects installed energy efficient measures during the performance period, which would dilute the total project savings achieved during the performance period. One implementer indicated that they started their program installing measures during the performance period but have stopped this practice of installing during the performance period at the direction of the PA. Some projects in other programs also appeared to have measure installations overlap with the performance period, but those cases were less clear as the installation dates were not identified in project documentation.

Recommendation

NMEC implementers should track key project dates including baseline start and end date, intervention period, performance period start and end date, and initial and true-up claim dates. This will help the evaluator to utilize correct baseline and performance period data to evaluate savings. These dates should be included in every Final M&V Report that is filed with the CPUC at the time the energy savings claim is made in CEDARS.

Documentation was varied and inconsistent at every level, from CEDARS reporting practices to variation across reports from a single implementer.

Such challenges are expected for a relatively new program delivery mechanism, especially one where the reporting needs diverge substantially from standard energy efficiency programs. All parties are new to NMEC, and the NMEC rulebook is new. Interpretations of basic guidance have not settled.

Identifying claims: NMEC projects are expected to be labelled as site-level NMEC in the tracking data and to have two claims that span two program years: an initial claim and a true-up claim. The initial claim is expected to occur after project installation and a true-up claim is expected shortly after the 12-month performance period is completed and final normalized savings are calculated. Additionally, changes in CEDARS meant the true-up claim was expected to have the 'PriorYearClaimID' field[11] (going forward, "ParentClaimID") populated to tie the true-up claim with the initial claim. However, DNV identified issues that defied nearly every one of the expectations listed above:

- Projects were listed as site-level NMEC when the projects should have been classified as other programs. (86 SDG&E projects and six PG&E projects.)
- Projects were accidentally claimed before installation was complete (three projects.) Two of these projects were later cancelled and will be zeroed out in the evaluation. The remaining project is undergoing installation verification as of this reporting (June 2023) and will be re-examined next evaluation.
- Projects had the initial and true-up claims in the same year. These projects had waited to make the initial claim until after the performance period was completed and final normalized savings were calculated. (21 PG&E projects.)
- There were 18 projects with initial claims in PY2020. Of those, 14 were trued-up in PY2021. None of the remaining four projects appear to be trued up in preliminary 2022 tracking data.
- Most projects did not include the prioryearClaimID with the true-up claims in the tracking data, making it difficult to both know that the claim was a true-up claim rather than an initial claim and to know which initial claim it should be paired with.
- The different approaches in tracking NMEC projects as well as the discrepancies that needed to be addressed required a substantial effort in order to determine which claims were final and ready for evaluation.

Savings claims: Savings claims in CEDARS reflect a range of different combinations of engineering-based forecasted savings and final model-based normalized savings. Some initial claims were based on normalized savings rather than

[11] This is explained in reporting guidance published by Energy Division as NMEC Reporting Guidance 04242020.pdf that was distributed to the PAs.

engineering-based forecasted savings. SCE appears to have claimed engineering-based forecasted savings for the initial claim and also claimed the full model-based normalized savings for the true-up claim, rather than the difference to adjust the initial claim. This consistently over-estimated final savings.

Project documentation: There was also substantial variation in the type and thoroughness of the project documentation provided. Some projects had relatively clear documentation that explained what had been planned for the project, what was done for the project, and why anything changed. Other documentation was very difficult to follow and did not provide any reasoning for why substantial changes were made during implementation or the performance period modeling.

Recommendations

- Existing guidance is clear that initial claims should be made in the year of installation and trued-up the following year with a positive or negative value that, when summed with the initial claim, equals the final weather-normalized estimate of savings. All claims should follow this structure.
- The PAs should use the PriorYearClaimID/ ParentClaimID field to clearly flag which projects are trued up in the CEDARS tracking data. This will help evaluators to accurately map the initial claims to the true-up claims for each project.
- The CPUC should consider whether rules around true-up timeliness may be necessary to ensure that all initial claims are eventually trued up.
- The PAs should develop data accuracy checks that assure total final claimed savings (the sum of preliminary and trued-up claims) are consistent with final weather-normalized savings estimates and review all initial site-level NMEC claims to monitor whether they should be trued-up to improve true-up timeliness.
- The CPUC should clarify NMEC reporting guidance to improve accuracy and consistency across PAs.
  - In the tracking data, these include the appropriate application of gross realization rates (GRRs)[12].
  - CPUC should provide clear guidance regarding the assignment of measure application types (MATs)[13] as well as associated expectations for program influence documentation in the NMEC context.
  - CPUC should provide clear guidance on when the change in installed measures requires an updated EUL calculation.
  - In the project-level documentation, the CPUC should develop a template of essential program data that must be provided with each project.

NMEC project savings claims are primarily electric (kWh).

Seventy percent, or 36 NMEC projects, made savings claims for energy (kWh) savings only, and did not claim demand (kW) savings or natural gas savings. While nearly half of projects forecasted demand or gas savings, most of these savings were never claimed with only a quarter of projects claiming demand savings and less than 10% claiming gas savings.

Gas and demand models: Both gas and demand (kW) models met basic model eligibility requirements much less frequently than the kWh models leading to foregone claims in gas and kW. The basic model eligibility criterion is a level of CVRMSE, a measure of variation unexplained by the model, that is less than 25%. The challenges for gas and demand models likely reflect a combination of greater seasonal variation in the gas data and higher variability and granularity in the hourly kW modeling process. An alternative criterion, fractional savings uncertainty (FSU), has been proposed as an

[12] GRRs are applied to savings estimates to reduce them to the level expected to be “realized” once the results are evaluated. The GRRs are based on historical evaluation results. Because historical specific to NMEC are not available, the default Custom Program GRR is applied.

[13] Measure application types are designations that determine the appropriate baseline and the expected useful life (EUL) for a measure.

alternative to CVRMSE. FSU effectively combines CVRMSE with the expected savings as a fraction of consumption. FSU offers a more direct assessment of whether remaining post-model variation is sufficiently low to get a reliable estimate of the expected savings.

Interactive effects: While one gas claim was negative due to lighting interactive effects,[14] it appears that interactive effects are not being consistently claimed. There were many projects with lighting which would often be expected to have heating-related interactive effects. The upcoming impact evaluation will look more closely at this issue.

Recommendation

- For 2024, electricity claims will need to be based on hourly electric models. The CPUC needs to address hourly model eligibility requirements that encourage customers to use daily electric models for energy claims.
- The CPUC should make FSU the primary model eligibility criterion. Savings as a percentage of consumption should be capped to avoid over-estimated savings bringing otherwise ineligible models into eligibility. This will improve gas model eligibility rates.
- Guidance regarding gas models and interactive effects should be included in the rulebook.

This evaluability study points to multiple challenges that will face the evaluation.

One important ambition of NMEC as a program approach is to simplify the evaluation process because a clear, reasonable, replicable, and roughly unbiased process has already been applied to estimate savings. In this way, the embedded performance-based aspect of NMEC projects makes an NMEC evaluation fundamentally different than typical deemed or custom evaluations. If performance was assessed appropriately, the evaluation should simply validate the claimed savings. A GRR for the custom program reflects the accuracy of the claimed savings. An NMEC GRR, in contrast, will reflect the validity of embedded M&V. The evaluation will include a validation of the embedded performance assessment process and an assessment of the appropriateness of the approach for estimating project savings. A second aspect of the evaluation will assess whether the project implementation was consistent with NMEC rulebook guidance[15] and whether any deviations from the guidance would have produced a different estimate of savings.

This evaluability study highlights two expected challenges that will be faced in the upcoming impact evaluation.

1. **COVID impacts:** The impact evaluation will need to review and validate the various approaches that were used to address and correct for the impacts of COVID impacts on building energy consumption. Additionally, the impact evaluation will consider adjustments to some models which used shortened performance periods related to COVID.
2. **Policy alignment:** NMEC projects included in the evaluation were implemented while policy and rulebook interpretations continued to be developed.

Based on the evaluability assessment, DNV identified the following elements as key focus areas for the evaluation:

- Eligibility of measures
- Effective useful life
- Baseline and performance period models
- Program influence

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[14] Interactive effects are increases in one fuel usage due to and energy efficient change in another fuel. As an example, lighting measures with electric savings typically increase gas usage because efficient bulbs, such as LEDs, do not produce as much heat as less efficient bulbs. As a result, more gas may be needed for space heating.

[15] or associated relevant guidelines for project implemented under prior guidance,

2 INTRODUCTION

This report presents key findings of the site-level normalized metered energy consumption (NMEC) evaluability study on behalf of the California Public Utilities Commission (CPUC). The CPUC approved an evaluability study separate from the evaluations that will follow because tracking data irregularities made it difficult to identify an initial scope for the evaluations without extensive preliminary research. The NMEC pathway is relatively new, and the existing California Energy Data and Reporting System (CEDARS) was not designed to support the complexities of NMEC reporting. As a result, considerable effort was required to identify the population of site-level NMEC projects. The evaluability study provided the opportunity to identify the site-level NMEC population for the subsequent evaluations and provide an overarching characterization of that population of projects to better understand the current scope of site-level NMEC projects.

The evaluability study and the impact evaluation studies that will follow are the first comprehensive site-level NMEC evaluations since the NMEC pathway expanded beyond the pilot phase. The only other evaluation that has partially touched on site-level NMEC to date was “PY2018–2019 California Statewide On-Bill Financing Impact Evaluation” published in 2022. That report focused only on the On-Bill Financing (OBF) Program, which was primarily a population NMEC vehicle, but did have some projects that were assessed via site-level NMEC. DNV considered the findings in that report as we assessed the wider site-level NMEC programs.

Over the last decade, the CPUC and the California Program Administrators (PAs) have been working to develop whole-building measurement and verification (M&V) program pathways to achieve deep savings in commercial buildings.

- In 2012, the CPUC requested that its regulated investor-owned utilities (IOUs) develop energy efficiency programs to encourage more comprehensive commercial building retrofits (Decision 12-05-015, 2012).[16]
- In 2015, the governor signed California Assembly Bill 802, which directed the CPUC to allow savings claims using a NMEC methodology (AB 802 Williams 2015).[17]
- In May 2019, the Commercial Whole Building Demonstration Joint Study was released. This study was an evaluation of a 12-building demonstration program and developed recommendations for future NMEC programs.[18]
- In December 2019, the Lawrence Berkeley National Laboratory (LBNL) Option C Technical Guidelines were published, which showed how to use NMEC methods to calculate energy and demand savings for site-level NMEC projects.[19]
- In 2020, the CPUC released an updated “Rulebook for Programs and Projects Based on Normalized Metered Energy Consumption” (referred to as the NMEC rulebook).[20]

The evaluability and evaluation studies cover the site-level NMEC projects with initial claims[21] in program years (PY) 2020 or 2021. The evaluability research efforts are guided by the NMEC evaluation workplan dated November 30, 2022.[22]

[16] “Decision 12-05-015,” calmac.org. 5/18/12. https://www.calmac.org/events/Decision_12-05-15.pdf.

[17] California Legislative Information, “AB-802 Energy efficiency, Assembly Bill No. 802, Chapter 50,” leginfo.legislature.ca.gov., 10/8/2015. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB802

[18] California Public Utilities Commission, Pacific Gas and Electric Company, “Commercial Whole Building Demonstration Joint Study Report,” calmac.org, 5/1/19. https://www.calmac.org/publications/Commercial_Whole_Building_Joint_Study_ID_PGE0431.01.pdf

[19] Ibid

[20] CPUC, “Rulebook for Programs and Projects Based on Normalized Metered Energy Consumption,” January 7, 2020, https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/n/6442463694-nmec-rulebook2-0.pdf

[21] Site-level NMEC projects typically have two claims, with the initial claim occurring at the time of installation and the true-up claim occurring following the 12-month performance period.

[22] California Public Utilities Commission, “California Energy Efficiency Energy Contracts-Program Year 2020-2021 Commercial, Industrial, and Agriculture Custom (CIAC) Projects Evaluation Work Plan-Final,” pda.energydataweb.com, 4/28/23., https://pda.energydataweb.com/#!/documents/2629/view.

2.1 Evaluability objectives

The objective of the evaluability study is to characterize the PY2020 and PY2021 site-level NMEC projects, determine whether the projects are ready to be evaluated, and make recommendations for how to improve project documentation and timeliness for future years to improve program evaluability. This report will address the following key research questions:

- What are the key characteristics of NMEC projects?
- What is the typical NMEC project timeline from project initiation through true-up claim?
- Why are some projects not trued up in the year following the initial claim?
- How do project characteristics correlate with claimed savings, evaluated savings, and realization rate?2

2.2 Program overview

The site-level NMEC pathway is offered as part of multiple programs that serve commercial or commercial-like buildings.[23] There were six programs with site-level NMEC claims in PY2020-PY2021, which are described in Table 2-1. In the California Energy Data and Reporting System (CEDARS) tracking database, each NMEC project makes two claims, one at the time of project installation and one approximately 12 months later following the performance period. For this evaluability study, DNV only included programs with initial claims made in PY2020-PY2021. Some claims initially listed as site-level NMEC from San Diego Gas & Electric's (SDG&E) Facility Assessment Services Program, High Opportunity Program and Projects' (HOPPs) Building Retro-Commissioning Program, Strategic Energy Management (SEM) Program, and from Pacific Gas and Electric's (PG&E) On-Bill Financing Program were later removed based on information provided by the PAs.

Table 2-1. Programs with site-level NMEC claims

PA	Program ID	Program name	Description
PG&E	PGE_IND_003	Manufacturing and Food Processing Efficiency Program/Industrial Systems Optimization Program (ISOP)	The ISOP program targets industrial manufacturing and food process customers and focuses on mechanical systems and behavioral, retro-commissioning, and operational (BRO) measures.
	PGE21011	Commercial Calculated Incentives	The Commercial Calculated Incentives program provides technical assistance and incentive support for commercial projects requiring custom calculations or whole-building NMEC methodologies.
	PGE2110012	University of California/ California State University (UC/CSU)	The UC/CSU program offers incentives for retrofit projects, monitoring-based commissioning, and training for campus energy managers.
SCE	SCE-13-L-003I	Public Sector Performance-Based Retrofit HOPPs	The Public Sector HOPPs program targets public sector buildings with stranded savings due to improvement delays or indefinite equipment repairs.
SCG	SCG3809[24]	Commercial Energy Management Technology for Lodging (CEMTL) Program	The CEMTL program targets small and medium commercial lodging buildings and seeks to provide savings opportunities that encompass the whole building rather than individual rooms.
SoCalREN	SCR-PUBL-B3	Public Agency Metered Savings Program	The Public Agency Metered Savings Program targets public sector stranded savings.

[23] The NMEC platform Is available to both the residential and commercial sectors. However, there are no current programs offering site-level NMEC to the residential sector. There are a number of population-level NMEC programs offered in the residential sector.

Table 2-2 shows the number of projects and initial claimed savings by program. All projects except for the Southern California Gas Company (SCG) CEMTL projects had electric claims, while very few had demand or gas claims. The PG&E Commercial Calculated Incentives program had the most projects and the highest electric savings.

Table 2-2. NMEC program summary

PA	Program ID	Program name	Projects	Initial claim savings		
				Electric (kWh)	Demand (kW)	Gas (therms)
PG&E	PGE_IND_003	ISOP	2	969,550	0.0	0
	PGE21011	Commercial Calculated Incentives	21	4,818,874	-78.3	-5,684
	PGE2110012	UC/CSU Program	1	777,848	92.7	100,105
SCE	SCE-13-L-003I	Public Sector HOPPs	15	1,491,350	0.0	0
SCG	SCG3809	CEMTL Program	2	0	0.0	4,456
SoCalREN	SCR-PUBL-B3	Public Agency Metered Savings Program	10	1,764,303	368.4	0
Total			**51**	**9,821,925**	**383**	**98,877**

Table 2-3 presents the site-level NMEC projects included in the evaluability study grouped by the initial claim program year and CEDARS true-up status. Initial claims are expected to occur in the year the project installation is completed[25], and true-up claims are to occur a year later to allow for completion of a 12-month performance period.[26] Consequently, DNV expected nearly all the PY2020 claims to be trued-up in PY2021 and none of the PY2021 claims to be trued-up. However, there were six PY2020 claims that were not trued-up and 21 PY2021 claims that were also trued-up in PY2021.

Table 2-3. PY2020 and PY2021 starting NMEC population

Group	Number of projects				Total
	PG&E	SCE	SCG	SoCalREN	
Trued-up 2020 claims	0	14	0	1	**15**
Trued-up 2021 claims	21	0	0	0	**21**
2020 claimed and not trued-up	0	1	3	2	**6**
2021 claimed and not trued-up	3	0	0	7	**10**
Total	**24**	**15**	**3**	**10**	**52**

[25] NMEC Reporting Guidance_04242020.PDF

[26] From the CPUC Ruling ADMINISTRATIVE LAW JUDGE'S RULING ISSUING REVISED RULEBOOK FOR PROGRAMS AND PROJECTS LEVERAGING NORMALIZED METERED ENERGY CONSUMPTION, January 7, 2020, "PAs must submit a final claim, with savings calculated using NMEC methods after the performance period is complete, for all NMEC-based savings counted toward goal attainment by January 31st of two years after the program year installed. For example, to count savings from 2020 installed projects toward 2020 goal attainment, the PA must submit a final savings claim for those projects by January 31, 2022. "

3 METHODOLOGY

To support the research objectives above, the study was comprised of the following three data collection activities as summarized in Table 3-1:

- Tracking data preparation and investigation
- Documentation review
- In-depth interviews (IDIs)

The tracking data preparation involved investigating the types of claims that informed which projects DNV included in the documentation review and the IDIs provided further context for the findings from both the tracking data review and the documentation review.

All three data collection activities required an understanding of how NMEC projects are tracked. Each site-level NMEC project is expected to have an initial claim[27] and a true-up claim[28] in the CEDARS tracking data. Identifying initial claim and true-up claim pairings is important for the evaluation, as the sum of the savings for the two claims together is expected to be the total meter-based savings for the project.[29] If a project is not trued-up yet, it may not be ready for evaluation.[30]

Table 3-1. Methodology summary

Tracking data prep	Documentation review	PA and Implementer interviews
Identify NMEC claims. The site-level NMEC pathway is part of multiple different programs. DNV identified claims based on the measure impacted type. **Classify claim type.** Each NMEC project has an initial claim following project installation using engineering-based forecasted savings and a true-up claim following the 12-month performance period after installation.	**Documentation request.** DNV requested project documentation for all 51 site-level NMEC projects with initial claims in PY2020-21. **Documentation review.** DNV collected information unavailable in the tracking data and investigated why some projects have not yet been trued up. DNV gathered information about 759 measures and 177 statistical models.	**Program Administrator (PA) IDIs.** DNV conducted 90-minute interviews via Teams with PG&E, SCE, SCG, SDG&E, and SoCalREN. The PAs included members of their policy, reporting, and technical teams. **Implementer IDIs.** DNV also conducted two, hour-long interviews with NMEC implementers via Teams.

Additional information about these three data collection activities is presented in Sections 3-1 through 3-3.

3.1 Tracking data preparation

Tracking data preparation involved two key stages, determining which projects were site-level NMEC and then classifying the claims as either 'initial' or 'true-up' claims.

3.1.1 Site-level NMEC project identification

Site-level NMEC is a project pathway for many different programs. The primary way of identifying site-level NMEC projects involved using the CEDARS tracking field called "Measure Impact Type" and filtering for projects listed as "Cust-NMEC-Site." After identifying which claims were listed as site-level NMEC, DNV confirmed with the PAs that the projects DNV identified through tracking data were site-level NMEC. This effort resulted in reassigning all SDG&E projects from site-level NMEC to custom.

[27] Initial claims are expected to occur after the installation of the project and are based on the engineering-based forecasted savings.

[28] True-up claims occur at least a year after the installation of the project and are a positive or negative savings differences that adjusts the initial claim up or down so that it is aligned with the meter-based normalized savings.

[29] NMEC Reporting Guidance_04242020.PDF

[30] One of the goals of the evaluability study is to determine which projects can be evaluated.

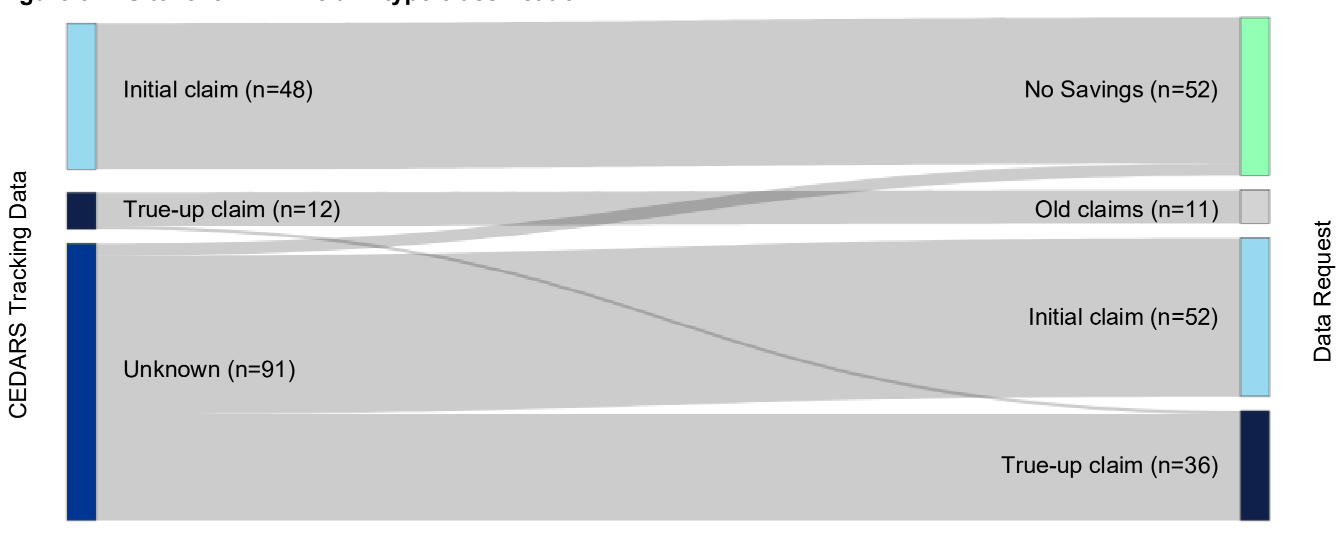
3.1.2 NMEC claim type classification

After identifying which projects were site-level NMEC, the next step was to classify the claims as either initial or trued-up claims. All site-level NMEC projects are expected to have an initial claim in the quarter that the project is installed and a true-up claim that adjusts the initial claimed savings to align with the meter-based model results following a 12-month performance period.[31] Identifying initial claim and true-up claim pairings is important for the evaluation, as the sum of the savings for the two claims is expected to be the total meter-based savings for the project. If a project is not trued-up, it may not be ready for evaluation.[32]

Figure 3-1 shows how the claims identified as site-level NMEC were identified based on the information provided in CEDARS (on the left) and how those claims were reclassified based on a data request submitted to the PAs. In most cases, the CEDARS data did not include information regarding whether a claim was an initial or true-up claim, or DNV needed additional information to decipher how claims were entered. The true-up claims were expected to have the claim ID from the initial claim entered in the CEDARS field "prioryearclaimID,"[33] however, only 12 out of 242 claims had this field populated, seven of the 12 had an incomplete value, and only one of the 12 was a true-up for an initial claim in PY2020 or PY2021. For one PA, DNV later learned that the claim type was embedded into the Claim ID itself. Some SoCalREN, PG&E, and SCG claims were confirmed to have no savings and so they were removed. Other claims were true-up claims from program years prior to 2020, and so they were removed from the evaluability study population, which is focused on projects with initial claims in PY2020 and PY2021. Figure 3-1 highlights the finding that there was not sufficient documentation included in the CEDARS tracking data to appropriately associate true-up claims to their initial claims, nor to appropriately classify most claims as site-level NMEC claims at all. Most claims were reclassified after receiving information in the PA data request.

When asked during interviews how they track the linkages between initial and true-up savings claims, some interview respondents stated that they have their own tracking systems that list initial claim and trued-up claim IDs. Others said they use the claim ID with one saying, "If it's the second or third claim, we put in the previous claim ID."

Figure 3-1. Site-level NMEC claim type classification



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[31] Energy Division Staff Guidance: NMEC Reporting. April 24, 2020.

[32] One of the goals of the evaluability study is to determine which projects can be evaluated.

[33] Energy Division Staff Guidance: NMEC Reporting. April 24, 2020.

3.2 Documentation review

DNV requested project documentation for all 51 site-level NMEC projects with initial claims in PY2020-PY2021. DNV then reviewed the project documentation to pull out key project, sub-measure, and model information not reported in CEDARS to characterize the projects, examine project timelines, and investigate why some projects have not yet been trued up. The focus of this documentation review is to explore and characterize what was done in advance of the impact and net-to-gross evaluation that will occur after the evaluability study. Table 3-2 lists the information collected through the documentation review.

Table 3-2. Documentation review information collected

Project	Measure	Model

• Were influence documents provided?
• Was the project application provided?
• Was a project-level M&V plan provided?
• Was a project feasibility study provided?
• Was a performance period report provided?
• Were engineering savings calculations provided?
• Was the baseline model provided?
• Was the performance period model provided?
• application and installation dates
• Custom project review ID
• Projected and paid incentive
• Implementer(s)
• Building type
• Baseline annual energy use
• Project effective useful life (EUL)
	• Forecasted energy and demand savings
	• Sub-measure name and description
	• Measure application types
	• Measure EUL
		• Model start and end dates
		• Goodness-of fit-statistics:
		  ○ Normalized mean bias error (NMBE)
		  ○ Coefficient of variation of the root mean square error (CV(RMSE))
		  ○ Coefficient of determination (R^2)
		• Fractional savings
		• Fractional savings uncertainty
		• Modeling tools
		• Meter type (utility meter or submeter)
		• Impacted meter(s)
		• Model form
		• Model frequency
		• Are independent variables other than temperature used in the model?
		• What normal weather data was used?
		• What other independent variables are being used?
		• Were any non-routine events identified?
		• How are non-routine events handled?

After collecting the data from the project documentation, DNV summarized the data to characterize project types, measures, savings, and models. Additionally, DNV assembled timelines for each project based on the dates provided in the documentation and reviewed to assess whether key documents were available.

3.3 In-depth interviews

DNV conducted IDIs with staff from PG&E, SCE, SCG, SCG&E, and SoCalREN in April of 2023. Interviews were conducted via MS Teams and lasted about 90 minutes each. To cover a range of topics, the PA typically included staff from multiple teams in the interview, including representatives from policy, reporting, and technical review/engineering teams. Additionally, DNV interviewed teams from two third-party NMEC program implementers. The interviews lasted about 60 minutes and were also conducted via MS Teams in April of 2023. Respondents were offered no incentive for completing the interview. Table 3-3 lists the research objectives covered by the PA and implementer interviews.

Table 3-3. PA and implementer interview research objectives

Research objectives	
PAs	**Implementers**
What is the motivation for developing an NMEC pathway?	How do implementors interact with the program and what role do they play on project teams?
What is the scale of the NMEC pathway?	What are motivations for participants in the program and what barriers have they faced?
What are the key characteristics of NMEC projects?	What are the key characteristics of NMEC projects?
What is the typical NMEC project timeline from project initiation through true-up?	What is the typical NMEC project timeline from project initiation through true-up?
Why are some projects not trued up in the year following the initial claim?	What are the major bottlenecks during the participation process?
How are savings determined and tracked?	How are baseline models and performance models made and adapted?
How are incentives distributed?	How are incentives distributed?
How do implementors interact with the program and what role do they play on project teams?	Satisfaction with participation to date and expected future participation
What are motivations for participants in the program and what barriers have they faced?	
What has participation been to date and how is it expected to change?	

4 RESULTS

Results are organized into the six primary sections below, each with its own subsections of results. Each primary section ends with key findings. DNV has summarized key findings across all sections in Section 5.

1. **Project characterization:** Reviews the characteristics of projects with the goal of understanding who is participating in the NMEC program.
2. **Measure characterization:** Review of measure types, measure application types, and EUL for NMEC projects.
3. **Savings claim characterization:** Summary of the many savings values across tracking data and project documentation, their applicability, and how they are used.
4. **Model characterization:** Review of the different approaches for creating, refining, and evaluating NMEC models.
5. **Timeline characterization:** Set of project timeline case studies to better understand the timeline of NMEC projects and how it is different from what is expected.
6. **Project evaluability:** Utilizes findings from the five sections above to determine which projects are evaluable, and considerations for the evaluability of the program overall.

4.1 Project characterization

There were 51 site-level NMEC projects with initial claims occurring within PY2020-PY2021. This section summarizes the project-level characteristics with the goal of understanding patterns of participation in the NMEC programs. Unless stated otherwise, in this section DNV looks at all the PY2020-PY2021 projects and initial claimed savings to compare projects using consistent metrics.

4.1.1 Project overview

Table 4-1 shows the number of initial and true-up claims and the associated savings by PA. The initial claim is expected to occur shortly after the project is installed and uses engineering-based forecast savings. The true-up claim is expected to occur shortly after the 12-month performance period is completed and the true-up savings are expected to be a positive or negative value that adjusts the initial claim to equal the model-based normalized savings. PG&E completed most of the projects reviewed (24 projects). SCE also had 15 projects with initial claims and SoCalREN had 10 projects with initial claims occurring in PY2020-PY2021. SDG&E did not claim any site-level NMEC projects during the same period. SCG claimed two site-level NMEC projects with savings, but both projects were canceled[34] and additional project documentation was not provided to us. Consequently, DNV reviewed project documentation for 49 sites from PG&E, SCE, and SoCalREN, which are characterized throughout this report.

Table 4-1. NMEC claim summary by PA

PA	Claims		Initial claim savings			True-up claim savings		
	Initial	True-up	Electric (kWh)	Demand (kW)	Gas (therms)	Electric (kWh)	Demand (kW)	Gas (therms)
PG&E	24	21	6,566,272	14.4	94,421	525,219	-10.0	-632
SCE	15	14	1,491,350	0.0	0	407,205	0.0	0
SCG	2	0	0	0.0	4,456	0	0.0	0
SoCalREN	10	1	1,764,303	368.4	0	15,547	5.5	0
Total	**51**	**36**	**9,821,925**	**382.8**	**98,877**	**947,971**	**-4.6**	**-632**

[34] These projects had an initial claim made before measure installation was completed and the tracking savings were not zeroed out or negated with a true-up.

4.1.2 Project documentation

As part of the project documentation review, DNV looked for the following key documents:

- **Application:** The application is the program participation agreement between the PA and the customer.
- **Project feasibility study (PFS):** The PFS includes a description of the planned energy efficiency activities.
- **M&V plan:** This document typically includes the baseline model specification, discussion of goodness-of-fit, non-routine events and adjustments, and plans for the performance period model and savings normalization. Sometimes the M&V plan is included in the same document as the PFS.
- **Influence documentation:** Documentation explaining how the program influenced the customer to complete the project.
- **Engineering savings:** Engineering savings are used to forecast project savings and are typically provided in a spreadsheet.

Table 4-2 summarizes how frequently DNV found each document type for each project. A little over half of projects provided all of the type documentation summarized here. One group of projects for a large tech customer (see Section 4.1.4) did not include any PFSs. Two projects did not include the live engineering savings calculations used to produce the forecasted project savings. The missing documentation will need to be requested again as part of the evaluation.

Table 4-2. Basic project documentation summary

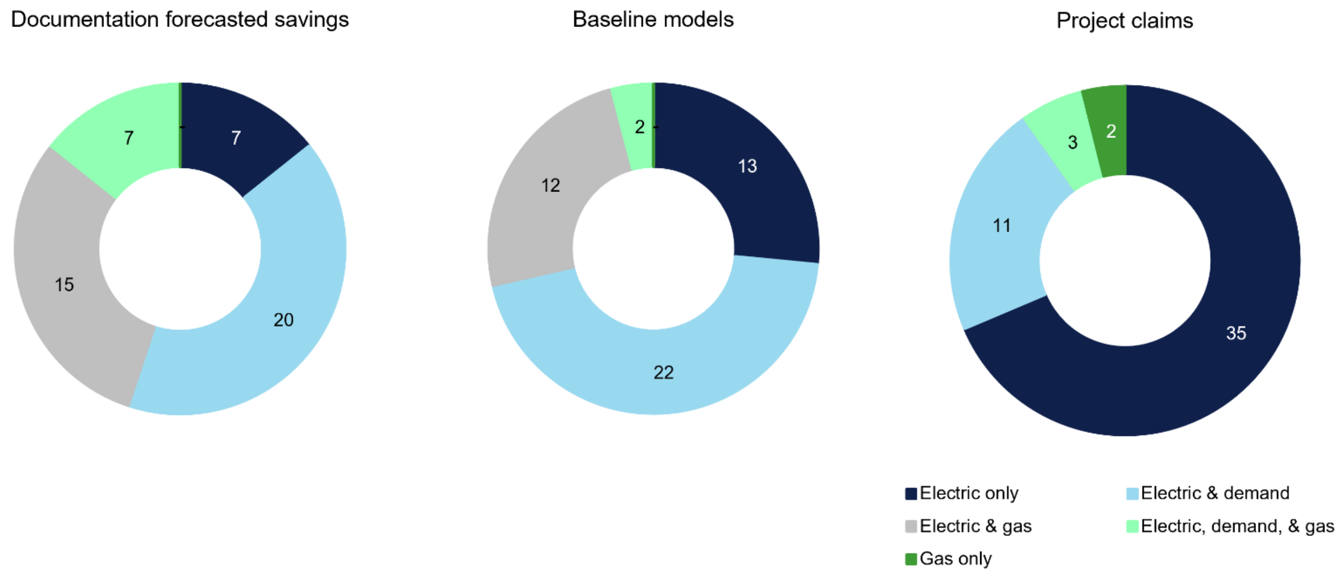
Were the following documents provided?					Project count	Percent
Application	PFS	M&V plan	Influence documentation	Engineering savings		
Yes	Yes	Yes	Yes	Yes	27	53%
Yes	No	Yes	Yes	Yes	19	37%
Yes	Yes	Yes	Yes	No	2	4%
No	Yes	Yes	Yes	Yes	1	2%
No	No	No	No	No	2	4%

In addition to reviewing whether documentation was provided, DNV also conducted a more qualitative assessment of the documentation provided. DNV found there was substantial variation in the type and thoroughness of the project documentation provided. Some projects had relatively clear documentation that explained what had been planned for the project, what was done for the project, and why anything changed. Other documentation was very difficult to follow and did not provide any reasoning or even acknowledge that substantial changes were made during project implementation or the performance period modelling. In some cases, it was also difficult to know which models were the final iterations.

4.1.3 Project savings types

The NMEC tracking data claims are overwhelmingly electric, but earlier project stages showed many more projects had forecast gas and demand savings. At the project documentation stage, only seven of 49 projects were solely forecasted electric kWh savings. At the project claims stage, 36 of 51 projects claimed only electric kWh. Figure 4-1 shows the change in project savings type across project stages, moving from forecast savings to baseline model development, and then to initial tracking data claim. Of the 22 projects with forecast gas savings, 15 provided baseline gas models. Of those 15 gas models, 12 did not pass the goodness-of-fit screenings. Of the remaining three projects, one model failed during the performance period, one failed when re-baselined, and one did not claim gas savings but did not provide an explanation.

Figure 4-1. Savings types by project stage



*The project count for claims is two greater than for the forecasted savings and baseline models, because there were two gas projects for which DNV did not receive documentation. These two projects were canceled but not negated in the tracking data.

4.1.4 Large customers

Sixty-five percent[35] of the site-level NMEC projects reviewed were from two customers, a large tech company (37%) and a school district (27%) (see Figure 4-2). As shown in Table 4-3, these two customers make up a large share of electric savings with the large tech customer and school district accounting of 42% and 12% of savings, respectively. Most gas savings came from one large project that was not either of these two large customers.

When looking at trued-up projects only, the two large customers accounted for 92% of electric-saving projects and 88% of electricity savings. The large gas project was not trued up, which left just one trued-up gas project with claimed savings of -632. Since there are only two customers that make up most of the savings, the characteristics of this population cannot be representative of future NMEC program years. More discussion of evaluability is in Section 4.6.

[35] When rounded, the 37% of projects from a large tech customer and 27% of projects from a school district make up 65% of NMEC projects.

Figure 4-2. Large customer groups proportion of projects

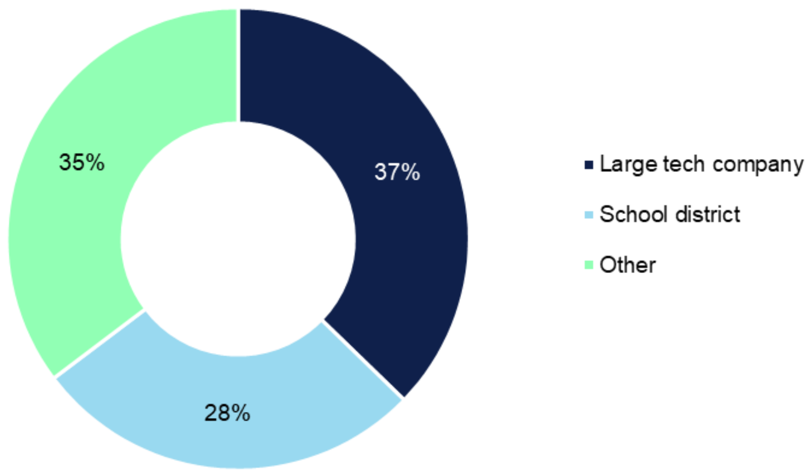


Table 4-3. Project counts and savings for large customer groups

Customer group	Projects		Initial savings			True-up savings		
	Initial	True-up	kWh	kW	therms	kWh	kW	therms
Large tech company	19	19	4,026,134	0.0	0	519,091	-10.0	-632
School district	14	14	859,030	0.0	0	407,205	0.0	0
Other	18	3	4,936,760	382.8	98,877	21,675	5.5	0
Overall	**51**	**36**	**9,821,925**	**382.8**	**98,877**	**947,971**	**-4.6**	**-632**

4.1.5 Building types

Most PY202-PY2021 site-level NMEC projects occurred in office buildings, followed by education buildings and parking structures as shown in Figure 4-3. There were also five projects in parking structures, three projects in refrigerated warehouses, a laboratory project, and a library project. The large tech company makes up most of the office building projects (19 out of the 25 projects shown below) and the school district makes up all the education projects. The remaining projects demonstrate considerably more building type variety.

Figure 4-3. Projects by building type

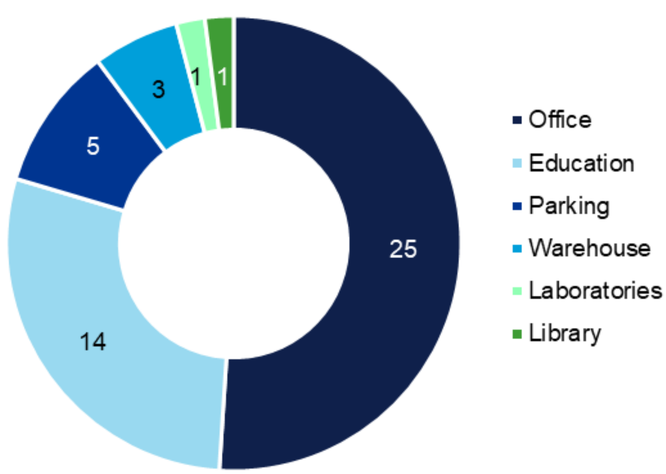
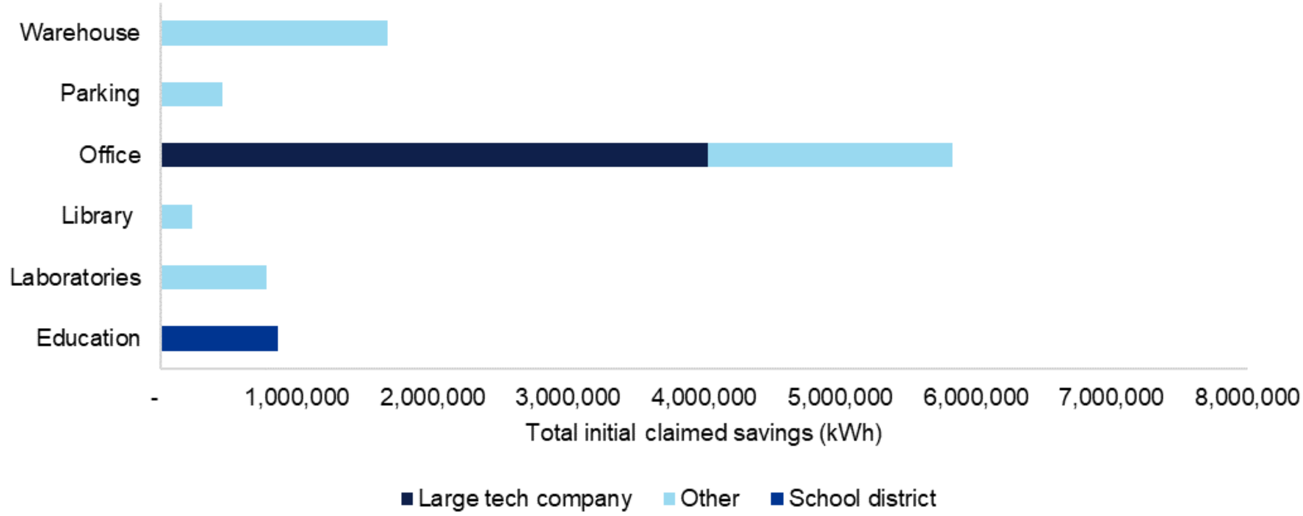


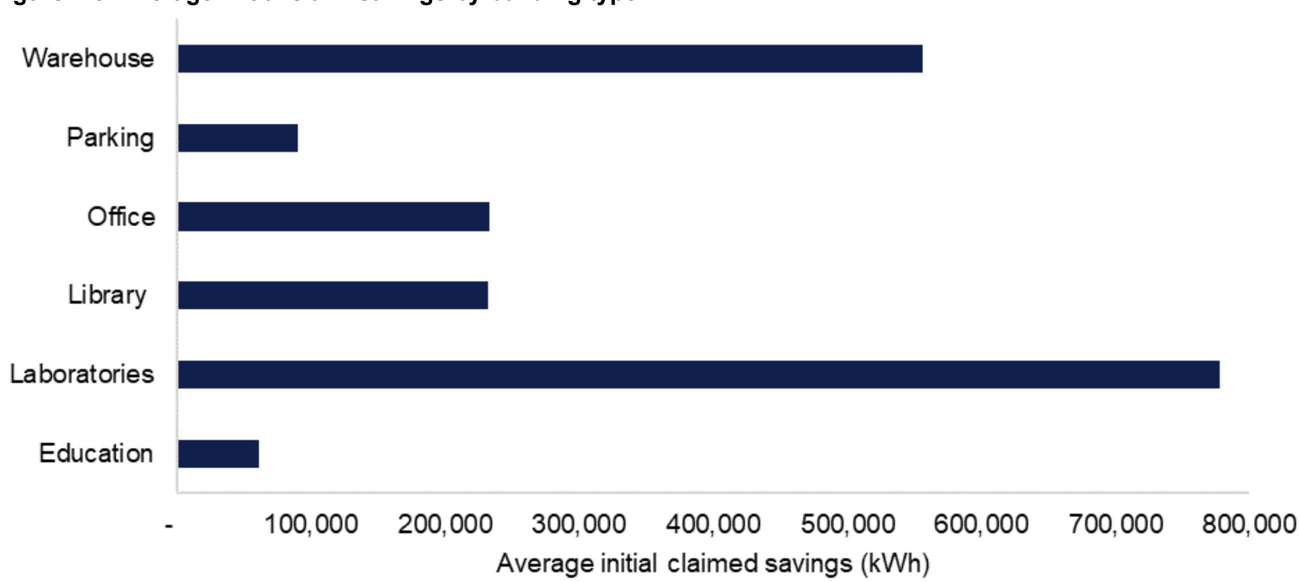
Figure 4-4 presents the total initial claimed electric savings by building type and breaks out savings coming from the largest customers as discussed in Section 4.1.4. Savings primarily came from offices, with most office savings coming from the large tech company. While warehouses were the fourth most common building type by project count, warehouses claimed the second highest total initial claim savings. All the savings from the education building type came from one school district.

Figure 4-4. Initial claimed electric savings by building type and large customer group



The largest average initial electric savings claims came from laboratory and warehouse projects as shown in Figure 4-5. The smallest projects, based on the average initial claim, were for the education and parking building types. Based on the relatively limited sample, it is hard to say whether there will be any enduring trends, but it is notable that the customers with multiple projects had smaller individual projects on average. This may indicate that the program was more attractive when the smaller projects could be grouped together.

Figure 4-5. Average initial claim savings by building type



4.1.6 Custom project review

The CPUC's Custom Project Review (CPR) process reviews a sample of projects with the goal of identifying any potential issues prior to project implementation. For site-level NMEC, projects selected for CPR are typically reviewed prior to implementation and then reviewed again following the performance period. NMEC projects are typically selected for CPR from the bi-monthly upload when incentives are greater than $100,000 and on an ad hoc basis. In 2021 and 2022, 51% of NMEC projects listed in the bi-monthly upload were selected for CPR.

Of the projects with initial CEDARS claims in PY2020 and PY2021, 24% of projects went through the CPR process, accounting for 43% of electric savings as shown in Table 4-4. On average, the selected projects were much larger than the rest of the population, which is in line with CPR NMEC project selection criteria. The projects in this evaluability study would have mostly been in a bi-monthly upload prior to 2021 and 2022, rather than in the population used to identify the 51% NMEC selection rates. However, the large difference in claimed projects that went through CPR (24%) and the NMEC CPR selection rate (51%) is still notable. This difference (51% vs. 24%) may suggest that NMEC projects going through CPR are being canceled or delayed at a higher rate than projects that do not go through CPR. However, during the interviews, only one PA indicated that they canceled a project after the CPR process. They stated, "One project in another program was cancelled that did not pass our quality review because there was not sufficient program influence. It came out of a disposition at the CPUC and then our team re-reviewed and decided not to pursue it."

Table 4-4. Custom project review summary[36]

CPR review	Project count	Electric savings (kWh)	Demand savings (kW)	Gas savings (therms)
No	39	5,066,475	328	4,456
Yes	12	4,755,450	55	94,421
Total	**51**	**9,821,925**	**383**	**98,877**

4.1.7 Incentive structures

The NMEC rulebook requires that "a significant portion of customer and implementer incentives" be based on performance. Table 4-5 summarizes the incentive structures to the extent that PAs could speak to them during the interviews as well as incentive rates as documented in program implementation plans.

While incentive structures vary by program and even project, all final incentives are paid out after projects are "trued-up" at the end of the 12-month performance period. Some programs offer an initial portion of the incentive based on a non-normalized analysis three months into the performance period. When respondents could speak to the incentive structure, they explained that incentives are capped at some percentage of project costs. The maximum percentage of allowed project costs varies by program and customer type, but all respondents indicated that the cap was based on project costs and not on any other metric. When projects perform better than the initial claim, respondents indicated that a larger incentive can be paid than originally planned but that the incentive still cannot exceed the cap based on the project cost. Of note, for programs with third-party implementers, PA respondents were generally unaware of the specific incentive structure.

36 This table uses initial project counts and savings from initial claims.

Table 4-5. Incentive structure summary

PA	Program name	Disbursement schedule	Cap	Rates
PG&E	Manufacturing and Food Processing Efficiency Program/ISOP	• 30%-40% payment at three months • The rest paid at true-up based on verified savings	Some percent of project costs	$0.12/kWh $1.50/therm
	Commercial Calculated Incentives	• Initial payment after installation based on forecasted savings • 30%-40% payment at three months • The rest paid at true-up based on verified savings	80% of project costs	$0.06-$0.12/kWh $75-$150/kW $0.50-$1.25/therm
	UC/CSU	• Initial payment after installation based on forecasted savings • 30%-40% payment at three months • The rest paid at true-up based on verified savings	Some percent of project costs	$0.24/kWh $1.00/therm
SCE	Public Sector Performance-Based Retrofit HOPPs	• 40% payment following the three-month report • 40% payment following the 12-month report • 20% payment following the 24-month report	~50% of project costs	$0.12/kWh $200/kW
SCG	CEMTL Program	• Varies by contract • Based on milestones	Unknown	$1.50/therm
SoCalREN	Public Agency Metered Savings Program	• SoCalREN did not offer incentives in PY2020 and PY2021	NA	$0

4.1.8 Project characterization findings

When looking at the 51 NMEC projects with claims in PY2020-PY2021, DNV found the following:

1. **PY2020-2021 site-level NMEC projects are dominated by two customers with many projects.** Sixty-five percent of projects and 54% of savings were from two customers, a large tech company and a school district. This will have implications for the representativeness of this population for future years of the NMEC program.

2. **Savings claims are mostly electric.** Most projects are claiming electricity savings of only 71%. Twenty-two percent of projects claim electric energy and demand savings and are not claiming gas savings. While nearly half of the projects began with forecast gas savings, only two projects ended up claiming any gas savings.[37] The lack of gas and electricity demand savings claims is explored further in Section 4.2, Measure Characterization and Section 4.4, Model Characterization.

3. **Most projects occurred in office buildings, followed by education buildings, and parking structures.** There is significant overlap between the largest two customers and building type, with all projects in education buildings occurring in the largest school district and the majority of the projects in offices (19 out of 25) occurring in the large tech company.

[37] Two additional projects claimed gas only savings, but these were determined to be accidental claims as the projects were canceled.

4.2 Measure characterization

The NMEC pathway utilizes a whole-building approach based on the change in energy usage at the meter, which means final savings are also at the whole-building level, rather than at the measure level. Projects are also tracked at the whole-building level rather than the measure level. To better understand the types of measures installed as part of NMEC projects in PY2020 and PY2021, DNV gathered information from the project documentation. Project documentation typically includes information regarding the measures that were initially planned, documentation indicating whether a measure was installed or not, engineering-based savings forecasted, EUL[38], and measure application types. Unless stated otherwise, in this section DNV looks at forecast savings for measures that were marked as installed for the population of 51 sites. DNV used forecast savings when comparing measures because forecasts are provided at the measure level.

4.2.1 Savings by measure category

When reviewing project documentation, DNV identified three measure categories installed across the NMEC projects: lighting, HVAC, and refrigeration. Figure 4-6 summarizes the electric, demand, and gas engineering-based forecast savings for installed measures. Lighting had the highest forecast electricity and demand savings followed closely by HVAC. For gas, 22 projects had forecast savings or interactive effects,[39] but only five ultimately became CEDARS claims. When filtering for trued-up projects, there is only one gas project with -632 therms from interactive lighting effects. The implications of this on evaluability are further discussed in Section 4.6.

Figure 4-6. Forecast savings by high-level measure category and fuel

[38] An estimate of the median number of years that the measures installed under the program are still in place and operable.

[39] Interactive effects are increases in one fuel usage due to and energy efficient change in another fuel. As an example, lighting measures with electric savings typically increase gas usage as LEDs don't produce as much heat as less efficient bulbs which typically means that more gas may be needed for space heating.

Figure 4-7 below breaks down the high-level measure categories into more descriptive sub-categories. This figure indicates that most electricity savings are from interior lighting and HVAC ventilation controls. Demand savings are mostly from interior lighting, and more distributed among the HVAC measures. Gas savings are primarily from HVAC setpoint controls followed by ventilation controls. There are some negative gas interactive savings from lighting measures.

Figure 4-7. Forecasted savings by measure category and fuel

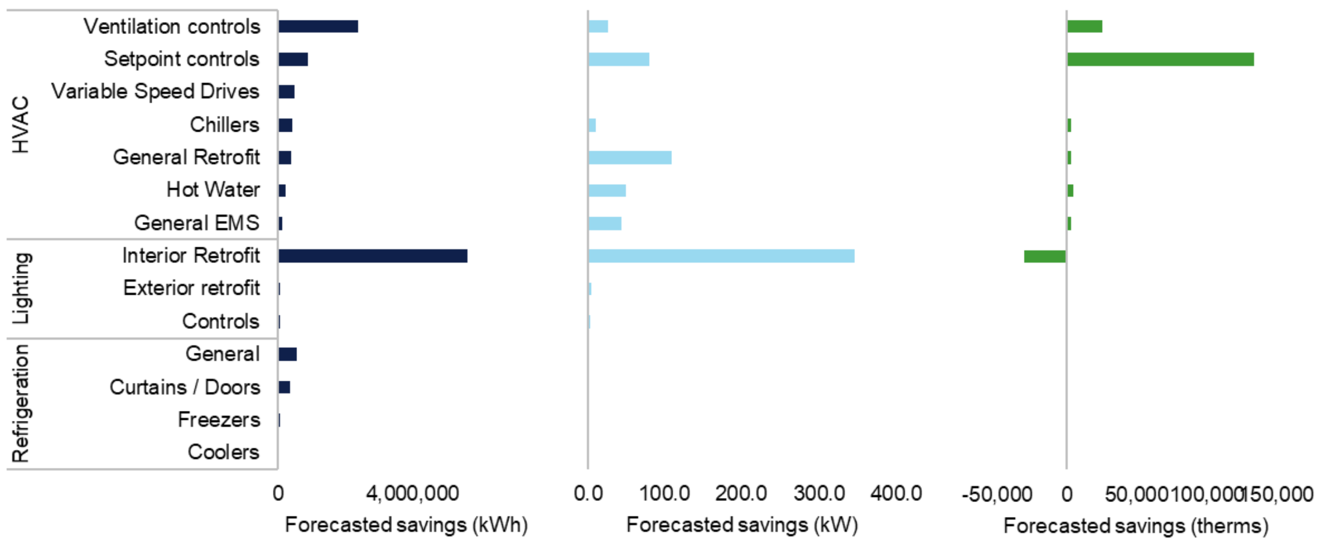
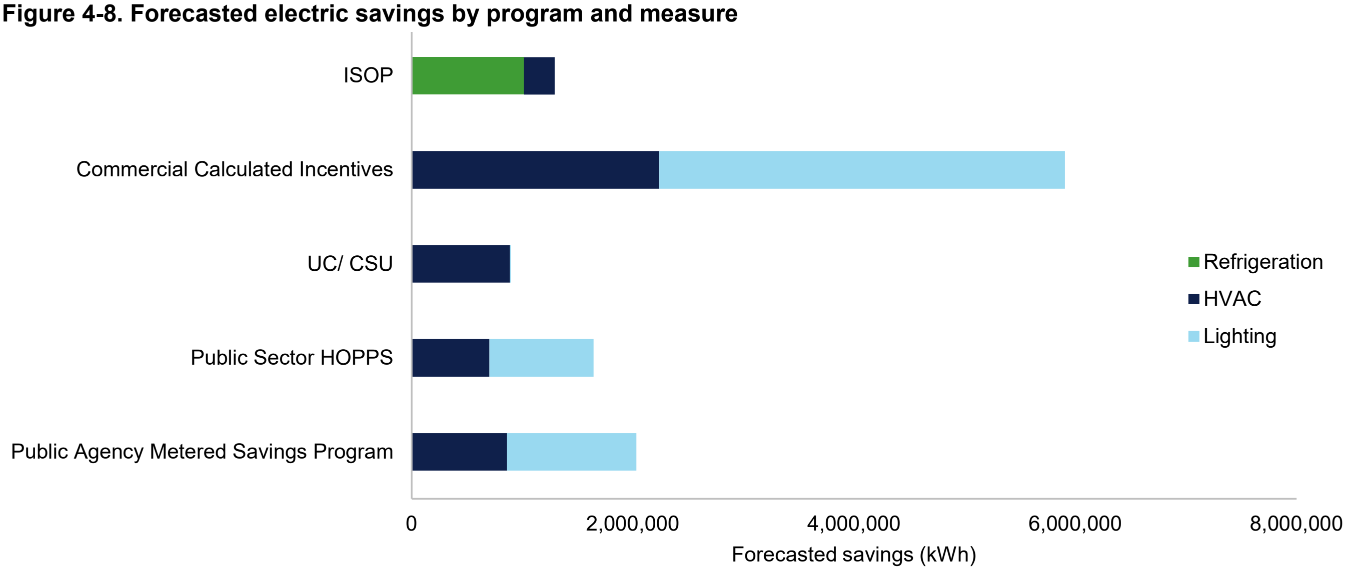


Figure 4-8 shows the forecast electric savings by measure category and program. The Commercial Calculated Incentives, Public Sector HOPPs, and Public Agency Metered Savings Programs all have a combination of HVAC and lighting savings. The UC/CSU program has HVAC savings only. The ISOP program, which targets industrial manufacturing and food process customers, has primarily refrigeration-related savings and some HVAC savings.

Figure 4-8. Forecasted electric savings by program and measure



4.2.2 Measure application types

Measure application types (MATs)[40] are an energy efficiency categorization related to the project type and context and are used to determine the appropriate approach for calculating measure life (EUL) and baseline for custom project measures. MATs are used for all custom projects as well as for site-level NMEC projects. For site-level NMEC projects, MATs are primarily used to determine the appropriate approach to determining measure life[41]. Individual measures within site-level NMEC projects are assigned MATs that determine the appropriate measure-level EUL. Measure-level EULs are then averaged, on a weighted basis using measure-level engineering savings forecasts, to calculate the expected project EUL. The following custom project MATs are also used in site-level NMEC projects:

- **Accelerated Replacement (AR):** Accelerated replacement means the replacement of existing equipment with higher efficiency equipment, while the existing equipment would have remained in operation for at least its remaining life. AR measures are assigned a measure-specific EUL.
- **Add-On Equipment (AOE):** Add-on equipment measures install new equipment onto existing host equipment. AOE measures are assigned an EUL equal to the host equipment remaining useful life.
- **Behavioral, Retro-commissioning, and Operational (BRO):** This group includes information or education programs that influence energy-related practices (behavioral), activities and installations that restore equipment performance (retro-commissioning), as well as measures that improve the efficient operation of installed equipment (operational). BRO measures are assigned a three-year EUL.
- **Normal Replacement (NR):** This group involves replacing existing equipment that has failed or no longer meets needs due to remodeling, upgrading, or replacement activities. NR measures are assigned a measure-specific EUL.

MATs are applied at the measure level, and a comprehensive project could be expected to have measures representing many MATs. In fact, most projects with electricity savings had the same MAT for all measures.[42] Figure 4-9 displays the share of electric projects with a single MAT vs. multiple MATs based on the documentation review. Most projects with electricity savings had only one MAT (92%), though larger projects were more likely to have multiple MATs, as can be seen based on the higher percentage of savings with multiple MATs. This could reflect a limited range of measures for a project or oversimplified application of MATs to the measures. It was out of scope for this analysis to validate MAT at the measure-level, so the implications of this finding remain unknown. A preponderance of single-MAT projects could indicate a limited range of measures that does not reflect the vision of more comprehensive, deep retrofits for NMEC projects. But there may be justifiable reasons for single-MAT projects, which will be explored during the evaluation. When asked during interviews if they consider MATs during the pre-screening process, PAs indicated that they (or their implementers) do not put much emphasis on MATs because their goal for NMEC is to have a streamlined and holistic process. There are some examples of projects with a single MAT that appear to have measures that would likely be assigned to another MAT. Also, some of the projects reviewed did not clearly specify MATs outside of the measure life spreadsheet and did not discuss why the specific MATs were selected.

[40] For more detailed definitions of each MAT, see: https://www.caltf.org/measure-application-types-1

[41] Savings for all site-level NMEC projects are estimated using an existing conditions baseline due to the performance-based approach, unlike custom projects, which use different baselines depending on the MAT.

[42] Full analysis of measures and MATs will be done for the ex post evaluation.

Figure 4-9. Electric project measure application type breakdown

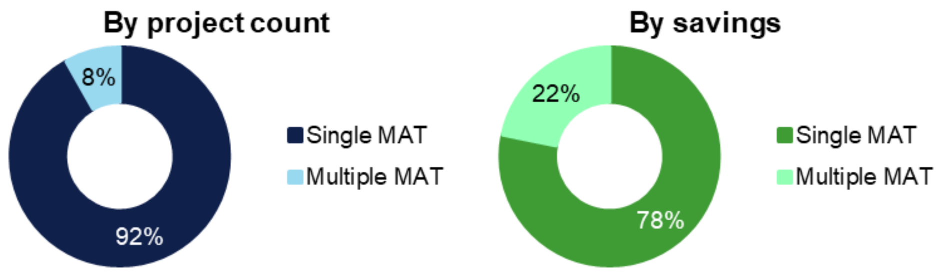
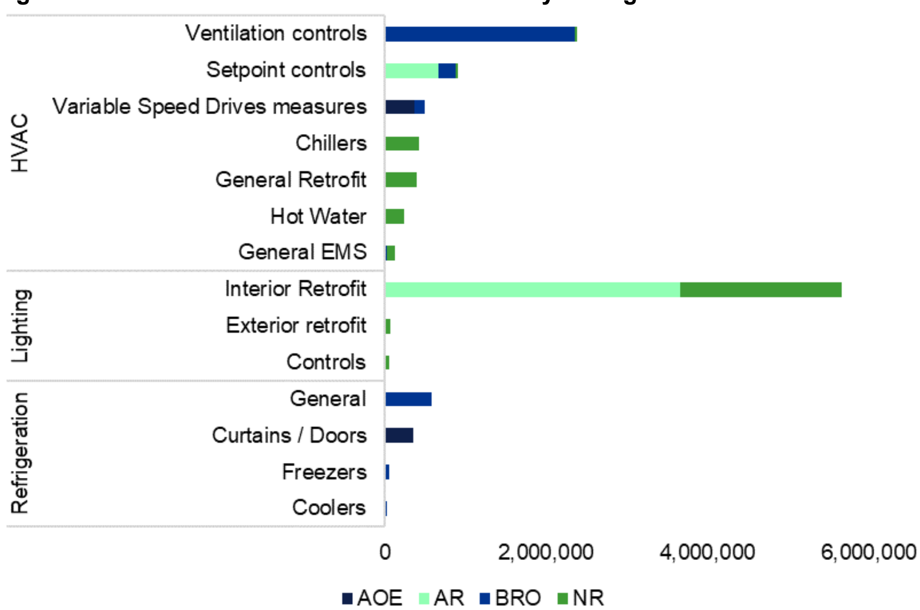


Figure 4-10 provides detailed measure-level breakout of MATs by savings and illustrates the challenge of generalizing about the typical use of MATs. The HVAC control and refrigeration measures tended to be BRO and they account for a large amount of savings. There are also a substantial number of NR measures implemented for each measure group, with most being lighting measures.

Figure 4-10. Electric measure MAT breakdown by savings



NR measures represent a challenge in the context of NMEC's existing conditions baseline. In the custom context, The NR MAT is reserved for measures that would have been replaced anyway but were replaced with a higher level of efficiency due to the program. They are only credited savings for efficiency beyond industry standard practice. In the context of NMEC and the existing conditions baseline, the performance-based estimate of savings for the project will include more savings than the marginal efficiency savings for these measures. If an installed measure fits the standard custom definition of NR, it will likely face challenges at the NTG stage. In contrast to this, NMEC's remit to address stranded savings implies a degree of acceleration of the project due to the program compared to what would have happened otherwise. This would indicate an AR MAT and remove any concerns regarding a claim of savings from the existing conditions baseline. To further complicate the matter, an NR MAT requires lower program influence documentation in the Custom program context. This may have been a motivation for assigning the NR MAT to measures that could have been AR. For this study, DNV was unable to establish the basis on which NR MATs were applied. The evaluation will determine the implications for savings claims and gross realization rates (GRRs).

The preliminary evidence gathered here supports the hypothesis that MAT may be applied variably to similar measures in the NMEC context. In addition to the NR MAT issue, the assignment of MAT remains important for correct calculation of EUL, and this will be assessed in the evaluation. Whether the preponderance of single-MAT projects signals a shortfall in the breadth of NMEC project efforts, remains to be seen. It is not a requirement that NMEC project be comprehensive. That expectation followed from the targeted scenario of remediating stranded savings.

4.2.3 Effective useful life

The EUL is used to calculate the project lifetime savings. The final savings for NMEC projects use a meter-based whole-building approach that does not have an EUL associated with the calculation. To derive a project-level EUL, EULs are assigned to the measures installed within the project and are weighted by the engineering-based forecast savings. Calculating project-level EULs in this way requires that measure-level savings be broken out when savings are forecast and that MATs and EULs be assigned to each installed measure. During interviews, PAs and implementers cited concerns about EUL requirements. One PA suggested developing an assumed EUL for NMEC, "if NMEC came up with a default they could remove measure-level calculation and encourage energy efficiency community to leverage NMEC more."

Table 4-6 presents the average, minimum, and maximum project-level EULs by program. Programs with more BRO measures, such as ISOP and Commercial Calculated Incentives, have lower project-level EULs as BRO measures use an EUL of three years.

Table 4-6. Project-level EUL in the tracking data

Program	Project EUL		
	Min	Average	Max
ISOP	3	3	3
Commercial Calculated Incentives	3	4	12
UC / CSU	15	15	15
Public Sector HOPPs	11	11	12
Public Agency Metered Savings Program	11	13	18
Overall	**3**	**8**	**18**

Table 4-7 shows the minimum, average, and maximum EUL by program, group, measure, and MAT, excluding BRO measures which all have an EUL of three years.

Table 4-7. Project documentation measure EUL ranges by program excluding BRO

Program	Group	Measure	MAT	Measure count	Minimum EUL	Average EUL	Maximum EUL
ISOP	Refrigeration	Curtains / doors	AOE	2	3	4	4
Commercial Calculated Incentives	HVAC	Hot water	AOE	1	5	5	5
		Ventilation controls	NR	1	15	15	15
	Lighting	Interior retrofit	AR	2	12	12	12
UC/ CSU	HVAC	Setpoint controls	AR	1	15	15	15
Public Sector HOPPs	HVAC	Variable speed drives measures	AOE	3	5	5	5
		Chillers	NR	2	15	18	20
		Ventilation controls	NR	1	15	15	15
	Lighting	Controls	NR	4	8	9	12
		Exterior retrofit	NR	1	12	12	12

Program	Group	Measure	MAT	Measure count	Minimum EUL	Average EUL	Maximum EUL
Public Agency Metered Savings Program		Interior retrofit	NR	59	8	11	12
	HVAC	Chillers	NR	1	15	15	15
		General EMS	NR	2	8	12	15
		General retrofit	NR	5	15	16	20
		Hot water	NR	6	0[43]	14	20
		Setpoint controls	NR	3	12	14	15
	Lighting	Exterior retrofit	NR	2	12	12	12
		Interior retrofit	NR	10	8	12	15

For NMEC projects, the PAs enter a project-level EUL into the tracking database at the time of the initial claim, which is supposed to occur after installation. Under typical conditions, the EUL is not changed with the true-up claim. This approach of setting the project EUL at the time of the initial claim should work well if all project implementation is completed prior to making the initial claim. In fact, the list of installed measures frequently changes from feasibility documentation to final installation, and documentation for both measures and resulting EUL is not always updated to reflect the final implemented project. The ISOP program often continued to implement additional measures throughout the performance period. This appears to be part of the program design but does not fit well in the NMEC process. In these instances, the EULs may need to be updated to align with what was installed. This is further complicated because measures installed later in the performance period will not be able to receive a full year of performance-based savings. There are no easy solutions to this challenge, and it is possible the ISOP program will change tactics to better fit within the NMEC process. If not, further consideration may be warranted. In addition to the ISOP situation, there were three instances of accidental claims where initial claims were made prior to installation. These were anomalies that should not need to be addressed in practice.

4.2.4 Uninstalled measures

While measure characterization is primarily focused on measures that were installed, DNV also gathered information about measures that were planned but not installed. The project feasibility study report typically provides information about the planned measure, and then the installation inspection or the post M&V report provides additional information about whether the planned measures or other measures were installed.[44] Since the initial claim is expected to occur following project installation, savings and other information about these measures do not make it into the tracking database unless there is an error. Uninstalled measures may be relevant to the evaluation if changes between the planning and installation phases are not properly documented or if there are patterns that may point to systematic issues facing NMEC projects.

Table 4-8 shows the count of measures and forecast savings by whether the measure was installed. DNV can see that most electric and demand savings were installed. Conversely, only about half of the forecast gas saving were installed. Of the measures with gas savings that were installed, most were not claimed. Most project files did not provide a clear explanation for why measures were not installed or not claimed.

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[43] Fuel substitution measure claiming increase in electricity use but no EUL.

[44] If measure changes are made between planning and installation, the EUL and forecasted savings estimates should be updated prior to making the initial claim. This issue was not investigated as part of the evaluability report but will be reviewed as part of the evaluation.

Table 4-8. Measure installation status for planned measures based on documentation

Measure installed	Count of measures	Forecasted electric savings (kwh)	Forecast demand (kW)	Forecast gas savings (therms)
Yes	291	11,720,157	674.9	141,995
No	463	2,857,325	41.7	144,035
Unknown	5	47,961	0.3	0

Table 4-9 provides a breakdown of forecast savings by whether the measure was installed and by program. This table indicates that the Commercial Calculated Incentives program accounts for most of the not installed measure savings with 86% and 100% for electric and gas, respectively. Most of the measures within the Commercial Calculated Incentives program that were not installed appeared to be due to a measure optimization approach where some measures were proposed initially, but the final measures were determined later. Consequently, the measure list changed between the planning stage and project implementation stage, but the EUL did not, as all measures were classified as BRO.

Table 4-9. Measure installation status for planned measures based on documentation by program

Program	Measure status	Count of measures	Forecasted electric savings (kwh)	Forecasted demand (kW)	Forecasted gas savings (therms)
ISOP	Yes	19	1,293,000	0.0	0
	No	1	21,000	0.0	0
	Unknown	0	0	0.0	0
Commercial Calculated Incentives	Yes	175	5,904,515	126.6	18,833
	No	460	2,471,383	0.0	144,035
	Unknown	0	0	0.0	0
UC/ CSU	Yes	3	895,384	110.0	114,839
	No	2	364,942	41.7	0
	Unknown	0	0	0.0	0
Public Sector HOPPs	Yes	65	1,595,934	5.6	0
	No	0	0	0.0	0
	Unknown	5	47,961	0.3	0
Public Agency Metered Savings Program	Yes	29	2,031,324	432.7	8,323
	No	0	0	0.0	0
	Unknown	0	0	0.0	0

4.2.5 Measure characterization findings

When characterizing the measures installed and not installed as part of the site-level NMEC projects, DNV found the following:

1. **Most electric savings came from lighting measures.** Forty-nine percent of engineering-based forecasted electric savings came from lighting measures followed by HVAC measures (42%). Refrigeration made up the remaining savings (9%).

2. **All gas savings came from HVAC measures.** All positive engineering-based gas forecasted savings came from HVAC and all negative interactive savings came from lighting measures.

3. **Most electric projects have a single MAT (78% of savings).** AR measures made up the most savings (37%), followed by similar shares for BRO (29%), and NR (28%). Application of MATs to measures may have some inconsistencies and reflect unclear NMEC rulebook guidance on the subject.

4 **Many planned measures were not installed measures.** The majority of electric savings were installed, while gas projects had half the savings not installed. Commercial Calculated Incentives program accounts for most of the not installed measure savings with 86% and 100% for electric and gas, respectively.

5 **Final documentation must reflect all implemented measures and only implemented measures.** Preliminary savings claims and the associated EUL are supposed to reflect all measures installed. When project plans change in the implementation process, the documentation is not always updated, particularly for EUL. While preliminary savings are updated via the performance-based savings estimate, the original claimed EUL remains in place and needs to appropriately reflect the length of the project lifetime. For a different but related challenge, some projects continued to install additional measures after posting preliminary savings claims based on initial implementations. Implementations during the performance period further complicate EUL calculations while leaving real, performance-based savings on the table.

4.3 Savings claim characterization

There are multiple savings values that come from project documentation and the CEDARS tracking data and are key for understanding whether data are being entered correctly and how projects are performing. These savings definitions are listed below in Table 4-10, broken out by whether the value is found in the project documentation or in the CEDARS tracking data:

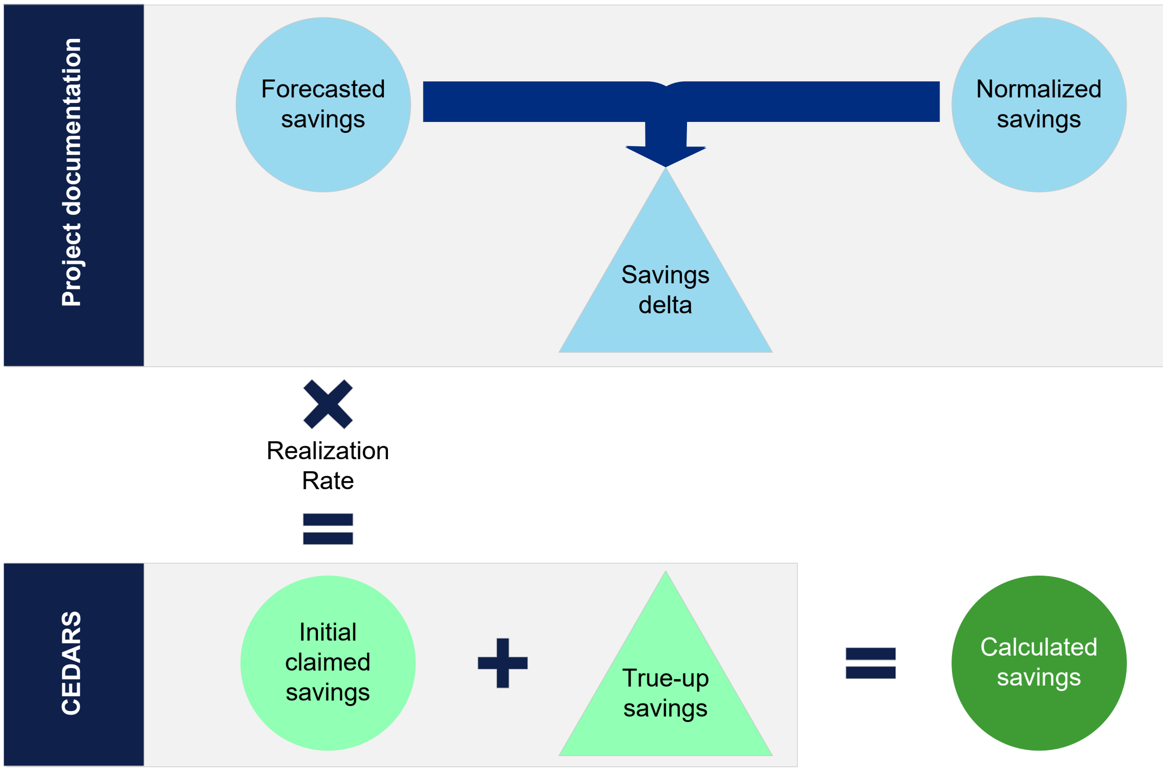
Table 4-10. Savings definitions

Project documentation	Tracking data (CEDARS)
Forecast savings: Engineering-based savings estimate for installed measures. DNV pulled this information from the provided project documentation.	**Initial claimed savings:** The savings claimed in CEDARS following project implementation.
Savings delta: The difference between normalized savings and forecasted savings. This value is not typically directly provided in the documentation, but it is implied.	**True-up savings:** The savings claimed in CEDARS following the end of the performance period. This value is expected to be the difference between initial claimed savings and the normalized savings.
Normalized savings: Savings calculated as the difference between the weather normalized baseline and performance period statistical models.	**Calculated savings:** The calculated savings is a sum of the initial claimed savings and true-up savings found in CEDARS. Calculated savings is expected to equal normalized savings.

Figure 4-11 summarizes the relationships described above and also shows where the ex-ante GRR is expected to be applied. There is some confusion regarding whether the GRR should be applied to both the initial and true-up claims or only to the initial claims. Given that no PA applied the GRR to the true-up claim, DNV can assume for now that the consensus expectation was to apply the GRR to only the initial claim.[45]

[45] Preliminary guidance provided by Staff in November 2021 indicated that final normalized/calculated savings estimates should use a GRR of 1.0. Future guidance may further clarify this process.

Figure 4-11. Expected relationships between savings values

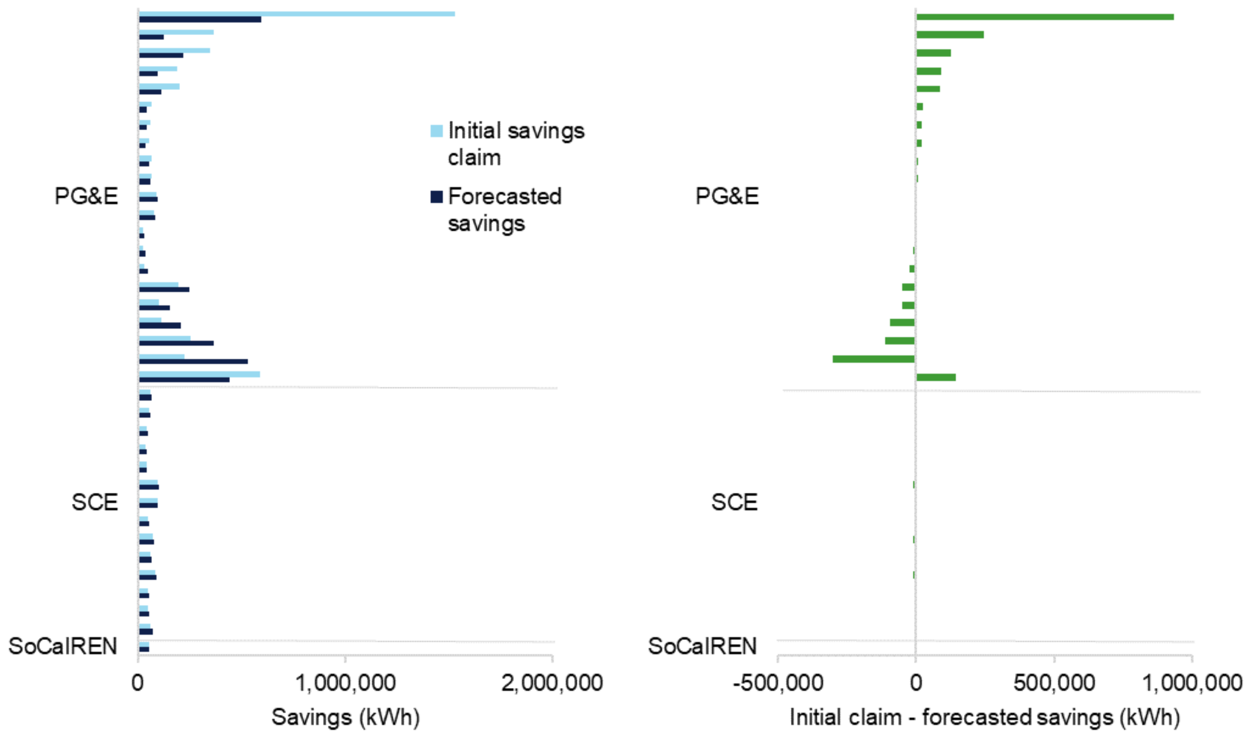


In the following sections, DNV compares the savings types listed in Table 4-10 and Figure 4-11 above and summarize the various ways that claims were made in PY2020-2021. The purpose of these comparisons is to try to understand how claims were made and how the CEDARS tracking data relates to the project documentation. Given that most claims were electric only, DNV focuses on electric savings in this section. Additionally, DNV only includes the 36 trued-up projects in this section.

4.3.1 Forecast vs. initial claim

In this section, DNV tests whether the initial claim in CEDARS is equal to forecast savings from the project documentation. The forecast savings could also have had the GRR applied. DNV compared the forecast savings provided in the project documentation with initial savings claim found in CEDARS for each project. In Figure 4-12, the graph on the left plots the two savings values next to each other while the plot on the right shows the delta between the two, with positive values indicating that the initial savings claim was higher than the forecast savings provided in the project documentation. If the initial savings claim were based on forecasted savings, the delta between the initial claim and forecasted savings in the plot on the right show be close to zero. For PG&E, roughly half of initial claims are higher than forecasted and the other half are lower, which does not follow the expected relationship. This indicates that PG&E's initial claims are not based on their forecasted savings. The basis for PG&E's initial claims is further explored in the following sections. For SCE, except for a couple small deviations, the initial claims and forecasted savings match. This pattern adheres more closely with the expected relationship, but DNV did not see evidence of a realization rate being applied.

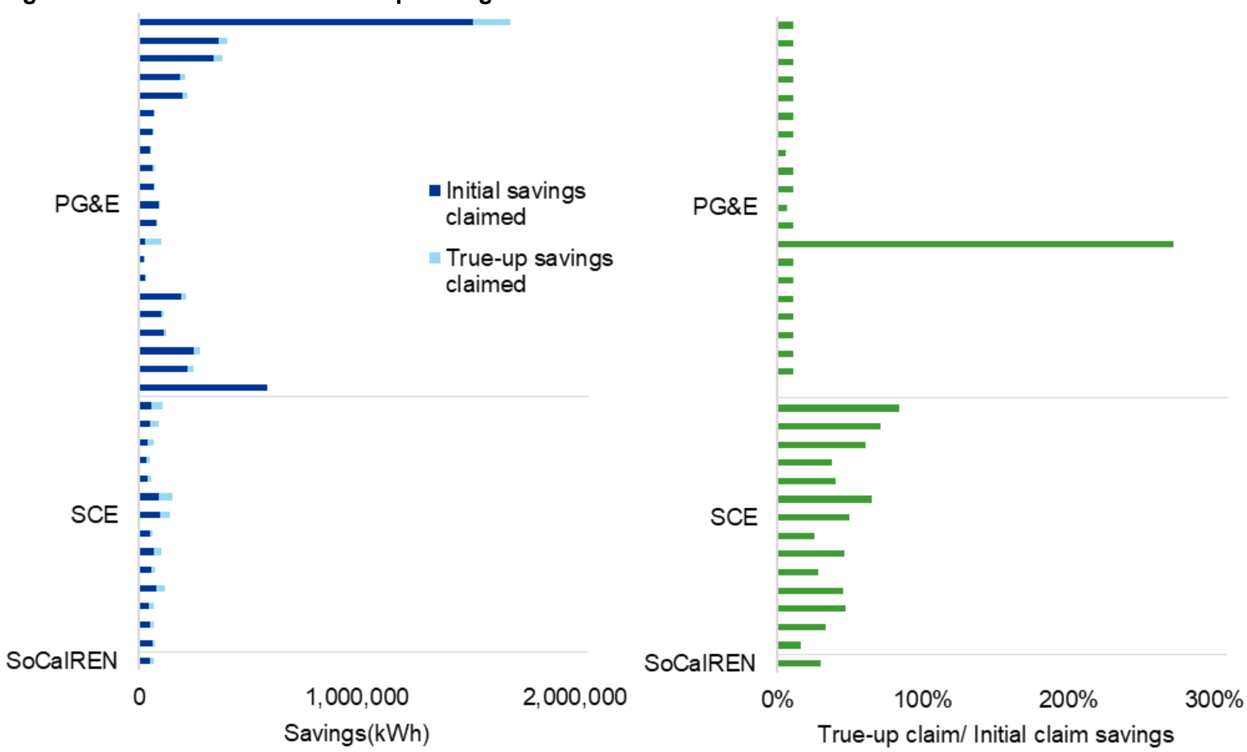
Figure 4-12. Initial and forecasted electric savings by project



4.3.2 Initial vs. trued-up savings

In the process of trying to understand the origin of the savings forecasts used to make initial claims, particularly for PG&E (see Section 4.3.1), DNV next looked at whether there may be a pattern connecting the initial and trued-up savings together. The trued-up claim is expected to be a savings delta (either positive or negative) that adjusts the initial claim to align with the meter-based normalized savings. However, all the true-up savings values in CEDARS were positive. Figure 4-13 shows the initial savings claim and the true-up savings claim stacked on the left and the ratio of true-up savings over initial claim savings on the right. With only a couple of exceptions, the PG&E true-up claims are 11% of the initial savings claims. This suggests that PG&E's initial claims are actually based off of normalized savings rather than forecasted savings. PG&E's true-up savings may not be true savings deltas and may be simply adding in the savings removed by applying the GRR to the initial claim. For SCE, the true-up savings range from 18% to 84% of the initial savings claims. This visual representation of SCE's claims does not fit expectations but also does not offer clues to what they are reporting. In response to a data request to classify claim types, SCE indicated that the true-up claims were mistakenly entered as initial claims, which may explain why the true-up savings do not follow the expected pattern.

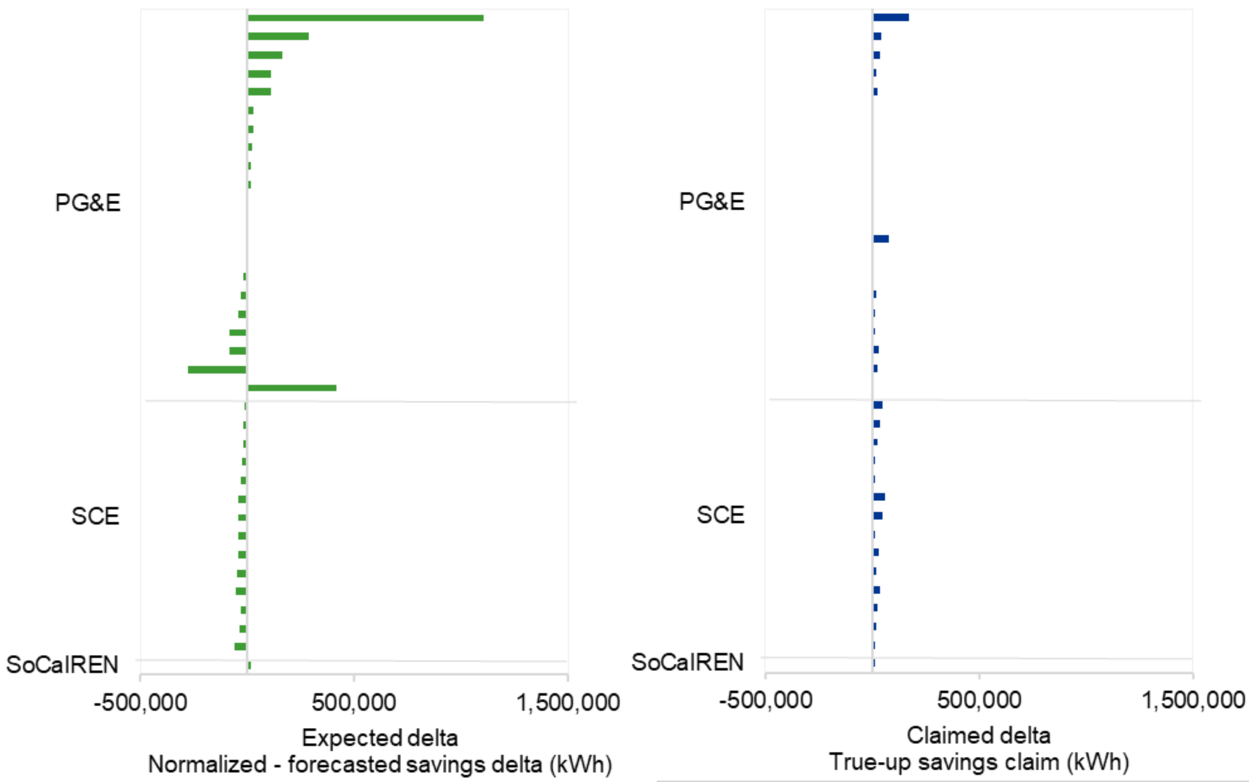
Figure 4-13. Distribution of trued-up savings – electric



4.3.3 Savings delta vs. claimed delta

Next, DNV tested whether the true-up savings matched the expected savings delta. Figure 4-14 shows the expected deltas, the difference between the normalized savings and the forecasted savings without a realization rate applied, compared with the CEDARS true-up savings claims. While the savings deltas are expected to be either positive or negative, the claimed savings deltas are all positive. While all positive deltas could be caused by conservative forecasted savings, that does not appear to be the case for these projects as the expected deltas, based on the forecasted and normalized savings in the project documentation, are both positive and negative. Based on the savings in the project documentation, PG&E and SCE should have both had some negative claimed deltas in the CEDARS tracking data but all true-up claims were positive.

Figure 4-14. Expected delta and claimed true-up

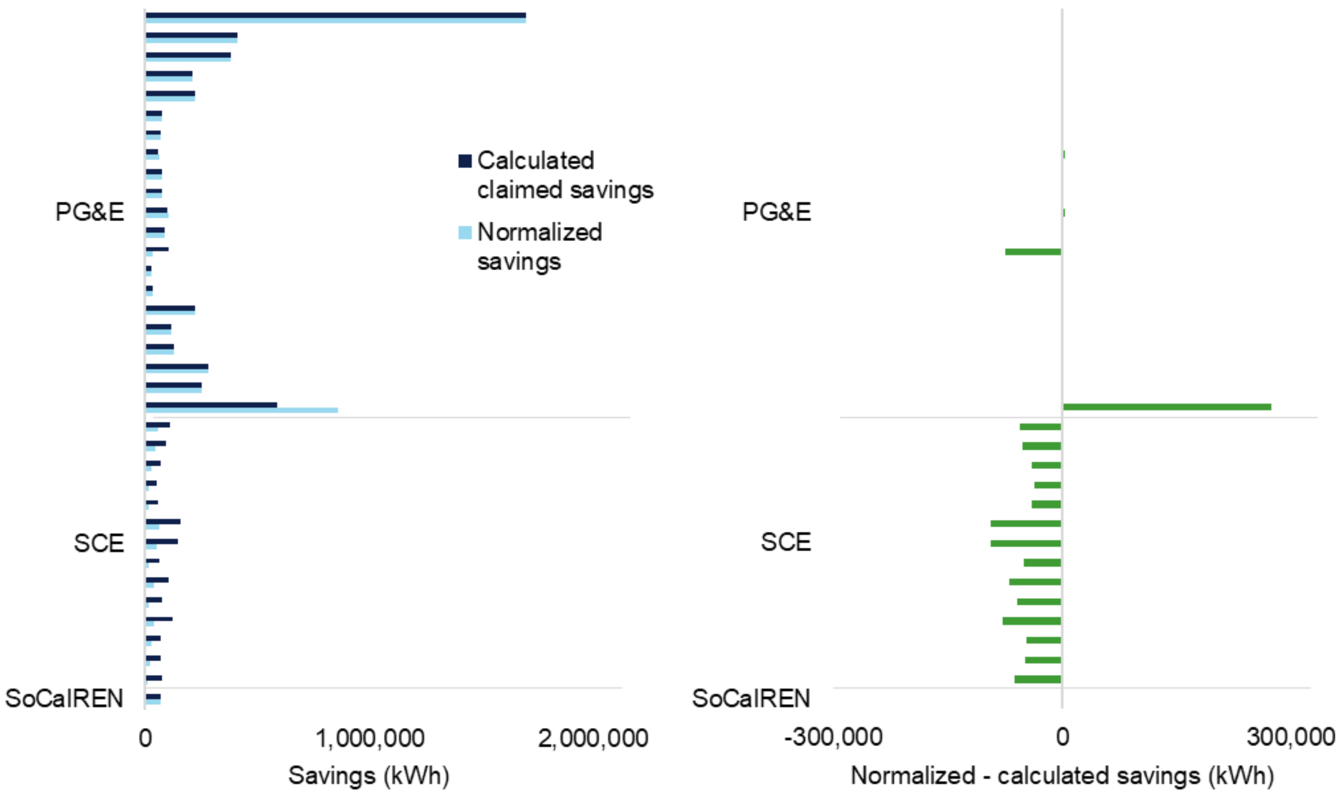


4.3.4 Normalized vs. calculated savings

Finally, DNV investigated whether the calculated savings (initial claim + true up) equals the normalized savings (difference between the weather normalized baseline and performance period statistical models)[46]. Having calculated savings equal to normalized savings is particularly important, as these values are the final project savings and are the key values that will be used in the evaluation efforts.

Figure 4-15 shows the calculated and normalized savings in the left figure and the delta between the two values in the right panel. With a couple of exceptions, PG&E's calculated and normalized savings were equal. SoCalREN's calculated and normalized savings were also equal. SCE's calculated savings were consistently higher than the normalized savings. DNV believes this result occurred because the full forecast savings was claimed as the initial claim and the full normalized savings was claimed as the true-up claim, which resulted in overclaimed savings. The discrepancies between the calculated savings and the normalized savings will have an impact on the evaluation efforts. DNV may "correct" the calculated savings by using the normalized savings from project documentation when calculating GRRs or net-to-gross rates as we expect the consistency in tracking data to improve in future years.

Figure 4-15. Calculated and normalized savings comparisons



[46] Performance based estimates of savings need to compare baseline to performance period consumption on the same weather basic. Avoided energy use is the term applied to savings calculated on weather during the performance period. This has the advantage of avoiding the necessity of a performance-period model. Weather-normalized savings indicates that both baseline and performance period are modeled, and consumption predicted at some form of typical meteorological year weather data (e.g., CZ2022). The weather normalized savings estimate should be more stable year over year.

4.3.5 Typical savings relationships by PA

Based on the savings relationships explored in prior sections, DNV developed a series of flow charts that summarize the ways in which each PA with electric claims appeared to be claiming savings in PY2020-2021. Figure 4-16 shows the pattern DNV observed in PG&E's data. All of PG&E's initial and true-up claims occurred in the same year. The initial claim appears to be based on the normalized savings rather than the forecasted savings and equals the normalized savings multiplied by the realization rate. The true-up savings claim appears to typically be equal to one minus the realization rate multiplied by normalized savings. Together, the initial savings claim and the true-up savings claim equal the normalized savings.

Figure 4-16. PG&E typical savings relationships between project documentation and CEDARS

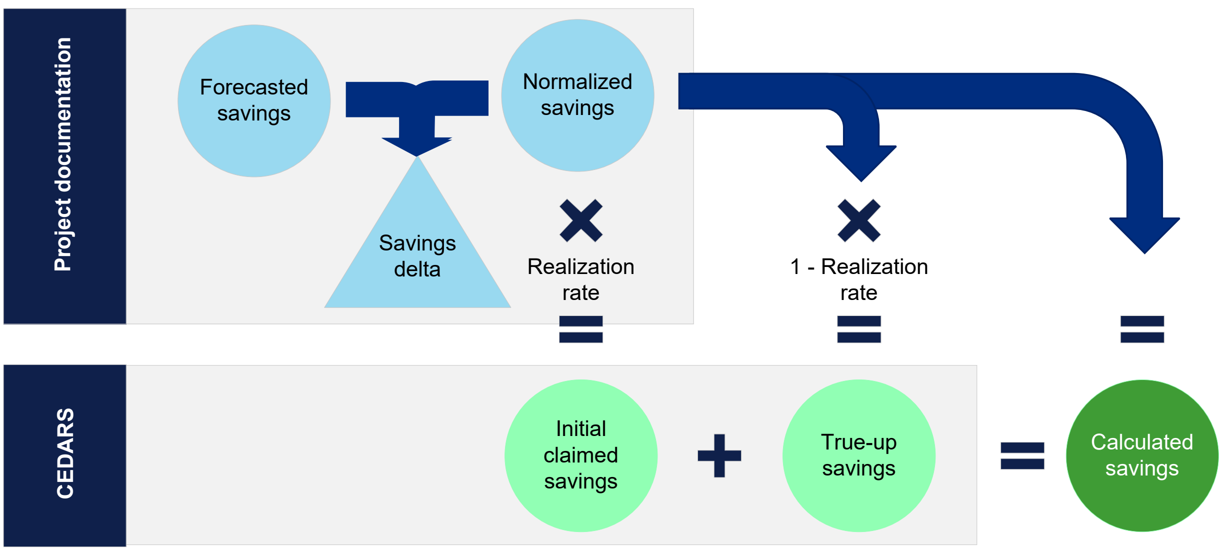
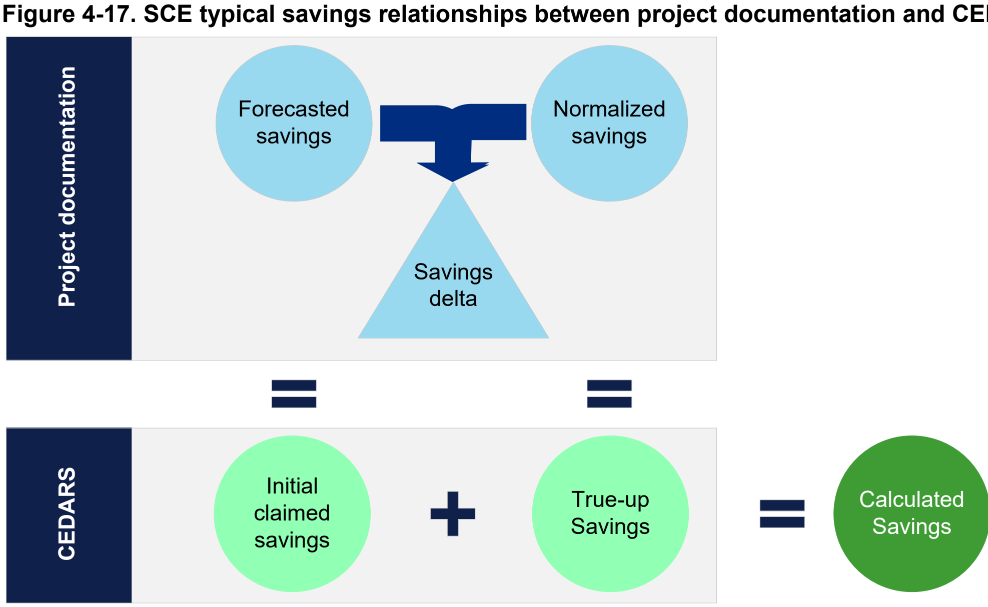


Figure 4-17 shows the pattern found in SCE's data. The initial savings claims equaled the forecasted savings, and the true-up savings claim generally equaled the meter-based normalized savings rather than being a delta to adjust the initial claim. This resulted in overclaiming savings for all trued-up projects.

Figure 4-17. SCE typical savings relationships between project documentation and CEDARS



SoCalREN's one trued-up project followed the expectations shown previously in Figure 4-14. The initial claim equaled the forecasted savings multiplied by the realization rate. The sum of the initial claim and the true-up claim equaled the normalized savings.

4.3.6 Savings claim process

Given the differences in how savings were tracked across PAs, DNV asked the PAs about their approach, any issues that they have faced, and how they conduct quality checks on the data they enter into the CEDARS tracking system.

Despite the observed deviations in the PAs' documentation from the expected savings relationships, interview respondents were generally able to describe the expected claim methodology. Given that our document review focused on projects that were initiated in PY2020 and PY2021, when NMEC was a new offering, and that the interviews were conducted in 2023, some of the observed inconsistencies could be the result of a learning curve. Indeed, one PA specifically said that since 2020, "We have created an NMEC team. We have become more efficient in our review team. We have learned a lot from the projects to date, and we have trained on design." For example, despite DNV observing in documentation instances where savings claims were made before the completion of the implementation phase, interview respondents in 2023 all said that the initial claim is made after installation/implementation has been verified.[47]

When asked how they perform quality control checks on the data entered in CEDARS, three of the five PA interview teams were able to provide a response. One detailed a process involving an automated IT workflow that includes a round of review at each data-entry point. For this PA, NMEC staff review the data from the project developers initially and then the reporting team sends the data to the metering team as data is reported. This PA also does "weeks of QC around end of year reporting." Another PA also said they run what they enter into CEDARS "by program people when we enter it and engineering people before we do our annual report." The third PA only cited a review during the annual report.

4.3.7 Savings claim characterization findings

When reviewing how savings claims were made for trued-up projects, DNV found the following:

1. **Each PA claimed savings in a different way and most PAs were not claiming savings as expected.** PG&E's initial claims were based on post-performance period normalized savings rather than the forecasted savings. SCE's initial claims matched the forecasted savings and did not appear to apply a GRR. Additionally, SCE's true-up claims were not the difference between normalized and forecasted savings, but the updated performance-based savings estimate in full. Given the two reported values are summed, this means SCE's total claim is roughly double what it should have been.

2. **The claims process may be more consistent in future program years.** The projects claimed in PY2020-2021 were made shortly after the NMEC rulebook and reporting guidelines were released and the NMEC reporting processes were likely still in development. During the interviews, the PAs indicated that their processes have been further developed and they described a reporting process in alignment with the expectations outlined in Figure 4-11.

4.4 Model characterization

Site-level NMEC uses statistical models to estimate savings based on the change in energy usage at the meter. For each project and fuel type, there are at least two models at project completion:

- **Baseline model:** A model that represents energy usage in the 12 months prior to installing the project.
- **Performance period model:** A model that represents energy usage in the 12 months after the project is installed.

[47] Interviewee respondents were asked, "At what project stage is the initial CEDARS claim made?"

Some sites required a second attempt at the baseline model and so a third model is provided:

- **Re-baselined model:** Some projects include an additional re-baselined model, which is an update to the baseline model. This most often occurs when there is a significant change that will impact usage (e.g., COVID) or when the gap between the end of the baseline model and the start of the performance period model is greater than 18 months.

A baseline model specified and tested for eligibility prior to the implementation of a project is an important part of the NMEC approach.

4.4.1 Modeling tools

Most projects were modeled with the programming language R (96%), and the rest in Excel (7%). Some of the projects classified as using R also used Excel for a portion of the calculation or summary statistics. All but one model that was created in R used the "nmecr" package,[48] an open-source R package that analyzes commercial building energy consumption using a meter-based, whole-building approach for site-level M&V of energy efficiency projects. During interviews, respondents also cited the nmecr package as a commonly used tool.

Daily models were the most common. All but one electric model was daily, with one model hourly. All gas models were daily, with one monthly. All demand models were, of course, hourly.

4.4.2 Non-routine events

Statistical energy usage models may need to be adjusted when non-routine events (NREs) occur that impact energy use. NREs typically include maintenance activities, power outages, or other occurrences that are short in duration and difficult to model. The COVID pandemic impacted energy usage substantially, particularly in certain building types like schools. Unlike typical NREs, the impacts from COVID were long lasting, variable, and posed continued modeling challenges. Table 4-11 summarizes the presence of NRE adjustments for electric project baseline, re-baseline, and performance period models as indicated by "Yes." All but four of the models with NREs were COVID-related adjustments. COVID-related adjustments typically involved adding an additional occupancy-related variable. The four non-COVID NRE adjustments involved using indicator variables or dropping small portions of data due to connectivity issues, school breaks, and unexplained usage fluctuations.

Table 4-11. Electric models with non-routine events[49]

Baseline	Re-baseline	Performance	Projects	Percent
Yes	Yes	Yes	19	48%
No	Yes	No	1	3%
No	No	No	14	35%
Yes	NA	No	1	3%
Yes	Unknown	No	1	3%
No	NA	No	4	10%
		Total	**40**	**100%**

A "yes" means that there was an NRE adjustment, a "no" indicates that there was not an NRE adjustment, "unknown" means that the documentation was unclear, and "NA" means that the model was not re-baselined.

[48] Kw Engineering, "nmecr R package." Accessed April 11, 2023. https://kw-engineering.com/nmecr-nmec-r-package-tool-energy-efficiency-project-savings-measurement-verification-analysis-amv/

[49] This table includes the 36 trued-up projects and the four additional projects that provided the performance period model.

4.4.3 Independent variables

Independent variables explain variation in the data and are used to normalize energy usage where there are changes in these drivers year to year. Independent variables address routine effects (schedule, weather) but additional independent variables can also be part of the strategy for addressing NREs (occupancy). More than 3/4 of electric projects (76%) included additional independent variables as shown in Table 4-12 below. A substantial portion (43%) of these additional variables are occupancy-related variables added to try to control for COVID-related occupancy shifts. One school district with 14 participating schools included variables to control for shifts in the school schedule such as holidays, summer school, and maintenance periods. Two additional projects included operation-related variables.

Table 4-12. Additional independent variables, electric[50]

Variable type	Project	Percent
Occupancy – daily building admits	19	39%
Occupancy – tenant occupied fraction of square feet	1	2%
Occupancy – Wi-Fi connections	1	2%
Operation – deliveries	1	2%
Operation – delivery size and operating schedule	1	2%
School schedule indicator variables	14	29%
None	12	24%

DNV also asked implementers about the additional independent variables that they use, both during PY2020-PY2021 and more recently. One implementer said, “most of the variables chosen are driven by COVID, for example: the need to track occupancy, and as projects were approved, the baseline period being effected by COVID.” That respondent cited using key card swipes and Wi-Fi connections as a proxy for occupancy necessitated by COVID impacts. Another implementer who administers a program mostly in industrial buildings with “commercial-like” loads said they include a production variable that they can get through a live stream of data but that they typically upload manually.”

4.4.4 Re-baselined models

A large portion of the electric models were re-baselined (35 projects, 71%). Re-baselining appeared to be driven primarily by COVID rather than by gaps between the end of the baseline period and the start of the performance period. Table 4-13 below shows that only one out of the 35 projects that were re-baselined had a gap of 18 months or more.[51] Figure 4-18 shows 59% of the projects that were re-baselined were adding occupancy-related variables to attempt to address COVID impacts. It is likely that the 37% of projects that did not provide a reason for re-baselining were also driven by COVID based on the project dates.

Table 4-13. Number of re-baselined projects vs 18 months – electric only

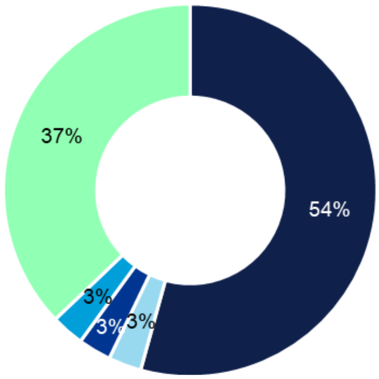
Greater than 18 months	Re-baselined		
	Yes	No	Total
Yes	1	2	3
No	34	12	46
Total	**35**	**14**	**49**

---

50 This table includes all 49 projects that provided at least one model. Eight of these projects did not provide a performance period model.

51 The NMEC rulebook states that a project should be re-baselined when the gap between the end of the baseline and the end of installation are more than 18 months. An updated baseline is required because the original baseline used is no-longer representative.

Figure 4-18. Reasons provided for re-baselining electric models



During interviews respondents cited COVID impacts on occupancy as a major challenge that needs to be accounted for. One respondent said, "projects were developed in 2019 before COVID and therefore occupancy looks weird after the pandemic." Another said, "post-pandemic we waited a long time for occupancy to come back up. There was a direction from the commission to make sure to true-up properly." Respondents also indicated that COVID impacted model assumptions due to causing supply chain delays.

4.4.5 Model goodness-of-fit metrics

Model goodness-of-fit metrics are used to measure how well the models fit the energy usage data. The NMEC rulebook [52] requires that baseline model goodness of fit be assessed and directs readers to see the LBNL guidelines[53] for proposed thresholds, which are:

- **Coefficient of variation of the root mean square error (CV(RMSE)):** CV(RMSE) is a measure of variability (of savings) relative to the average value of the variable (average energy consumption) used to determine how well the model predicting the variable (baseline consumption) fits the data. The lower the CVRMSE, the better the model fit. The proposed LBNL threshold for CV(RMSE) is less than 25%.
- **Normalized mean bias error (NMBE):** NMBE can indicate whether a model is over or under estimating energy use. The proposed LBNL threshold for NMBE is between -0.5% and 0.5%.
- **Coefficient of determination (R^2):** R^2 is the proportion of the variation in the dependent variable (energy consumption) explained by the regression model. The higher the R^2, the better the model explains variation in the dependent variable. The proposed LBNL threshold for R^2 is greater than 70%.
- **Fractional savings uncertainty (FSU):** FSU combines CV(RMSE) and percent savings. It is similar to relative precision in that it measures the uncertainty around the expected savings. As the value FSU decreases, confidence in the estimated savings level increases.

While the NMEC rulebook and LBNL guidelines specifically address baseline model goodness of fit, many of the projects reviewed use the metrics for both baseline (and re-baselined) models and performance period models. Consequently, the savings for some fuels were not claimed due to not meeting the goodness-of-fit metrics. The following sub-sections present electric (Section 4.4.5.1), demand (Section 4.4.5.2), and gas (Section 4.4.5.3) model goodness-of-fit metrics.

[52] https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/n/6442463694-nmec-rulebook2-0.pdf
[53] https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/l/6442463695-lbnl-nmec-techguidance-01072020.pdf

Each section has figures that show the goodness-of-fit metrics for the baseline, re-baseline (where applicable), and performance period models as well as the threshold level specified in the LBNL guidelines. The figures show all available models, including models that were later not used and models that have not yet been trued-up.

4.4.5.1 Electric models

All of the PY2020-2021 projects reviewed had electric models. Figure 4-19, Figure 4-20, and Figure 4-21 show the model fit statistics compared to the LBNL threshold for each metric. FSU is provided for all baseline or re-baselined models while CV(RMSE) and R^2 are provided for all models. All models met the CV(RMSE) threshold and nearly all met the FSU threshold of less than 50% for 10% savings. All models met the NMBE threshold and were near zero, so DNV did not include that figure. The R^2 values were more variable.

Figure 4-19. Electric model goodness of fit, fractional savings uncertainty for 10% savings[54]

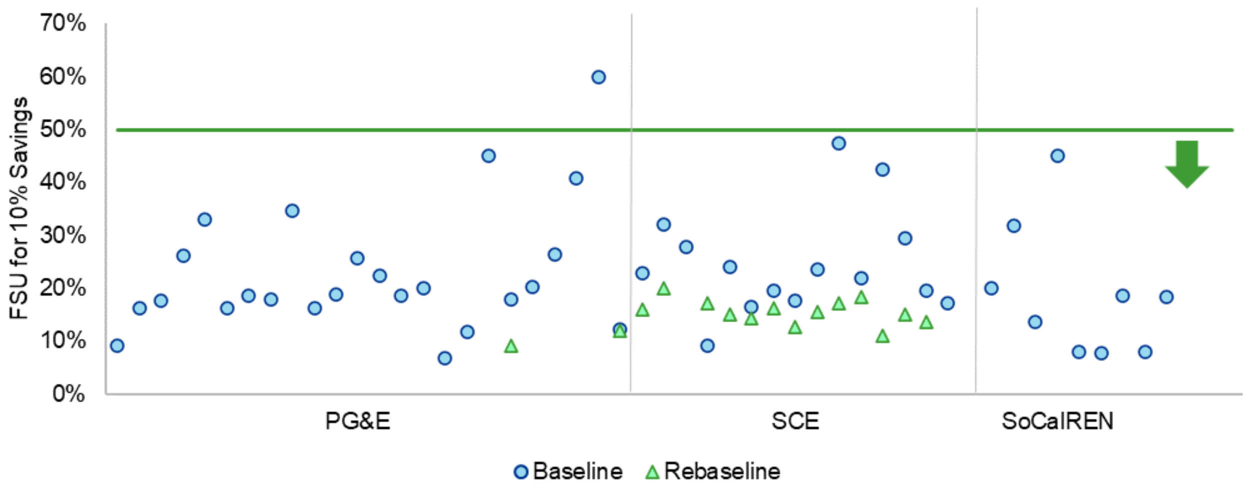
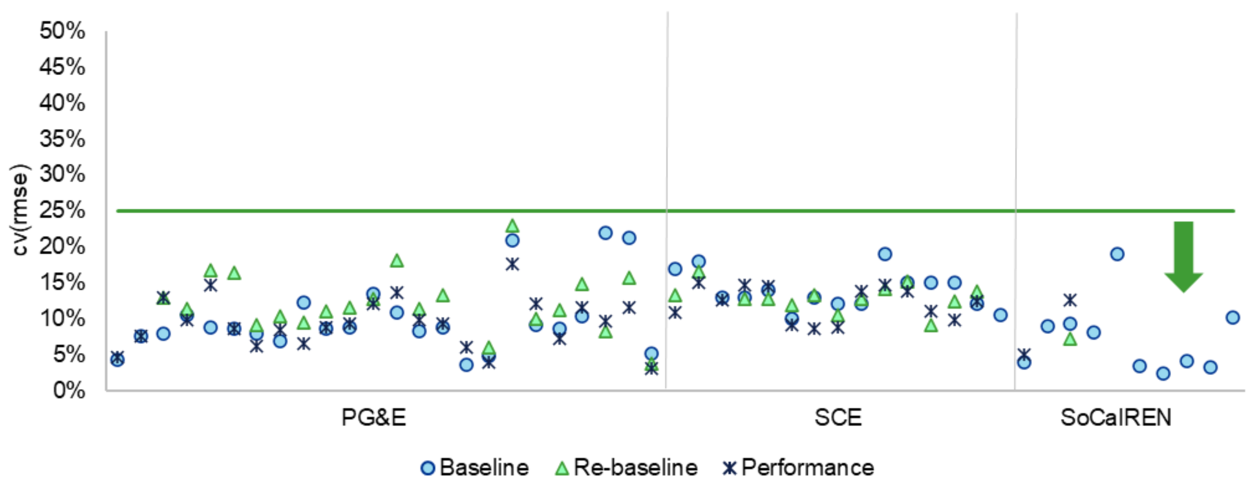
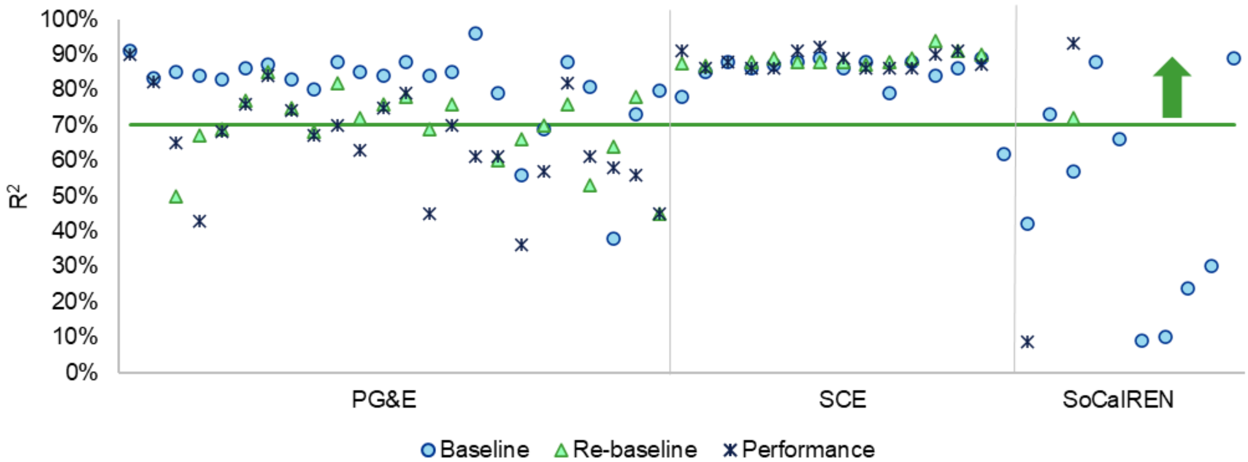


Figure 4-20. Electric model goodness of fit, CV(RMSE)



[54] The FSU for 10% savings, rather than the FSU for the forecasted fractional savings, is used here to compare across projects on a common savings percentage basis.

Figure 4-21. Electric model goodness of fit, R^2



4.4.5.2 Demand models

While all projects claimed electric savings and provided electric models, not all projects produced demand models (24) and fewer claimed demand savings (13). All but one project used a separate hourly demand model in addition to the daily model used to estimate energy savings. Hourly models are currently necessary to claim demand savings. However, the hourly model can also be used to estimate annual kWh. The PAs and implementers have indicated that the separate models reflect the challenge of consistently meeting eligibility requirements with the hourly model. In 2024, separate claims of kW and kWh savings will be replaced by a single electric claim based on aggregated hourly savings valued at hourly total system benefit (TSB) levels. While other paths to TSB savings will be used at first, there may be an opportunity to streamline the electric modelling process and provide an empirically based customer hourly shape for TSB calculations if an hourly model can appropriately characterize electric load. The plots below illustrate that a greater share hourly models fail to meet basic CV(RMSE) requirements.

Figure 4-22 and Figure 4-23 show the model fit statistics compared to the LBNL threshold for CV(RMSE) and R^2. FSU is rarely provided for hourly models, which are typically used for demand savings estimation, and so the FSU figure is not shown. None of the SCE projects claimed demand savings, but the PG&E and SoCalREN projects did make initial demand savings claims.

Figure 4-22. Demand model goodness of fit, CV(RMSE)

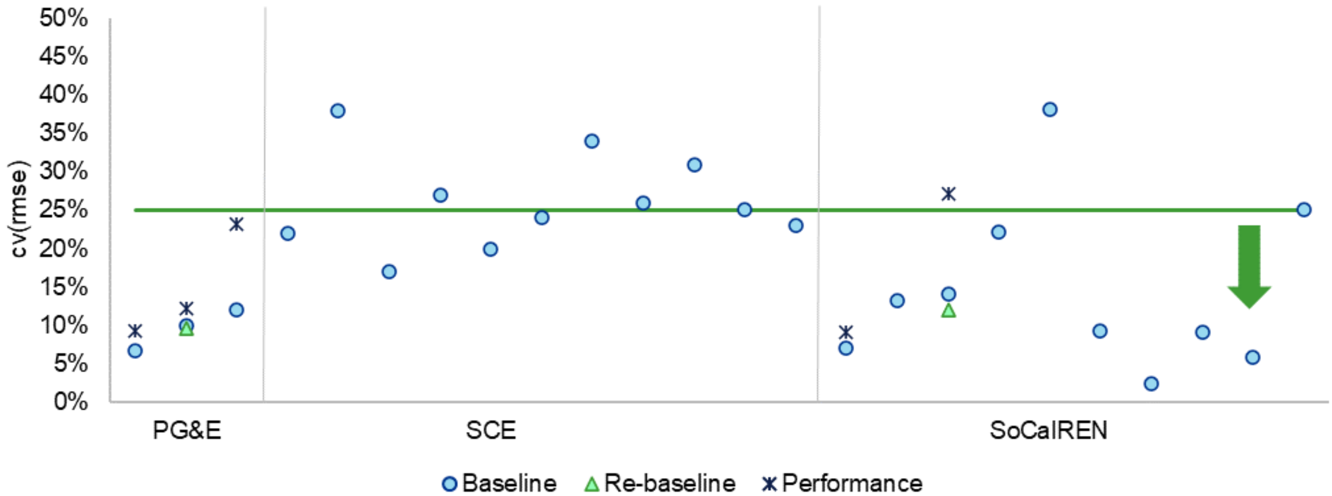
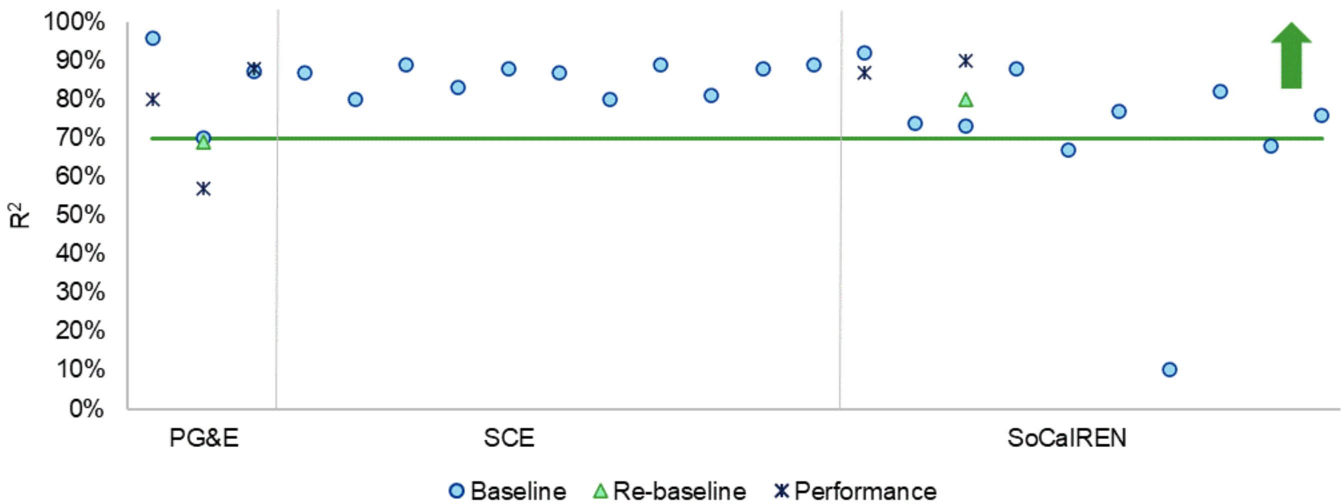


Figure 4-23. Demand model goodness of fit, R^2



4.4.5.3 Gas models

There has been considerable discussion among stakeholders regarding the difficulties of modeling gas consumption in a way that will produce eligible projects. KW Engineering, on behalf of SoCalGas, PG&E, and SDG&E, produced a report entitled "Natural Gas Model Acceptance Criteria Research and Development" that addressed this issue.[55] The report proposed that an FSU of less than 50% for 10% savings at 90% confidence should be an additional criterion for models that fail the CV(RMSE) criteria. This approach intends to increase the share of eligible sites while maintaining reasonable eligibility criteria. The report results are based on a large number of gas customer models. The gas model results in this evaluability study, while illustrating the challenge of gas models, indicate that FSU would not have increased the eligibility rate among these customers.

[55] kW Engineering, "Natural Gas Model Acceptance Criteria Research and Development". Southern California Gas Company, Pacific Gas & Electric Company, San Diego Gas & Electric Company, 9/28/2022. https://pda.energydataweb.com/api/view/2771/Gas Model Acceptance Final Report 9.28.2022.pdf

Figure 4-24, Figure 4-25, and Figure 4-26 show the gas model fit statistics compared to the LBNL threshold for each metric. Most of the gas models provided in the project documentation failed to meet the goodness-of-fit thresholds with some FSUs as high as 500%. Given the poor model goodness-of-fit, only one of the models shown below actually was used to claim gas savings and that project has not yet been trued up. The project with a performance period model included in the figures below did not end up making a gas savings claim due to the model fit statistics and unexplained increases in gas usage during the performance period.

Figure 4-24. Gas model goodness of fit, fractional savings uncertainty for 10% savings[56]

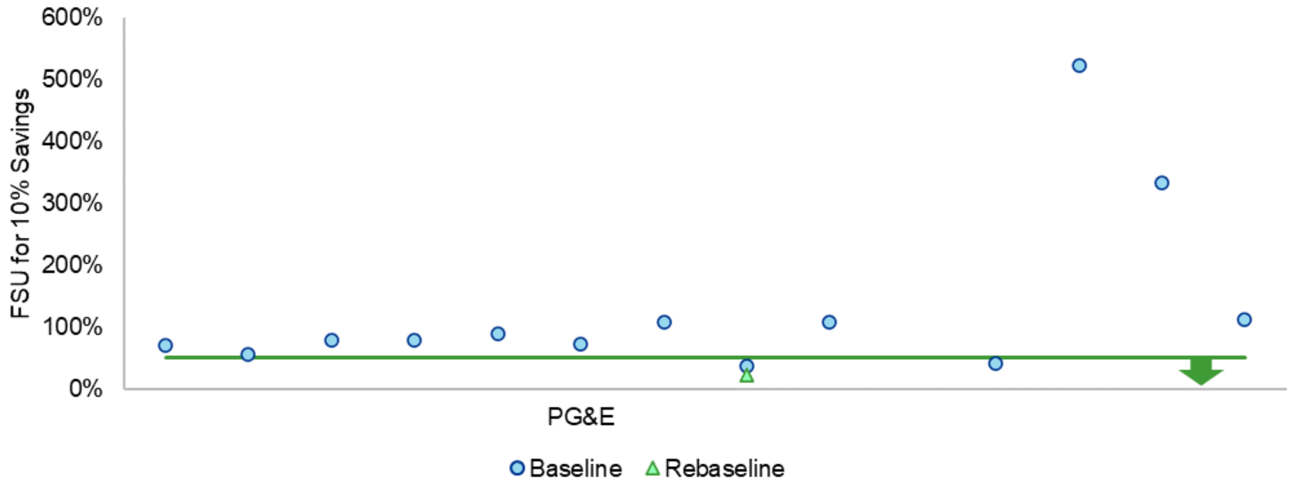
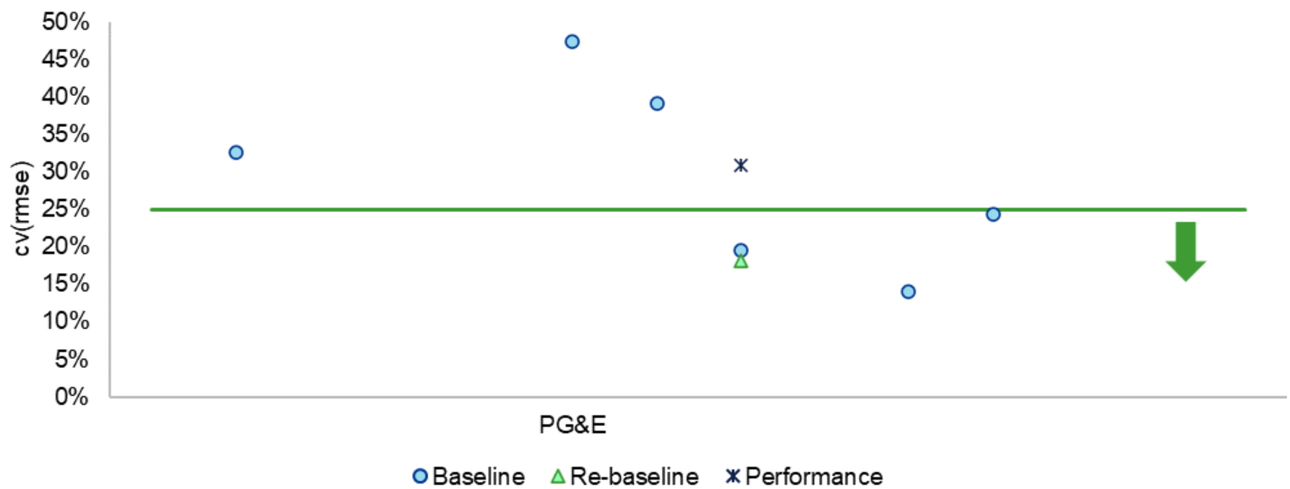
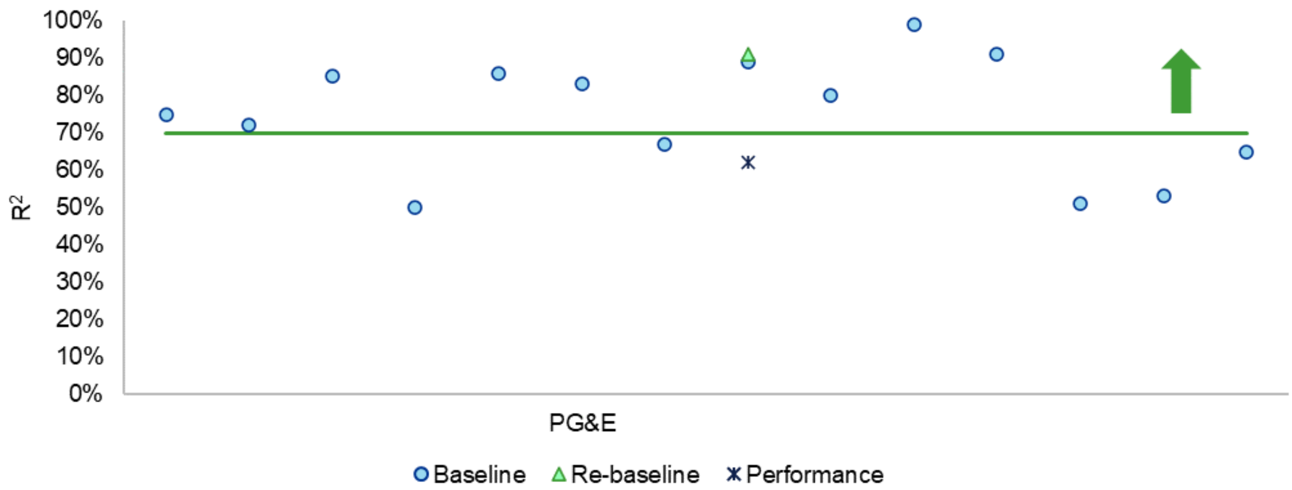


Figure 4-25. Gas model goodness of fit, CV(RMSE)



[56] The FSU for 10% savings, rather than the FSU for the forecasted fractional savings, is used here to compare across projects on a common savings percentage basis.

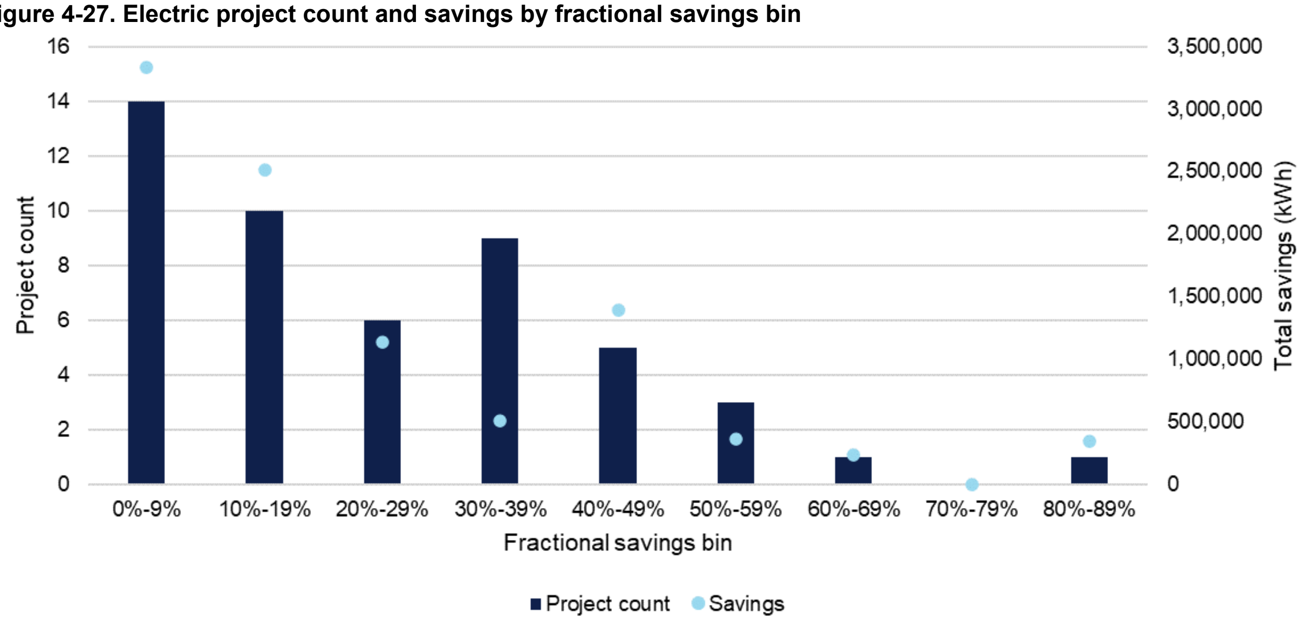
Figure 4-26. Gas model goodness of fit, R^2



4.4.6 Fractional savings

The NMEC rulebook recommends[57] that projects should aim to save at least 10% of annual consumption. Fractional savings, the percentage of annual consumption saved, is calculated during project planning, and uses engineering-based forecast savings. Figure 4-27 shows the number of projects and total forecast savings in different fractional savings bins for all projects.[58] Fourteen projects, 34% of the initial savings claims, had fractional savings below 10%. Ten projects had forecast fractional savings of 40% or more of annual usage. Projects with high fractional savings (>40%) may warrant additional scrutiny prior to implementation to ensure that forecast savings assumptions and annual usage are reasonable.

Figure 4-27. Electric project count and savings by fractional savings bin

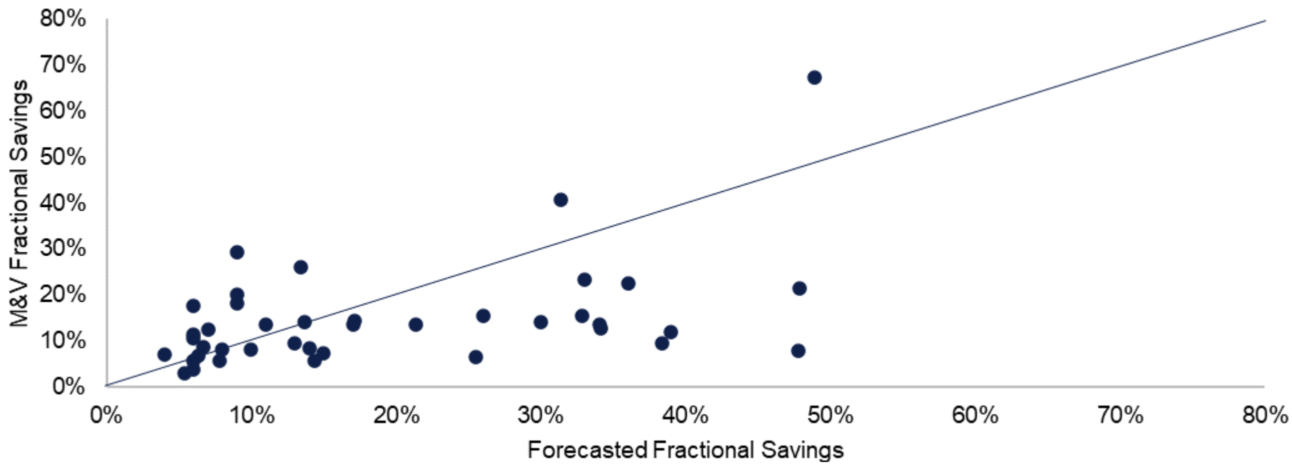


[57] CPUC, "Rulebook for Programs and Projects Based on Normalized Metered Energy Consumption Version 2.0", cpuc.ca.gov, 1/7/20, https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/n/6442463694-nmec-rulebook2-0.pdf

[58] Fractional savings is provided as part of the project planning documentation and was provided for all projects with electric savings. It does not typically include the ex-ante GRR adjustment.

Figure 4-28 plots the forecasted fractional savings shown above against the approximate fractional savings achieved (M&V fractional savings) for the smaller subset of projects for which DNV has a performance period model. While the M&V fractional savings is not typically reported, DNV calculated it using the normalized energy savings and annual energy usage. Most projects are achieving a smaller savings fraction than forecasted. Only two of 15 projects with forecasted fractional savings greater than 20% achieved or surpassed their forecasted savings. Of those that failed, achieved fractional savings are roughly half of what was forecasted and even lower for the greatest forecasted fractional savings.

Figure 4-28. Electric forecasted fractional savings vs. M&V fractional savings



4.4.7 Model characterization findings

Key findings through a characterization of model review are included below.

1. **COVID substantially impacted the NMEC models.** The COVID pandemic resulted in increased non-routine events, model re-baselining, and the incorporation of more occupancy-related variables. COVID offered a substantial stress test to the concept of site-level NMEC and the ability to adapt to that challenge, e.g., with occupancy variables, may prove useful under more typical conditions. If such data can be reliably captured at many sites and prove to be correlated with consumption, a greater share of buildings will meet eligibility criteria and the models will make routine a potential source of non-routine events.

2. **Models were re-baselined without sufficient explanation.** While COVID necessitated re-baselining for many projects, a large number of projects re-baselined without an explanation of why it was necessary. Re-baselining should only occur under unusual circumstances and documentation must be provided to support the decision. Establishment of the model specification in advance of implementation is a key concept for NMEC and where that standard cannot be met must be carefully monitored.

3. **Most gas models fell below the goodness-of-fit thresholds and were therefore not used to claim savings.** Gas models even tended to struggle with meeting fractional savings uncertainty goodness-of-fit targets. This finding means that, in most cases, gas savings are not being claimed as part of NMEC projects even when installed measures would be expected to achieve gas savings. Further research is justified into improved model specifications and/or more appropriate eligibility requirements.

4 **Further research is needed to develop suitable eligibility requirements to support the hourly models that may be of interest for future TSB-based savings claims.** While more hourly models used for demand met the goodness-of-fit requirements than the gas models, only one project used an hourly model for electric savings, opting instead to use daily models for electric savings. The PAs and implementers have indicated that the separate models reflect the challenge of consistently meeting eligibility requirements with hourly models.

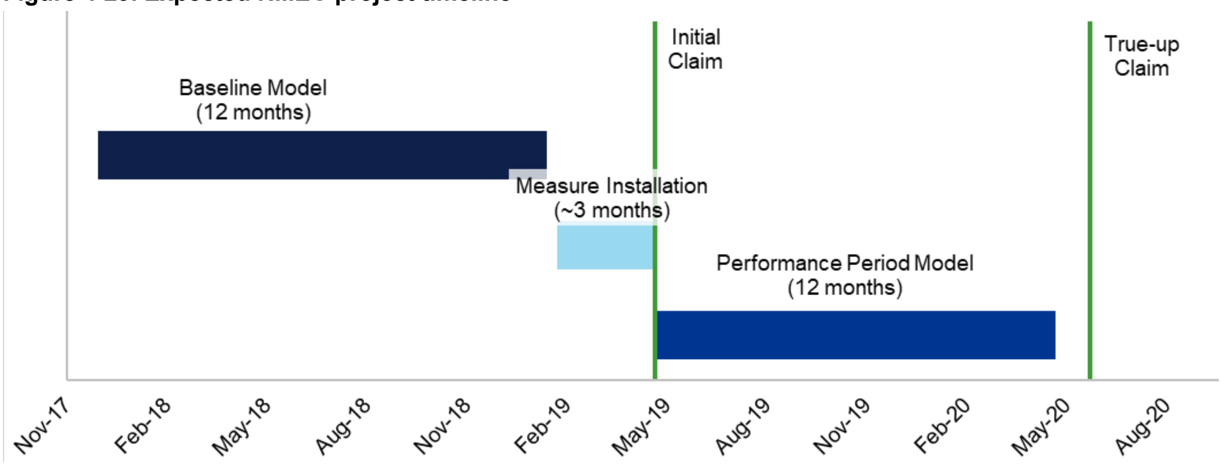
5 **Fractional savings above 20% are rarely realized.** A danger of moving to FSU as a key goodness-of-fit metric is that over-estimated fractional savings could make poorly performing models appear eligible. An upper bound on the fractional savings on which FSU can be calculated appears to be a reasonable approach.

6 **For daily kWh models, The CV(RMSE) and FSU results (at 10% savings) illustrate the similarity of the two goodness-of-fit criteria.** FSU calculated on forecasted fractional savings (rather than assuming 10%) could provide a better indicator of whether results would meet precision goals. Smaller percentage savings would meet criteria with better behaved models and models with CV(RMSE)s above 25% might be sufficient with higher expected savings. In combination with findings related to poor realization of higher fractional savings, the use of higher fractional savings in the FSU calculation should likely be limited.

4.5 Project timeline

Figure 4-29 below provides the expected project timeline for a generic project where the baseline period starts in January 2018. Terms used in the timeline are defined below the figure.

Figure 4-29. Expected NMEC project timeline



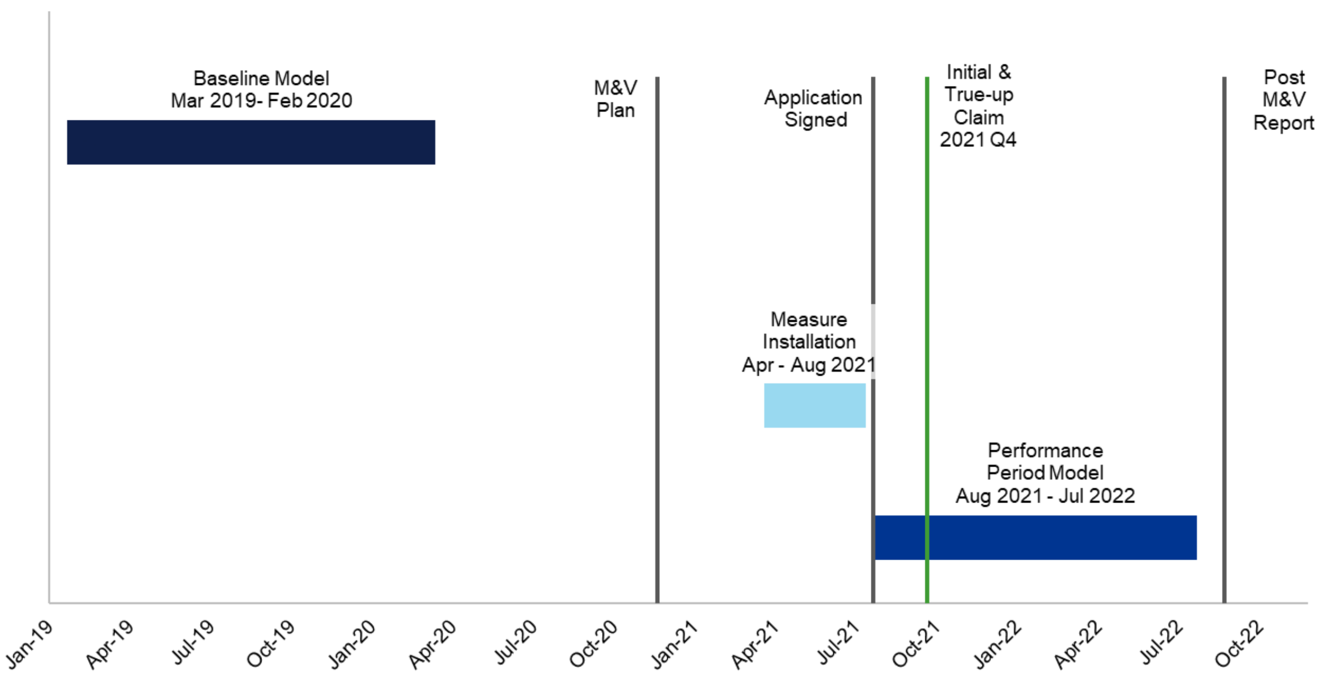
- **Baseline model:** The 12-month pre-installation period used to estimate baseline energy usage. The active work for this phase does not take 12 months, but data is gathered to cover 12 months.
- **Measure installation:** This is the period when the project is installed, which should be after the baseline and before the performance period to fully measure project savings. DNV found installation periods to be loosely defined (DNV used invoice or inspection dates to approximate) in most cases. Installation dates were provided for only four projects. In some cases, installation occurred during the performance period. During the IDIs, COVID and supply chain delays were frequently identified as causes for installation delays, with some projects taking up to three years to complete the planning through installation phases. Commissioning may also take additional time.
- **Initial claim date:** The date in which the initial claim was made in the tracking database. The initial claim date is expected to occur shortly after installation. However, DNV found that initial claims often (21 out of 36 trued-up claims) did not occur until after the performance period.

- **Performance period model:** The 12-month post-installation model used to estimate the change in energy usage following project completion. For 14 projects in the same school district, the performance period was only three months.
- **True-up claim date:** The date or quarter in which the true-up claim was made in CEDARS. The true-up claim date is expected to be soon after the performance period. However, DNV found that true-up claims often occurred more than a year after the performance period was complete.

4.5.1 Industrial Systems Optimization Program case study

The PG&E ISOP had two projects in PY2020-PY2021, one of which was trued up in PY2021. Figure 4-30 shows the timeline for the trued-up project. Most of the project was implemented in April 2021 with a tune-up or optimization event, followed by additional installations ending in August 2021. This project used an earlier than typical baseline period (March 2019-February 2020) to avoid the COVID impacts observed in the 2020 energy usage data. The performance period potentially overlaps with the end of the installation window, as it begins in August 2021. The initial claim was made in Q4 2021 as was a true-up claim, but the true-up claim was zero. Given that the performance period model covered part of 2022, it is possible that the true-up record was made in error.

Figure 4-30. PG&E Industrial Systems Optimization Program timeline case study

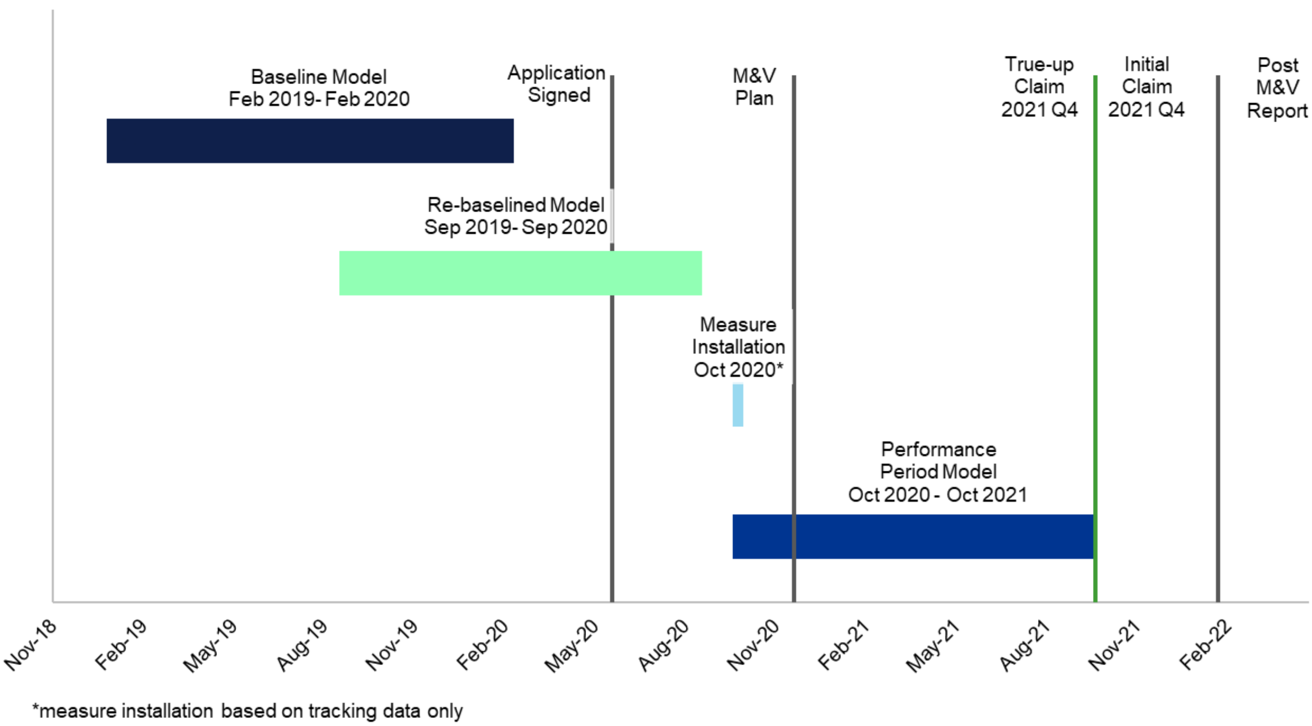


4.5.2 Commercial Calculated Incentives Program case study

As discussed in Section 4.1.4, a large tech company accounted for 19 of the 21 projects in PG&E's Commercial Calculated Incentives Program. Figure 4-31 summarizes the timeline for these 19 projects, which had a baseline model from February 2019 to February 2020. While the project documentation did not provide measure installation/implementation dates, the tracking data indicated installation occurred in October 2020. The performance period model also began in October, which indicates an overlap with the installation period.

This project was also re-baselined, shifting the baseline model to September 2019 through September 2020, though no explanation for the change was provided. Both the initial and the true-up claims occurred in Q4 2021. It is unclear why the initial claims did not occur in 2020 following the CPUC reporting guidance,[59] but it is possible that the claim was delayed until after the projects were fully installed.

Figure 4-31. PG&E Commercial Calculated Incentives project timeline case study

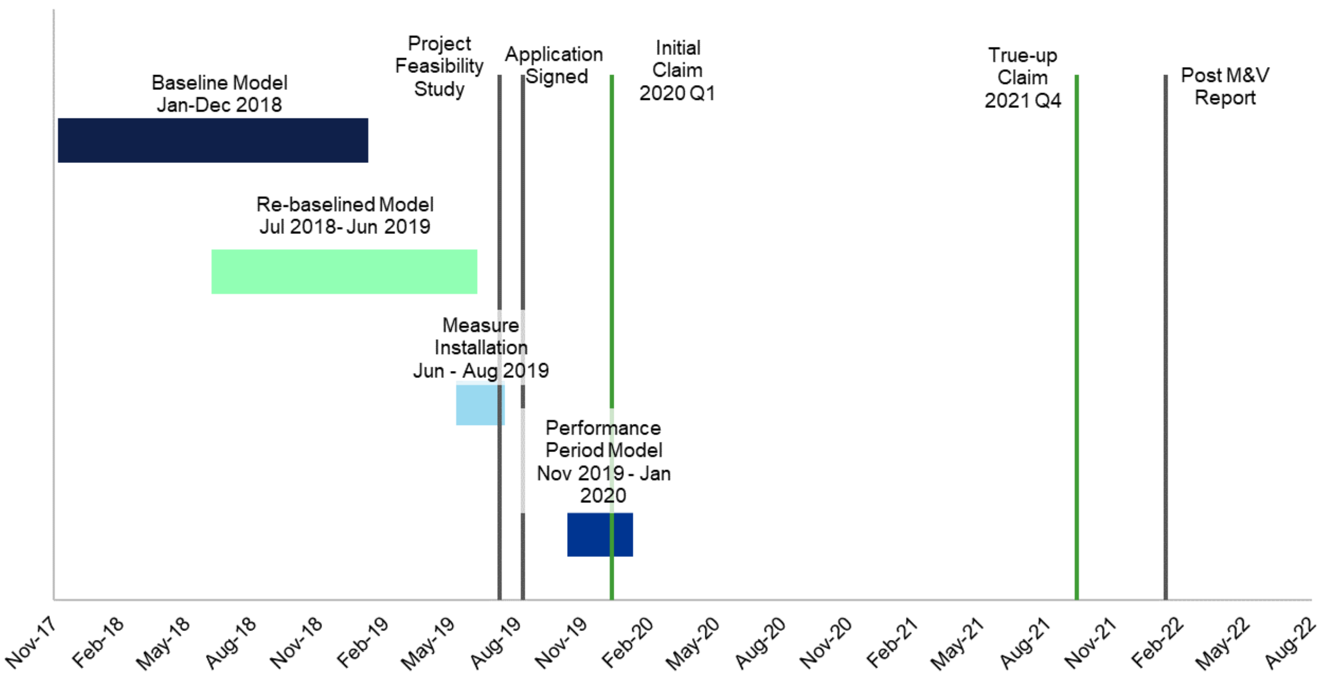


[59] Energy Division Staff Guidance: NMEC Reporting. April 24, 2020.

4.5.3 Public Sector Performance-Based Retrofit High Opportunity Program case study

Fourteen of the 15 projects in the Public Sector Performance-Based Retrofit High Opportunity Program were completed in a single school district as discussed in Section 4.1.4. The timeline shown in Figure 4-32 includes the key dates across the projects. The Project Feasibility Study (PFS), M&V Plan, and Post M&V reports included all 14 projects. The schools had an initial baseline model that spanned January through December 2018. The specific installation dates were not clear in the project documentation, but invoices were dated between June and August 2019. While the PFS had indicated that the performance period would be 24 months, the final performance period was only three months. This is likely due to COVID impacts, however, no explanation for the change was provided. Additionally, the final project documentation packages indicated that the projects were re-baselined to cover a period of July 2018 to June 2019, which appears to overlap with the installation period. No explanation was provided for this change. In CEDARs, the initial claim was made in the first quarter of 2020 and the true-up claim occurred in the fourth quarter of 2021.

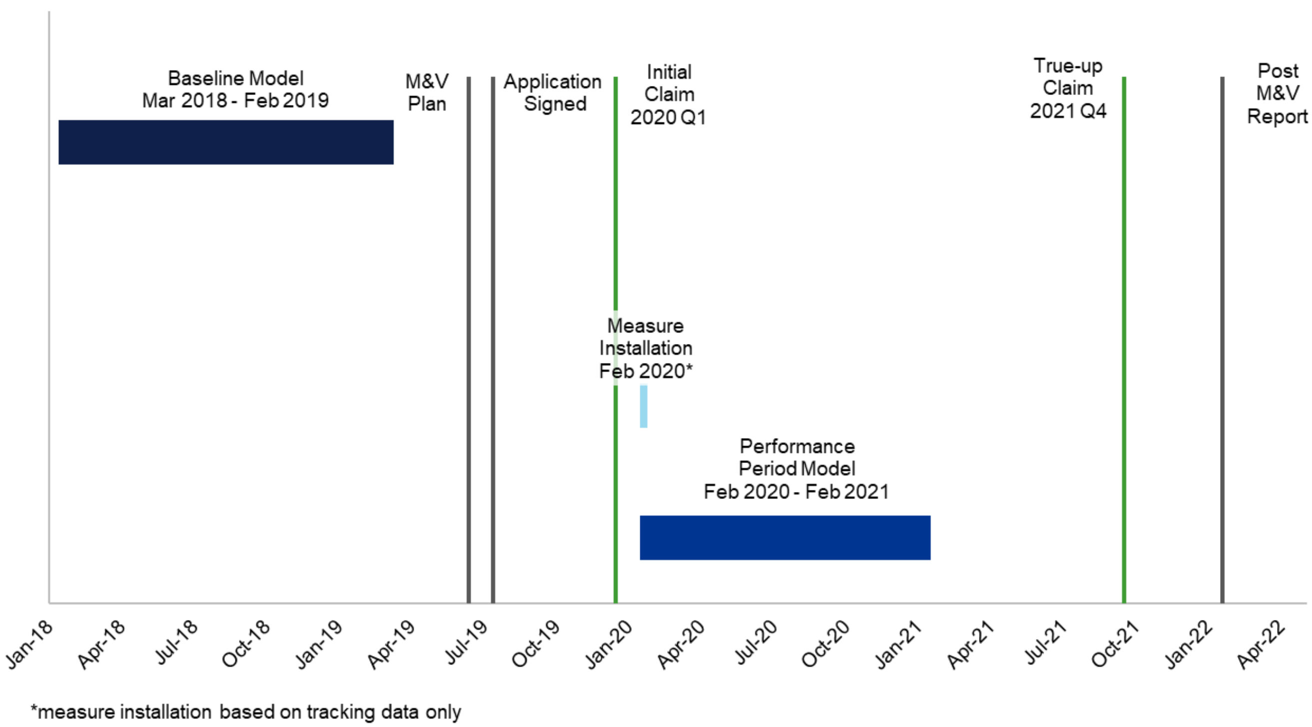
Figure 4-32. SCE Public Sector Performance-Based Retrofit High Opportunity Program timeline case study



4.5.4 Public Agency Metered Savings Program case study

One out of 10 SoCalREN Public Agency Metered Savings Program projects was trued-up in PY2020-PY2021. The project's timeline is shown in Figure 4-33. The baseline model included energy usage from March 2018 to February 2019. While the project documentation indicated that measure installation was verified in July 2020, the documentation was unclear about when the measures were installed, so DNV used the February 2020 installation date provided in CEDARS. The performance period model included data from February 2020 through February 2021. The initial claims also occurred when expected, with the initial claim occurring in the year the project was implemented and the true-up claim occurring in the year of the performance period model. The post M&V report was dated after the true-up claim quarter, but this may be due to the window of time following the program year when tracking records can be modified.

Figure 4-33. SoCalREN Public Agency Metered Savings Program timeline case study



4.5.5 Project phase process findings

In addition to the key project phases seen in the project documentation and discussed above, the PAs and implementers also described the pre-screening phase and the pre-installation phase.

- **Pre-screening phase:** Implementers pre-screen projects to decide if NMEC is a good opportunity and to assess each project's eligibility.
- **Pre-installation phase:** Implementers identify energy efficiency measures and estimate their potential energy savings. Key activities in this phase include a feasibility study and a project-level M&V plan. PAs review and approve plans.

In the sections below, DNV describes each process from the PA and implementer perspective and discusses the challenges faced in each phase and how many projects typically drop out at each stage. It is important to note that implementation team structures and implementation processes have changed for most PAs since the projects included in this evaluability study were implemented. Since PY2020-2021, some PAs have partially or entirely moved to a third-party implementer model for NMEC while other PAs have moved more implementation in house. Additionally, some programs involve many different organizations including a third-party implementer, sub-contractors who may be responsible for the NMEC models or engineering aspects, and a PA or sub-contractor technical review team.

4.5.5.1 Pre-screening phase

Process

During the pre-screening phase, respondents described checking if potential projects make sense for the NMEC pathway. One implementer said that they look to see if projects are, "predictable, not in disrepair, without non-routine events, capable of deep savings." The implementers typically have a few meetings with the client during this phase to assess which program offerings, NMEC or otherwise, are best suited for the project opportunity and client's needs. PAs indicated that the pre-screening process is typically done by the implementers and then the implementers bring applicable projects to the program. Therefore, the PAs typically do not have much visibility into this phase. Respondents indicated that this phase takes two weeks to three months depending on the required back-and-forth with the customer and the complexity of the facility.

Challenges

PA respondents indicated that the major barrier they have faced during the pre-screening process is a lack of clarity in the NMEC rulebook. For example, one PA expressed uncertainty determining which measures qualify: "at industrial properties, can something be 'commercial-like' enough to qualify? And does outdoor lighting count as being part of an existing building since its outside?" Another PA highlighted their perception of a mismatch between the holistic intention of NMEC and the reality of having to conduct measure-level analysis. They said, "the rulebook says use a whole-building holistic approach and that it's all metered pre and post, but now we have to measure each measure application type for EUL savings at the measure level and this seems to be more the custom route."

Implementers did not identify major barriers in the pre-screening phase. Instead, they said the pre-screening phase is a checkpoint to identify if potential projects make sense for the NMEC pathway. If projects do not meet the criteria, the implementers simply do not push the project towards the NMEC pathway.

Attrition

Respondents indicated that 100% of potential projects that make sense for NMEC as determined by an implementer or self-implementing PA make it through the pre-screening phase and into the baseline/pre-installation phase.

4.5.5.2 Pre-installation

Process

During the pre-installation phase, project teams identify energy efficiency measures and estimate their potential energy savings. One implementer referred to this process as the "treasure hunt." Another implementer described initiating the phase with an "optimization event" in which an engineer goes onsite to identify measures and even implements low or no-cost measures that day. They said, "It's a great experience when we get onsite, and they are saving energy that day."

During this phase, project teams create a baseline model using energy usage data. Respondents highlighted multiple ways to get energy usage data. The most streamlined method was to use "green button," which automates the transfer of a customer's usage data to the implementer.[60] To set up the green button transfer, customers simply log on to their utility account and grant permission to the implementer by pressing a button. One implementer said, "we have a five-minute call with whoever pays the bills, they log onto a portal and approve our access." Without the green button, customers must manually give consent to the PA for the implementer to get energy usage data and then data must be manually obtained and entered into the model.

The pre-installation phase also includes a project feasibility study (PFS) and a project-level M&V plan. Typically, the PFS and M&V plan are submitted by the implementer to the PAs. The PAs then conduct a technical review of the drafts or hire a sub-contractor to conduct the technical review before approving the plans and allowing the project to move into installation/implementation. PAs typically have service agreements with implementers detailing the maximum allowed time for review before the PAs respond to implementers. Respondents indicated that the maximum allowed response time is 30 to 40 days but that if things go well, they can respond in two weeks.

Respondents indicated that the baseline/pre-installation phase typically takes one to three months although one implementer said, "it varies widely depending on customer availability and access to data. If the model works perfectly, and we don't need data, then its 1 to 1.5 months. But we've had projects take over a year."

Challenges

The most frequently mentioned barrier related to data quality and obtaining data. Both the PAs and implementers highlight struggles with data as a barrier for this phase. In fact, data was the only barrier in this stage cited by implementers. PAs also reported struggles relating to how to select MATs and associated baselines. One PA said, "when we assign measure application types, and we have different baselines for different MATs that's been a struggle to develop which application type for each project.' Another PA said, "we have one project that went to CPUC and received a disposition that for NMEC, standard practice applies which was different than the implementor's understanding." Lastly, two PAs cited struggles related to technical understanding. One said, "our only challenge is when the CPUC selects some for review, it is a challenge to understand what the implementers are giving us and what the CPUC is asking for." Another said, "there are multiple tools and multiple software packages so the technical reviewer has to know those and have access to those, or if we assign external reviewers, we need to know the external reviewers have used that software before."

Attrition

Two PA respondents said that more than 90% of projects that enter the pre-installation phase move forward into implementation/installation. They explained that projects fall out of the NMEC pathway if they determine that a custom pathway makes more sense or if supply chain delays cause trouble with financing.

[60] https://www.greenbuttondata.org/

4.5.5.3 Implementation/installation

Process

The implementation/installation phase is conducted by the customer themselves. One implementer said, “we leave this to the customers to find the contractors and get it all installed.” The phase concludes when the implementor gets notified that installation is complete and conducts a verification inspection. Of note, one implementer described concluding implementation before installing all measures. This implementer starts modeling and monitoring savings as soon as the pre-installation period begins. Once a substantial amount of the measures has been implemented, they start the performance period rather than delay for the sake of a few “odds and ends.” The implementer said they are adjusting this approach given feedback from the CPUC. Respondents indicated that installation typically takes about 10 months but can be completed in as few as three months for simple projects or take more than two years for complicated projects encountering COVID delays.

Challenges

The main barrier cited by PAs and implementers for this phase was long installation times exacerbated by the COVID pandemic’s impact on supply chains. Delays sometimes last up to two years which can require the performance period to start later than maximum allowed 18 months following the baseline period. One implementer said, “it used to take six to eight months, but now eight to 14 months or even 18 months is common.”

Other challenges result from the implementer not being involved in the installation. For example, the customer hires their own contractors who install measures but may not install measures as they were specified by the implementer. This issue happens more frequently due to COVID supply chain impacts forcing customers to select available alternatives. The lack of implementer presence during installation allows for non-routine events to be missed. One PA said, “during this time, anything the customer does at the site can impact the energy usage of the site and we should be very mindful of those and approach the customer at the right time to get that right, we’ve had savings be negated and we don’t know what happened.“ Finally, despite implementers’ attempts to regularly check-in with customers and emphasize the value of program participation, it can be challenging for implementers to confirm when implementation has concluded and performance monitoring can begin. For all these reasons, one implementer stated, “It could be an improvement if we were paid to oversee the installation process.”

One final challenge mentioned by respondents was implementers occasionally not understanding all the processes or needs of a customer. Occasionally, suggested measures impact some other process at the facility in an unforeseen way and the implementer must work with the customer to adjust things.

Attrition

Two PAs reported that more than 90% of projects that start implementation, complete implementation. They said that projects sometime drop out if the customer faces a funding issue.

4.5.5.4 Performance period/reporting

Process

The performance period starts after installation has been verified and lasts for 12 months. After the 12-month period, implementors write a final normalized savings report and submit for PA review and approval. The PAs either review the analysis themselves or use a contracted technical reviewer. Reporting takes about 1 to 1.5 months to complete after the 12-month performance period. Some programs also require an initial savings report three months into the performance period. This three-month report does not have normalized savings, but it does allow the implementer to confirm if savings are accruing or if something needs to be adjusted. Some programs disperse a portion of the incentive upon completion of the three-month initial savings report. Lastly, one program requires quarterly updates to ensure that the PAs are aware early on if savings differ drastically from the initial claim.

Challenges

The main challenge cited during the performance period/reporting phase was non-routine events complicating modeling and normalized savings analysis. However, overall, respondents indicated that there are few challenges in the performance period/reporting phase. One implementer said, "most of the challenges are on the initial project development side so there is not as much here.

Attrition

Respondents indicated that 100% of projects that enter the performance period complete the performance period.

4.5.6 Key timeline findings

Key findings from this review are listed below.

1. **Incorrect timeline procedures.** The project and claim timelines often deviated from expectations, with some measures being installed during the performance period, some projects having short performance periods (three months), some initial claims occurring prior to installation and others not occurring until after the performance period.

2. **Significant COVID induced delays.** During interviews, respondents indicated that the major cause of project delays were impacts from the COVID pandemic in the installation/implementation period. Respondents said without COVID, the implementation phase would typically take three to six months, but due to COVID supply chain impacts, implementation takes an average of 11 months and can take as long as 30 months. COVID also impacted the models as some projects needed to be re-baselined or additional variables needed to be collected to adjust for occupancy and other changes. Respondents reported no other major delays in any other project phase including pre-screening, pre-installation/baseline, and reporting.

4.6 Project evaluability

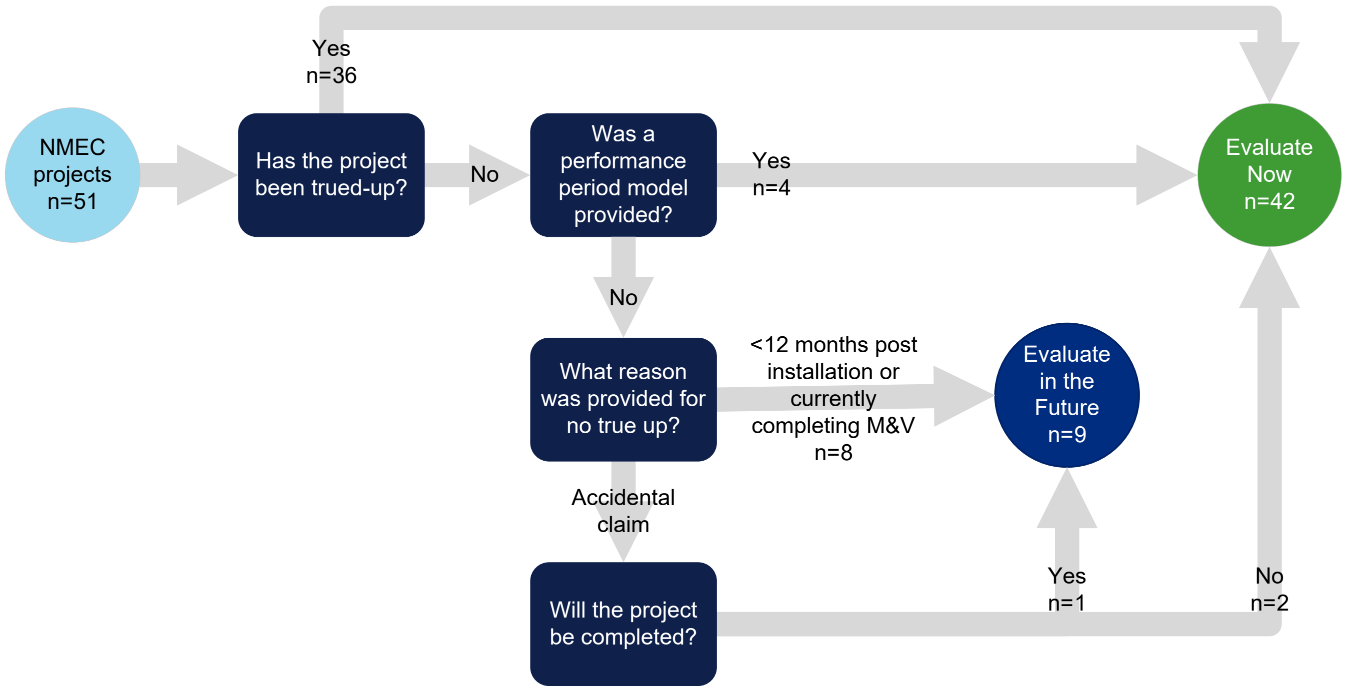
This section explores the implications of the characterization efforts on the impact and net-to-gross evaluations. Given that this is the first evaluation of the NMEC pathway since it left the pilot phase, DNV is including as many projects as possible in both the impact and net-to-gross evaluations. For net-to-gross, DNV will include all 51 projects in the evaluation. DNV may add additional projects after the PY2022 tracking data is finalized.

On the impact side, DNV reviewed project documentation and developed an impact evaluability framework to determine which projects to include in the evaluation. The flow chart (Figure 4-34) outlines projects that will be included in the impact evaluation during this cycle and highlights items for improving how projects are tracked to make it easier to identify fully complete (trued-up) projects. Of the 51 projects with initial claims in PY2020-PY2021, 42 are evaluable and will be included in the impact evaluation sample design. Of the 42, 36 pass the most basic determination of whether a project is evaluable, i.e., trued-up. True-up status can theoretically be determined by a review of the tracking data.[61] Additionally, trued-up projects have a final claimed savings estimate that evaluators can use to calculate a GRR. Two projects that were accidentally claimed before installation was complete, cancelled, and never trued-up or zeroed out will also be evaluated as zero savers. An additional four projects for which DNV received performance period models and documentation but that have not been trued-up in CEDARS yet will be evaluated this round for information purposes. Future evaluations may not

[61] While DNV has learned more about the different methods the PAs use to report and track site-level NMEC projects, additional steps to improve the tracking process would be needed to avoid the need for a preliminary data request to clarify which projects have been trued up.

include projects that have not been trued-up yet, but DNV is including them this evaluation cycle to provide as much information as possible given the early stage of the NMEC pathway.

Figure 4-34. NMEC impact evaluability framework



There are nine projects that will be evaluated next cycle or may be included in this evaluation if final models are available this summer. Eight of these projects have not finished their performance period or do not yet have final models and therefore do not have a final claimed savings to evaluate. All but one of these projects had an initial claim in 2021, and so they would not be expected to be trued-up in the same year[62] given the 12-month performance period. One project will be evaluated in a future evaluation cycle despite having substantially more than 12 months since the claim. The initial claim was accidentally claimed prior to completing installation which took much longer than expected. The project will be evaluated once it is trued up or will be treated as a zero saver in a future evaluation if it is not trued up.

In each of the following sections, DNV looks at the size of the population by key segments and discuss implications for the evaluation.

4.6.1 Evaluability by fuel

Table 4-14 shows the project count and initial claimed savings for the impact population (42 sites across fuels) and net to gross population (51 sites). As discussed in prior sections, all the NMEC projects claim electric savings while relatively few in the full net-to-gross population (13) claimed demand savings, and very few (four) claimed gas savings. Demand savings are quite small compared to the other fuels (383kW) and 96% of gas savings is from one project. Therefore, the impact and net-to-gross evaluations will calculate electric realization rates and will provide information about how the demand and gas savings projects performed but will not produce demand and gas realization rates. The evaluation will also look for any interactive effects that may not have been claimed.

[62] 21 projects with initial claims in 2021 were also trued up in 2021, but these projects were installed in prior years and the initial claims were not made until after the performance period which is at least a year later than expected.

Table 4-14. Evaluable projects and savings by fuel

Fuel	Impact evaluation		NTG evaluation	
	Project count	Initial savings	Project count	Initial savings
Electric (kWh)	40	7,699,066	49	9,821,925
Demand (kW)	5	59	13	383
Gas (therms)	4	98,877	4	98,877

Projects may be counted multiple times if they have multiple fuels. The purpose of this table is to show how many sample points are available for each fuel.

4.6.2 Evaluability by customer group

As shown in Table 4-15 below the majority of electric projects (83%) and electric savings (63%) in the impact population comes from two customers, one large tech company and one school district. This indicates that the evaluation will be heavily weighted towards two customers' electric savings Since there are only two customers that make up a large portion of the savings, the resulting realization rates may not be applicable to future NMEC program years.

Table 4-15. Evaluable Projects and savings for large customer groups – electric only

Customer group	Impact evaluation		NTG evaluation	
	Project count	Initial savings (kWh)	Project count	Initial savings (kWh)
Large tech company	19	4,026,134	19	4,026,134
School district	14	859,030	14	859,030
Other	7	2,813,902	16	4,936,760
Total	**40**	**7,699,066**	**49**	**9,821,925**

4.6.3 Evaluability by PA

Table 4-16 shows the number of electric projects that will be included in the impact evaluation and the net-to-gross evaluation by PA. DNV focuses on electric savings as it was the most common. The table shows that PG&E accounts for the majority of electric projects (60%) and electric savings (85%) in the impact population. SCE accounts for 35% of projects, yet only 11% of savings. SoCalREN only accounts for a minor percentage of projects (5%) and savings (4%).

Out of the nine projects in the NTG population and not in the impact population, one is SCE and eight are SoCalREN. All of PG&E sites will be part of both the impact and NTG evaluations.

Table 4-16. Number of electric projects and savings by PA

PA	Impact evaluation		NTG evaluation	
	Project count	Initial savings (kWh)	Project count	Initial savings (kWh)
PG&E	24	6,566,272	24	6,566,272
SCE	14	859,030	15	1,491,350
SoCalREN	2	273,764	10	1,764,303
Total	**40**	**7,699,066**	**49**	**9,821,925**

As indicated in Section 4.3, there were substantial variations across the PAs in how savings were tracked, resulting in inconsistent and often incorrect reported savings. It is expected that total reported savings is equal to initial claim plus trued up claimed savings, where the trued-up savings is the savings delta (either positive or negative) that adjusts the initial claim to align with the meter-based normalized savings. However, it was found that each of the three PAs with trued up savings (PG&E, SCE, SoCalREN) calculated total reported savings in different ways. From an evaluability standpoint, using the tracked savings would result in different realization rates for each PA solely due to how they were reporting savings. Table

4-17 below describes the process of how savings were reported by PAs for trued-up projects. Given that NMEC is a new pathway and the PAs indicated that they now report NMEC projects in alignment with the reporting guidance, DNV plans to adjust savings as if they were reported correctly when producing realization rates. This will provide a more applicable realization rate going forward and the ability to ascertain differences in realization rates between the PA and customer group that are not due to reporting differences.

Table 4-17. Expected RR based on tracking data by PA

PA	Trued-up projects	How savings were reported
PG&E	21	Final reported savings do not include realization rate.
SCE	14	The trued-up savings included both claimed and initial savings resulting in initial claimed being double counted.
SoCalREN	1	Savings were reported as expected for the one SCR project.
Total	36	N/A

4.6.4 Project evaluability findings

Key evaluability findings are listed below.

1. **Forty-two projects will be included in the impact evaluation population and all 51 projects will be included in the net-to-gross evaluation population.** Out of 51 projects, 36 are trued up and ready to be included in the impact evaluation. Six additional projects will be evaluated this cycle and are expected to have been trued up in PY2022. DNV may include additional projects if they are also trued-up in PY2022.

2. **Two PAs made accidental claims, meaning claims were made prior to installation.** DNV found three accidental claims, one that was claimed before installation was complete and two that were claimed but the projects were cancelled and never zeroed out. The two projects that were cancelled will be included in the evaluation as zero savers. The other project will be included in a future evaluation as either a completed project or a zero saver, as the PA indicated that it is currently going through installation verification.

3. **The impact evaluation will focus on electric projects.** The evaluation is most appropriate for electric projects. All projects have electric savings. On the impact side there are only five projects with demand savings that total in just 59kW and three positive saving gas projects, with one site accounting for 96% of positive savings.

4. **Two customers make up most of the impact and net-to-gross populations.** Two customers make up 83% of electric projects and 63% of electric savings in the impact evaluation population. This means that the impact and net-to-gross results will also be heavily weighted by these customers, which may limit the applicability of the realization rates for future projects.

5. **The variation in savings reporting across PA will impact realization rates if tracked savings are used in the calculation.** There were substantial variations across the PAs in how savings were tracked, resulting in some overclaims. Given that NMEC is a new pathway and the PAs indicated that they now report NMEC projects in alignment with the reporting guidance, DNV plans to adjust savings as if they were reported correctly when producing realization rates.

5 FINDINGS AND RECOMMENDATIONS

This section summarizes all findings from the evaluability study and highlights the implications from the findings and recommendations from the research team.

5.1 Project characterization

1. **PY2020-2021 site-level NMEC projects are dominated by two customers with many projects.** Sixty-five percent of projects and 54% of savings were from two customers, a large tech company and a school district. This will have implications for the representativeness of this population for future years of the NMEC program.
2. **Savings claims are mostly electric.** Most projects are claiming electricity savings only (71%). Twenty-two percent of projects claim electric energy and demand savings and are not claiming gas savings. While nearly half of the projects began with forecast gas savings, only two projects ended up claiming any gas savings.[63]
3. **Most projects occurred in office buildings, followed by education buildings and parking structures.** There is significant overlap between the largest two customers and building type, with all projects in education buildings occurring in the largest school district and the majority of the projects in offices (19 out of 25) occurring in the large tech company.

Implications

- The dominance of two customers with many sites will limit the applicability of the impact and net-to-gross evaluation to future program years. To partially combat this, DNV plans to incorporate additional projects into the evaluation that have final models but are not yet trued-up in the CEDARS tracking data.
- The impact and net-to-gross evaluations will likely only produce electric realization rates, although gas and demand projects will also be evaluated.

Recommendations

- Evaluators should maintain a list of NMEC projects included in bi-monthly reports from the PAs from which selections for CPR are made. Track projects through to completion to determine if CPR review increases the likelihood of a project not being completed.

5.2 Measure characterization

1. **Most electric savings came from lighting measures.** Forty-nine percent of engineering-based forecasted electric savings came from lighting measures followed by HVAC measures (42%). Refrigeration made up the remaining savings (9%).
2. **All gas savings came from HVAC measures.** All positive engineering-based gas forecasted savings came from HVAC and all negative interactive savings came from lighting measures.
3. **Most electric projects have a single MAT (78% of savings).** AR measures made up the most savings (37%), followed by similar shares for BRO (29%), and NR (28%). Application of MATs to measures may have some inconsistencies and reflect unclear NMEC rulebook guidance on the subject.
4. **Many planned measures were not installed measures.** The majority of electric savings were installed, while gas projects had half the savings not installed. Commercial Calculated Incentives program accounts for most of the not installed measure savings with 86% and 100% for electric and gas, respectively.

[63] Two additional projects claimed gas only savings, but these were determined to be accidental claims as the projects were canceled.

5 **Final documentation must reflect all implemented measures and only implemented measures.** Preliminary savings claims and the associate EUL are supposed to reflect all measures installed. When project plans change in the implementation process, the documentation is not always updated, particularly for EUL. While preliminary savings are updated via the performance-based savings estimate, the original claimed EUL remains in place and needs to appropriately reflect the length of the project lifetime. For a different but related challenge, some projects continued to install additional measures after posting preliminary savings claims based on initial implementations. Implementations during the performance period further complicate EUL calculations while leaving real, performance-based savings on the table.

Implications

- Most electric savings came from lighting measures. However, it appears that relatively few projects claimed gas interactive effects that typically are expected with lighting measures. The ex post evaluation will investigate whether additional interactive effects should have been claimed.
- Correct assignment of MAT at the measure level is important for determining EUL and baseline. The NR MAT functions differently in the NMEC context than for custom projects. NR may be assigned to avoid the necessity of providing the program influence documentation required for AR MATs. However, in the context of NMEC and an existing conditions baseline, NR raises particular concerns regarding attribution.

Recommendations

- Projects that include measures with expected interactive effects should either include a gas NMEC model or claim an engineering-based estimate of interactive effects. Guidance provided in an Early Opinion is currently available and will be included in the current revisions to the rulebook.
- CPUC should provide clear guidance regarding the assignment of MATs as well as associated expectations for program influence documentation in the NMEC context.
- Final documentation should reflect all implemented measures and only implemented measures. Complete documentation as of installation assures appropriate EUL. No additional installations provide full accounting of performance period savings. CPUC should provide clear guidance that a change in installed measures requires an updated EUL calculation.

5.3 Savings claim characterization

1 **Each PAs claimed savings in a different way and most PAs were not claiming savings as expected.** PG&E's initial claims were based on post-performance period normalized savings rather than the forecasted savings. SCE's initial claims matched the forecasted savings and did not appear to apply a GRR. Additionally, SCE's true up claims were not the difference between normalized and forecasted savings but, instead, the updated performance-based savings estimate in full. Given the two reported values are summed, this means SCE's total claim is roughly double what it should have been.

2 **The claims process may be more consistent in future program years.** The projects claimed in PY2020-2021 were made shortly after the NMEC rulebook and reporting guidelines were released and the NMEC reporting processes were likely still in development. During the interviews, the PAs indicated that their processes have been further developed and they described a reporting process in alignment with expectations.

Implications

- The different approaches used to track NMEC projects, as well as errors in CEDARS claims, meant that it took a substantial effort to determine which claims were site-level NMEC projects and which claims were ready for evaluation.
- The inconsistent approaches to savings claims could impact the evaluation realization rates, depending on whether the evaluation uses the savings claimed in CEDARS or the normalized savings found in the project documentation.

Recommendations

- Existing guidance is clear that initial claims should be made in the year of installation and trued-up the following year with a positive or negative value that, when summed with the initial claim, equals the final weather-normalized estimate of savings. All claims should follow this structure.
- The PAs should use the PriorYearClaimID / ParentClaimID field to clearly flag which projects are trued up in the CEDARS tracking data. This will help evaluators to accurately map the initial claims to the true-up claims for each project.
- The CPUC should consider whether rules around true-up timeliness may be necessary to ensure that all initial claims are eventually trued up.
- The PAs should consider approaches for completing data accuracy checks and reviewing all initial site-level NMEC claims to monitor whether they should be trued-up to improve true-up timeliness.
- The CPUC should clarify NMEC reporting guidance on other issues to improve accuracy and consistency across PAs. In the tracking data, these include the appropriate application of GRRs. In the project-specific documentation, the CPUC should develop a template of essential program data that must be provided with each project.

5.4 Model characterization

1 **COVID substantially impacted the NMEC models.** The COVID pandemic resulted in increased non-routine events, model re-baselining, and the incorporation of more occupancy-related variables. COVID offered a substantial stress test to the concept of site-level NMEC and the ability to adapt to that challenge, e.g., with occupancy variables, may prove useful under more typical conditions. If such data can be reliably captured at many sites and prove to be correlated with consumption, a greater share of buildings will meet eligibility criteria and the models will make routine a potential source of non-routine events.

2 **Models were re-baselined without sufficient explanation.** While COVID necessitated re-baselining for many projects, a large number of projects re-baselined without an explanation of why it was necessary. Re-baselining should only occur under unusual circumstances and documentation must be provided to support the decision. Establishment of the model specification in advance of implementation is a key concept for NMEC, and where that standard cannot be met must be carefully monitored.

3 **Most gas models fell below the goodness-of-fit thresholds and were therefore not used to claim savings.** Gas models even tended to struggle with meeting fractional savings uncertainty goodness-of-fit targets. This finding means that, in most cases, gas savings are not being claimed as part of NMEC projects even when installed measures would be expected to achieve gas savings. Further research is justified into improved model specifications and/or more appropriate eligibility requirements.

4 **Further research is needed to develop suitable eligibility requirements to support the hourly models that may be of interest for future TSB-based savings claims.** While more hourly models used for demand met the goodness-of-fit requirements than the gas models, only one project used an hourly model for electric savings, opting instead to use daily models for electric savings. The PAs and implementers have indicated that the separate models reflect the challenge of consistently meeting eligibility requirements with hourly models.

5 **Fractional savings above 20% are rarely realized.** A danger of moving to FSU as a key goodness-of-fit metric is that over-estimated fractional savings could make poorly performing models appear eligible. An upper bound on the fractional savings on which FSU can be calculated appears to be a reasonable approach.

6 **For daily kWh models, The CV(RMSE) and FSU results (at 10% savings) illustrate the similarity of the two goodness-of-fit criteria.** FSU calculated on forecasted fractional savings (rather than assuming 10%) could provide a better indicator of whether results would meet precision goals. Smaller percentage savings would meet criteria with better behaved models, and models with CV(RMSE)s above 25% might be sufficient with higher expected savings. In combination with findings related to poor realization of higher fractional savings, the use of higher fractional savings in the FSU calculation should likely be limited.

Implications

Gas and demand savings may be occurring alongside the measures achieving electric savings without being claimed. Alternatively, some measures may be left uninstalled when gas and demand models do not meet goodness-of-fit thresholds.

Recommendations

- For 2024, electricity claims will need to be based on hourly electric models. The CPUC needs to address hourly model eligibility requirements that encourage customers to use hourly electric models for energy claims.
- The CPUC should make FSU the primary model eligibility criterion. Savings as a percentage of consumption should be capped to avoid over-estimated savings bringing otherwise ineligible models into eligibility. This will improve gas model eligibility rates.
- Guidance provided in Early Opinions regarding gas models and interactive effects should be included in the rulebook.
- All model re-baselining must be accompanied with documentation justifying the decision. If re-baselined during the original pre-installation period due to an undetected NRE such as COVID, the model should remain consistent with additional variables addressing the issue (e.g., adding occupancy to address COVID closures).

5.5 Project timeline

1. **Incorrect timeline procedures.** The project and claim timelines often deviated from expectations, with some measures installed during the performance period, some projects having short performance periods (three months), some initial claims occurring prior to installation, and others not occurring until after the performance period.

2. **Significant COVID induced delays.** During interviews, respondents indicated that the major cause of project delays were impacts from the COVID pandemic in the installation/implementation period. Respondents said without COVID, the implementation phase would typically take three to six months, but due to COVID supply chain impacts, implementation takes an average of 11 months and can take as long as 30 months. COVID also impacted the models as some projects needed to be re-baselined or additional variables needed to be collected to adjust for occupancy and other changes. Respondents reported no other major delays in any other project phase including pre-screening, pre-installation/baseline, and reporting.

Implications

Installing measures during the performance period may dilute the savings achieved by a project as the savings would only be realized for a portion of the 12-month performance period.

Recommendation

Site-level NMEC implementers should track key project dates including baseline start and end date, intervention period, performance period start and end date, and initial and true-up claim dates. This practice will help the CPUC and evaluators to use correct baseline and performance period data to evaluate savings.

5.6 Project evaluability

1. **Forty-two projects will be included in the impact evaluation population and all 51 projects will be included in the net-to-gross evaluation population.** Out of 51 projects, 36 are trued up and ready to be included in the impact evaluation. Six additional projects will be evaluated this cycle and are expected to have been trued up in PY2022. DNV may include additional projects if they are also trued-up in PY2022.

2. **Two PAs made accidental claims, meaning claims were made prior to installation.** DNV found three accidental claims, one that was claimed before installation was complete and two that were claimed but the projects were cancelled and never zeroed out. The two projects that were cancelled will be included in the evaluation as zero savers. The other project will be included in a future evaluation as either a completed project or a zero saver, as the PA indicated that it is currently going through installation verification.

3. **The impact evaluation will focus on electric projects.** The evaluation is most appropriate for electric projects. All projects have electric savings. On the impact side there are only five projects with demand savings that total in just 59kW and three positive saving gas projects, with one site accounting for 96% of positive savings.

4. **Two customers make up most of the impact and net-to-gross populations.** Two customers make up 83% of electric projects and 63% of electric savings in the impact evaluation population. This means that the impact and net-to-gross results will also be heavily weighted by these customers, which may limit the applicability of the realization rates for future projects.

5. **The variation in savings reporting across PAs will impact realization rates if tracked savings are used in the calculation.** There were substantial variations across the PAs in how savings were tracked, resulting in some overclaims. Given that NMEC is a new pathway and the PAs indicated that they now report NMEC projects in alignment with reporting guidance, DNV plans to adjust savings as if they were reported correctly when producing realization rates.

APPENDIX A. RESPONSE TO COMMENTS

Comment #	Commenter	Report Page	Comment	Evaluator's Response
1	PG&E	N/A	PG&E appreciates the opportunity to review and provide comments on this draft report. It was well-written and well-organized. PG&E also appreciates the shift from a measure-level evaluation to a program-level evaluation and looks forward to this approach on-going.	Thank you.
2	PG&E	N/A	Due to some complications in our internal systems, the true-ups for two projects (CPR 529, 636) were not filed timely. These true-ups will be included in our 2023Q3 claims. PG&E asks that the evaluators consider these true-ups in the impact evaluation, and if they choose to do so can provide claim information prior to the 2023Q3 claims filing date if needed.	Thank you for providing this update on these projects. We will consider adding these sites to the evaluation if the documentation can be provided promptly and the budget and timeline allow.
3	PG&E	6	The last paragraph on this page states that "the basic model eligibility criterion is a level of CVRMSE, a measure of variation unexplained by the model, that is less than 50%." All SLNMEC programs in PG&E territory use a threshold of 25% for CV(RMSE) in their program level M&V plan in alignment with the LBNL technical guidance.	We have corrected this so that it is consistent with LBNL guidance and the modeling section of this report.

Comment #	Commenter	Report Page	Comment	Evaluator's Response
4	PG&E	7	The report states that for 2024, electricity claims will need to be based on hourly electric models. While we agree that adding granularity to the data yields more accurate models and enables peak demand reduction claim, it is not always possible to develop an hourly electric model due to factors such as facility type, nature of independent variables, and more. In addition, we were unable to find this as a requirement in any of the current guidance documents and rulebooks. In addition, current CET does not need an hourly model to calculate TSB. An hourly model may only add value and increase the accuracy of the TSB when CET can accept an hourly model. Therefore, we request removing this statement from the report until an hourly-enabled CET is available and the CPUC has created guidance around how to make claims using customized DEER load shapes for the estimates and the true-up claims.	We have revised the text to indicate that hourly models may be of greater interest with the transition to total system benefit.
5	PG&E	7	In 2022, SoCal Gas, PG&E, and SDG&E funded a research project that was conducted by kW Engineering on the natural gas model acceptance criteria. Here is a link to the final report: https://pda.energydataweb.com/api/view/2771/Gas%20Model%20Acceptance%20Final%20Report%209.28.2022.pdf This research concludes: Use the current CV(RMSE) criterion of 25% to determine whether a natural gas NMEC project is acceptable (models based on daily or monthly time interval data only). Should the model fail the CV(RMSE) test, calculate the FSU assuming 10% savings. If there is a savings estimate available, use it in the FSU equation instead. If the FSU is < 50% at a 90% confidence level, accept the building as an NMEC project. Adding a citation of this research report to the evaluability report would strengthen the stance that the CPUC should make FSU the primary model eligibility criterion.	This study is discussed in section 4.4.5.3 of the evaluability report. We have added some clarifying text to make the text clearer.

Comment #	Commenter	Report Page	Comment	Evaluator's Response
6	PG&E	7	PG&E would like to add that there have been recent changes in the interpretation of the SLNMEC requirements which may impact the evaluation. For instance, we have received Ex-Ante dispositions that required SLNMEC projects comply with the E-5115 requirements on program influence. In addition, some dispositions stated that proposed measures in SLNMEC projects should still meet or exceed the ISP. Recently, CPUC team has communicated to PG&E that influence requirements for SLNMEC projects should be set by NMEC Rulebook and that NMEC measures should only meet or exceed Title 24 requirements. PG&E team is worried that the comments in older dispositions could have negative impact on the evaluation as recent evolution of influence and ISP policy would not be communicated to the evaluation team in a timely manner.	Thank you for sharing your concern. We are aware of the EAR memo and are in close communication with the CPR team. If there are specific dispositions or issues that you are concerned about regarding the evaluation, please let us know.
7	PG&E	24	We agree that project should be holistic and ideally comprise multiple MATs. PG&E generally selects AR in our claims for all site-level NMEC projects as there isn't a clear MAT to use for these projects that use existing conditions baseline and can contain multiple MATs. PG&E has previously suggested in working groups that NMEC receive a MAT for these cases (such as WB for whole building).	There is no movement to create a project-level NMEC MAT at this time. At the measure-level, MAT is needed for determining EUL and is also relevant when measures are NR. If baseline is ignored, MAT should be easy to identify and is necessary for calculating the project-level savings weighted EUL.

Comment #	Commenter	Report Page	Comment	Evaluator's Response
8	PG&E	20	PG&E agrees with evaluators' assessment that CPR selected projects are not being canceled or delayed at a higher rate than projects that do not go through CPR in PG&E's territory. However, there are several instances of dispositions that would have caused a project to be cancelled or significantly delayed if PG&E were to comply fully with all directives in the dispositions. CPR feedback in many cases has not been determined to be official NMEC policy, and PG&E has been collaborating with CPUC and CPR team to clarify that policy, particularly through the NMEC working group. In many cases (such as CPR 765 for influence documentation and CPR 803 and CPR 851 for standard practice requirements), the directives provided in dispositions was later rescinded in conversations with the CPR team after their interpretation of NMEC/Custom requirements evolved, many months after dispositions were issued. The uncertainty created by an evolving and inconsistent understanding of the applicability of custom requirements would have had a significant chilling effect on NMEC project uptake had PG&E not collaborated with the CPUC over several months on certain aspects of several dispositions. Due the advisory nature of NMEC dispositions PG&E approves project installation while the CPR process is still underway. Often, project installation Timing doesn't line up with the timing of CPR feedback.	Thank you for sharing your concerns. We are aware of the EAR memo and the discussions that have occurred between PG&E and the CPR team. As the NMEC pathway further develops, we expect that there will be fewer and fewer edge cases. The NMEC project reviews are advisory and are not intended to delay project installation.
9	PG&E	30	The forecasted energy savings at the pre-install stage will be reviewed and may change to due many reasons such as project scope change. The initial savings claim is based on the forecasted energy savings at the post-install stage. I recommend making a change to the definition of “Forecasted savings” in the Table 4-10: “Forecast savings: Engineering-based savings estimate calculated at post-installation."	We have revised the definition to "Engineering-based savings estimate for installed measures."

Comment #	Commenter	Report Page	Comment	Evaluator's Response
10	PG&E	35	PG&E recognizes that there may have been some discrepancies in savings reporting in these initial NMEC projects, including some issues with our internal systems but wants to characterize what our methodology is now. These prior claims often had completed or nearly completed the performance period before we had the systems and training in place to make the estimate claim, resulting in the two claims being made in the same year. Our current claims methodology is: after our projects complete post-installation review, we make an initial savings claim equal to the forecasted savings multiplied by the gross realization rate of 0.9. After our projects complete the performance period and the post-performance period review, PG&E then makes a true up claim that is equal to the Normalized Savings (with as GRR of 1.0) minus the initial savings claim. This should result in a final total claim equal to the Normalized Savings. We think this methodology aligns with the expectations from the NMEC reporting guidance and the guidance commission staff has provided on NMEC GRRs, as well as the definitions provided in Table 4-10.	Thank you for providing this information about PG&E's current methodology for claiming site-level NMEC projects.
11	PG&E	52	Per CPUC guidance in past dispositions, PG&E directed the implementer to postpone optimization events until the pre-install package is fully reviewed and approved. This change was implemented on projects with application signed after Q1 of 2023.	Noted.

Comment #	Commenter	Report Page	Comment	Evaluator's Response
12	SCE	7, 46	"The CPUC should make FSU the primary model eligibility criterion. Savings as a percentage of consumption should be capped to avoid over-estimated savings bringing otherwise ineligible models into eligibility. This will improve gas model eligibility rates." "Fractional savings above 20% are rarely realized." "For daily kWh models, The CV(RMSE) and FSU results (at 10% savings) illustrate the similarity of the two goodness-of-fit criteria." Questions: a. Can clearer guidance be provided for when to use FSU over CV(RMSE) when evaluating the eligibility of gas and demand models? b. Per the NMEC rulebook, fractional savings should be at least 10%, and recommendations here suggest fractional savings should be under 20% to be reasonable. Is this the range for which fractional savings can be considered usable?	10% savings is a recommendation, not a requirement. CVRMSE without meaningful consideration of the magnitude of savings may not be a useful metric. FSU is effectively CVRMSE in the context of fractional savings. The real strength of FSU is that predicted fractional savings are used in the denominator, rather than 10%. If reasonable numbers are used, it gives a better approximation of the potential precision of savings estimates. Allowing inflated fractional savings would give an unreasonable picture of expected precision so it makes sense to have some upper bound on the denominator.
13	SCE	3	Question: Can direction be provided on the rules for reporting site-specific NMEC projects with multiple service accounts for a single site? SCE currently counts each service account within a site as its own project and project ID.	Aggregation is reasonable, perhaps even advisable, if a project at a single site affects multiple service accounts.
14	kW Engineering	8	Footnote 21 at the bottom of the page says SLNMEC projects typically have two claims. This depends on program design, SCE's HOPPs program which is still active has 3 savings reporting milestones and incentives, after 3 months (which are likely the initial claim), after 12 months (likely the true-up savings) and after 24 months (Unsure if this is reported in CEDARs).	We have not seen any additional true-up claims for these projects. From the documentation received, it appears that the initial claim was engineering-based forecasted savings, and the true-up claim was based on forecasting the 3-month model to estimate 12 months of savings.

Comment #	Commenter	Report Page	Comment	Evaluator's Response
15	kW Engineering	9 & 13	Wouldn't cost-effectiveness of program delivery be an evaluability objective? Did this effort include gathering implementation costs to enable the evaluation to include cost of program delivery in the impact evaluation? Similar question for complexity of SLNMEC processes – did the evaluability study gather info on individual program procedures (PFS, M&V Plan, technical review reqs.) and NMEC Rulebook 2.0 requirements (e.g., 'early review') to enable evaluation of program processes?	Cost effectiveness was not an objective of this evaluability study. We did conduct in-depth interviews with program staff and implementers to gather additional information regarding project stages, timelines, and any challenges faced. You can find this information in section 4.5.5.
16	kW Engineering	15	Some initial savings claims are analysis of meter data, not engineering calculations. This is more relevant in the earlier years of 2020 and 2021. This might be the case with the PG&E projects.	Yes, most of the PG&E initial claims appeared to be based on the normalized savings rather than engineering-based savings. This is discussed in section 4.3.5.
17	kW Engineering	16	Were installation reports collected to support the initial savings claim? These would be updated forecast savings based on actual measures installed. This practice may have been more consistent in later years.	We used installation inspection reports or installation information provided in final 12-month reports to indicate whether or not installation had occurred for the purposes of this report.
18	kW Engineering	20	The NMEC Rulebook states projects will undergo 'early review' (which are intended not to halt approvals but be addressed with the savings claims) not custom project review. We still find projects are halted until early review is addressed similarly to how CPR affects custom calculated projects.	The NMEC review process is similar to the CPR process but now separate from the CPR process. The NMEC review does not have standing to halt a project. If it is halted, the PA has made that decision.

Comment #	Commenter	Report Page	Comment	Evaluator's Response
19	kW Engineering	21	Table 4-5 under disbursement for SCE's PSPBR program the disbursement schedule is 40% at the 3-month report, 40% at the 12-month report and 20% at the 24-month report.	We have added these details to the report. Thank you.
20	kW Engineering	24	MATs are necessary for determining weighted EULs. Will the impact evaluation recommend other ways to determine SLNMEC savings lives?	Determining other ways for assigning site-level NMEC EULs is not within scope of the impact evaluation. While we recognize the challenge of developing EULs from site-level MATs, a fixed EUL at any level will have various shortcomings and other reasonable alternatives are not apparent. Staff and evaluators are always open to new proposed approaches that support the full range of NMEC projects and fairly value the life-time savings therein.
21	kW Engineering	24	NR measures are defined by equipment that are beyond their useful lives, but this is generally an average or other approximate number. Often equipment is still operating, or 'repaired indefinitely' which clouds the classification. Isn't capturing savings from equipment that is below code but past its measure life a form of capturing stranded savings and therefore allowed by the NMEC Rulebook? AB802 makes no distinction for MAT. Does the NTG survey penalize SLNMEC projects when they include such NR measures that are still operating?	Normal replacement is not defined based on years post useful life. The NR MAT is used "where existing equipment (including Add-On Equipment) has either failed, no longer meets current or anticipated needs, or is planned to be replaced for reasons unrelated to the program" (CPUC Statewide Custom Project Guidance Document v 1.4). If a measure was still operating, it would likely be AR, rather than NR.

Comment #	Commenter	Report Page	Comment	Evaluator's Response
22	kW Engineering	32	See comment above (sec 4.1.1, p 5) for possible explanations of basis for initial savings claims and true-up claims. Only recently (e.g., last two years) do we start seeing installation reports that update the PFS forecast savings based on actual measure installations. The impact of the cost of delivery of this process is high, so the relative benefit of requirements of multiple stages of savings estimations (and review) should be considered.	From what we see in the data, it appears that PG&E claims were based on normalized savings rather than forecasted savings. SCE's initial claims were based on forecasted savings, but the true-up claim was the full normalized savings rather than the delta. It is important to know which measures are installed, as this will also impact the savings-weighted EUL that will be claimed. Assuming projects do not substantially deviate from plan, this effort should be a relatively straightforward task that indicates whether or not each planned measure was installed. From the perspective of the evaluation, a fully updated PFS is not necessary. Rather, we are looking for information about what was installed and when it was installed and any deviations from the plan. This information could be in a simple spreadsheet or in the post-performance period report.

Comment #	Commenter	Report Page	Comment	Evaluator's Response
23	kW Engineering	39	R2 should not be a criterion for model acceptance. It should only be guidance. When there is low variation in energy use, R2 will be poor, but the models random error (measured by CVRMSE) and bias error (NMBE) may still be acceptable. There are many times (e.g., data centers) the dependent variable doesn't explain, or explains only the small variation the energy use. Poor R2 should not prevent these projects from participation. FSU is not specifically required by the NMEC Rulebook or the LBNL guidance document. However, the NMEC Rulebook has language in it that savings must be distinct from 'variations in consumption' if savings are less than 10% of baseline use. ASHRAE's FSU formulas are used to demonstrate this.	Agreed.
24	kW Engineering	41	Yes, hourly models can be used to estimate kWh savings. However, when kWh savings is less than 10% hourly model FSUs should not be used to demonstrate that savings is distinct from 'variations in consumption' The devil is always in the details. LBNL has demonstrated that autocorrelation in the data renders ASHRAE's FSU formula unreliable for hourly models (and borderline for daily models). It only adjusts for lag-1 autocorrelation, rendering most FSU calcs to underestimate uncertainty. This would help acceptance of more SLNMEC projects savings estimates but introduces risk that these savings are not real. I can find the LBNL reference upon request. Also, I am working with industry experts on a Stats and Uncertainty Application Guide that will include methods more general than ASHRAE's formula that address this issue. Publication should be in 2024.	We share this concern. We would welcome collaboration on addressing this and other concerns with the FSU formula.

Comment #	Commenter	Report Page	Comment	Evaluator's Response
25	kW Engineering	45	It will be interesting to see how a figure like Figure 4-28 looks when the forecasted savings is replaced by installed forecasted savings (IR stage values).	Noted. For this figure, we used the forecasted fractional savings as that is the value commonly available that is used when determining whether or not a project is a good fit for NMEC.
26	kW Engineering	45	Item 1. COVID impact on models. Many of the techniques used to address NREs (including COVID) are from EVO's NRE/A Application Guide (available at evo-world.org) – a collection of methods from industry experts. It would be interesting, but likely out of scope for this study due to lack of data, to compare the additional occupancy variable methods used in SLNMEC with the comparison/granular profile methods used in popNMEC.	Thank you for the suggestion. Testing NRE techniques against the comparison or granular profile methodology is out of scope for this evaluation.
27	kW Engineering	46	Item 6. Agree that FSU for daily models may be a better criterion than CVRMSE for reasons stated. Agree with caution that a limit on fraction of savings F should be used. If the future requires hourly models, a better savings uncertainty method than ASHRAE's FSU will be needed, for reasons cited above.	Noted.
28	kW Engineering	47	Figure 4-32 shows SCE's PSPBR projects had only a 3-month reporting period. The program has since developed 12-month savings reports and will develop 24-month savings reports.	Based on the documentation we received, it appeared that the 12-month reports were based on a 3-month model that was projected to 12 months.

Comment #	Commenter	Report Page	Comment	Evaluator's Response
29	DSA	25	What is a “remit to address” in this context? I’m used to seeing that term on invoices but not in the context of EE baselines. It seems like DNV is accepting NR projects getting overstated gross savings due to the NMEC procedure using the as-found baseline to train the regression model since the NTG adjustment will presumably give NR projects a significant haircut? Is there anything that should be considered with respect to eligibility or calibration of gross savings to protect against NR projects diluting the effectiveness of NMEC offerings?	This is a less common (British) usage of the word remit, meaning the task or area of activity officially assigned to an individual or organization. NMEC is not intended to reward below-code savings for NR measures. Measures that are identified as NR will be adjusted for below code savings separate from the NTG process. As discussed in the report, different PAs appeared to follow different decision rules with regards to choosing MAT, so the evaluation will make its own independent assessment of MAT prior to applying an adjustment if necessary.
30	DSA	41	It feels odd for projects to claim kWh savings but not kW savings. I appreciate that this goes away, sort of, in 2024 when things move to a single hourly model. In the meantime, can DNV make a recommendation about savings claims procedures when thresholds are met for one resource type (e.g., kWh) but not others (e.g., kW and therms)?	Many of the site-level NMEC programs do not offer kW incentives, which likely further reduces the number of projects that follow through with making kW savings claims. Making recommendations about savings claims when one model type passes and another does not is out of the scope of this study, but it is something that is under consideration as part of the rulebook revisions.

Comment #	Commenter	Report Page	Comment	Evaluator's Response
31	DSA	49	These timeline charts are fabulous and really highlight some of the irregularities around timing. Would the study be willing to put out a strawman proposal of how this should work in addition to highlighting the need for more guidance in the rulebook? Maybe the initial claim needs to be made within XX days of the start of the performance period and the true-up needs to be made within YY days of the end of the performance period. For NMEC to scale, it seems like we need more of an orderly assembly-line approach to production rather than these artisanal small-batch jobs. I love the 'template' recommendation and think this study lists many of the key elements.	Thank you. There is currently an NMEC reporting guidance document which says that the "PAs will claim the total estimated First Year savings for the site in the Claim Yr_Qtr of the project installation…[and] PAs shall report a claim in the quarter that a project completes it's performance period, using the PriorYearClaimID field to true-up actual costs and savings achievements."

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