GROUP D

Custom Industrial, Agricultural, and Commercial (CIAC) 2023 Impact Evaluation

California Public Utilities Commission
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Glossary of key terms and acronyms

Accelerated Replacement (AR) – A measure application type (MAT) used for the replacement of existing equipment that could and would remain operational without program intervention. It is used in direct contrast to the Normal Replacement MAT, which is used when existing equipment either could not or would not remain operational. Accelerated replacement (non-capacity expansion) measures and replacement of “operating equipment that when broken, non-functional, or unable to provide the intended service is typically repaired” can be classified as AR.

Add-On Equipment (AOE) – A measure application type (MAT) used for installations of new equipment onto pre-existing equipment, improving the nominal efficiency of the host system. The existing host system must be operational without the AOE equipment, continue to operate as the primary service equipment for the existing load, and be able to fully meet the existing load without the add-on component. The add-on equipment must not be able to operate on its own. The actual energy reduction occurs at the host equipment, not at the add-on component, although any add-on component energy usage must be subtracted from the host energy savings.

Authority Having Jurisdiction (AHJ) – An organization, agency, or individual responsible for ensuring that the codes, standards, and regulations are followed within their jurisdiction—and holding the authority to enforce those codes, standards, and regulations, issue permits, and conduct inspections. AHJs may vary depending on the location and jurisdiction, and identifying the specific AHJ for a particular project or activity is critical to ensuring regulatory compliance.

Behavioral, Retro-commissioning, and Operational (BRO) – A measure application type (MAT) used for measures that either restore or improve energy efficiency and that can be reasonably expected to produce multi-year energy efficiency savings. By definition, BRO measures result in performance that does not exceed the nominal (rated or original) efficiency of the pre-existing condition. EE savings from correcting deferred maintenance, performance restoration, and operational characteristics fall within the BRO category. In the case of either normal or accelerated equipment replacement, separate claims should be made for energy savings related to the equipment replacement and energy savings related to operational factors and updating maintenance. There are three BRO subtypes: BRO Behavioral (BRO-Bhv), BRO Operational (BRO-Op), and BRO Retro-commissioning (BRO-RCx).

Building Weatherization (BW) – A measure application type (MAT) used for non-mechanical building efficiency improvements such as windows, insulation, air sealing, and duct sealing.

California Energy Data and Reporting System (CEDARS) – This database 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).[1]

California Electronic Technical Reference Manual (eTRM) – A statewide repository of California’s deemed measures, including supporting values and documentation.

California Technical Forum (Cal TF) – A collaborative of experts who use independent professional judgment and a transparent, technically robust process to review and issue technical information related to California’s integrated demand side management portfolio. The Cal TF was created in 2014 by a broad group of stakeholders and is funded by participating program administrators (PAs).

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

Custom Core Template (CCT) – DNV created an Excel-based CCT to organize and communicate evaluation information for each claimed project in a sample. This spreadsheet is used to ensure a uniform and systematic approach to determining and communicating gross savings methods, calculations, and results.

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

Database for Energy Efficiency Resources (DEER) – 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) PAs, private sector implementers, and the EE industry across the country to develop and design energy efficiency programs.[2]

Design Light Consortium (DLC) – Provides a list of certified lighting products used for energy efficiency lighting projects.

Energy Division (ED) – The division of the California Public Utilities Commission (CPUC) responsible for regulating and overseeing the state's energy utilities and policies. The ED ensures that California's investor-owned utilities (IOUs) provide safe, reliable, and affordable electric and gas services while advancing the State's climate and clean energy goals.

ED tracking data – The officially claimed electric and gas impacts as captured in the CEDARS (defined above) data and reporting system.

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

Effective useful life (EUL) – An estimate of the median number of years that the measures installed under the program will remain in place and operable.

Free rider – Program participant who would have installed the program measure or equipment in the absence of the program.

Gross realization rate (GRR) – The ratio of achieved energy savings to forecasted energy savings. A realization rate of 100% means the evaluated savings match exactly those forecasted, while lower or higher realization rates means forecasted savings were over- or under-forecasted, respectively.

Gross savings – 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 incentives offered under the program.

High Opportunity Projects or Programs (HOPPs) – A program offering a systematic process to identify operational and maintenance improvements that optimize building performance and ensure that building systems function efficiently and effectively. HOPPs RCx is designed to ensure persistence of savings by requiring customers to commit to a three-year maintenance plan.

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

Interactive effects – The secondary impacts that energy-saving measures have on other systems within a building or facility, and which can influence the overall energy savings and cost-effectiveness of energy efficiency measures.

International Performance Measurement and Verification Protocol (IPMVP)[3] – A standardized approach to measuring and verifying energy efficiency investments. IPMVP incorporates M&V best practices in a non-prescriptive framework, allowing it to be applied flexibly based on a measure's application and the available information.

Lifecycle savings – 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 to account for the untapped useful life of the outgoing equipment.

Measure – See "energy efficiency measure" definition.

Measure application type (MAT) – The installation basis for efficiency claims. 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.

Metric million British thermal unit (MMBtu) – A unit traditionally used to measure heat content or energy value. MMBtu is the common unit upon which sampling is based.

Modified Lighting Calculator (MLC) – A standardized tool used for calculating deemed energy savings from lighting retrofits and installations in utility energy efficiency programs across California. It was designed to bring consistency, transparency, and accuracy to the estimation of savings from lighting projects that are claimed by program administrators (PAs), third-party implementers, and evaluators.

Net savings – The savings realized after accounting for free-ridership, calculated by multiplying 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; used to estimate and describe the free-ridership that may be occurring within energy efficiency programs.

New Construction (NC) – A measure application type (MAT) used where equipment is installed in either a new area or an area that has been subject to a major renovation, to expand capacity of existing systems, or to serve a new load. The NC MAT is used where there is no reference operation for existing conditions, such as with new construction, expansions, added load, a change in the function of the space (e.g., office to laboratory), or a substantial change (e.g., ~30% or more) in design occupancy. New construction, capacity expansion, and replacing "equipment that is actually broken, nonfunctional, or unable to provide the intended service" is eligible for the Normal Replacement MAT, but ineligible for Accelerated Replacement.

Normal Replacement (NR) – A measure application type (MAT) 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. The NR MAT may be applied to any measure or program, with certain exceptions, and without a burden of proof. This MAT includes measures that previously fit into the now-retired Replace on Burnout (ROB) MAT.

Normalized metered energy consumption (NMEC) – High opportunity programs or projects (HOPPs) that provide incentives based on metered energy consumption. This initiative fulfills the directive for utilities to quickly identify high

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

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.

Outdoor air temperature (OAT) – Local climate zone (CZ) weather data used to regress equipment operation for weather dependent data to estimate annual operation.

On Bill Financing (OBF) – A program that provides zero-interest loans to businesses, government entities, and non-residential customers to implement energy efficiency projects with no upfront capital costs. The repayment is conveniently added to the monthly utility bill, with the energy savings from the installed measures meant to offset the loan payments.

Preponderance of evidence (POE) – The standard to demonstrate that the replacement of inefficient equipment or processes with a more energy efficient alternative more likely than not resulted from an energy efficiency program offering and would not have happened without that program.

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),[4] Pacific Gas & Electric (PG&E), Southern California Edison (SCE), Southern California Gas (SCG), San Diego Gas & Electric (SDG&E).

Peak demand – The maximum level of metered demand during a specified peak demand period for installed or implemented measures. CPUC Resolution E-4952 approved the Database for Energy-Efficient Resources (DEER) for 2020 and revised the DEER Peak Period definition to 4:00 p.m. – 9:00 p.m., effective January 1, 2020.

Relative precision – A ratio of the error bound divided by the value of the measurement itself. This provides the error on a relative basis, 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.

Remaining useful life (RUL) – An estimate of the median number of years that a measure being replaced under the program would have remained in place and operable had the program intervention not caused its replacement.

Savings by Design (SBD) – A sunset statewide energy efficiency program in California, approved by the California Public Utilities Commission (CPUC) and designed to encourage high-performance, energy-efficient design and construction practices in non-residential new construction and major renovation projects.

Standard Practice Baseline – An estimate of the activity or installation that would take place absent the energy efficiency program, as required by code, regulation, or law, or as expected to occur as standard practice (SP). The Standard Practice Baseline activity or installation must meet the anticipated functional, technical, and economic needs of the customer, building, or process and provide a level of service comparable to that provided by the energy efficiency (EE) measure. Savings claims shall be generated based on equipment choices that operate at a level of service comparable to that provided by the EE measure. If there is not a viable and comparable baseline solution that offers a comparable level of service as the EE measure, the energy use of the baseline solution must be adjusted to provide a level of service comparable to that provided by the EE measure.

Statewide – Energy efficiency programs or activities that are essentially similar in design and available in all CPUC regulated utility service areas in California, administered by a CPUC-specified PA.

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[4] MCE is a not-for-profit public agency that MCE provides electricity service to more than one 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 evaluation report presents the findings and impacts of the California Program Administrators' (PAs') 2023 Custom Industrial, Agricultural, and Commercial (CIAC) programs. DNV independently determined to what extent site-specific custom projects in the CIAC programs realized their forecasted electric peak demand, electric energy, and natural gas savings (i.e., non-deemed[5] savings claims). In this report, "custom activity" refers to large commercial and industrial (C&I) and agricultural projects involving complex equipment and systems that require site-specific verifications and savings calculations. This evaluation covers qualifying claims from non-residential new construction projects offered through California Energy Design Assistance (CEDA), formerly known as Savings by Design.[6]

Overall goals

1. Develop first-year and lifecycle net and gross savings[7] for the Custom program with a targeted precision of better than ±10% at 90% confidence.
    a. Gross savings are changes in the energy consumption of program participants that result directly from the installed energy efficiency measures (EEM), regardless of why customers participated.
    b. Net savings are changes in energy use attributable to a particular energy efficiency program—that is, energy savings that a participant would not have realized without the influence of the program.
    c. Lifecycle savings refer to the savings that occur over the lifetime of an energy-efficient technology or measure installed by a program participant.
2. Develop meaningful and actionable recommendations to improve program delivery of energy efficiency savings.

Evaluation objectives

1. Quantify first-year and lifecycle gross kWh, peak (highest demand) kW,[8] and therm savings by sampling domain (e.g., by PA, by subject area, and by lighting/non-lighting).
2. Calculate the ratio of evaluated savings to the savings forecasted by PAs, referred to as the gross realization rate (GRR), by sampling domain. GRR is calculated by comparing the energy savings evaluated (or realized) in the 2023 program year to the energy savings predicted before the implementation of the energy efficiency measures.
3. Provide analysis of the factors driving the GRR.
4. Recommend how PAs can improve GRRs.
5. Quantify the ratio of the program's evaluated net and gross savings,[9] referred to as the net-to-gross ratio (NTGR), by sampling domains.

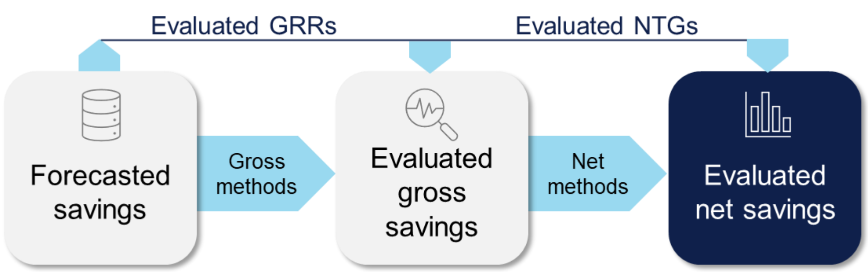
5 Non-deemed savings refer to energy savings that are not predefined or pre-approved by regulators or PAs.
6 SBD represents 7% of first-year kWh and 11% of first-year therms of all CIAC claims.
7 Gross savings are the changes in energy use resulting from energy efficiency activities, regardless of what factors may have motivated the program participants to take actions. We develop ratios of the evaluated savings to the PA-reported savings values, referred to as gross realization rates, to express the evaluation results as a percent relative to the reported value
8 Peak kW refers to the highest level of power consumption or demand over a specific period, typically within a certain timeframe such as a day, month, or year.
9 This factor represents net program load impacts divided by gross program load impacts. Evaluators apply it to gross program load impacts to convert them into net program load impacts.

6. Identify the factors that characterize free-ridership and provide recommendations to reduce free-ridership. Free-ridership[10] occurs when participants would have installed the same EEMs in the absence of the program. Such participants receive program benefits for actions they would have taken even without the program influence.
7. Determine and apply proper measure application type (MAT) for gross savings estimates.
8. Identify gaps in the planned evaluation, measurement, and verification (EM&V) activities for custom programs and describe emerging evaluation issues for PAs to address going forward.
9. Provide actionable recommendations to the PAs and stakeholders to address gaps and improve future programs and projects.

1.2 METHODOLOGY OVERVIEW

DNV evaluated gross and net savings that the PAs forecasted for Custom and Savings by Design[11] (SBD) projects installed in program year (PY) 2023. We present savings for these two types of projects together in this executive summary but separately throughout the body of the report. Our gross and net savings calculation methods are described in the final study work plan[12] and summarized below. This study adhered to International Performance Measurement and Verification Protocol (IPMVP)[13] and the California Evaluation Protocol.[14] Figure 1-1 shows the overall evaluation process.

Figure 1-1. CIAC gross and net savings methods PY2024



The PY2023 sampling plan used data from the CEDARS program to create a stratified random sample of 71 projects. The goal was to achieve 90/10 precision for both electric and gas impacts and the NTGR. The projects were grouped by factors like PA, project size, measure group, fuel type, and finance type. The analysis focused on GRR and NTGR across different factors.

[10] Statewide Custom Project Guidance Document, version 1.4, pg. 39.

[11] SBD is the non-residential new construction program. SBD savings are estimated via either a "Systems" or "Whole Building" approach. The Whole Building approach requires a program-approved energy simulation tool to estimate energy savings, while a typical Systems approach project can use simplified modeling.

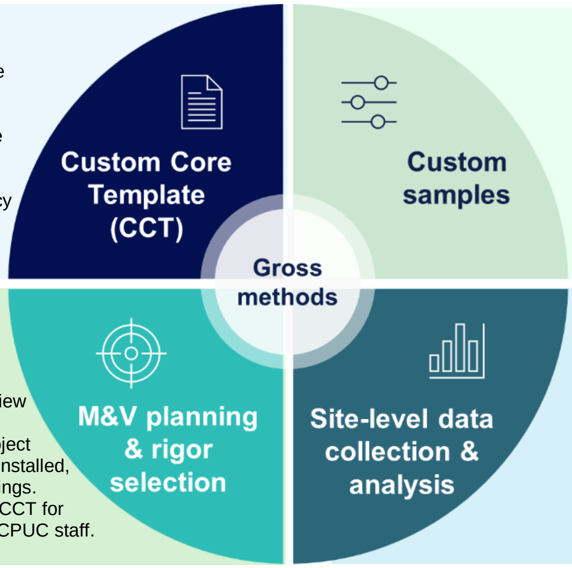
[12] GROUP D Evaluation, Measurement, & Verification of Program Year 2023 Commercial, Industrial, and Agriculture Custom Projects Work Plan, California Public Utilities Commission, September 30, 2024.

[13] IPMVP is a protocol that facilitates 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.

[14] The California Evaluation Protocol (CEP) is a set of guidelines and procedures developed by the California Public Utilities Commission (CPUC) for conducting evaluations of energy efficiency programs.

Gross methods

Our evaluation of gross savings took the following steps, in sequence: 1) sample design, 2) a site-specific evaluation via use of a Custom Core Template,[15] 3) extensive measurement and verification (M&V) planning, and 4) site-level data collection and analysis for sampled sites from each area of interest.



- Excel-based tool to organize/ communicate site-level findings, driving results aggregation at the portfolio level
- Includes measure qualification review, calculation methods, site documentation gathered, independent savings estimates, realization rates, and discrepancy analysis comparing predicted energy savings with measured results

- We used data from Custom projects that have undergone energy efficiency retrofits or upgrades to statistically select a sample of projects for evaluation.
- Custom had a final sample of 68 sites, including 27 lighting sites and 41 non-lighting.
- We completed 40 on-site visits to support the evaluated savings estimates through direct measure observation and performance data collection.

- Sampled projects received site-specific M&V plans based on desired level of rigor (degree of accuracy) for review and approval by CPUC staff.
- We determined rigor vis-a-vis project complexity, nature of equipment installed, and magnitude of forecasted savings.
- We documented M&V plans in a CCT for each site and submitted them to CPUC staff.

Data collection at sampled sites included:

- Evidence of operation
- Customer interviews
- Energy models
- Custom analysis tools and methods
- Billing analysis
- Trend or equipment performance logs
- Photographic evidence of installations

Net methods

The net-to-gross (NTG) assessment estimated the portion of gross energy savings attributable to the financial incentives or activities (e.g., audits, technical assistance) of an energy efficiency program. The **NTG approach** used in this study and summarized below is consistent with approaches used in previous custom project attribution research in California.

DNV completed 58 participant NTG surveys. We used these surveys to collect the information needed to calculate three component scores which made up the NTGRs for each project.

- Two program attribution scores measured the **relative strength of program and non-program influences** on decision-making.
  - For the first program attribution score, the study asked program participants to rate the relative importance of a list of program influences as well as a list of non-program influences on their decision to implement the energy efficiency measures. The study based the attribution score on the highest influence rating for a program influence divided by the sum of the highest rating for a program influence and the highest rating for a non-program influence.
  - For the second program attribution score, the study asked program participants to divide 10 points between their collective program influences and their collective non-program influences.
- A third program attribution score measured the likelihood that the participating customer would have installed program-qualified equipment in the absence of the program.

[15] DNV created an Excel-based Custom Core Template (CCT) to organize and communicate evaluation information for each claimed project in the sample. We used this spreadsheet to ensure a uniform and systematic approach to determining and communicating gross savings methods, calculations, and results.

We calculated NTG ratios as the average of these three program attribution scores.

1.3 EVALUATED PROGRAM SAVINGS CLAIMS

This evaluation focused on the energy savings forecasted by the PAs. The forecasted savings[16] in the CIAC study included **18,894 MWh first-year electric** savings and **107,930 MWh** lifecycle energy savings in PY2023. Total forecasted **first-year gas savings were 548.1 thousand therms** and total **forecasted lifecycle gas savings were 4,104 thousand therms**. Of the 206 projects in the population, DNV sampled 68 projects to inform the gross evaluation and 58 projects to inform the net evaluation. Of the 58 NTG surveys, 44 were with projects also included in the gross sample.

Table 1-1. PY2023 forecasted electric and gas savings

Group		First-year			Lifecycle		
	Number of projects	Forecasted savings (MWh)	Forecasted savings (MW)	Forecasted savings (thousand therms)	Forecasted savings (MWh)	Forecasted savings (MW)	Forecasted savings (thousand therms)
Electric only	183	18,894	2.8	N/A	107,930	17.8	N/A
Natural gas*	23	N/A	N/A	548	N/A	N/A	4,104
Overall	206	18,894	2.8	548	107,930	17.8	4,104

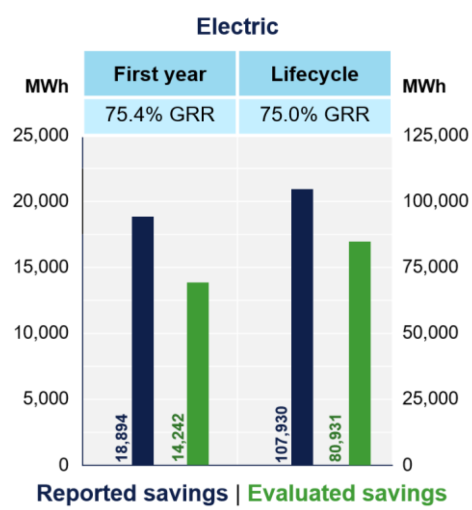
*Fifteen gas projects also had electric savings. The remaining eight were gas-only projects.

1.4 RESULTS

Gross savings results

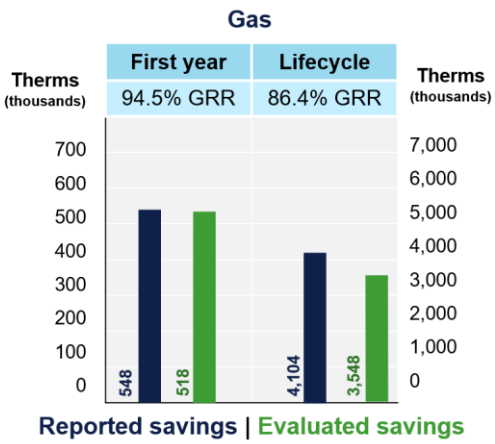
The following graphics show the overall evaluated statewide electric and gas results and GRRs. "Statewide" refers to all PAs and represents the overall results for California.

- The 75% electric lifecycle realization rate[17] for PY2023 is the highest observed over the last three evaluation cycles (PY2020–2021 was 48% and PY2022 was 38%).
- Projects within the CIAC study in PY2023 had evaluated first-year gross electric savings of 14,242 MWh and evaluated lifecycle gross electric savings of 80,931 MWh, with statewide GRRs of ~75% for both.
- Key drivers of the electric first-year and lifecycle realization rates were:
  – Inoperable measures,[18] with a −13% impact on the GRR



16 Savings excludes activity associated with High Opportunity Projects or Programs (HOPPs) that reflect savings adjustments made in the period of interest.
17 Realization rate is the ratio of achieved energy savings to forecasted energy savings. A realization rate of 100% means the evaluated savings match exactly those forecasted, while lower or higher realization rates means forecasted savings were over- or under-forecasted, respectively.
18 The measure is no longer operating at the time of evaluation, whether it has been decommissioned or removed from site.

- Inappropriate baselines,[19] with a −8% impact on the GRR
- Ineligible measures,[20] with a −7% impact on the GRR



- The 86% gas lifecycle realization rate for PY2023 is much higher than the previous study (PY2022 was 19%) but largely in line with the evaluation period before that (PY2020 – 2021 was 89%).[21]
- Projects within the CIAC study in PY2023 had evaluated first-year gross natural gas savings of 518 thousand therms and evaluated lifecycle gross natural gas savings of 3,548 thousand therms, with statewide GRRs of 94.5% and 86.4%, respectively.
- Key drivers of gas first-year and lifecycle realization rates were:
  - Changes in operating conditions,[22] which had a −17% impact on the GRR
  - Ineligible measures, which had a −14% impact on the GRR
  - Calculation methods, which had a +35% impact on the GRR

Table 1-2 presents the electric first-year and lifecycle evaluated energy and demand gross savings and precisions, both statewide and by PA. A discussion of the drivers of PA electric energy realization rates follows.

Table 1-2. Electric first-year and lifecycle evaluated gross energy savings by PA[23]

PA	First-year savings				Lifecycle savings			
	Forecasted	Evaluated gross	GRR	RP%*	Forecasted	Evaluated gross	GRR	RP%*
Energy (MWh)								
MCE	749	567	76%	±23%	8,999	3,199	36%	±22%
PG&E	8,251	4,827	58%	±17%	37,083	23,459	63%	±14%
RCEA	152	79	52%	±69%	740	293	40%	±65%
SCE	8,206	7,442	91%	±15%	43,781	38,146	87%	±13%
SCR	599	505	84%	±0%	3,552	2,917	82%	±0%
SDG&E	937	821	88%	±4%	13,774	12,917	94%	±5%
Statewide	18,894	14,242	75%	±10%	107,930	80,931	75%	±7%
Demand (kW)								
MCE	61	42	69%	±69%	731	247	34%	±63%
PG&E	1,670	850	51%	±34%	7,740	5,049	65%	±19%
RCEA	25	16	63%	±106%	133	56	42%	±94%
SCE	585	778	133%	±11%	3,529	4,308	122%	±1%
SCR	105	109	104%	±0%	613	677	110%	±0%
SDG&E	347	306	88%	±3%	5,067	4,778	94%	±2%
Statewide	2,793	2,101	75%	±14%	17,813	15,115	85%	±7%

* Relative precision at the 90% confidence level.

- **PG&E**, representing approximately 44% of statewide forecasted first-year MWh savings, had a first-year MWh GRR of 58% with a relative precision of ±17% and a lifecycle MWh GRR of 63% ±14%. Five projects had savings greater than forecasted (up to 121%) and seven had savings less than 50% of forecasted savings. This included four zero-saver projects (three of which had inoperable measures and the fourth an inappropriate baseline), two projects with changes in site operating conditions, and a site where one of the two measures evaluated was ineligible.

[19] Represents a difference in evaluated and reported baseline, including a different standard practice, code, or pre-existing baseline.

[20] Measure approval by the PA not consistent with CPUC policies, guidance, and rulebook eligibility.

[21] The 2020-2021 evaluation included one very large gas site that heavily influenced that study's lifecycle realization rate.

[22] Evaluator M&V or collected trend data informs different operating parameters, including hours of use, setpoints, efficiency, etc.

[23] Electric savings and gas first-year and lifecycle savings by PA are presented in the tables below. Note that a small subset of program activity (<1%) was not included in the sample. The results calculated from the sample at the program/measure level were applied to this subset of activity to determine total impacts.

- **SCE**, representing approximately 43% of statewide forecasted first-year MWh savings, had a first-year MWh GRR of 91% with a relative precision of ±15% and a lifecycle MWh GRR of 87% ±13%. Five projects representing 13% of SCE claims had first-year kWh GRRs ranging from 129% to 174%. All five upward savings adjustments were due to changes in operating conditions. Two projects had kWh GRRs of less than 50%. This included one site that was a zero-saver (due to eligibility) and one site with a 16% realization rate due to changes in site operating conditions.
- **SDG&E**, representing approximately 5% of statewide forecasted MWh first-year savings, had a first-year MWh GRR of 88% with a relative precision of ±4% and a lifecycle MWh GRR of 94% ±5%. Changes in operating conditions at three projects drove the lower-than-100% realization rate.
- **MCE, RCEA and SCR**, representing approximately 8% of statewide forecasted first-year MWh, had first-year MWh GRR's of 76%, 52%, and 84%, respectively. Among these PAs, all but one site was a lighting site and performed very well. Only four of the 15 projects had realization rates below 50%, two due to changes in the savings baseline,[24] one due to a calculation error, and one due to a change in site operating conditions.

Table 1-3 presents the gas first-year and lifecycle evaluated therm gross savings and precisions statewide and by PA.

Table 1-3. Natural gas first-year and lifecycle-evaluated gross savings by PA

PA	First-year savings				Lifecycle savings			
	Forecasted therms (1,000)	Evaluated gross therms (1,000)	GRR	RP%*	Forecasted therms (1,000)	Evaluated gross therms (1,000)	GRR	RP%*
MCE[25]	−3.9	−2.5	64%	±38%	−47.4	−14.4	30%	±33%
PG&E	324.5	287.6	89%	±3%	1,643.4	1,296.9	79%	±7%
RCEA	−2.1	−0.6	28%	±89%	−10.0	−2.1	21%	±37%
SCE	4.1	−2.8	-68%	±35%	10.0	3.2	32%	±22%
SCR	−0.1	−0.1	54%	±0%	−0.5	−0.4	73%	±0%
SDG&E	37.4	38.3	102%	±9%	520.5	571.2	110%	±9%
SCG	188.3	198.1	105%	±17%	1,988.1	1,693.2	85%	±10%
Statewide	548.1	518.0	95%	±7%	4,103.9	3,547.5	86%	±6%

* Relative precision at the 90% confidence level.

Below we discuss the drivers of each PA's natural gas realization rate, except for those PAs with impacts due only to interactive effects (MCE, RCEA, and SCR).

- **PG&E**, representing approximately 58% of total forecasted positive statewide first-year therm savings, had a first-year GRR of 89% with a relative precision of ±3%. Some notable site-level results include two zero-saver projects among the PG&E zero-savers noted in the discussion of electric results above, also categorized as due to inoperable measures. Five projects fully offset this by achieving over 100% of their forecasted savings—three increased due to operating conditions and two due to calculation methods.
- **SCE**, representing approximately 1% of forecasted positive statewide first-year therm savings, had a first-year GRR of −68% with a relative precision of ±35%. DNV recommends that the statewide realization rate of 95% be applied to SCE because the majority of SCE savings were negative due to interactive effects. The large positive savings of one project in the population but not selected in the sample offset all the SCE projects with negative impacts.
- **SDG&E**, representing approximately 7% of forecasted positive statewide first-year therm savings, had a first-year GRR of 102% with a relative precision of ±9% and a lifecycle GRR of 110% ±9%. The two gas projects sampled for SDG&E had realization rates of 97% and 35% for first-year savings, both adjusted due to differences in operating conditions.

[24] The baseline is the condition or set of conditions against which energy savings from an energy efficiency measure are calculated. It represents the energy consumption that would have occurred in the absence of the energy efficiency intervention.

[25] MCE, RCEA and SCR have negative natural gas savings due to the interactive effects of lighting measures.

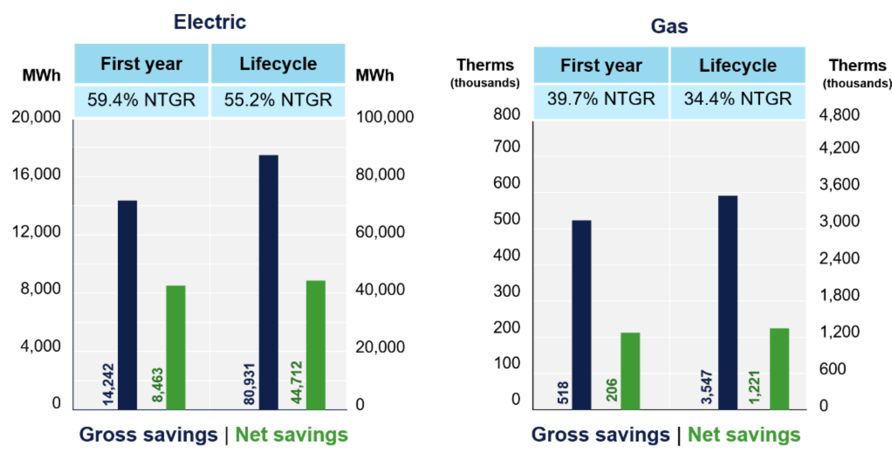
- **SCG**, representing approximately 34% of forecasted positive statewide first-year therm savings, had a first-year GRR of 105% with a relative precision of ±17%. Of the four projects evaluated for SCG, two had realization rates greater than 100% (105% and 153%) and two had realization rates lower than 100% (42% and 77%). Our evaluation adjusted the two projects with greater than 100% realization rates based on differences in calculation methods and the two projects with less than 100% realization rates based on differences in operating conditions.

Net savings results

The CIAC study found that the evaluated statewide first-year net electric savings were 8,463 MWh with a statewide NTGR of 59%. The PY2023 electric NTGR is modestly lower than the PY2022 result of 61% and higher than the PY2020–2021 result of 43%. The stability of NTGRs around 60% over the last two evaluations offers some certainty and confidence around planning values and an assessment of the program's effectiveness in influencing participants. However, the free-ridership rate of 41% implies that 41% of the savings would have happened in the absence of program incentives or services.

The evaluated statewide first-year net gas savings are 206 thousand therms with an NTGR of 40%. This estimate is materially lower than the PY2022 result of 76% but higher than the PY2020–2021 result of 15%. The PY2023 NTG result is driven in large part by three large gas projects representing nearly 48% of forecasted first-year gas savings and had NTGRs of 20%, 24%, and 37%, respectively.

- The project with a 20% NTGR result was due to the reported high importance of non-program factors such as previous experience with the equipment (making them predisposed to install similar equipment), a recommendation received from an auditor or engineer external to the program, the need for regulatory compliance in their equipment selection, the desire to improve product quality, and compliance with the company's normal equipment operations and maintenance policy. In addition, the participant gave the program incentives an importance score of only 3 on a 0-10 scale.



- The project with a 24% NTGR result was due to reported low incentive importance in respondents' decision-making (only 5 importance rating out of 0-10 scale), the installed equipment representing their standard practice, and the project receiving substantial design support from the Collaborative for High Performance Schools (CHPS).
- The project with a 37% NTGR was due to non-program drivers such as respondents' desire to improve product quality, the importance of recommendations from a consulting engineer, and previous experience with the measure.

Table 1-4 shows the first-year and lifecycle electric net savings broken down by PA. CIAC had an overall first-year electric energy NTGR of 59% with a relative precision of ±4%, and a lifecycle NTGR of 55% with a relative precision of ±4%. NTGRs are largely consistent among most PAs, with SDG&E at 26%, but all others range from 51% (PG&E) to 66% (SCE). As noted earlier, the PY2023 first-year statewide NTGR is largely consistent with that calculated in the PY2022 report, which was higher than the NTGRs observed in PY2020–2021. This trend suggests that the NTG improvement observed in PY2022 has remained stable.

Table 1-4. Electric first-year and lifecycle-evaluated net savings by PA

PA	First-year net savings			Lifecycle net savings		
	MWh	NTGR	RP%*	MWh	NTGR	RP%*
Energy (MWh)						
MCE	308	54%	±11%	1,703	53%	±11%
PG&E	2,474	51%	±8%	9,820	42%	±10%
RCEA	44	55%	±7%	155	53%	±11%
SCE	4,880	66%	±4%	25,005	66%	±3%
SCR	277	55%	±0%	1,565	54%	±0%
SDG&E	212	26%	±7%	3,343	26%	±7%
Statewide	8,463	59%	±3%	44,712	55%	±3%
Demand (kW)						
MCE	22	53%	±3%	129	52%	±6%
PG&E	472	56%	±5%	2,456	49%	±5%
RCEA	10	61%	±5%	32	57%	±12%
SCE	494	63%	±2%	2,685	62%	±1%
SCR	60	55%	±0%	368	54%	±0%
SDG&E	77	25%	±5%	1,203	25%	±5%
Statewide	1,159	55%	±3%	7,111	47%	±2%

* Relative precision at the 90% confidence level.
Table note: Our evaluation calculated the domain (PA) NTGRs with a blend of embedded and non-embedded samples and applied these NTGRs to the evaluated gross savings totals to derive the savings values in this table. Due to this expansion process, the total of the domain estimates does not equal the statewide savings.

Table 1-5 shows the first-year and lifecycle natural gas net savings broken down by PA. As above, MCE, RCEA, and SCE have negative savings due to lighting interactive effects. The first-year NTGR for gas projects is 40% with a relative precision ±5%, and the lifecycle NTGR is 34% with a relative precision of ±6%. As noted earlier, this NTGR is much lower than that observed in PY2022, but much higher than PY2020–2021. Two large projects drove most of the gas NTGR, which the body of this report explores further. For SCG, of the five projects in the CIAC population, only two completed NTG surveys. Of those two, one had an NTGR of 48%, while the other had an NTGR of 20%, producing a weighted result of 28%. Including only two projects with large variability in their results led to SCG's higher relative precision.

Table 1-5. Natural gas first-year and lifecycle-evaluated net savings by PA

PA	First-year savings			Lifecycle savings		
	1,000 therms	NTGR	RP%*	1,000 therms	NTGR	RP%*
MCE	−1.5	58%	±9%	−8.2	57%	±10%
PG&E	126.4	44%	±4%	578.1	45%	±5%
RCEA	−0.3	44%	±10%	−0.9	41%	±21%
SCE	−1.7	63%	±8%	2.0	64%	±7%
SCR	0.0	48%	±0%	−0.2	48%	±0%
SDG&E	9.2	24%	±1%	136.6	24%	±1%
SCG	55.0	28%	±36%	394.7	23%	±23%
Statewide	205.6	40%	±5%	1,221.4	34%	±6%

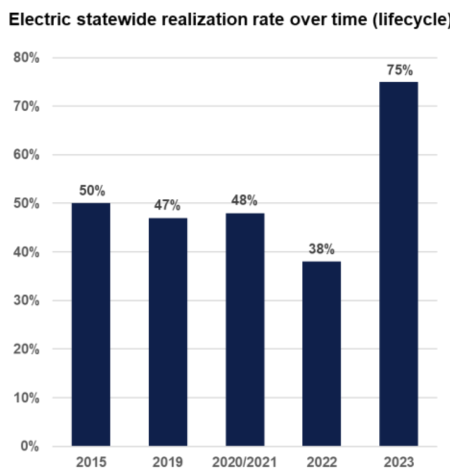
* Relative precision at the 90% confidence level.
Table note: Our evaluation calculated the domain (PA) NTGRs with a blend of embedded and non-embedded samples and applied these NTGRs to the evaluated gross savings totals to derive the values in this table. Due to this expansion process, the total of the domain estimates does not equal the statewide savings.

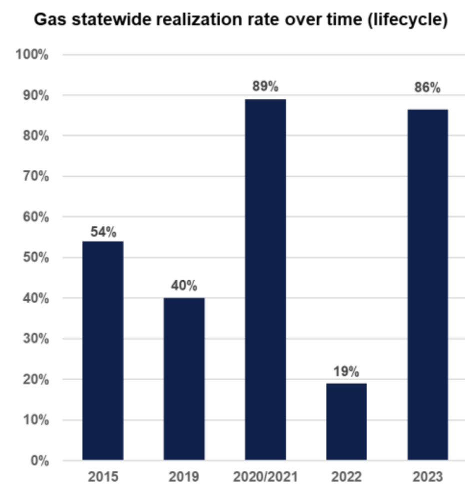
1.5 CONCLUSIONS AND RECOMMENDATIONS

DNV drew on all impact evaluation activities to develop the conclusions and recommendations presented here, which represent the most impactful recommendations based on our assessment. The body of this report explores these in greater detail, and provides supplemental conclusions and recommendations. Overall, the evaluation found that GRRs improved year-over-year, largely attributable to an improvement in the application of MATs, refinements in the application of project baselines, and adherence to CPUC eligibility rules.

The figures below show statewide electric (left) and gas (right) lifecycle gross realization rates since the 2015 program year evaluation. The 75% statewide lifecycle electric GRR observed in PY2023 is substantially above all previous studies, which ranged from 38% to 50%. Key drivers of lower realization rates in previous evaluation cycles appear to have waned in this evaluation cycle. For example, in PY2022, the study found that the primary discrepancies lowering GRR were ineligible measures and adjustments to baselines. However, this evaluation found fewer occurrences of these discrepancies overall, with six occurrences of those two discrepancies in PY2023, while PY2022 had 28 such occurrences.

The statewide gas lifecycle GRR for PY2023 was 86%, compared to 19% for PY2022. The PY2022 value was also lower than previous years and was largely influenced by two projects. The PY2020/2021 evaluated GRR of 89%, which this year's realization rate nearly matches, included a large savings project that accounted for over 90% of all gas savings.





Conclusion 1: Operating conditions continue to be the primary driver of changes in gross realization rates. In PY2023, 30 electric projects and 17 gas projects saw changes in operating conditions, driving an overall 3% increase of first-year electric GRRs and an 8% decrease of first-year gas GRRs. PY2022 had 22 changed electric projects and six changed gas projects, resulting in a reduction of the overall first-year electric GRR by 7% and a 1% reduction in first-year gas GRRs. Changes to operating conditions include updated trend data or onsite data collection that informs different operating parameters (hours of use, setpoints, efficiency, etc.), which are largely outside the control of PAs or implementers.

Conclusion 2: This study found a more consistent application of MATs than in previous evaluations. The PY2023 evaluation found seven instances of normal-replacement (NR) projects that were overturned to accelerated-replacement (AR) and one instance of an AR project overturned to NR. The PY2022 evaluation found a subset of 20 occurrences of inappropriate baseline applications (due to incorrect MAT designation), resulting in a 22% reduction in first-year electric savings and 15% in first-year gas savings. This reduction in overall changes to MATs indicates that the PAs are working closely with customers to ensure they are applying appropriate baselines and MATs. The PAs also appear to have improved their ability to capture the preponderance of evidence (POE)[26] required for an AR designation.

Recommendation 1: The PAs should continue recent improvements in applying appropriate MATs to each claim, using MAT definitions in the Statewide Custom Project Guidance Document version 1.4 to determine the appropriate MAT. Additionally, PAs should conduct pre- and post- installation reviews, use the California Technical Forum (CalTF) and custom workpapers, and continue to engage with the CPUC and stakeholders to ensure they apply the correct MATs.

[26] POE is the standard required to demonstrate that the replacement of inefficient equipment or processes with more energy efficient alternatives more likely than not resulted from an EE program offering and likely would not have happened otherwise.

Conclusion 3: The incidence of zero-saver projects is decreasing. The PY2023 evaluation has six projects (out of 68) with no savings (i.e., zero-savers). The PY2022 evaluation found 16 of 72 to have no or negative savings, driven largely by ineligible measures (14 occurrences). In PY2023, of the six projects our evaluation found to have no savings, we adjusted four due to inoperable measures, one due to an inappropriate baseline, and one due to being "other." The reduction in zero-saver projects may reflect improved measure performance, better installation practices, or enhanced project verification efforts.

Recommendation 2: The PAs should continue to adjust programs to adhere to statewide guidance and make other program improvements to reduce zero-savers when possible. If PAs perform pre-inspections during pre-installation verification and ensure proper measure eligibility screening, they can further reduce zero-saver projects. Better installation quality control (such as ensuring installation is in alignment with the design and equipment specifications) and implementation contractor training can further minimize errors before savings claims are submitted. Furthermore, continued training of third-party implementers in specific CPUC program eligibility criteria can also be expected to reduce zero saver occurrences.

Conclusion 4: MAT application also improved for lighting projects. The PY2023 evaluation found seven lighting projects incorrectly claimed an AR MAT instead of NR, leading to discrepancies in savings. By contrast, the PY2022 evaluation overturned AR baselines to NR for a high fraction of the lighting-only projects sampled (15 of 39) for evaluation. This year's improved alignment between claimed and evaluated MATs suggests that PAs have improved their vetting of AR projects.

Recommendation 3: The PAs should continue completing the AR questionnaire for all AR projects, ensure supporting evidence is documented as defined in Resolution E:5115, and probe participants during the project planning phase to verify that baselines qualify as AR before claiming savings, by for example, confirming that existing equipment is operational and that the program has influenced the decision to replace the equipment.

Conclusion 5: High-Opportunity Projects or Programs (HOPPs) report incremental savings changes that confound impact evaluations. The evaluation found that five of eight HOPPs projects forecasted negative first-year electric savings, and three of eight projects forecasted negative first-year gas savings. Because some of these projects had positive evaluated first-year savings, the calculated realization rates were negative. This negative realization rate was not reflective of overall statewide gas or electric performance; therefore, DNV removed the HOPPs projects from the overall results.

Recommendation 4: HOPPs should only be evaluated after Year 3 savings have been claimed, as early-year savings can be highly variable and misleading due to incremental savings adjustments. In the first year, projects may report negative savings due to forecasted operational changes, retrofits, or phased implementations, leading to unreliable realization rates that do not accurately reflect long-term performance. Waiting until Year 3 can allow evaluators to assess the final adjusted savings impacts, ensuring a more accurate and meaningful evaluation of HOPPs projects' effectiveness.

Conclusion 6: The evaluation identified inconsistencies in savings claims and effective useful lives (EULs) for HOPPs projects, which could impact future year claims. Specifically, Year 3 savings claims did not follow PA guidance, as they reported the entire project's savings with a 3-year EUL rather than the incremental difference from the prior year. Also, due to limited access to prior-year savings data, DNV could not verify past claims, raising concerns that the final-year savings claim could result in a significantly negative value.

Recommendation 5: PAs should clarify the correct savings claim methodology for HOPPs projects to ensure Year 3 claims only account for incremental changes from initial claims and increase the accuracy of savings reporting. Future discrepancies could be limited if project tracking allowed verification of prior-year claims, aligning evaluations with the intended methodology.

Conclusion 7: Interior lighting savings required adjustments due to MAT classification, HOU/CDF differences, and HVAC effects. Interior lighting projects exhibited larger discrepancies, with major adjustments stemming from incorrect MAT classifications, significant variations in hours of use (HOU) and coincident demand factors (CDF) compared to DEER assumptions, and the omission of HVAC interactive effects in savings calculations.

Recommendation 6: The PAs should work to enhance MAT classification accuracy by thoroughly assessing pre-existing equipment conditions and replacement intent. Additionally, they should work to improve claim accuracy by incorporating more site-specific data on lighting operation and HVAC effects into savings estimates.

2 INTRODUCTION

This report presents the evaluation results for the California Program Administrators' (PAs') Custom Industrial, Agricultural, and Commercial (CIAC) programs for program year 2023 (PY2023). The CIAC final work plan, dated August 30, 2024, guided this evaluation effort.[27]

2.1 Background

The CIAC study's overall purpose was to evaluate energy and demand savings for CIAC projects installed in PY2023. This impact evaluation quantified gross and net first-year and lifecycle energy savings and peak demand reduction, for both electricity and gas. The study presents recommendations for improving program-delivery quality control, maintaining clear and complete project documentation, and submitting appropriate savings claims consistent with project documentation. This evaluation also assessed the PAs' project-specific documentation of the calculation methods, baselines, and savings parameters used to forecast savings.

2.2 Evaluation objectives

This study had six primary objectives:

1. Develop first-year and lifecycle evaluated net and gross savings for the Custom program with a targeted precision of better than ±10% at 90% confidence.
1. Determine the reasons for any difference between evaluated (ex post) and forecasted (ex ante) savings; identify issues with respect to reported savings estimation methods, inputs, and program procedures; and make recommendations to improve the savings estimates and realization rates of the evaluated programs.
2. Provide results and data that will assist with updating workpapers/measure packages and Database for Energy Efficiency Resources (DEER) values.
3. Estimate the proportion of program-installed measures and actions that would have been implemented absent program participation (free-ridership), determine the factors that characterize free-ridership, and, as necessary, provide recommendations for reducing free-ridership.
4. Provide timely feedback to the California Public Utilities Commission (CPUC), PAs, and other stakeholders on the evaluation research study to facilitate timely program improvements and support future program design efforts.
5. Provide recommendations to improve program performance in delivering energy efficiency savings.

2.3 CPUC policies and guidance

When designing and implementing this evaluation, DNV considered the codes and regulations that were in effect at the time of project approval and the following CPUC policies and guidance:

- CPUC Energy Efficiency Policy and Procedures Manual, Version 6
- Statewide Custom Project Guidance Document, Version 1.4
- Utility Statewide Custom Policy and Procedures Manuals
- 2020 Savings by Design Participant Handbook, which provides policies and procedures for participation in the statewide Savings by Design program
- Savings by Design Baseline Guidance Document
- PA-specific program policy and procedure manuals
- Energy Efficiency Industry Standard Practice (ISP) Guidance, Version 3.1
- 2016 Savings by Design Healthcare Baseline Procedures

[27] https://pda.energydataweb.com/#!/documents/4035/view

- Assigned Commissioner and ALJ Ruling Regarding High Opportunity Energy Efficiency Programs or Projects ALJ Ruling on Certain Measurement and Verification Issues, including Third-Party Programs
- Title 20 and 24 requirements in place when projects were permitted
- CPUC policy papers and state-government memos that address topics such as the savings for sites using non-Investor-Owned Utilities (IOU) fuel sources
- CPUC resolution E5115, which adopts minimum evidence requirements for Custom projects' Accelerated Replacement measure type
- CPUC resolution E-4867 approving the DEER updates for 2020
- CPUC resolution E-4952 revising DEER update for 2020
- CPUC resolution E-4818 affecting assignment of project baselines
- Dispositions of reviews of custom projects by CPUC staff
- CPUC resolution E-4939, which affects the preponderance-of-evidence requirements for Accelerated Replacement projects and the definition of small-business customers
- New construction permit requirements for the PAs as specified in SB-1414
- Fuel Substitution Technical Guidance for Energy Efficiency, Version 2.0
- CPUC D.19-08-009 Fuel Substitution Decision[28]
- Project Ineligibility Table from the 2020-2021 CIAC Work Plan
- Evaluation Guidance Questions and Responses from the 2020-2021 CIAC Work Plan
- Assigned Commissioner and Administrative Law Judge's Ruling Regarding High Opportunity Energy Efficiency Programs (HOPPs) Or Projects, Rulemaking 13-11-005 (Filed November 14, 2013)
- Assembly Bill (AB) 802
- Other CPUC decisions and guidance documents as appropriate

[28] D.19-08-009 adopted the fuel substitution test and ordered the creation of this fuel substitution guidance document. D.19-08-009 provides direction on the fuel substitution test, fuel substitution measure eligibility, and utility credits for savings claims.

3 METHODOLOGY

The published final work plan describes most of the methodology for this evaluation.[29] This section documents the final methods DNV used, including the planned sample design, achieved sample sizes, gross savings, measurement and verification (M&V) activities, net savings approach, and final expansion procedures. The evaluation followed the International Performance Measurement and Verification Protocol (IPMVP) and the California Evaluation Protocol throughout its execution.

To better fulfill the evaluation objectives listed in Section 2.2, DNV collected information on 68 gross sample points and 58 net sample points.[30] The gross site evaluation was based on on-site verification, phone interviews, virtual data collection, and extensive analysis. The net evaluation used an interview-based approach to determine net-to-gross (NTG) scores. Both gross and net evaluation results are presented in Section 4 of this report.

3.1 Sample design

A sample design and data collection memo[31] delivered to the CPUC and PAs detailed the proposed sample design to evaluate gross and net savings, sample domains, target completes, and target precisions.[32] In July 2024, DNV obtained final project tracking data for all commercial and industrial (C&I) programs that included non-deemed project savings claims from CEDARS. The populations presented in this report are based on the claims from the final ED tracking data for PY2023. We finalized the population after performing data cleaning to remove placeholder claims, mis-assigned claims, and assignment of claims to other program evaluations.

The overall gross realization rates (GRRs) included both positive and negative savings . The sample design used error ratios available from previous cycles of California C&I evaluations to determine the sample size for key domains of interest. The sample design used forecasted savings calculated by removing the default GRRs[33] that had been applied by the system in calculating the savings reported in the ED tracking data. The sample design stratified by MMBtu savings to provide a consistent unit of measure accounting for projects that can have both electric and gas savings.

3.1.1 Gross and net savings sample design overview

Table 3-1 summarizes the key assumptions for the sample allocations. Estimated precisions are shown in subsequent sections. In contrast to previous evaluation cycles, which used separate gross and net-to-gross ratio (NTGR) samples, both the gross and NTGR samples for the PY2023 evaluation include the same sampled projects. The limited population for PY2023 and the increased error ratio assumption for the gross analysis align the gross and net error ratios enough to use a single sample for both analyses.

[29] https://pda.energydataweb.com/#!/documents/4035/view

[30] A sample point is defined as an individual project installed at a specific site.

[31] https://pda.energydataweb.com/api/downloads/4035/CIAC%20PY2023%20Evaluation%20Sample%20Design%20Memo%20-%20Final.pdf

[32] Sample Design and Data Collection: https://pda.energydataweb.com/api/downloads/3867/CIAC%20PY2022%20Evaluation%20Sample%20Design%20Memo.pdf

[33] CPUC, "Default Custom Measure Gross Realization Rates,": D1107030 Attachments A-B (ca.gov)

Table 3-1. CIAC sample design assumptions and approach

Parameter	Description (PY2023)
Population	Tracking data set for the program year, aggregated at the application (project ID) level
Explicit sampling strata	• PA • Size (MMBtu) • Measure group • Fuel type • Finance type
Gross sample allocation	71 projects, allocated for optimal overall precision while targeting 90/10 results by fuel type and 90/10 overall (MMBtu) with additional sample for RCEA/MCE
NTGR sample allocation	71 projects, allocated for optimal overall precision while targeting 90/10 results by fuel type and 90/10 overall (MMBtu) with additional sample for RCEA/MCE. This may require performance of NTG surveys beyond the gross sample, depending on decision-maker availability.
Sample design approach	Stratified random sampling to be extrapolated using ratio estimation
Target parameters	GRR, NTGR
Analysis domains	• PA • Fuel (Electric only vs. Combined fuel or Gas only) • Measure Group (Lighting vs. Non-Lighting) • Finance type (OBF or Non-OBF)
Error ratios	By PA and fuel based on historical Custom and Industrial results from three prior CA evaluation cycles
Projected Precision at 90% confidence (based on current error ratio assumptions)	• CIAC PY2023 • Gross MMBtu savings by energy unit (electric): 10% • Gross MMBtu savings by energy unit (gas): 10% • NTGR by electric fuel type: 10% • NTGR by gas fuel type: 10%
Savings size stratification	Custom – up to 3 strata based on savings, depending on the number of samples in the cell
Contingency and back-up sample[34]	• Gross impact and NTGR sample: 50% initial over-sample for a primary sample to account for response rates • All gross impact primary samples are included plus additional ones as needed. The remaining projects are pre-sorted into a random selection sequence for each non-census-attempt sampling cell to produce additional backup cases as needed.

3.1.2 Gross sample completions and response rates

Table 3-2 shows the population counts, sample design quotas, and final sample achieved for key analysis dimensions. Overall, the DNV team recruited 96% of gross projects and 83% of net surveys in the primary sample design. For each of the four projects not recruited, the customer was either initially unresponsive or became unresponsive during the evaluation process. We made multiple attempts (a minimum of three), in addition to outreach from the respective PA and, in some cases, from the CPUC.

[34] Backup sample estimates will be contingent on sufficient population.

We recruited 100% of lighting projects and 93% of “other” (i.e., non-lighting) projects. Regarding the recruitment of financing types, we recruited 100% of OBF projects and 95% of “other” financing projects.

Table 3-2. Overall gross sample response rate by fuel and key analysis dimensions

Dimension	Sampled design		Gross		Net	
	Population (N)	Sample design quota	Final sample (n)	% complete	Final sample (n)	% complete
PA						
PGE	39	25	25	100%	20	80%
MCE	36	9	9	100%	10	111%
SCE	81	15	16	107%	13	81%
RCEA	25	4	4	100%	8	200%
SCG	5	4	4	100%	2	50%
SDGE	15	12	8	67%	4	50%
SCR	5	2	2	100%	2	100%
Statewide	**206**	**71**	**68**	**96%**	**59**	**87%**
Measure type						
Lighting only	121	27	27	100%	29	107%
Other	85	44	41	93%	30	73%
Total	**206**	**71**	**68**	**96%**	**59**	**87%**
Finance type						
OBF	42	8	8	100%	5	63%
Other	164	63	60	95%	54	88%
Total	**206**	**71**	**68**	**96%**	**59**	**85%**

The DNV team recruited gross and net participants separately; as such, the total number of final sample counts for gross will not always align with the final sample counts for net.

3.1.3 Expansion methods

This section presents the methodology used to expand the sample results to the population to calculate program-level estimates of gross realization and the NTGRs.

This evaluation used stratified ratio estimation to calculate separate ratios for each domain of analysis, which were implementation PA, program, finance type, and measure group (lighting only and all other measures). We calculated the GRR as the weighted evaluated savings divided by the weighted tracking forecasted savings. For NTGR calculations for embedded sites for which this evaluation conducted both gross and net analyses, the denominator in the ratio expansion was the evaluated gross savings for the domain instead of the tracking savings. We used this embedded approach for the net expansion to leverage the additional information collected in the gross analysis. After establishing the final recruited sample and estimating the project-level electric and/or gas impacts, DNV developed the sampling weights to expand the sample results to the population. The sampling weights reflect the achieved sample post-stratification, which is the ratio of the completed sample counts divided by the population counts within each analysis cell.

3.2 Gross savings methods

3.2.1 Overall methods overview

This section describes the approach to evaluating gross savings. We sought to keep our gross savings approach consistent with previous evaluation study methodologies. Our efforts relied on on-site verification, virtual verification, and phone surveys to confirm facility- and measure-level operation, along with other virtual data collection techniques. Figure 3-1 shows three core aspects of the methods used across our evaluation, followed by a more detailed discussion of our methods.

Figure 3-1. Custom evaluation approach

During the evaluation process, we determined appropriate baselines based on preponderance of evidence of program influence, relevant building code, program rules, CPUC policy requirements, and industry standards. When necessary, we performed a "mini ISP" study to support evaluated baselines.

Through discrepancy analysis, we assessed the reasons for variances between the forecasted and evaluated savings for each sampled project. The site-level discrepancy assessment shows the primary drivers of the realization rates.

To ensure quality control, senior engineers worked with lead engineers for review, verification, and approval stages before site-specific report submission.

3.2.1.1 Custom Core Template and M&V plans

We leveraged the previously created Excel-based Custom Core Template (CCT) to organize and communicate evaluation information for each claimed project in the sample. The CCT served as the final site-specific evaluated savings deliverable and was the common source for reference material that engineers used to create M&V plans and document data collected in developing estimates of impacts. Critically, the CCT guided and captured the determination of whether measures were eligible or ineligible. Before developing full-fledged customized M&V plans, we determined project eligibility in the CCT based on CPUC guidelines. Determining eligibility required an assessment of compliance with the CPUC decisions, rulings, and policies such as the statewide Custom program requirements and program-specific requirements.[35] As appropriate, we reviewed with the CPUC and PAs those sites determined to be ineligible before removing their savings from the evaluation.

The CCT stored claim information downloaded from the tracking database, savings calculation methodologies, supplemental data, energy model references, site visit documentation, and realization rate determination in a common format shareable as site-level deliverables. The CCT ensured we followed CPUC guidelines and consistently developed and systematically followed best practices for pre-implementation review/evaluation. It also facilitated data sharing between DNV's CPR[36] team and the larger DNV team when the evaluation included a CPR site. We assigned projects and their accompanying CCTs to lead engineers based on subject area, measure category, and team member experience and specialty. We assigned a senior engineer to each sample project to ensure quality throughout the CCT-driven process.

[35] The Statewide Custom Project Guidance Document (https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/custom-projects-review-guidance-documents), program-specific manuals, Statewide custom program and policy manual, various CPUC decisions and resolutions, CPUC EE Policy Manual, CPUC guidance, CPR directives, are some of the resources DNV intends to use to determine project eligibility.

[36] Custom Project Review (CPR) refers to the process of selecting projects for further review of eligibility, baseline, program influence, and savings approaches used for projects submitted in a given program year.

We embedded site-level M&V plans in the CCT to maintain and store all available information on a given project in a single, easily accessible location. These plans served as the roadmap to determining the evaluated estimate of savings for a site. Engineers followed each M&V plan to document site visits, data collection, and methodology for estimating savings (and to ensure realization rates). The M&V plans allowed DNV engineers to validate key project information preliminarily determined from project files, such as baseline, eligibility, fuel substitution, non-IOU fuel source, data availability, and engineering methods. The M&V plan included a section to document applicant-reported engineering methods to determine whether the provided templates could be repurposed for evaluation, or whether the evaluators required a custom analysis template. The M&V template also fully documented the engineer's site-level activities and data gathering (e.g., which facility representatives were interviewed, what data was requested and received). Senior engineers reviewed each plan to maintain the quality standards of typical M&V procedures and policy requirements. Through a review of project documentation, we assessed M&V rigor as a key part of M&V planning, taking into consideration forecasted savings, end-use type, and the complexity of the project.

3.2.1.2 Recruitment and data collection

We recruited sampled customers to schedule a site contact interview and to inform any modifications needed to the M&V plan before more formal data collection. For a selection of customers, we conducted on-site verification. The PAs assisted these efforts in various ways, including providing accurate customer contact information, providing introductory correspondence, and/or contacting the participant to encourage them to participate in evaluation activities, including both NTG and gross surveys and verifications.

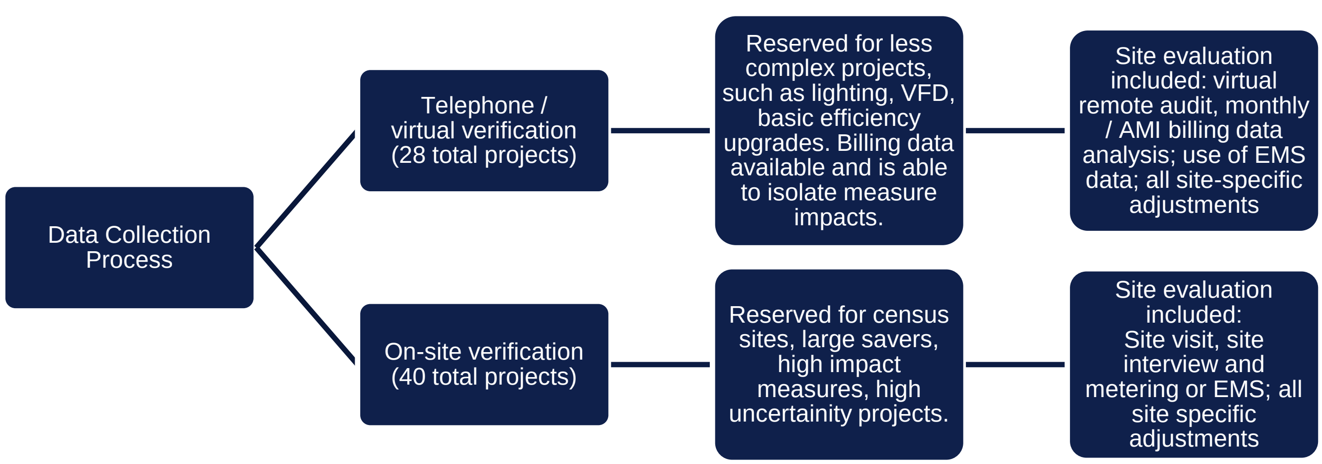
Data collection

Data collected for projects varied but could include:

- On-site verification of installed equipment
- Customer verification of installed equipment, including pictures and video, when possible, for confirmation
- Customer reported EMS/trend log data on current operational conditions including but not limited to load, hours of use (HOU), process temperatures, and seasonal variations (This information is collected for current conditions as well as historical changes since measure installation.)
- Trend data from onsite monitoring systems or building management systems that show equipment operation
- Production data if equipment operation is directly related to production

Figure 3-2 provides an overview of the data collection process and the key differences between processes for different sites.

Figure 3-2. Data collection process



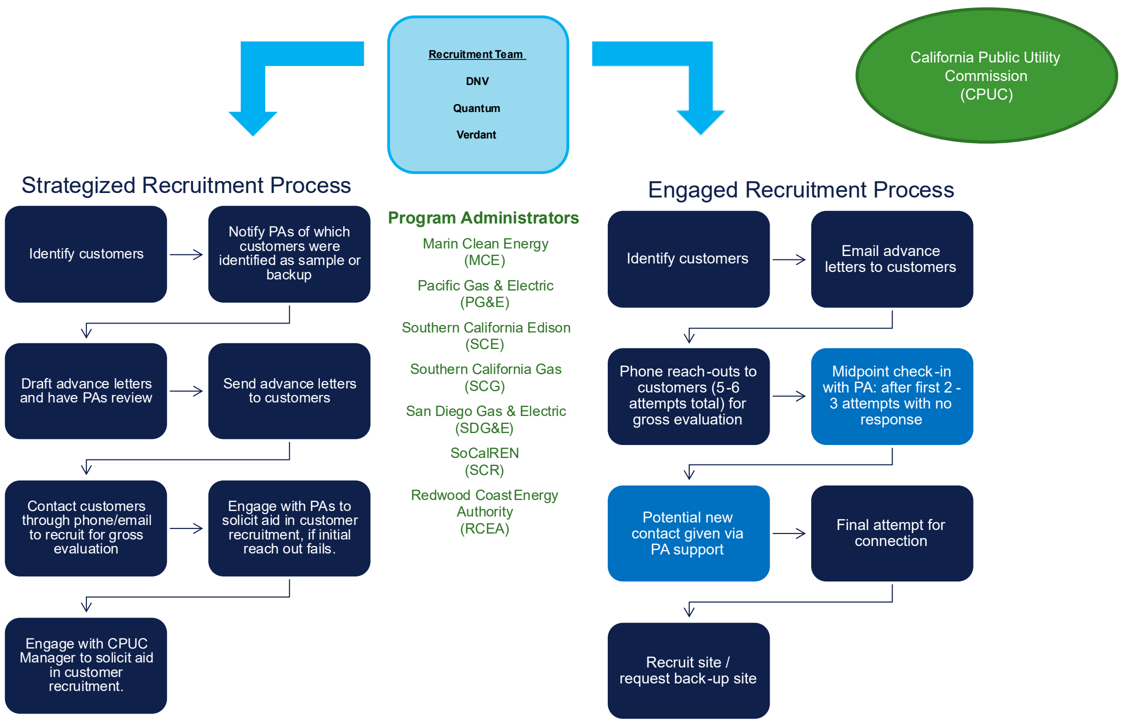
Gross recruitment

Recruitment efforts started with an introductory email sent to prospective participants. Once the DNV team made initial contact, we attempted to reach the participants by phone at different times of day and different days of the week to maximize contact success. We used each M&V plan to guide site contact interviews to collect updated parameters for the savings calculations. The sample contained projects with multiple measures installed.

Recruitment efforts started in mid-September 2024. These efforts engaged one lead recruiter and two active recruiters at DNV, as well as support from two subcontractors, Quantum and Verdant. Most of the sites recruited were within the expected number of attempts, ranging between one and five outreaches, with an initial email that included a description of the site and a customer notification letter. Though our team had many successful outreaches on our own, we had support from the PAs and CPUC when needed. If not for both parties' efficient email replies with updated information, quick phone calls, and suggested support for implementing different patterns of outreach methods, we may not have had such success. Our collaborative efforts made this recruitment process efficient and smooth from start to complete. The evaluation team was able to fulfill all 68 of 71 targeted sites through recruitment.

Figure 3-3 outlines the recruitment process. We also provided examples of some of our challenges.

Figure 3-3. Recruitment process



Of the 71 gross sample points, we successfully recruited 68. Of the three sample points not recruited and subsequently dropped, two were in SDG&E's service territory, while one was in SCE's service territory. One of the SDG&E projects was a HOPPs project that did not claim any savings and was included in the sample incorrectly. The second SDG&E project was successfully recruited, and an initial interview was completed. After multiple unsuccessful attempts to reconnect with the customer to obtain additional operational data, the DNV team determined that this project was no longer viable for inclusion in the sample. Similarly, the one SCE project had initial contact with the customer, but after several attempts to obtain building system data, we dropped the sample point. None of the three dropped sample points had assigned backups within the population (i.e., there were no projects delivered by the same PA, within the same technology group).

DNV would like to acknowledge the recruitment support provided by the PAs during the PY2023 evaluation. Often, when a customer became unresponsive, we notified the PAs, which successfully reconnected the evaluation team with the customer, allowing them to complete the site-level evaluation.

Net recruitment

In PY2023, 206 sites took part in the CIAC program, but this evaluation set the net recruitment goal at 58 sites to achieve 90/10 precision targets. To meet this goal, we used several experienced recruiters and began contacting backup sites early in the process. Additionally, we made up to eight attempts to complete surveys, exceeding the CPUC's requirement of three attempts. The outreach team was mindful of the January 2025 wildfires in Southern California and temporarily paused data collection attempts to sites in affected areas until the situation abated. Also, the sample size enabled us to perform a meaningful comparison of NTGRs between HTR and non-HTR sites, which we could not do in the PY2020-2021 and PY2022 CIAC impact evaluations due to the small sample sizes.

3.2.2 Measure analysis

As part of each site-specific evaluation, we collected facility- and measure-specific information from the participant, including consumption data, photographic evidence of installed equipment or controls, trend data if available, equipment functional tests, and any other supplemental information to confirm current operation and load. When PA-provided data was available to complement the analysis, we considered it for inclusion. All sample points used current post-installation data acquired from the customers, consumption data, and/or photographic evidence directly from the customer or on-site verification efforts.

After completing the program file review and conducting the site interview or virtual audit with the customer, the evaluation engineers finalized M&V plans based on the updated information from the site and developed the final analysis approach, which Section 3.2.2.1 discusses further for Custom and SBD individually. This finalized M&V plan within the CCT reflected limitations and achievements in executing the planned site-level tasks. The CCT also identified any discrepancies or significant changes found throughout the evaluation process.

After reviewing the current data provided by the customer, the engineers determined the viability of repurposing PA-provided analysis templates or creating new custom evaluation analysis templates. The final M&V plan documents the engineering approach we determined is best suited based on measure-specific requirements to accurately determine savings. DNV clearly documented inputs and assumptions based on trend data, spot measurements, or other information gathered from the customer, including photographs of building management system (BMS) settings. We assigned the adjustments made to savings estimates in the process described above to various categories to understand program savings drivers. These categories of adjustment factors include tracking data adjustment, ineligible projects, measure count changes, application of an inappropriate baseline, discovery of inoperable measures, changes in operating conditions, and savings changes due to calculation methods.

The diversity of Custom projects warrants careful consideration when selecting the most defensible and cost-effective M&V for each sampled project. We assessed several key criteria to assign project-level rigor, as illustrated in Table 3-3 and further detailed in the following sections.

Table 3-3. Savings discrepancy factors

Adjustment factor		Description
	Tracking data	Differences attributed to incorrect adjustments or unexplained changes to savings that occurred between completion of the analysis and entry into the PA tracking system.
	Ineligible project	Circumstances around measure approval by the PA are not consistent with CPUC policies, guidance, and rulebook eligibility.
	Measure count	Differences are attributed to the number of units used in the project calculations and the number of units operating at the time of evaluation.
	Inappropriate baseline	Represents a difference in evaluated and reported baseline, including a different standard practice, or pre-existing baseline.
	Inoperable measure	The measure is no longer operating at the time of evaluation, whether it has been decommissioned or removed from site.
	Operating conditions	Evaluator M&V or collected trend data informs different operating parameters, including hours of use, setpoints, efficiency, etc.
	Calculation methods	Differences attributed to changes in calculation methodology between that used for forecasting savings and evaluation analysis. The evaluator only changed analysis methodology when necessary to accurately calculate savings such as employing an 8760 model.
• • •	**Other**	Differences that cannot be attributed to other categories due to their unique nature.

3.2.2.1 Custom-specific analysis methods

This section includes a discussion of Custom-specific methods not covered in Section 3.2.1, broken out by non-lighting and lighting measures.

Non-lighting

Custom non-lighting projects, by nature, are unique and therefore warrant tailored approaches to estimate energy and demand savings. However, based on our experience with evaluating Custom non-lighting projects in California since 2006, certain measure groups are more conducive to a templated analysis approach. During the development of the M&V plan, we determined the viability of repurposing the PA-provided analysis templates for use as the evaluated model with current information provided by the participant. If we determined that the previously used approach was not a viable method or if we identified a more accurate savings approach, we used or developed alternative approaches. These instances generally relied on previously developed and automated M&V tools that leverage high-frequency trend data. Some of the key features for these in-house tools/savings approaches are:

- Reliable analysis with built-in engineering guidance regarding appropriate assumptions and applications
- Traceable calculations including relevant citations
- Automatic vetting of input and output parameters for improved quality control
- Automated 8,760 spreadsheet tool

When required, we used a typical meteorological year (TMY) climate zone (CZ) 2010 (CZ2022) dataset based on the specific California climate zone location for temperature-sensitive calculations. We calculated energy savings either by the hour in an 8,760 model or allocated to each hour in the year to estimate demand and annual savings impacts. Each analysis provided estimates for annual savings and demand, as specified in the DEER 2020 update. We used the following demand definitions to calculate peak demand reduction:

- The peak demand impacts of energy efficient measures (EEMs) are represented by the average kWh reduction over a 15-hour window.
- The 15-hour window is from 4 p.m. to 9 p.m. (five hours) over a three-day "heat wave" that occurs on consecutive days in June through September.
- The first day of that heat wave is determined for each climate zone and marks the start date for the peak demand period.
- Consistent with Title 24 and CZ2022, a 2009 calendar year was used to determine which days are weekends and holidays.

The following provides an example of estimating energy savings for an HVAC retro-commissioning (RCx) project in this study. This project involved schedule optimization and discharge static pressure reset on air handling units. To quantify the savings, the PA used a custom tool to model savings, which used actual trends to develop regressions against outdoor air temperature (OAT) for the same data period. Aligning with the IPVP Option B approach, the DNV evaluator gathered the most recent trend data and developed regressions against OAT for the same period, applying these regressions to CZ2022 weather bins to estimate energy savings at each bin. When developing the site-specific M&V plan, the DNV evaluator determined the PA approach to be a viable and accurate option and used it as a basis for determining evaluated savings. As a part of the data collection efforts, the evaluator was able to collect up to six months of recent trend data, providing valuable insights into the current operation of the impacted equipment. The evaluator adhered to Option B as the chosen evaluation methodology, employing provided trend data to develop regressions against OAT and applying these regressions to local CZ2022 weather data to accurately determine energy savings for the impacted equipment.

Similar details can be observed in each site-specific CCT, which are provided as deliverables within this report. These CCTs detail the specific analysis methods used for each project, including a high-level discussion of algorithms, inputs, assumptions, and calibration methods where applicable.

Lighting

We evaluated lighting-only projects via telephone surveys with each site contact, followed by on-site visits. The evaluation team gathered information with site contacts on five items: (1) Confirm measure installation and measure quantities; (2) obtain self-reported lighting operating hours; (3) establish the condition and functionality of the lighting equipment removed to determine if the lighting project was Accelerated Replacement or Normal Replacement of existing lights; (4) obtain information about the lighting equipment removed; and (5) obtain information about lighting controls.

PAs submitted a savings calculator for each project, with most projects using the Modified Lighting Calculator (MLC), and just projects using the Crane High Mast LED Calculator.[37] Project engineers reviewed the information submitted with the project documentation and the customer survey and on-site responses, and where necessary, adjusted the input parameters of the PA-submitted savings calculators. Below we list the general approach for lighting-only project evaluation.

1. We verified that the facility type and location from the project documentation, verified through the telephone survey and the on-sites, agree with the savings calculator inputs. Facility type determines the DEER hours of use (HOU), coincident demand factor (CDF), and facility location determines HVAC interactive effects (IE) parameters for the savings calculation.
2. We compared measure quantities and type (long fluorescents vs. high-intensity discharge, and interior vs. exterior) as reflected in documentation invoices, photographs, or project feasibility studies, with quantities and measure types as input into the savings calculator. During on-site visits, we verified that the LEDs present at each site matched the documented quantities. We updated quantity inputs to the savings calculators when needed.

[37] The Crane High Mast LED Calculator is a CPUC-approved calculator for exterior LED installations on high-mast cranes. These installations do not fit within any current DEER building type.

3. We reviewed equipment spec sheets and verified that the lighting installed was DLC-listed or otherwise eligible for custom installations. We compared the documented manufacturer and model information with the lighting calculator inputs to verify that wattage inputs for the existing in-situ measure, standard practice baseline measure, and new LED measure were correct and reflected measure information from the Design Lighting Consortium (DLC) directory.
4. Based on the lighting schedule from the survey, we confirmed or adjusted during the on-site visit. Using adjustment factors developed from previous evaluations for consistency, we estimated the lighting hours of use (HOU) and coincident demand factors (CDF) for each site.[38] We compared these with the DEER-based HOU and CDF for the building type/climate zone for each site and we substituted the evaluation HOU/CDF in the PA-provided calculator where appropriate.[39]
5. Using existing and LED measure life information in conjunction with the evaluated HOU, we estimated the effective useful life (EUL) and Remaining Useful Life (RUL) of lighting measures and compared them with the PA-claimed EUL and RUL. We substituted evaluation-based EUL and RUL values if the PA-claimed values were incorrect (for example: RUL=4 instead of RUL=5 for a project replacing HIDs) or when the rated measure life, in conjunction with the evaluation- or DEER-based HOU, required the EUL/RUL to be capped (example: HOU=5,000 hours and LED rated life of 50,000 hours cap the EUL to 10 years.)
6. Based on customer statements regarding the lighting equipment condition prior to the project—whether they were viable and providing adequate lighting, or whether they were failing or not providing sufficient lighting, or if the customer had otherwise decided that new lighting was necessary—we confirmed or revised the MAT of Accelerated Replacement (AR) or Normal Replacement (NR) categorization as needed. Since all PA-submitted calculators had used AR conditions as inputs, we edited MAT only when the evaluation determined that a project was, in fact, a Normal Replacement.

An example of this approach is a lighting installation at an industrial parcel sorting facility. The equipment information provided in the invoices and spec sheets and DLC screenshots—quantities, wattage, lighting output—matched the inputs from the PA-provided MLC. The site visit confirmed the quantities installed and verified the new LEDs were still in operation. The evaluator obtained facility operation information during the on-site and determined that the HOU and CDF for interior lights were much higher than the DEER HOU and CDF for this building type. The evaluator edited the MLC by substituting the evaluation-based HOU and CDF. The high HOU caused caps in EUL and RUL. The change in HOU/CDF is the only source of discrepancy between claimed and evaluated first year savings. EUL and RUL caps also affect evaluated lifecycle savings estimates.

A grocery store-anchored shopping area replaced parking lot pole HIDs with LEDs. The customer survey verified the quantities installed, the type of equipment removed, the current operation schedule of the lights, and established that the existing lighting was viable, and the customer would not have installed the same higher-than-standard-practice LEDs without program-provided incentives. A site visit confirmed quantities installed and confirmed dusk to dawn operation of the new pole lighting. The evaluation determined that the PA-provided MLC already captured all the information correctly and made no changes to the claimed savings.

A manufacturing facility replaced interior and exterior wall HIDs with LEDs. The PA claimed the project MAT as AR. The evaluation engineer reviewed project documentation, photographs, invoices, equipment spec sheets, and the MLC lighting model used by the implementer to estimate savings. The site contact verified the quantities installed, the type of equipment removed, the current operation schedule of the new lights, and answered questions about the likelihood that the same lighting equipment would have been installed at the same time in the absence of program incentives. Based on customer responses and the documentation provided, the evaluation engineer determined not only that the lighting replaced was old and failing,

[38] Group D Evaluation, *2019 Custom Industrial, Agricultural and Commercial (CIAC) Impact Evaluation*, February 1, 2022, SBW https://pda.energydataweb.com/api/view/2583/GroupD-CIAC%202019%20Ex%20Post%20Evaluation%20PDF%20Final%202.pdf

[39] Since the adjustment factors have a standard deviation of 25%, we only replaced the DEER HOU and CDF if the evaluated values were different by more than 25%. Only interior lighting parameters are adjusted, since no adjustment factors exist for exterior lighting.

but also that the customer had made the decision to replace the lighting before learning of the incentive provided by the program—meaning the correct MAT=NR. An on-site visit found that the LED quantity was correct and confirmed the operation schedule obtained during the survey. The evaluation verified building type and climate zone inputs to the MLC, and the customer-reported lighting operation schedule implied an HOU within 25% of the DEER HOU. The only adjustment to the PA-provided calculator was a change of MAT to NR; this was the only source of discrepancy between the claimed savings and the much lower evaluated first year and lifecycle savings.

The custom evaluation found some unusual situations in PY2023. One PA claimed NR MATs for all their custom lighting-only projects. We verified that, for the sampled projects, annual savings and incentives paid were obtained from MLC calculations that had used MAT=AR as input. The engineering team confirmed with the PA that they had intentionally claimed the lighting projects as MAT=NR, although the common expectation is that custom claims and savings calculations must be consistent. The evaluation determined that all but one of the PA's sampled projects fulfilled AR conditions. First-year discrepancies for the AR projects were due to the PA claiming Total Direct first baseline savings for indoor lighting, rather than Total Claimable Direct+Indirect savings which include HVAC interactive effects. Facility operation-based HOU or CDF were more than 25% different than DEER HOU/CDF and also required MLC adjustments for some projects. The PA's claim that all projects were claimed as MAT=NR meant that the project was claiming first baseline annual savings—again, calculated with MLC inputs of MAT=AR—for the entire EUL=12 measure life. For the projects confirmed to be MAT=AR, the first baseline annual savings can be claimed only during the RUL period, followed by the much lower second baseline savings for the remaining EUL-RUL period—and this led to discrepancies between claimed and evaluated lifecycle savings.

Another PA installed lighting-only projects at sites with multiple meters. To comply with CEDARS requirements that savings be connected with specific meters, these projects claimed savings in "pieces", one per meter, with savings for each "piece" matching the fraction of total usage corresponding to that meter. Unaware of this, the Group D sampling strategy selected only certain "pieces" for evaluation. The evaluator assessed each lighting project in its entirety and confirmed with the PA which other "pieces" belonged together.

Each individual lighting-only CCT discusses the source of discrepancies between evaluated and claimed savings.

Overall, in PY23, the lighting-only projects present relatively limited discrepancies between evaluated and claimed savings:

- We rarely adjusted savings for exterior lighting, as survey and on-site visits usually confirm quantities installed and DEER HOU-consistent dusk to dawn operation. Of the 26 lighting-only projects sampled in PY2023, eight projects installed only exterior lighting, and eight installed exterior and interior lighting. The evaluation confirmed savings as claimed for most of these. We adjusted first year savings only for one project for which evaluated MAT=NR. One on-site visit also found that the new LED exterior lighting had become inoperable within the first year after installation; the customer had already replaced half of the failed exterior LEDs and was planning to replace the remaining failed lamps over time. Since the project documentation shows operational exterior LEDs at the time of installation, and the customer could not pinpoint the time of failure, the evaluation assigned EUL=RUL=1 for exterior lighting. Evaluated first year savings for exterior lighting match claims, but the shortened EUL/RUL significantly reduces evaluated lifecycle savings for exterior lighting when compared to claims.
- Eighteen of the 26 sampled sites installed interior lighting: ten interior lighting only, and eight interior and exterior lighting. Major adjustments to the claimed savings were due to MAT=AR changed to NR (2 cases). Significant adjustments were due to lighting operation (HOU or CDF) much longer or much shorter than that of DEER prototypes (10 cases, with 4 adjusted downward and 6 adjusted upward.) Smaller adjustments were due to PAs claiming Total Direct savings which omit the HVAC interactive effects (6 sites). EUL or RUL corrections (2 sites) or capping for sites with high evaluated HOUs (3 sites) also influenced evaluated lifecycle savings for interior lighting.

3.3 Net savings methods

The net evaluated savings plan leveraged DNV's extensive experience with custom project attribution research in California, as well as information from an NTG research effort. In 2024, DNV undertook a research effort to better align NTG methodologies for the Group D research areas with current program design and delivery. The task involved reviewing the Program Implementation Plans (PIPs) and Measurement and Verification Plans, and conducting interviews and discussions with stakeholders, including the PAs. As a result, our team revised the 2015 NTG survey instruments from the previous evaluations (PY2020 – PY2021) and scoring algorithm. The specific details of the modifications are described in the sections below.

3.3.1 NTG data collection

The DNV team employed a variety of methods to administer the different survey instruments. For the largest savers and most complex projects, we conducted enhanced rigor interviews with several entities involved in the project. These included primary decision-makers, CFOs, vendor representatives, utility account executives, program staff, and other decision influencers, along with a review of market data to establish an appropriate baseline.

Initially, we used project size, as measured by program incentives, to categorize projects into basic rigor, standard rigor, or high rigor categories. However, we adjusted the breakpoints from the previous round (e.g., less than $60,000 in incentives for the basic rigor category, $60,000 to $125,000 for the standard rigor category, and over $125,000 for the enhanced rigor category). The current study assigned projects to rigor categories based on the following criteria:

- **Enhanced rigor**: Projects in the top 10% based on incentive amount, including those with important measures or high complexity (e.g., a mix of measure application types). While project size and complexity are often correlated, this is not always the case.
- **Standard rigor**: The next quartile of projects in terms of incentive amounts after those in the enhanced rigor category.
- **Basic rigor**: All remaining projects that did not qualify for the enhanced rigor or standard rigor categories.

The gross and net savings teams collaborated to shorten the time between completing the gross savings analysis and the net savings analysis. This is crucial because if projects claiming AR have evaluated NTGRs at or below 0.5, the gross savings invalidate the AR MAT and establish a different baseline for their analysis.

The DNV team conducted some surveys for repetitive measures, like lighting, using computer-aided telephone interview (CATI) software. The CATI approach offered several advantages: (1) the surveys were tailored to reflect the unique characteristics of each program, including program descriptions, response categories, and skip patterns; (2) it significantly reduced inaccuracies associated with traditional paper and pencil methods; and (3) it automated the process of checking for inconsistent answers, with follow-up prompts triggered by inconsistencies.

Our sampling approach aimed to complete NTG surveys/interviews with the entire population of embedded projects. In the last round, we achieved a much higher survey/interview completion rate using DNV staff compared to the CATI firm. Therefore, in the current round, we completed NTG surveys/interviews with the approximately 46 embedded projects and 13 net-only projects. The original net sample design targeted 71 participants. Due to difficulties in obtaining survey responses, we completed and used 59 in the NTG analysis.

DNV's data collection approach varied based on the NTG rigor assigned to each project:

- **Basic rigor**: Participants in this group received NTG surveys containing all the key questions used for NTG scoring in the standard/enhanced rigor interview guides, but with fewer follow-up questions for qualitative elaboration and generally shorter, simpler question batteries.
- **Standard rigor**: Participants in this group underwent in-depth interviews with more complex and comprehensive question batteries than the basic rigor surveys. These interviews sometimes included multiple decision-makers, such as vendor

interviews indicated by customer responses. Additionally, two different evaluators reviewed almost all standard rigor evaluations, and in two cases, this led to revisions of the original NTG assessment.

- **Enhanced rigor**: Participants in this group received in-depth interviews nearly identical to those for standard rigor participants. However, enhanced rigor projects involved more research from the evaluation team to compare project baseline assumptions with those from Common Practice Baseline studies. Due to their greater size, enhanced rigor projects were more likely to require NTG interviews with multiple project influencers. Enhanced rigor also included a similar quality control approach as described for standard rigor.

As previously mentioned, DNV revised the survey instruments based on the results of a research effort to better align NTG methodologies for the Group D research areas with current program design and delivery. Specifically:

- **Revised PAI-1 - N6 battery:** The revised instrument reintroduced the N6 question battery, which had previously been part of the 2022 CIAC evaluation. The N6 battery asks about the alternative actions respondents would have taken if they had not participated in the program and whether they had plans to implement those alternative actions. The original CIAC method addresses the timing counterfactual but does not cover the efficiency or quantity counterfactual. The N6 battery aims to gather some of this missing information in a condensed format, as incorporating a full QET battery would further lengthen an already extensive interview guide.
- **N2 response options:** The revised instrument added two new response options to question N2, which asks whether the decision to implement a project was made before or after the customer learned about the program's incentives or on-bill financing. The new options are: "learned about the project and the incentives as part of a complete project proposal," and "other scenario, please describe." These options aim to ensure that the NTGR is only reduced if the respondent indicates that they decided to implement the project before learning about program incentives or on-bill financing.
- **On-bill financing influence:** The revised instrument added the availability of on-bill financing as a specific program influence listed for PAI-1.
- **Corporate policy influence:** The revised instrument included a follow-up question about the N3m corporate policy influence to determine if the referenced policy is a company environmental or sustainability policy that should not result in a reduction to the NTGR.
- **Previous experience with programs:** The revised instrument removed the influence "N3f your previous experience with this Program or a similar utility program" from scoring as a non-program influence to ensure that programs are not penalized for customers having positive past experiences with programs.
- **Clarified language:** The revised instrument clarified the language of several questions (e.g., “To replace old or outdated equipment” became “To replace existing equipment with more efficient equipment”).

3.3.2 NTGR estimation approach and scoring

DNV used three scores to calculate the NTGR:

- **Program attribution index 1 (PAI-1):** This score reflects the influence of the most important program and program-related elements in the customer's decision to select the specific program measure. It also includes program influence through vendor recommendations. The final PAI-1 score is based on the highest rating for a program influence factor divided by the sum of the highest rating for a program influence factor and the highest rating for a non-program influence factor. As part of the NTGR re-alignment, we updated the scoring approach to account for the addition of the N6 battery of questions, which asks respondents about what alternative actions they would have taken if they had not participated in the program. The scoring from the N6 battery is based on the following question, “On a 0-to-10 scale of likelihood, how likely it is that you would have implemented the [ALTERNATIVE ACTION] if you had not installed the program qualifying equipment?”

- **Program attribution index 2 (PAI-2):** This score captures the perceived importance of the program (whether rebate, recommendation, training, or other program intervention) relative to non-program factors in the decision to implement the specific measure that was eventually adopted or installed. The survey instrument asked respondents to assign importance values to both program and non-program influences so that the two total 10. The DNV team adjusted the PAI-2 score (i.e., divided by 2) if respondents had already decided to install the specific program-qualifying measure before learning about the program.

- **Program attribution index 3 (PAI-3):** This score captures the likelihood that the customer would have selected the exact same equipment if the program had not been available (the counterfactual). We calculated the PAI-3 score as 10 minus the likelihood of installing the same equipment.

The average of these three program attribution index scores produced the NTGR.

For the PY2023 evaluation we made some modest changes in the NTG interview guides based on some feedback we received and discussion we had with CPUC staff including:

- *Project timing:* Over the years, the NTG interview guides have asked the question: "Now I'd like to ask you about when you learned that your project would be eligible for incentives or on-bill financing through the program. When was the decision to install this MEASURE made in relation to the availability of incentives or on-bill financing?" In past years, the response options had been limited to "Before" or "After." This is a key question because, as noted above, if a project decision-maker stated that they decided to install the measure before becoming aware of the program incentives and financing, the project's PAI-2 score is cut in half.

  After our discussions with the CPUC staff, we concluded that having only "Before" and "After" options was too constricting and did not capture the nuances and complexities of project decision-making. Making the options too binary might force interviewers or interviewees to try to fit more complex and nuanced scenarios into one of these two options. Therefore, in the NTG interview guides for the PY2023 evaluation we expanded the response option to include: "Before," "After," "Learned about the project and the incentives as part of complete project proposal," and "Other scenario" (which required the project decision-makers to describe the scenario). The fact that several PY2023 project decision-makers selected these new response options indicated it was a welcome addition. We only assessed the PAI-2 penalty if respondents gave the "Before" response.

- *Previous program participation:* In past CIAC evaluations the team would ask project decision-makers to rate the relative importance of: "Your previous experience with this PROGRAM or a similar utility program?" as a project driver using a 0-10 importance score. We would then their responses to this question as a non-program project driver for the calculation of the PAI-1 factor. However, the program evaluation community is divided on whether prior program *participation* should be an indicator of free ridership or of program attribution. There are plausible arguments on both sides of this issue. Because of the uncertain direction of this program driver, we chose to no longer score it in the PY2023 NTG calculations.

- *Corporate policies:* In the PY2022 evaluation, the evaluation team discontinued the previous practice of counting the importance ratings that project decision-makers gave to their corporate sustainability policies as non-program project drivers in the calculation of the PAI-1 factor. The evaluation team made this change in response to CPUC Resolution E-4818 which stated that "Sustainability policies or energy policies have been shown to be highly indicative of energy efficiency and integrated demand side management measure uptake. As such, we promote the adoption of these policies and withdraw from the guidance document the example of using a sustainability policy as evidence against program influence." The evaluation team continued this practice for the PY2023 evaluation.

- *The N6 question battery:* In the PY2023 NTG interview guides we also added a series of NTG questions first developed in 2015 as possible replacement for one of the three PAI-I factors described above. We deemed this series the "N6 question battery." These questions go beyond the current NTG questions in exploring counterfactual project outcomes beyond efficiency and timing (e.g. measure quantity/size). For the PY2020-2021 CIAC evaluation the CPUC approved a modified version of this N6 battery to be implemented on a pilot basis. For the PY2023 evaluation we piloted these questions again for the purpose of calculating alternative NTGRs, using the NTG factors derived from the N6 questions to replace the current PAI-1 factors in the scoring.

Because the PAI-I battery contains many questions about both program project drivers and non-program project drivers, and because the PAI-I calculations use only the maximum program project drivers and the maximum non-program project drivers, changing the scoring of any one of these factors—whether dealing with prior energy efficiency program participation or corporate sustainability policies—usually only has minimal impacts on overall NTG scoring. For example, when we changed the corporate sustainability policy scoring in the PY2022 evaluation, only two of the 68 sites (3%) had their NTGRs altered due to this scoring change, and the program-wide NTGRs were unaltered.

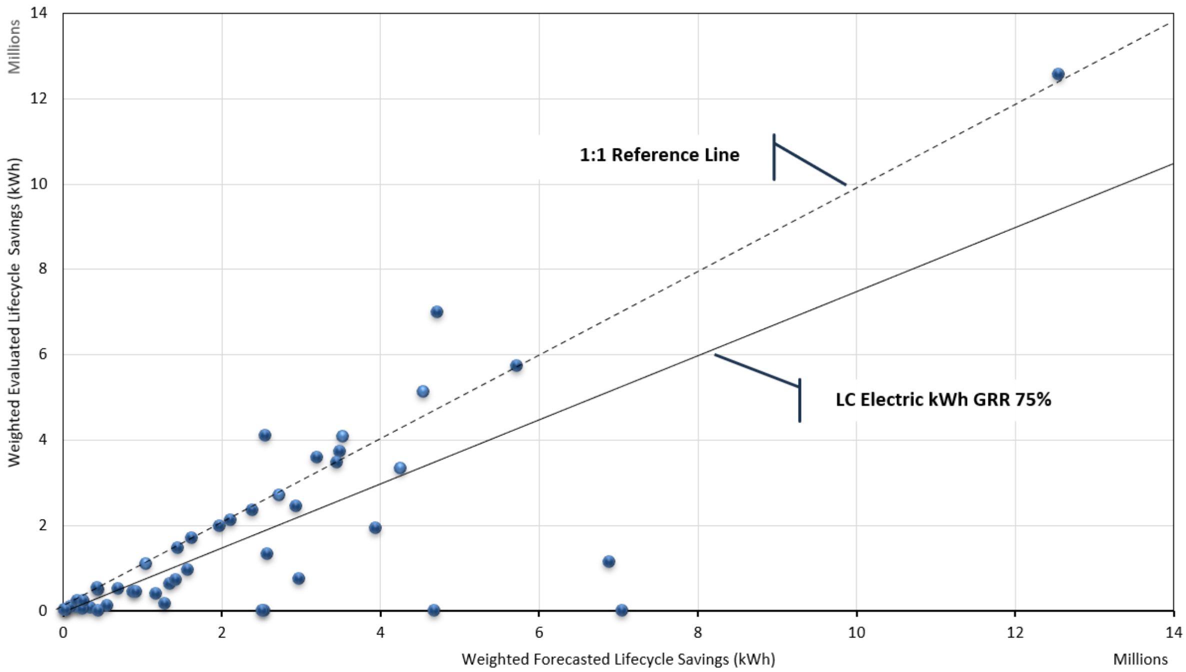
4 RESULTS

In this section, we present our findings related to gross and net savings by key reporting dimensions. This section also includes the impact of baseline changes, reasons for differences in gross savings, and a comparison of findings to those from previous impact evaluations. Below, we have included our examination of the reliability, sensitivity, and drivers of the NTGR, which measures the program's influence on participants' decisions to implement efficiency measures.

4.1 Gross electric savings and realization rates

This section provides gross electric savings and realization rates results. Figure 4-1 compares the weighted forecasted and evaluated lifecycle electric energy savings for all sites in the final sample. The diagonal dashed line indicates where each sample point would have been plotted had the forecasted estimates been 100% accurate. The points below the dashed line represent sites with evaluated savings less than the forecasted estimate, while those above the line are instances where evaluated savings were larger than the forecasted estimates. This view makes clear that many sites fell along the 1:1 reference line, indicating their forecasted savings were fairly accurate. This includes the largest site in the sample (upper left). The 37 sites below the dashed line pulled the realization rate down to 75% overall. Although far fewer than last year, this includes six with zero savings.

Figure 4-1. Weighted lifecycle electric gross energy savings scatterplot (all sites)



4.1.1 Gross savings results by subject area

Table 4-1 summarizes the first-year and lifecycle forecasted savings, evaluated savings, GRR, and relative precision for custom, OBF, and SBD projects and at the statewide level. Statewide, the PAs achieved 14,242 MWh of gross first-year energy savings and 2,101 kW of gross first-year demand savings, with 75% GRRs for both. Statewide lifecycle savings were similar, producing 80,931 MWh in lifecycle energy savings, with a 75% GRR.

SBD projects performed well, with an 86% first-year GRR, while the Custom GRR came in lower at 63%, and the OBF GRR higher at 115%. OBF projects were limited to lighting-only projects, which follow a largely prescriptive approach that uses a modified lighting calculator (MLC) with deemed hours of use (HOU), coincident factors, and other parameters as the basis for claimed savings. The evaluation may adjust these values based on on-site findings, but in PY2023 they required little correction. Custom non-lighting projects used on-site data collection, such as BMS or billing data, to update usage and savings, resulting in lower realization rates.

Table 4-1. Statewide gross electric energy and demand savings results by subject area

Subject area/ finance type	First-year				Lifecycle			
	Forecasted savings	Evaluated savings	GRR	Relative precision*	Forecasted savings	Evaluated savings	GRR	Relative precision *
Energy (MWh)								
Custom	13,708	8,644	63.1%	±14.7%	69,556	45,183	65.0%	±12.6%
SBD	1,261	1,086	86.1%	±11.7%	18,427	16,776	91.0%	±11.1%
OBF	3,925	4,512	114.9%	±11.0%	19,947	18,972	95.1%	±4.4%
Statewide	18,894	14,242	75.4%	±9.6%	107,930	80,931	75.0%	±7.4%
Demand (kW)								
Custom	1,964	1,218	62.0%	±24.0%	8,401	5,492	65.4%	±17.2%
SBD	551	534	96.9%	±3.5%	8,022	8,232	102.6%	±3.6%
OBF	278	349	125.8%	±23.6%	1,389	1,390	100.0%	±3.5%
Statewide	2,793	2,101	75.2%	±14.5%	17,813	15,115	84.9%	±6.5%

* Relative precision at the 90% confidence interval

4.1.2 Gross savings results by PA

Table 4-2 summarizes the first-year and lifecycle energy and demand forecasted savings, evaluated savings, GRR, and relative precision at the PA level. We present all results at the 90% confidence interval. A discussion of the drivers of the electric energy realization rates by PA follows the table.

Table 4-2. Statewide gross electric energy and demand savings results by PA with outlier

Subject area	First-year							
	Forecasted savings	Evaluated savings	GRR	Relative precision*	Forecasted savings	Evaluated savings	GRR	Relative precision*
Energy (MWh)								
MCE	749	567	75.7%	±23.3%	8,999	3,199	35.5%	±21.8%
PG&E	8,251	4,827	58.5%	±16.7%	37,083	23,459	63.3%	±14.4%
RCEA	152	79	51.6%	±69.0%	740	293	39.5%	±64.8%
SCE	8,206	7,442	90.7%	±14.8%	43,781	38,146	87.1%	±12.9%
SCR	599	505	84.3%	±0.0%	3,552	2,917	82.1%	±0.0%
SDG&E	937	821	87.6%	±4.4%	13,774	12,917	93.8%	±4.8%
Statewide	18,894	14,242	75.4%	±9.6%	107,930	80,931	75.0%	±7.4%
Demand (kW)								
MCE	61	42	69.0%	±68.6%	731	247	33.8%	±62.6%
PG&E	1,670	850	50.9%	±34.2%	7,740	5,049	65.2%	±19.2%
RCEA	25	16	63.0%	±106.1%	133	56	41.7%	±94.3%
SCE	585	778	133.1%	±10.6%	3,529	4,308	122.1%	±1.1%
SCR	105	109	104.1%	±0.0%	613	677	110.4%	±0.0%
SDG&E	347	306	88.1%	±3.0%	5,067	4,778	94.3%	±2.5%
Statewide	2,793	2,101	75.2%	±14.5%	17,813	15,115	84.9%	±6.5%

***** Relative precision at the 90% confidence interval

Gross realization rates by PA ranged from 52% to 91%, with a statewide GRR of 75%. Drivers of the various PA rates are summarized below.

- **PG&E**, representing approximately 44% of statewide forecasted first-year electric energy savings, had a first-year electric energy GRR of 59%, with a relative precision of ±17%, and a lifecycle electric energy GRR of 63% ±14%. Five sites had savings greater than forecasted (up to 121%), and seven had savings that were less than 50% of what was forecasted. This included four zero-saver sites (three of which had inoperable measures and the fourth an inappropriate baseline), two sites with changes in site operating conditions, and a site where one of the two measures evaluated was ineligible.
- **SCE**, representing approximately 43% of statewide forecasted first-year electric energy savings, had a first-year electric energy GRR of 91%, with a relative precision of ±15%, and a lifecycle electric energy GRR of 87% ±13%. Five projects representing 13% of SCE claims had first-year electric energy GRRs ranging from 129% to 174%. All five upward savings adjustments were due to changes in operating conditions. Two sites had electric energy GRRs of less than 50%. This included one site that was a zero-saver (due to ineligibility) and one site with a 16% realization rate due to changes in site operating conditions.
- **SDG&E**, representing approximately 5% of statewide forecasted electric energy first-year savings, had a first-year electric energy GRR of 88%, with a relative precision of ±4%, and a lifecycle electric energy GRR of 94% ±5%. The sub-100% realization rate was due to changes in operating conditions at three sites.
- **MCE**, **RCEA**, and **SCR**, collectively representing approximately 8% of statewide forecasted first-year MWh, had first-year energy GRRs of 76%, 52%, and 84%, respectively. Among these PAs, all but one site were lighting sites and performed very well. Only four of the 15 sites had realization rates below 50%. These included two that the evaluation overturned from an AR MAT to an NR MAT, one due to a calculation error and one due to a change in site operating conditions.

4.1.3 Gross savings results by measure type

Table 4-3 summarizes the statewide first-year and lifecycle forecasted electric energy savings, evaluated savings, GRR, and relative precision for “Lighting Only” and “Other” projects. As the name suggests, “Lighting Only” means a Project ID includes only lighting claims. “Other” means a project includes HVAC, process, or whole-building measures. These projects may include lighting measures, but do not include only lighting measures. As mentioned above, lighting-only projects performed well, with a first-year electric energy GRR of 89% and demand gross realization rate of 78%. Lifecycle energy lighting and other gross realization rates are 72% and 76%, respectively. Lifecycle energy GRRs for lighting and non-lighting projects were more similar—with a slightly higher non-lighting GRR—because the evaluation changed the savings baseline for several lighting projects from Normal Replacement (NR) to Accelerated Replacement (AR).

Table 4-3. Statewide gross electric energy and demand savings results by measure type

	First-year				Lifecycle			
Measure type	**Forecasted savings**	**Evaluated savings**	**GRR**	**Relative precision***	**Forecasted savings**	**Evaluated savings**	**GRR**	**Relative precision***
Energy (MWh)								
Lighting only	3,414	3,047	89.2%	±4.7%	25,171	18,261	72.5%	±4.0%
Other	15,480	11,195	72.3%	±12.2%	82,759	62,670	75.7%	±9.6%
Statewide	18,894	14,242	75.4%	±9.6%	107,930	80,931	75.0%	±7.4%
Demand (KW)								
Lighting only	156	121	77.8%	±27.6%	1,439	917	63.7%	±17.8%
Other	2,637	1,980	75.1%	±15.3%	16,374	14,198	86.7%	±6.9%
Statewide	2,793	2,101	75.2%	±14.5%	17,813	15,115	84.9%	±6.5%

***** Relative precision at the 90% confidence interval

4.1.4 Gross savings results by CPR activity

Table 4-4 summarizes the statewide first-year and lifecycle electric energy savings, GRR, and relative precision by CPR status. Electric projects that have undergone the CPR process appear to be performing better than those that have not. Both first-year and lifecycle GRRs for CPR projects are higher than those for non-CPR projects, though the relative precision around the lifecycle results is high.

Table 4-4. Statewide gross electric energy savings GRRs by CPR

CPR status	First-year GRR	Relative precision*	Lifecycle GRR	Relative precision*
Yes	75.8%	±12.5%	80.1%	±11.3%
No	72.6%	±28.3%	74.6%	±17.5%

* Relative precision at the 90% confidence interval

4.1.5 Discrepancy analysis

This section presents an analysis of the savings adjustments that account for differences between forecasted and evaluated electric savings estimates for the sampled projects. Note that this analysis is based on adjustments associated with first-year gross savings. Table 4-5 describes the factors that may have impacted a project.

Table 4-5. Savings adjustment factors

Discrepancy factor	Description
Tracking data	Differences attributed to incorrect adjustments or unexplained changes to savings between completion of the forecasted savings analysis and claimed savings entered into the PA tracking system
Ineligible measure	Measure approval by the PA not consistent with CPUC policies, guidance, and rulebook eligibility
Measure count	Differences attributed to the number of units used to forecast savings not consistent with the number of units operating at the time of evaluation
Inappropriate baseline	Represents a difference in evaluated and reported baselines, including a different standard practice, code, or pre-existing baseline
Inoperable measure	Measure no longer operating at the time of evaluation, whether decommissioned or removed from site
Operating conditions	Evaluator M&V or collected trend data informs different operating parameters, including hours of use, setpoints, efficiency, etc.
Calculation methods	Differences attributed to changes in calculation methodology between the forecasted savings and evaluated savings analysis. The evaluator only changed analysis methodology when necessary to accurately calculate savings, such as employing an 8,760 model.)

When DNV revised gross evaluated impacts for a project from forecasted savings, we recorded and ranked the associated adjustment factors. Some projects had only one discrepancy factor. For example, we would categorize an ineligible project (due to a policy violation or ineligible measure) as having a single discrepancy. If there were multiple factors (e.g., evaluated parameters were different from the operating parameters and adjustments were made to baseline conditions), we ranked the discrepancies from most to least impactful and recorded their associated impact as a percentage of savings increased or reduced to accurately report on the impact on each discrepancy. We classified discrepancy factors into seven categories, as presented in Table 4-6, which shows the number of instances a given discrepancy occurred and its impact on overall GRRs in the electric sample.

Table 4-6. Key drivers of electric GRR

Discrepancy category	Negative impact		Positive impact		Overall	
	# instances	Impact on GRR	Impact on GRR	# instances	Impact on GRR	# instances
Tracking data discrepancy	0	0%	<1%	1	1%	1
Ineligible measure	1	-4%	0%	0	-4%	1
Measure count	1	0%	<1%	1	0%	2
Inappropriate baseline	4	-5%	0%	1	-5%	5
Inoperable measure	4	-5%	0%	0	-5%	4
Operating conditions	15	-9%	6%	16	-3%	31
Calculation method	6	-1.6%	<1%	3	-1.5%	9
Other	1	-7%	0%	0	-7%	1
Total	32	**-31%**	**7%**	**22**	**-25%**	**54**

The following discrepancies were both the most frequent and had the largest impact on first-year gross savings:

- **Operating conditions** for primary equipment, which the DNV team often verified as different from the operating conditions at the time of initial implementation. Changes in HOU, observed load, control settings, or equipment efficiency were often the primary drivers in adjusting evaluated savings. Fifteen projects had differing operating conditions that negatively impacted evaluated savings, while 16 projects had differing operating conditions that positively impacted evaluated savings, with a net positive impact of −3%.
  - One example is an SBD project for which the evaluation updated post-implementation utility consumption data with recent data, spanning November 2023 through October 2024. The claimed savings calculation used just a partial year, February 2023 through June 2023. The baseline energy consumption remained the same. This project had a first-year electric energy realization rate of 112%.
  - Another example comes from an overhaul of an agricultural pump system that provides potable water for a reservoir that feeds a county water distribution system. The project replaced the pump bowls and cleaned the well casing perforations. The facility's well-water pump-motor is the only electric load on the site's electric meter. Thus, the evaluation analysis used the AMI data to determine the evaluated savings. The baseline period for the evaluation analysis was 2021 and 2022 and the post installation period was nine months of 2024 (January through September). The resulting realization rate for the project was 16%.
- **Inoperable measures** were the second most impactful discrepancy. DNV found a total of four projects had missing or inoperable measures at the time of evaluation, resulting in an overall reduction of 5% to the first-year electric GRR.
  - For one project, as confirmed with the site-contact, the site removed Aeration Based Ammonia Control (ABAC) and Internal Mixed Liquor (IML) controls shortly after installation, putting back into operation a pre-existing dissolved oxygen (DO) control. The installed ABAC system cut down oxygen in the wastewater system so much that the bacteria in the tank died, leaving sewage improperly treated. After observing the TSS (Total Suspended Solids) levels, the site analyzed effluent under a microscope to find significantly reduced live cells. The site contact indicated that after reverting the ABAC controls to pre-existing DO operation the IML system is also no longer in operation. This project had a first-year electric energy realization rate of 0%.
- **Inappropriate baseline** selection of inappropriate use of baseline conditions (including invalid MAT and used equipment installation) was also a primary driver of discrepancies between evaluated savings and forecasted savings. Evaluated savings for four projects were lower because the evaluators corrected the baseline used in the PAs' savings forecasts.

Adjustments in baselines were largely attributed to NR projects that incorrectly assigned pre-existing conditions as the baseline. Inappropriate baselines accounted for a roughly 5% reduction in first year electric energy GRR.

- One example of inappropriate baseline selection comes from a process optimization at a wastewater treatment plant that serves a large industrial food processing facility. Water treatment at this facility includes biochemical oxygen demand (BOD) removal and nitrification prior to discharge into percolation ponds. Optimizing this process involved various scoped operational and reconfiguration improvements that leveraged the existing system components and infrastructure to improve the plant's efficiency. The main driver of savings is a reduction of aerator load (kW), while maintaining an equivalent service level requirement measured as DO concentration. DNV found the pre-existing configuration could not sustain the required load, as stated during CPR review of this project. After normalizing pre-existing conditions to current load requirements, the required input horsepower (HP) to meet that load is 1,876, which is higher than what is available on-site (1,795 HP).

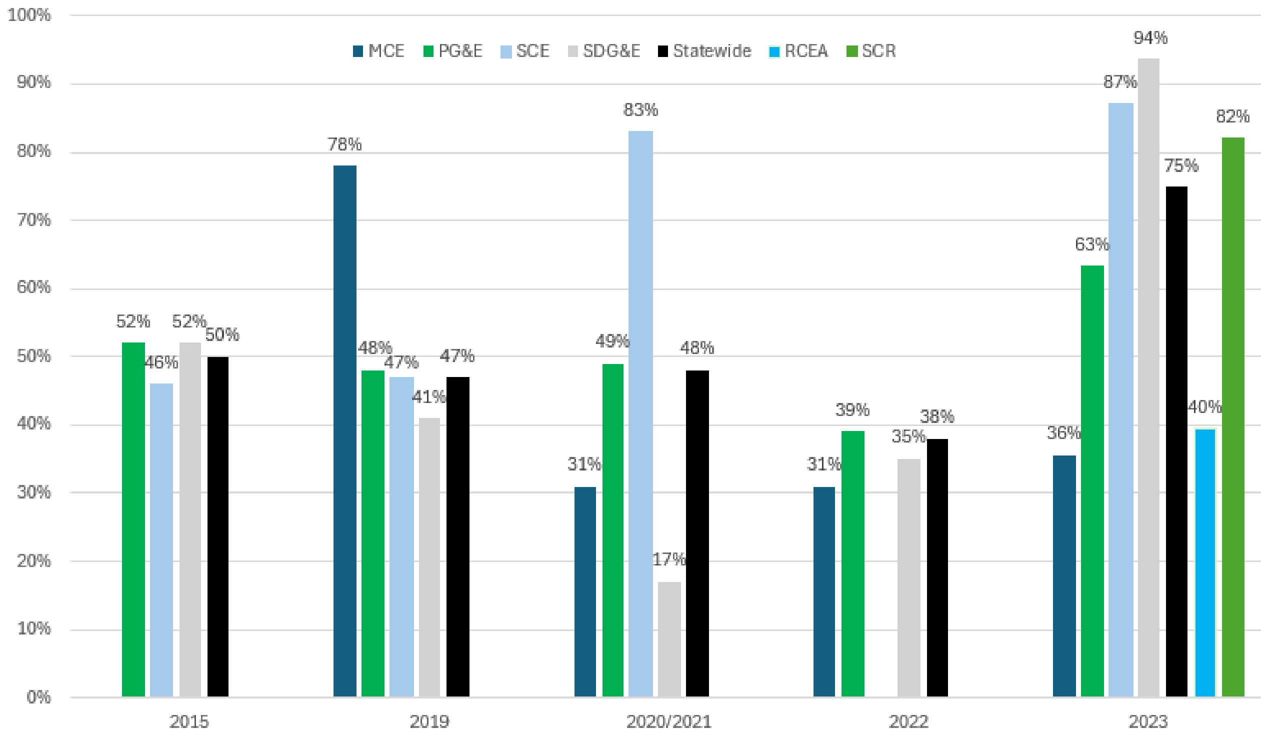
4.1.6 Comparison to previous evaluation findings

Figure 4-2 compares the 2023 estimates of electric lifecycle GRR by PA and statewide to prior evaluations. Overall, the evaluation found that GRRs improved year-over-year, largely attributable to an improvement in the application of MATs, refinements in project baseline application, and adherence to CPUC eligibility rules. The bullets below describe drivers of the 2023 lifecycle GRRs.

- **MCE**, **RCEA**, and **SCR**, collectively representing approximately 8% of statewide forecasted electric energy savings, had lifecycle electric energy GRRs of 36%, 40%, and 82%, respectively. The lifecycle GRRs are being driven by adjustments to the PA-claimed EUL and RUL of lighting measures. The evaluation adjusted EUL and RUL values if the PA-claimed values were incorrect (for example: RUL=4 instead of RUL=5 for a project replacing HIDs) or when the rated measure life, in conjunction with the evaluation- or DEER-based HOU, required the EUL/RUL to be capped (for example: HOU=5,000 hours combined with an LED rated life of 50,000 hours caps the EUL at 10 years).
- **SDG&E**, representing approximately 5% of statewide forecasted electric energy savings, had a lifecycle electric energy GRR of 94%. The lower than 100% realization rate was due to changes in operating conditions at three sites. One large project that had a low realization rate drove PY2022 results for SDG&E .
- **SCE**, representing approximately 43% of statewide forecasted electric energy savings, had a lifecycle electric energy GRR of 87%. Five projects representing 13% of SCE claims, had first-year electric energy GRRs ranging from 129% to 174%. All five upward savings adjustments were due to changes in operating conditions. Two sites had electric energy GRRs of less than 50%. This included one site that was a zero-saver (due to ineligibility) and one site with a 16% realization rate due to changes in site operating conditions. SCE's improved realization rate can be attributed to fewer AR projects being overturned to NR.
- **PG&E**, representing approximately 44% of statewide forecasted electric energy savings, had a lifecycle electric energy GRR of 63%. Five sites had savings greater than forecasted (up to 121%) and seven had savings that were less than 50% of what was forecasted. This included four zero-saver sites (three of which had inoperable measures and the fourth an inappropriate baseline), two sites with changes in site operating conditions, and a site where one of the two measures evaluated was ineligible. PG&E's improved realization rate can be attributed to fewer zero-saver projects, indicating a closer adherence to CPUC policy, and fewer downward adjustments to baseline considerations.

In Figure 4-2, the navy bars show statewide lifecycle GRRs since 2015. As noted earlier, the 75% statewide lifecycle electric GRR observed in PY2023 is substantially above all previous studies, which ranged from 38% to 50%. Key drivers of lower realization rates in previous evaluation cycles appear to have waned in this evaluation cycle. For example, in PY2022, the study found that the primary discrepancies lowering GRR were ineligible measures and adjustments to baselines. However, this evaluation found fewer occurrences of these discrepancies overall, with six occurrences of those two discrepancies in PY2023, while PY2022 had 28 such occurrences. The improvement in ineligible measure observations has an outsized impact on the realization rate as they result in fewer sites with no savings. Like the statewide result discussed above, the lifecycle GRRs of PG&E, SDG&E, and SCE all performed better this year than in all previous years studied, going back to 2015.

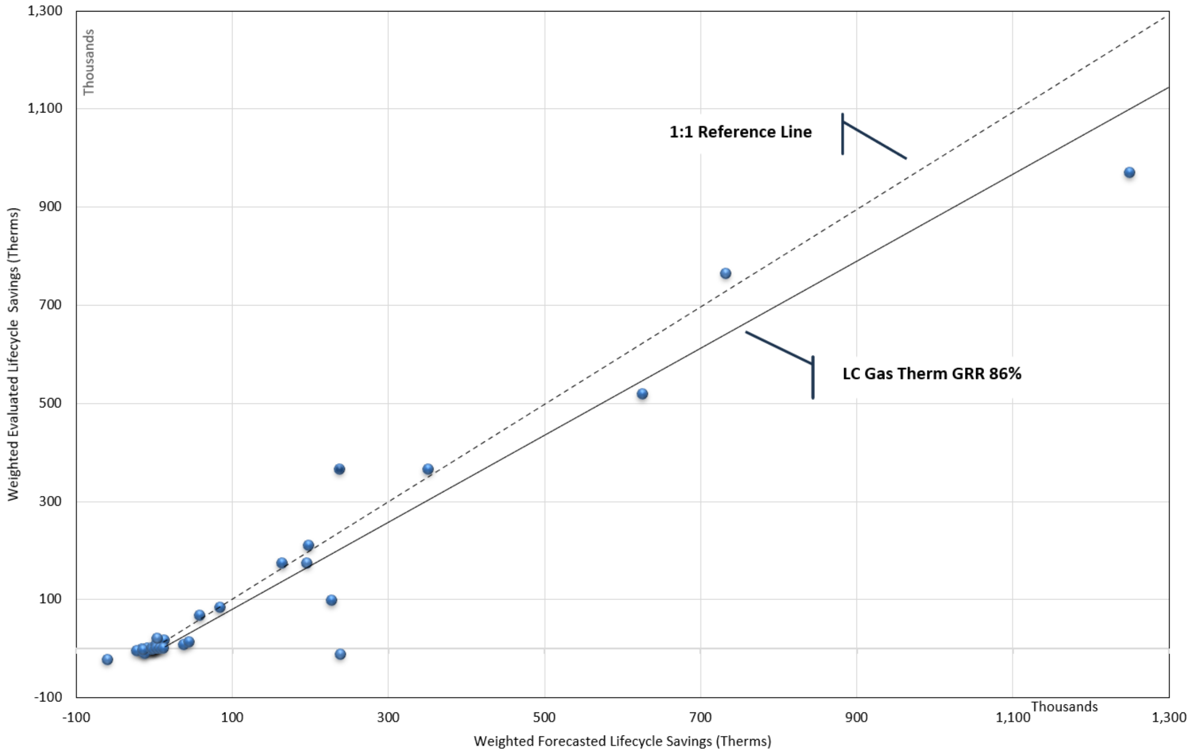
Figure 4-2. Statewide electric energy lifecycle GRR results by program year and PA



4.2 Gross natural gas savings and realization rates

This section provides gross gas savings and realization rates results. Figure 4-3 compares the weighted forecasted and evaluated lifecycle gas energy savings for all sites in the final sample. As above in the electric results, the diagonal dashed line indicates where each sample point would have been plotted had the forecasted estimates been 100% accurate. The points below the dashed line represent sites with evaluated savings less than the forecasted estimate, while those above the line are instances where evaluated savings were larger than the forecasted estimates. This view makes clear that, while four sites did have zero savings, most fell within a reasonable distance of the reference line, as reflected in a gross realization rate of 86% with very good precisions, which can be seen in the next series of tables.

Figure 4-3. Weighted lifecycle gas gross energy savings scatterplot (all sites)



4.2.1 Gross savings results by subject area

Table 4-7 summarizes natural gas first-year and lifecycle forecasted savings, evaluated savings, GRR, and relative precision at the statewide level and for each subject area. Statewide, the PAs achieved 518 thousand therms of gross first-year savings with a 95% GRR. Statewide lifecycle savings performance was similar, producing 3,548 thousand therms in lifecycle energy savings, with an 86% GRR.

Custom projects performed well, with a 97% first-year GRR, while the SBD GRR came in lower at 77%, and the OBF GRR higher at 143%. OBF shows negative savings as it overwhelmingly captures the impact of interactive effects from lighting savings. Lifecycle GRRs reflect similar performance among all three sets of results, ranging from 81% to 91% with good precisions.

Table 4-7. Statewide gross natural gas energy savings results by subject area

Subject area/ finance type	First-year				Lifecycle			
	Forecasted savings (thousand therms)	Evaluated savings (thousand therms)	GRR	Relative precision*	Forecasted savings (thousand therms)	Evaluated savings (thousand therms)	GRR	Relative precision*
Custom	489.1	474.2	96.9%	±7.2%	3,244.6	2,845.8	87.7%	±6.0%
SBD	61.6	47.6	77.3%	±13.4%	872.2	713.5	81.8%	±13.7%
OBF	−2.6	−3.7	143.2%	±26.1%	−12.9	−11.8	91.3%	±6.0%
Statewide	548.1	518.0	94.5%	±6.7%	4,103.9	3,547.5	86.4%	±5.5%

***** Relative precision at the 90% confidence interval

4.2.2 Gross savings results by PA

Table 4-8 summarizes natural gas first-year and lifecycle forecasted savings, evaluated savings, GRR, and relative precision by PA. We present all results at the 90% confidence interval.

- **PG&E**, representing approximately 58% of total forecasted positive statewide first-year therm savings, had a first-year GRR of 89%, with a relative precision of ±3%. Although the realization rate is high, PG&E projects include two zero-saver sites (due to inoperable measures) that were fully offset by five projects with over 100% of forecasted savings, three of which this evaluation adjusted upward due to operating conditions and two due to calculation methods.
- **SCE**, representing approximately 1% of forecasted positive statewide first-year therm savings, had a first-year GRR of −68% with a relative precision of ±35%. DNV recommends the statewide realization rate of 99.5% be applied to SCE because the majority of SCE's savings were negative due to interactive effects. This evaluation's sample did not include one large positive savings site, which offset all the SCE projects with negative impacts.
- **SDG&E**, representing approximately 7% of forecasted positive statewide first-year therm savings, had a first-year GRR of 102%, with a relative precision of ±9%, and a lifecycle GRR of 110% ±9%. The two gas projects sampled for SDG&E had realization rates of 97% and 35% for first-year savings, both adjusted due to differences in operating conditions.
- **SCG**, representing approximately 34% of forecasted positive statewide first-year therm savings, had a first-year GRR of 105%, with a relative precision of ±17%. Of the four projects evaluated for SCG, two had realization rates greater than 100% (105% and 153%) and two had realization rates lower than 100% (42% and 77%). The evaluation adjusted the two projects with greater than 100% realization rates based on differences in calculation methods and the two projects with less than 100% realization rates based on differences in operating conditions.
- **MCE**, **RCEA**, and **SCR** all claimed negative therm savings. These claims represent increases in gas usage attributable to the installation of high efficiency lighting, which can increase heating loads.

Table 4-8. Gross natural gas energy savings results by PA

PA	First-year				Lifecycle			
	Forecasted savings (million therms)	Evaluated savings (million therms)	GRR	Relative precision*	Forecasted savings (million therms)	Evaluated savings (million therms)	GRR	Relative precision*
MCE	−3.9	−2.5	64.1%	±38.1%	−47.4	−14.4	30.4%	±33.4%
PG&E	324.5	287.6	88.6%	±3.0%	1,643.4	1,296.9	78.9%	±7.0%
RCEA	−2.1	−0.6	27.7%	±88.8%	−10.0	−2.1	21.1%	±37.0%
SCE[40]	4.1	−2.8	−67.6%	±35.3%	10.0	3.2	31.9%	±22.4%
SCR	−0.1	−0.1	54.3%	±0.0%	−0.5	−0.4	73.3%	±0.0%
SDG&E	37.4	38.3	102.3%	±8.9%	520.5	571.2	109.7%	±8.8%
SCG	188.3	198.1	105.2%	±17.0%	1,988.1	1,693.2	85.2%	±9.8%
Statewide	548.1	518.0	94.5%	±6.7%	4,103.9	3,547.5	86.4%	±5.5%

***** Relative precision at the 90% confidence interval

4.2.3 Discrepancy analysis

This section presents DNV's analysis of the discrepancies that account for differences between forecasted and evaluated savings estimates for the sampled natural gas projects. Note that this analysis is based on discrepancies associated with first-year gross gas savings and has been categorized based on the factors described above in Table 4-5.

[40] SCE had two sites with positive gas savings, one of which was evaluated within the Savings by Design program, the other site was not evaluated. DNV recommends that SCE applies the statewide gas realization rate by subject area listed in Table 4-7.

When DNV found gross evaluated impacts for a project were different than the forecasted savings, we recorded and ranked the associated discrepancy factors. Some projects had only one discrepancy factor. For example, we would categorize an ineligible project (due to a policy violation or ineligible measure) as having a single discrepancy. If there were multiple factors (e.g., evaluated parameters were different than the operating parameters and adjustments were made to baseline conditions), we ranked the discrepancies from most impactful to least impactful and recorded their associated impacts as percentages of savings increased or reduced. We classified discrepancy factors for natural gas into seven categories: tracking data, ineligible measures, measure counts, inappropriate baseline, ineligible measures, operating conditions, and calculation methods.

Table 4-9 shows the number of instances a given discrepancy occurred, and its impact on overall gross realization rates in the electric sample. We noted a total of 35 discrepancy instances, with 17 causing a negative impact (−17% total) and 18 contributing to a positive impact (+12% total), leading to a minimal overall net impact of −6% on the GRR.

Table 4-9. Key drivers behind natural gas GRR

Discrepancy category	Negative impact		Positive impact		Overall	
	# instances	Impact on GRR	Impact on GRR	# instances	Impact on GRR	# instances
Tracking data discrepancy	1	−2%	0%	0	−2%	1
Ineligible measure	1	−4%	0%	0	−4%	1
Measure count	0	0%	<1%	1	<1%	1
Inappropriate baseline	0	0%	<1%	2	<1%	2
Inoperable measure	2	−1%	0%	1	−1%	3
Operating conditions	10	−10%	2%	9	−8%	19
Calculation method	3	−1%	10%	5	8%	8
Other	0	0%	0%	0	0%	0
Total	**17**	**−17.4%**	**11.9%**	**18**	**−5.5%**	**35**

The following discrepancies were both the most frequent and had the largest impact on first-year gross savings.

- Differences in the **calculation method** used to estimate evaluated savings compared to those used to estimate forecasted savings negatively impacted the evaluated savings of three projects and positively impacted the evaluated savings for five projects.
  - A steam process improvement project provides an example of this type of discrepancy. The evaluation team found that gas savings increased because of two main reasons: (1) the estimated annual boiler gas usage increased from 120 MMCF to 154 MMCF (a 29% increase), and (2) the evaluation adjusted the estimated delta enthalpy used to quantify steam flow rate from 1191.4 But/lb to 1007 Btu/lb. This adjustment effectively increased the steam mass flow rate i.e., the boiler load, so the energy savings due to DA tank water preheating increased by the same amount (~ 18%), resulting in an overall project realization rate of 153%.
- For one project, many of the measures installed did not meet T24 requirements and the evaluation deemed them **ineligible measures**. DNV referenced a prior CPR disposition for a very similar project with very similar measures, which resulted in a rejected CPR claim (766) from September of 2022. Therefore, the evaluation zeroed out savings for many of the installed measures.
- Ten projects had differing **operating conditions** that negatively impacted evaluated savings (−10%), while nine projects were positively impact (+2%) by differing operating conditions.

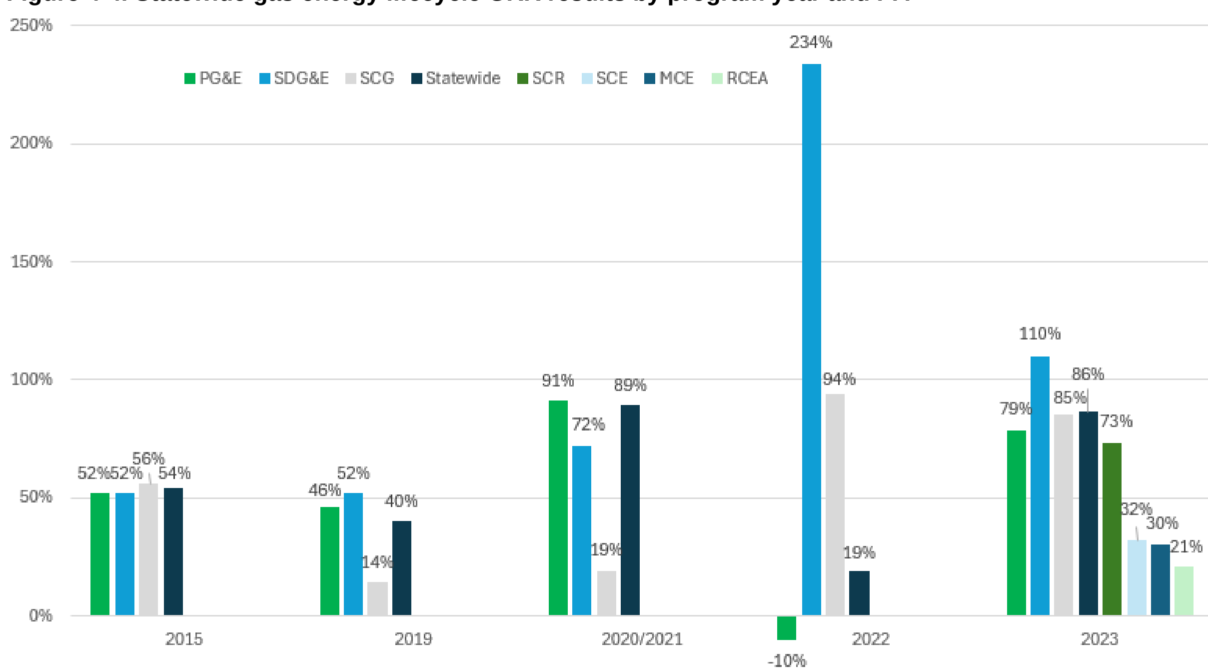
- As an example, for one project, DNV collected trend data that showed the post installation period supply fan speed and the space temperature was higher than PA predicted during the occupied and unoccupied periods, which reduced the heating savings from this measure, resulting in an overall project level realization rate of 84%.

4.2.4 Comparison to previous evaluation findings

Figure 4-4 compares the PY2023 estimates of gas lifecycle GRR by PA and statewide. We found considerable fluctuation in gas realization rates across the PAs.

- **PG&E**'s PY2023 lifecycle GRR (79%) was higher than PY2022's (−10%) but approaching the previous cycle of 91% (PY2020/2021) and much higher than the lifecycle GRRs of PY2019 (46%) and PY2015 (52%). Lighting projects drove the PY2022 negative realization rate, and gas usage can increase when energy efficient lighting measures require more facility heating.
- The **SCG** lifecycle GRR (85%) in PY2023 was lower than PY2022's (94%), but both evaluations saw smaller populations than in the past, perhaps reflecting more impactful oversight. Of the four projects sampled in PY2023 for SCG, two had realization rates above 100% (105% and 153%, respectively), and two had realization rates lower than 100% (42% and 77%, respectively). DNV adjusted the two projects with GRRs greater than 100% based on differences in calculation methods and adjusted the two projects with GRRs less than 100% based on differences in operating conditions.
- The **SDG&E** GRR was 110%, The two gas projects sampled for SDG&E had realization rates of 97% and 35% for first-year savings, both adjusted due to differences in operating conditions. One project for which the evaluation found differences in calculation methods influenced the PY2022 GRR of 234%. The 110% GRR observed this year is higher than the 3 years prior to the result in 2022.
- **MCE**, **RCEA**, and **SCR** had minimal gas claims that were largely attributable to interactive effects of installed lighting measures.
- The **statewide** lifecycle GRR for PY2023 was 86%, compared to 19% for PY2022. The PY2022 value was also lower than previous years and was largely influenced by two projects. The PY2020/2021 evaluated GRR of 89% included a large savings project that accounted for over 90% of all gas savings.

Figure 4-4. Statewide gas energy lifecycle GRR results by program year and PA

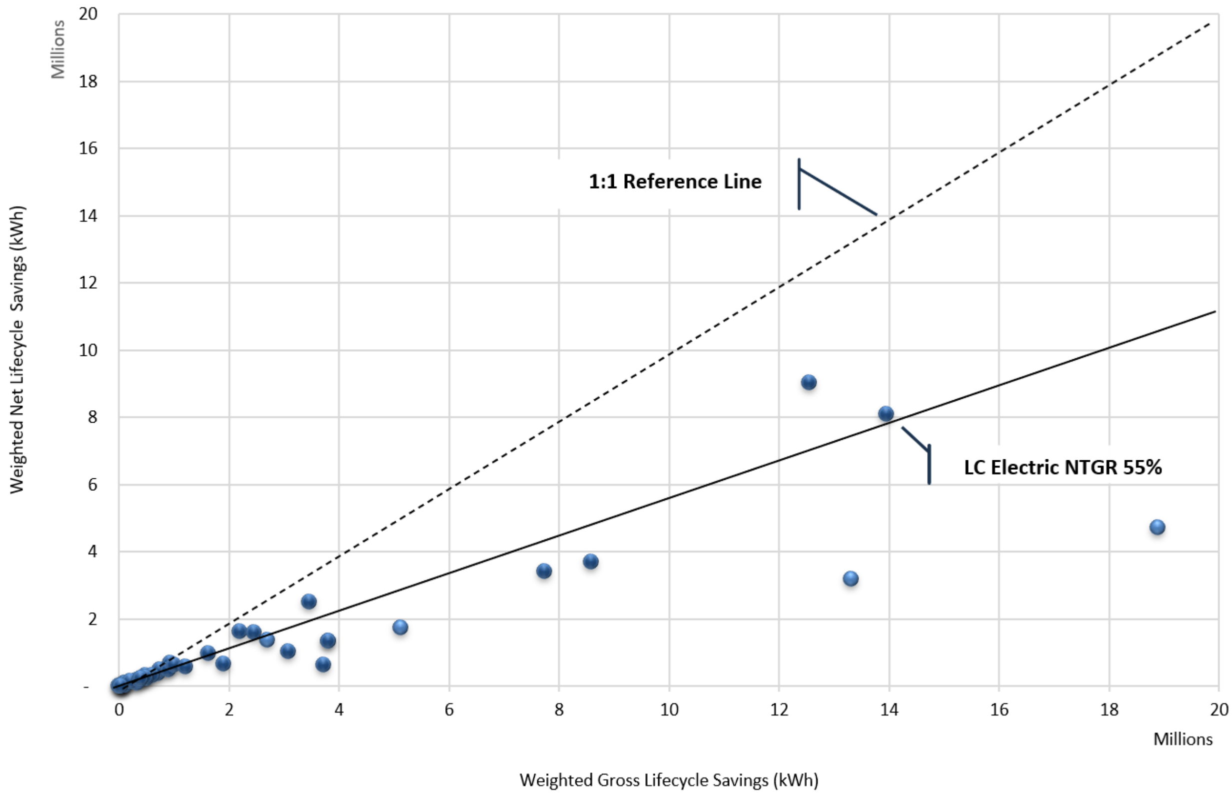


4.3 Net savings results and ratios

4.3.1 Net electric savings results and ratios

This section provides net electric savings and net-to-gross ratios. Figure 4-5 compares the weighted gross and net lifecycle electric energy savings for all sites in the final sample. Similar to the gross results above, the diagonal dashed line indicates where each NTG result would have been plotted had they all had a ratio of 1 (i.e., all savings attributable to the program). The final lifecycle net to gross estimate is 55%, reflecting the impact of the spread of results below the reference line.

Figure 4-5. Weighted lifecycle electric net energy savings scatterplot (all sites)



4.3.1.1 Net results by subject area

Table 4-10 shows net electric energy and demand savings results broken out by program. This PY2023 report is the first CIAC impact evaluation to show separate NTG results for OBF. The overall statewide first-year electric energy NTGR was 59%, with a relative precision of ±3.3%; this includes custom, SBD and OBF programs. The OBF projects had a higher first-year NTGR (67%) than the standard Custom projects (59%). Projects that applied for OBF financing likely had a greater need for financial support than the average Custom project and thus the project decision-makers were willing to give the programs more attribution for such projects. While some Custom projects also valued the program incentives, this was not always the case, as we discuss in subsection 4.3.4. As has been the case in previous CIAC evaluations, the SBD program had the lowest NTGR. However, it is important to note that this program is being phased out.

For the Custom program and overall CIAC, the lifecycle electric energy NTGRs were slightly lower than the first-year NTGRs. These differences are essentially the result of projects with shorter lifetimes (as measured by the EULs of a single measure or a combination of measures) having higher NTGRs than projects with longer lifetimes.

Table 4-10. Net electric energy and demand savings results by program

Program	First-year Net savings	First-year NTGR	First-year Relative precision*	Lifecycle Net savings	Lifecycle NTGR	Lifecycle Relative precision*
Energy (MWh)						
Custom	5,078	58.7%	±4.4%	25,701	56.9%	±4.1%
SBD	320	29.5%	±5.6%	4,927	29.4%	±5.6%
OBF	3,041	67.4%	±4.0%	12,946	68.2%	±3.1%
Statewide	8,463	59.4%	±3.3%	44,712	55.2%	±3.0%
Demand (kW)						
Custom	694	57.0%	±3.3%	2,895	52.7%	±4.2%
SBD	188	35.2%	±2.3%	2,883	35.0%	±2.4%
OBF	233	66.7%	±3.6%	935	67.3%	±2.3%
Statewide	1,159	55.2%	±2.2%	7,111	47.1%	±2.0%

* Relative precision at the 90% confidence interval.
Table note: The domain (program) NTGRs were calculated with a blend of embedded and non-embedded sample. These NTGRs were applied to the evaluated gross savings totals to derive the values in this table. Due to this expansion process, the total of the domain estimates may not equal the overall savings.

Table 4-11 shows NTGR by PA and statewide. Most of the PA electric energy first-year NTGRs fell within a narrow range (51% – 55%) except for SCE (66%) and SDG&E's (27%). However, SDG&E only accounted for a small volume of projects in PY2023. While in PY2022 PG&E accounted for the most net electric savings, in PY2023 SCE became the leader in this area. Since SCE projects had both the highest NTGR (66%) and the greatest volume of net savings, these projects raised the overall CIAC NTGR.

Comparing the PA-specific net savings findings between PY2022 and PY2023 reveals some differences. While in PY2022 PG&E accounted for the vast majority (95%) of the CIAC first-year net electric savings, in PY2023 SCE accounted for the majority (58%) of first-year net electric savings. In PY2022 only three PAs (PG&E, SCE, and SDG&E) had net electric savings. However, as Table 4-11 shows, six PAs had net electric savings in PY2023.

Table 4-11. Net electric energy and demand savings results by PA

PA	First-year			Lifecycle		
	Net savings	NTGR	Relative precision*	Net savings	NTGR	Relative precision*
Energy (MWh)						
MCE	308	54.2%	±11.0%	1,703	53.2%	±11.3%
PG&E	2,474	51.3%	±8.3%	9,820	41.9%	±10.2%
RCEA	44	55.4%	±7.5%	155	52.9%	±11.3%
SCE	4,880	65.6%	±3.8%	25,005	65.6%	±3.3%
SCR	277	54.9%	±0.0%	1,565	53.6%	±0.0%
SDG&E	211	25.8%	±7.4%	3,317	25.9%	±7.4%
Statewide	8,463	59.4%	±3.3%	44,712	55.2%	±3.0%
Demand (kW)						
MCE	22	53.2%	±3.1%	129	52.3%	±5.5%
PG&E	472	55.6%	±4.5%	2,456	48.7%	±5.2%
RCEA	10	60.7%	±5.2%	32	57.3%	±12.4%
SCE	494	63.4%	±2.4%	2,685	62.3%	±1.2%
SCR	60	55.4%	±0.0%	368	54.3%	±0.0%
SDG&E	77	25.1%	±5.3%	1,203	25.2%	±5.3%
Statewide	1,159	54.5%	±2.8%	7,111	47.1%	±2.0%

* Relative precision at the 90% confidence interval.
Table note: The domain (PA) NTGRs were calculated with a blend of embedded and non-embedded sample. These NTGRs were applied to the evaluated gross savings totals to derive the values in this table. Due to this expansion process, the total of the domain estimates may not equal the overall savings.

4.3.1.2 Net results by measure type

Table 4-12 presents disaggregated net savings results by measure type. The PY2023 first-year electric energy NTGR of the lighting measure types was higher (67%) than the NTGR for non-lighting measure types (55%). This continues a pattern of many years of CIAC evaluations where the lighting projects' NTGRs were higher than those of the non-lighting projects. The difference between the lighting and non-lighting measures was greater for the lifecycle NTGRs (66% vs. 49%). Lighting projects are less likely than non-lighting projects to be motivated by non-program drivers such as improving product quality, which can reduce program attribution.

In PY2023, the difference between the lighting and non-lighting first-year electric energy NTGRs (67% vs. 55%) was much narrower than it had been in PY2022 (66% vs. 42%). The frequency of lighting projects in the CIAC portfolio has been notably decreasing over time. In PY2022 lighting projects accounted for 73% of CIAC first-year net electric energy savings, while in PY2023 lighting projects only accounted for 24% of the CIAC first-year net electric energy savings.

Table 4-12. Statewide net electric energy and demand savings results by measure

Measure	First-year			Lifecycle		
	Net savings	NTGR	Relative precision*	Net savings	NTGR	Relative precision*
Energy (MWh)						
Lighting	2,039	66.9%	±2.8%	12,101	66.3%	±2.7%
Non-lighting	6,192	55.3%	±5.2%	30,798	49.1%	±4.8%
Statewide	8,463	59.4%	±3.3%	44,712	55.2%	±3.0%
Demand (kW)						
Lighting	76	62.9%	±1.1%	572	62.4%	±2.0%
Non-lighting	1,085	54.8%	±2.3%	6,589	46.4%	±2.1%
Statewide	1,159	55.2%	±2.2%	7,111	47.1%	±2.0%

* Relative precision at the 90% confidence interval.
Table note: The domain (measure) NTGRs were calculated with a blend of embedded and non-embedded sample. These NTGRs were applied to the evaluated gross savings totals to derive the values in this table. Due to this expansion process, the total of the domain estimates may not equal the overall savings.

4.3.1.3 Comparison to previous evaluation findings

Table 4-13 compares the statewide PY2023 electric energy lifecycle NTGR results to evaluated results from previous years. The PY2023 statewide NTGR was virtually unchanged from PY2022 (55% vs. 56%). Except for PY2022, the electric energy PY2023 statewide NTGR was the highest it has been since 2015.

The PA-specific NTGR time series shows that SCE nearly tripled its NTGR from PY2021 to PY2023, while MCE's NTGRs have been at similar levels from PY2020 to PY2023. The NTGRs for both PG&E and SDG&E declined over this period, with the SDG&E NTGR having the biggest drop. However, the SDG&E volume of CIAC projects in PY2023 was very small, providing the second-lowest volume of net savings among the six PAs. A small sample of projects can lead to great variability in the NTGRs.

Table 4-13. Statewide electric energy lifecycle NTGR results by program year and PA

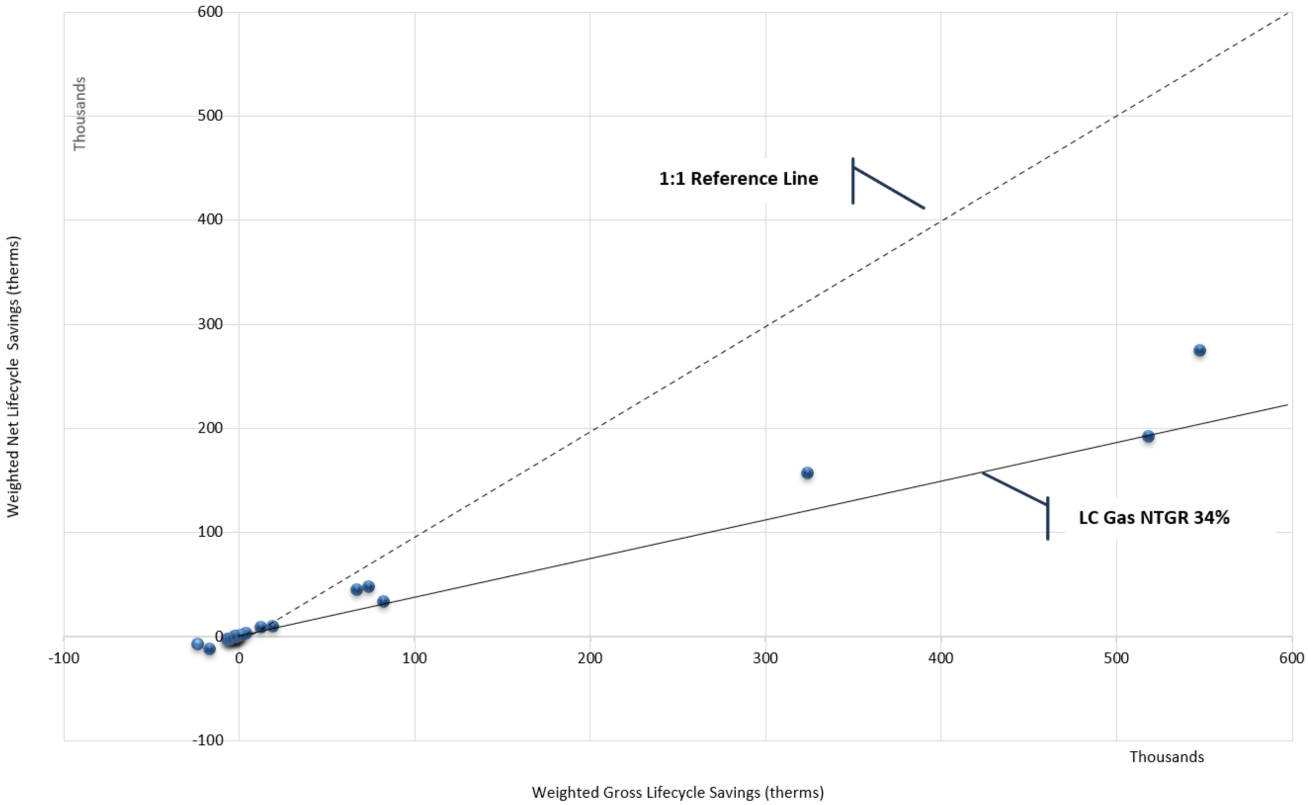
PA[41]	2015	2019	2020	2021	2022	2023
MCE	N/A	40%	51%	N/A	55%	53%
PG&E	53%	46%	38%	41%	56%	42%
SCE	57%	51%	31%	23%	N/A	66%
SDG&E	50%	49%	13%	N/A	50%	26%
Statewide	**54%**	**47%**	**34%**	**39%**	**56%**	**55%**

4.3.2 Net gas savings results

This section provides net electric savings and net-to-gross ratios. Figure 4-5 compares the weighted gross and net lifecycle gas energy savings for all sites in the final sample. The diagonal dashed line indicates where each NTG result would have been plotted had they all had a ratio of 1 (i.e., all savings attributable to the program). The final lifecycle net to gross estimate is 34%, which includes the impact of negative interactive impacts of lighting projects which dampens the trend line compared to that observed in the electric net to gross scatterplot presented earlier.

41 For values from 2015 through 2019, source: 2019 Custom Industrial, Agricultural, and Commercial (CIAC) Impact Evaluation (Group D–D11.04), SBW Consulting, February 12, 2023, page 58.

Figure 4-6. Weighted lifecycle gas net energy savings scatterplot (all sites)



4.3.2.1 Net results by subject area

Table 4-14 shows net natural gas energy savings results broken out by program. The statewide CIAC NTGRs for natural gas measures were 40% with ±5% relative precision for first-year net savings and 34% with ±6% relative precision for lifecycle net savings. While the table shows widely varying NTGRs (24% – 63%) for the three programs, the Custom program accounts for 97% of the CIAC-wide first-year net gas savings. Therefore the 41% first-year gas NTGR for the Custom program is the primary driver for the statewide 40% first-year NTGR. The negative net gas savings for the OBF program is due to interactive effects where the loss of heat from lighting retrofits must be made up by additional operation of natural gas heating equipment.

The PY2023 gas NTGRs were primarily driven by three larger projects which had NTGRs in the 20% – 37% range. A closer examination of their responses to the NTG questions revealed that decision-makers for all three projects said that their companies had decided to install the energy efficient measures before becoming aware of the program incentive and on-bill financing. In addition, two of these three projects did not value the availability of the program incentives very highly. When asked about the relative importance of the program incentives on the project decision-making using a 0-10 importance scale, one project only gave an importance rating of three and the other project gave an importance rating of five. Finally, these project decision-makers cited several important non-program project drivers including the desire to improve product quality and previous experience with the energy efficient measures.

Table 4-14. Net natural gas energy savings results by program

Program/finance type	First-year			Lifecycle		
	Net savings (thousand therms)	NTGR	Relative precision*	Net savings (thousand therms)	NTGR	Relative precision*
Custom	195.8	41.3%	±5.0%	1,047.7	36.8%	±6.4%
SBD	11.4	23.9%	±0.6%	170.7	23.9%	±0.6%
OBF	−2.4	63.0%	±8.1%	−7.6	64.5%	±7.3%
Statewide	205.6	39.7%	±4.9%	1,221.4	34.4%	±5.8%

*Relative precision at the 90% confidence interval.
Table note: The domain (program) NTGRs were calculated with a blend of embedded and non-embedded sample. These NTGRs were applied to the evaluated gross savings totals to derive the values in this table. Due to this expansion process, the total of the domain estimates may not equal the overall savings.

4.3.2.2 Net results by PA

Table 4-15 presents the net natural gas energy savings NTGR results broken down by PA. While the table shows a wide range of first-year natural gas NTGRs (24% – 63%) across the PAs, two of the PAs account for nearly 90% of the total CIAC first year net savings (PG&E at 62% and SDGE at 27%). Therefore, the overall CIAC first-year gas NTGR is primarily determined by projects from PG&E and SDG&E. As noted, the negative gas savings are due to interactive effects resulting from lighting projects.

Table 4-15. Net natural gas energy savings results by PA

PA	First-year			Lifecycle		
	Net savings (thousand therms)	NTGR	Relative precision*	Net savings (thousand therms)	NTGR	Relative precision*
MCE	−1.5	58.0%	±9.1%	−8.2	56.6%	±10.0%
PG&E	126.4	43.9%	±3.6%	578.0	44.0%	±5.2%
RCEA	−0.3	43.8%	±9.6%	−0.9	40.8%	±21.4%
SCE[42]	N/A	63.0%	±8.1%	N/A	64.5%	±7.3%
SCR	0.0	48.0%	±0.0%	−0.2	48.0%	±0.0%
SCG	9.2	23.9%	±0.6%	136.6	23.9%	±0.6%
SDG&E	55.0	27.8%	±36.4%	394.7	23.3%	±22.6%
Statewide	205.6	39.7%	±4.9%	1,221.4	34.4%	±5.8%

*Relative precision at the 90% confidence interval.
Table note: The domain (PA) NTGRs were calculated with a blend of embedded and non-embedded sample. These NTGRs were applied to the evaluated gross savings totals to derive the values in this table. Due to this expansion process, the total of the domain estimates may not equal the overall savings.

4.3.2.3 Comparison to previous evaluation findings

Table 4-16 compares the PY2023 estimates of gas lifecycle NTGRs by PA and statewide with gas lifecycle NTGRs from the PY2015, PY2019, PY2020-2021, and PY2022 evaluations. While the PY2023 gas lifecycle NTGR was much lower than the PY2022 gas lifecycle NTGR, the PY2022 NTGR was determined primarily by one PA (SCG), which accounted for the vast majority of gas savings in that year. The PY2023 gas lifecycle NTGR of 0.34 was more than twice that of the PY2020 – 2021 NTGR (0.14) and fairly close to the straight average of the PY2015, PY2019, and PY2020-2021 NTGRs (0.42).

As noted, the PY2023 gas NTGRs were primarily driven by three larger projects which had NTGRs in the 20% – 37% range. This has been a pattern in recent years where the samples of gas projects have been smaller than those for electric projects,

[42] As stated in the gross realization rate analysis Table 4-8, DNV recommends that SCE apply the gross gas realization rate to the ex ante savings to calculate the ex post gross savings. The non-Savings by Design site with positive therm savings was evaluated in the net to gross analysis so the net to gross ratio is appropriate to determine final net savings for SCE.

with a small number of projects accounting for the bulk of the CIAC-wide gas savings. In cases such as PY2022 where the large gas projects had higher NTGRs, this drove the CIAC-level NTGRs upward. In PY2020 – 2021 and PY2023 the opposite occurred. The larger volume of electric projects and the variation in project sizes makes it harder for a handful of projects to drive the CIAC-level NTGRs.

Table 4-16. Statewide gas energy lifecycle NTGR results by program year and PA

PA[17]	2015	2019	2020, 2021	2022	2023
PG&E	0.53	0.48	0.14	0.45	0.45
SCG	0.57	0.44	0.19	0.78	0.24
SDG&E	0.50	0.51	0.29	0.60	0.23
Statewide	**0.54**	**0.48**	**0.14**	**0.75**	**0.34**

4.3.3 Hard-to-Reach (HTR) customers

DNV also performed a comparison of the evaluation outcomes for HTR and non-HTR customers for PY2023, as shown in Table 4-17.[43] All of the HTR sites exclusively installed lighting measures, so we used non-HTR lighting sites to perform the assessment. As show below, MCE performed the majority of the evaluated lighting projects, although their NTGRs and evaluated first-year gross savings were lower than the other PAs. This could indicate that the PA worked on smaller lighting projects and more non-program influences affected the decision making to install these measures. Also, RCEA performed the majority of the HTR projects (8) and received the highest NTGR for that demographic (0.62). Across all the PAs, HTR customers had on average a slightly higher NTGR, 0.61 versus 0.57. However, the non-HTR projects had a notably higher average rate of first-year gross savings, which indicates that the HTR projects were likely smaller scale than the non-HTR sites. One HTR customer noted that they were able to install equipment at more than 10 locations because the program incentive helped cover the project costs. Another HTR customer said they were impressed with how streamlined the PA's process was and described it as a turn-key experience. In previous evaluation years, there was not an adequate number of HTR projects in the population or the survey sample to perform this analysis, so we cannot show a year-to-year comparison.

Table 4-17 Average NTGR results and first-year savings for HTR and non-HTR customers

HTR status	Population (N)	PA	Average NTGR	Average evaluated first year gross savings (kWh)
By PA				
HTR	2	MCE	0.42	12,802
	8	RCEA	0.62	8,470
	1	SCR	0.53	20,393
Non-HTR	8	MCE	0.57	29,755
	2	PG&E	0.58	206,189
	5	SCE	0.69	281,300
Statewide				
HTR	15	All	0.61	11,411
Non-HTR	11	All	0.57	153,647

[43] At the time these projects were implemented, the definition for commercial HTR projects was a project in a building that met both a geographic criterion (e.g., businesses in areas other than U.S. OMB Combined statistical areas of the greater Los Angeles, San Francisco, and Sacramento OR a disadvantage community as defined by CALEPA) and at least one of the following: Language (e.g., primary language spoken is other than English), Business Size (e.g., fewer than 10 employees or being classified as Very Small based on energy consumption levels), or Leased/Rented Facility. In May 2023 the CPUC issued a new definition of HTR, but these projects were defined using the old definition.

4.3.3.1 Updated NTG approach comparison

4.3.4 Key factors influencing NTGRs

In this section, we discuss some of the key factors that influenced overall NTGRs of the projects under CIAC. First, we compare the relative importance of the program and non-program project drivers at the program-wide level of analysis. Then we compare the relative importance of the program and non-program project drivers for projects which were in the top quartile of NTGRs vs. those in the bottom NTGR quartile. This “quartile analysis” also looks at trends in differences over six past CIAC evaluations that used a similar NTG methodology.

4.3.4.1 Program-wide comparisons

In this subsection, we compare the relative importance of the program and non-program project drivers at the program-wide level of analysis.

Program project drivers: The evaluation team asked the project decision-makers to rate the relative importance of various program or non-program project drivers using a 0-10 rating scale, where 0 meant “Not at all important” and 10 meant “Extremely important.” Table 4-18 compares the average rating and distribution of ratings for the project drivers that the decision-makers considered most important. The smaller sample sizes for some of the project drivers are primarily due to some project decision-makers saying that a particular project driver was not applicable to their project (e.g., they never used a consulting engineer).

The table shows that they considered the program rebates to be more important than other program drivers such as technical assistance or recommendations from program vendors or PA staff. One recommendation of the PY2022 CIAC evaluation report was for the Custom programs to pursue “better identification of projects for which incentives serve as the ‘tipping point.’” There was evidence of the Custom programs making some progress in this area since the average importance rating for the rebates in PY2023 was 7.7 up from 7.3 in PY2022. Between PY2022 and PY2023, there was also an increase in the importance ratings for other program factors including technical assistance (increasing from 6.5 to 6.7), recommendations from program vendors (increasing from 4.5 to 5.9), and recommendations from program staff (increasing from 4.1 to 5.5).

Non-program project drivers: Table 4-18 also shows the most important non-program project drivers. The most important of these, and the most important of all the project drivers, whether program or non-program, was the desire to improve product quality with an 8.6 average importance rating. Other important non-program drivers included previous experience with the energy-efficient measures and a recommendation from a consulting engineer.

Table 4-18. Ratings for the importance of factors on measures

Program factor	Sample size[44]	Average rating[1]	Percentage of respondents		
			Low (0 to 3)	Medium (4 to 7)	High (8 to 10)
Program factors					
Program “rebate”	57	7.7	5%	33%	61%
Program-provided technical assistance or feasibility studies	46	6.7	15%	37%	48%
Recommendation from program vendor	42	5.9	24%	33%	43%
Recommendations from PA staff	42	5.5	26%	38%	36%
Top non-program factors					
Improved product quality	52	8.6	0%	13%	87%
Previous experience with this type of measure	49	6.8	14%	29%	57%
Recommendation from auditor/consulting engineer	34	5.7	32%	18%	50%

Table note: On the 11-point scale, 0 was “Not at all important(?)” and 10 was “Highly important(?).”

4.3.4.2 NTG quartile comparisons

In this subsection we compare the relative importance of the program and non-program project drivers for projects which were in the top quartile of NTGRs vs. those in the bottom NTGR quartile.

Program project drivers:

Table 4-19 compares projects with NTGRs in the top quartile to projects with NTGRs in the bottom quartile as to how frequently they rated various program-related project drivers as highly important (ratings of 8-10 on a 0-10 importance scale). PY2023 project decision-makers in the top NTGR quartile were nearly four times as likely as those in the bottom NTGR quartile to say that the program rebates were important. This large disparity between the proportion of top quartile decision-makers who deemed the rebates important vs. those in the bottom quartile who did so continues a trend from the PY2020-2021 and PY2022 CIAC evaluations. Further evidence of the importance of rebates and incentives is provided in some selected quotes from decision-makers below:

- “We wouldn't have moved forward without the incentives.”
- “Without the incentive, this project would have been delayed or not completed.”
- “[The incentive] was very helping in moving this project forward, otherwise we would have kept using the previous equipment.”
- “It was the incentive that opened the door to getting an energy evaluation.”

The table also shows that the PY2023 project decision-makers in the top NTGR quartile were more than twice as likely to value technical assistance or feasibility studies as those in the bottom NTGR quartile. Top quartile decision-makers were also more likely (44% of respondents) than their bottom quartile counterparts (33%) to value recommendations from PA staff.

[44] This is the number of respondents who gave a numerical rating. It excludes those who gave responses such as “Don’t know,” those who refused to respond, and cases where the questions were not applicable.

Table 4-19. Percentage highly rating importance of program factors, by evaluation year and NTGR group[1]

NTGR factor	Highest quartile of NTGRs					Lowest quartile of NTGRs				
	2015	2019	2020-21	2022	2023	2015	2019	2020-21	2022	2023
Sample size[2]	52	84	47	17	15	52	82	46	17	14
Program “rebate”	100%	52%	87%	100%	79%	50%	74%	32%	10%	21%
Program-provided technical assistance or feasibility studies	65%	44%	47%	30%	45%	40%	27%	22%	40%	20%
Recommendations from PA staff	16%	13%	25%	33%	44%	41%	0%	26%	8%	33%
Program marketing materials	16%	25%	22%	38%	11%	14%	16%	23%	0%	29%

[1] Percentages represent the share of interviewees rating the factor between 8 and 10 on a 0-10 scale where 0 is “Not at all important(?)” and 10 is “Highly important(?).” Quartiles are established based on the number of projects and the value of the NTGR associated with the project.
[2] Sample sizes vary by row depending mostly on the number of respondents who gave “not applicable” responses (e.g., they never received program technical assistance, **etc.).**

Non-program project drivers: Table 4-20 compares the relative importance of the non-program project drivers between projects that had NTGRs in the highest quartile vs. those that had NTGRs in the lowest quartile. It also shows the percentage of project decision-makers who said that their companies decided to install the energy efficiency measures before becoming aware of the program incentives or on-bill financing.[45]

The table shows that none of the PY2023 top NTGR quartile project decision-makers said that a decision had been made to go ahead with the energy efficient project before becoming aware of the program incentives and financing. In contrast, nearly half (43%) of the project decision-makers in the bottom NTGR quartile said that the decision to install the energy efficient measures had been made before they learned about the incentives and financing.

However, the Custom programs deserve credit for reducing the impact of this source of free ridership. One of the net savings recommendations from the PY2022 CIAC evaluation was to “improve project screening practices to ensure that the decisions to go forward with the project were not already made.” The PY2023 Custom program made significant progress in this area since the 43% of bottom NTGR quartile projects that had decided to install the energy efficient measures before learning of the incentives and financing was less than half the frequency in PY2022 (88%).

The table also shows that for PY2023 projects in the highest NTGR quartile, the top three drivers included the importance of the project achieving an acceptable payback or ROI (85% of respondents), the desire to improve product quality (77%), and previous experience with the energy efficient measure (55%). These were also the top three non-program drivers in the PY2022 and PY2020-2021 CIAC evaluations among top NTGR quartile projects.

However, there were also some differences in the non-program project drivers of top NTGR quartile projects in PY2023 vs. those of earlier years. For example, 50% of the top quartile project decision-makers in the PY2022 CIAC evaluation deemed regulatory compliance important, compared to only 20% of the top quartile decision-makers in the PY2023 CIAC evaluation. In addition, while 50% of the top quartile project decision-makers in PY2022 identified compliance with normal maintenance/replacement policies as an important driver, only 36% of the top quartile project decision-makers in PY2023 cited this as an important driver.

When comparing the responses of the project decision-makers in the top NTGR quartile with decision-makers in the bottom NTGR quartile, there were notable differences in the frequencies with which each group identified factors as important for the following non-program project drivers:

[45] The interview question was: “Now I’d like to ask you about when you learned that your project would be eligible for incentives or on-bill financing through the program. When was the decision to install this MEASURE made in relation to the availability of incentives or on-bill financing?” The response options to this question included “Before,” “After,” “Learned about the project and the incentives as part of complete project proposal,” and “Other scenario.”

Other scenario, please describe:

- *Regulatory compliance:* Project decision-makers in the lowest NTGR quartile were more than twice as likely as decision-makers in the top NTGR quartile to mention regulatory compliance as an important project driver (43% vs. 20%).
- *Importance of age/condition of old equipment:* Project decision-makers in the lowest NTGR quartile were more than twice as likely as decision-makers in the top NTGR quartile to mention this as an important project driver (56% vs. 27%).
- *An acceptable ROI or payback:* Project decision-makers in the top NTGR quartile were more likely (85% of respondents) to cite this as important driver than project decision-makers in the bottom NTGR quartile (57%). This is likely correlated with the higher percentage of top NTGR quartile respondents who valued the rebates vs. their bottom quartile counterparts (see discussion above).

Table 4-20. Percentage highly rating importance of non-program factors, by evaluation year and NTGR group[1]

	Highest quartile of NTGRs					Lowest quartile of NTGRs				
NTGR factor	**2015**	**2019**	**2020-21**	**2022**	**2023**	**2015**	**2019**	**2020-21**	**2022**	**2023**
Sample size[2]	52	84	47	17	15	52	85	46	17	14
Made decisions before discussion with program	4%	12%	2%	12%	0%	88%	36%	32%	88%	43%
Standard practices	26%	0%	28%	13%	38%	56%	0%	57%	50%	36%
Compliance with normal maintenance/ replacement policies	15%	20%	32%	50%	36%	38%	19%	67%	73%	44%
Improved product quality	0%	0%	61%	83%	77%	0%	4%	80%	94%	73%
Regulatory compliance	0%	29%	38%	50%	20%	0%	21%	54%	20%	42%
Importance of age/condition of old equipment	35%	30%	41%	31%	27%	40%	48%	93%	67%	56%
Previous experience with energy efficiency measure	Not asked	24%	53%	54%	55%	Not asked	38%	52%	31%	45%
Recommendation of a designer or consulting engineer	Not asked	21%	38%	33%	50%	Not asked	11%	31%	70%	50%
An acceptable ROI or payback	Not asked	71%	81%	82%	85%	Not asked	85%	56%	19%	57%

[1] Percentages represent the share of interviewees rating the factor between 8 and 10 on 0-10 scale where 0 is "Not at all important(?)" and 10 is "Highly important(?)." Quartiles are established based on the number of projects and the value of the NTGR associated with the project.
[2] Sample sizes vary by row.

4.4 Measure application type discussion

Table 4-21 compares forecasted and evaluated first-year and life cycle savings by the measure application type, including unweighted gross realization rates for kWh and therm savings. As discussed in Sections 4.1 and 4.2, the application of inappropriate baselines resulted in an overall reduction in evaluated savings as compared to forecasted savings. This was particularly evident in AR measures. The PY2023 evaluation found seven instances of Normal Replacement (NR) projects that were overturned to Accelerated Replacement (AR) and one instance of an AR project overturned to NR resulting in a reduction of 32% of first-year electric savings and 3% of first-year gas savings. The PY2022 evaluation found a subset of 20 occurrences of inappropriate baseline applications (due to incorrect MAT designation), resulting in a reduction of 68% of first-year electric savings and 55% of first-year gas savings. This reduction in overall changes to MATs indicates that the PAs are working closely with customers to ensure they are applying appropriate baselines and MATs. The PAs also appear to have improved their ability to capture the preponderance of evidence (POE)[46] required for an AR designation.

[46] POE is the standard required to demonstrate that the replacement of inefficient equipment or processes with more energy efficient alternatives more likely than not resulted from an EE program offering and likely would not have happened otherwise.

Table 4-21. MAT comparison for first year and lifecycle savings (unweighted)

MAT	Electric			Natural gas		
	Forecasted kWh	Evaluated kWh	GRR (%)	Forecasted therm	Evaluated therm	GRR (%)
First-year savings						
AOE (Add-on Equipment)	829,579	400,514	48%	298,451	250,030	84%
AR (Accelerated Replacement)	3,783,368	4,182,222	111%	(3,560)	(5,330)	150%
BRO-Op	1,638,473	78,867	5%	59,700	91,140	153%
BRO-RCx	3,882,318	1,985,283	51%	103,883	118,456	114%
BW (Building Weatherization)	-	-	NA	-	-	N/A
NC (New Construction)	1,220,840	811,889	67%	64,790	49,510	76%
NR (Normal Replacement)	1,206,806	1,049,810	87%	(1,615)	(22)	1%
Overall	12,561,384	8,508,585	68%	521,648	503,784	97%
Lifecycle savings						
AOE (Add-on Equipment)	4,324,842	2,495,227	58%	2,522,587	2,053,794	81%
AR (Accelerated Replacement)	19,917,320	20,417,421	103%	(18,011)	(21,286)	118%
BRO-Op	4,915,418	236,602	5%	179,100	-	0%
BRO-RCx	13,741,105	7,690,122	56%	368,263	581,686	158%
BW (Building Weatherization)	-	-	NA	-	-	N/A
NC (New Construction)	17,583,907	15,129,254	86%	920,450	745,625	81%
NR (Normal Replacement)	11,767,749	8,934,553	76%	(19,579)	(270)	1%
Overall	72,250,342	54,903,179	76%	3,952,809	3,359,550	85%

[1] The evaluated therm is a large negative number compared to the forecasted therm and therefore, the RR represents increased therm consumption and not savings.
U.D. = undefined because the forecasted savings were zero.

4.5 Effective useful life and remaining useful life discussion

Table 4-22 provides a comparison of EUL and RUL by PA for the evaluated measures. The differences in EUL and RUL can largely be attributed to the differences in MAT, as noted in Section 3.2.2.1. This difference in EUL and RUL is a key factor in the lower evaluated lifecycle savings compared to the forecasted lifecycle savings, resulting in a lifecycle gross realization rate of less than the first-year gross realization rate. Lifecycle savings are the savings associated with the lifetime of an efficiency measure undertaken by a program participant. Equipment replaced early in its useful life (e.g., Accelerated Replacement) might receive reduced savings for a portion of its lifetime. For example, if a project had a forecasted EUL of 12 years and an evaluated EUL of 8 years. This adjustment to the EUL would result in lower lifecycle savings when comparing forecasted to evaluated kWh savings. It should be noted that the PY2023 evaluation found fewer instances of overturned MAT when compared to previous evaluations, as discussed in Section 4.4 and indicative of an improved alignment with first-year and lifecycle savings.

Table 4-22. EUL and RUL comparison by PA (weighted average)

PA	Measure 1				Measure 2			
	Forecasted		Evaluated		Forecasted		Evaluated	
	EUL	RUL	EUL	RUL	EUL	RUL	EUL	RUL
SCE	8.7	5.0	8.7	5.0	12.0	5.0	12.0	5.0
MCE	12.2	N/A	11.7	6.7	12.0	N/A	12.0	0.0
PGE	8.5	4.5	8.5	4.5	5.7	4.5	5.7	0.8
RCEA	12.0	5.0	12.0	5.0	12.0	4.7	12.0	4.7
SDGE	8.2	N/A	8.2	N/A	9.6	N/A	9.6	0.0
SCG	8.5	N/A	8.5	N/A	N/A	N/A	N/A	N/A
SCR	8.4	4.0	8.4	4.0	N/A	N/A	N/A	N/A
Average	9.7	2.0	9.6	2.0	9.9	2.7	9.9	2.7

4.6 HOPPs projects discussion

Table 4-23 summarizes the electric and gas results for all HOPPs projects included in the sample. The evaluation found that five of eight HOPPs projects forecasted negative first-year electric savings, and three of eight projects forecasted negative first-year gas savings. These values are more appropriately called savings adjustments since they reflect upward or downward revisions to an initial savings claim. Because some of these projects had positive evaluated first-year savings, the adjustments and calculated realization rates were negative. This negative realization rate did not reflect overall statewide gas or electric performance; therefore, DNV removed the HOPPs projects from the overall statewide results. HOPPs projects are no longer being implemented through the CIAC program and are not being offered through NMEC.

Table 4-23. HOPPs summary results

Subject area	First-year				Lifecycle			
	Forecasted savings	Evaluated savings	GRR	Relative precision*	Forecasted savings	Evaluated savings	GRR	Relative precision*
Energy (MWh)								
HOPPs	(877)	(157)	17.9%	±288.2%	(35)	(148)	428.0%	±268.3%
Statewide	**18,894**	**14,242**	**75.4%**	**±9.6%**	**107,930**	**80,931**	**75.0%**	**±7.4%**
Demand (MW)								
HOPPs	(0.30)	(0.25)	81.7%	±24.2%	(0.4)	(0.0)	8.9%	±98.8%
Statewide	**2.8**	**2.1**	**75.2%**	**±14.5%**	**17.8**	**15.1**	**84.9%**	**±6.5%**
Gas (Thousand Therms)								
HOPPs	(2.83)	15.59	-551.2%	±64.8%	48.13	25.87	53.8%	±36.4%
Statewide	**548.1**	**518.0**	**94.5%**	**±6.7%**	**4,103.9**	**3,547.5**	**86.4%**	**±5.5%**

HOPPs should only be evaluated after Year 3 savings have been claimed, as early-year savings can be highly variable and misleading due to incremental savings adjustments. In the first year, projects may report negative savings due to forecasted operational changes, retrofits, or phased implementations, leading to unreliable realization rates that do not accurately reflect long-term performance. Waiting until Year 3 can allow evaluators to assess the final adjusted savings impacts, ensuring a more accurate and meaningful evaluation of HOPPs project effectiveness.

4.7 Zero-saver project review

Table 4-24 provides an unweighted comparison of GRRs with and without the inclusion of projects for which the evaluation found no or negative savings for both PY2023 and PY2022.

The PY2023 evaluation evaluated six projects (out of 68 sampled) with no savings (i.e., zero-savers). In PY2022, of the 72 projects sampled, 16 were evaluated to have no or negative savings, driven largely by ineligible measures (14 occurrences). In PY2023, of the six projects found to have no savings, four were due to inoperable measures, one due to an inappropriate baseline, and one due to being “other.” The reduction in zero-saver projects may reflect improved measure performance, better installation practices, or enhanced project verification efforts before submission.

These estimates are provided for informational purposes only to illustrate the impact these projects have on the unweighted sample population. Overall, in PY2023, the GRR for electric demand increases from 61% and 80% to 104% and 101% for first-year and lifecycle, respectively. The GRR for electric energy increases from 70% and 75% to 93% and 88% for first-year and lifecycle, respectively. The GRR for natural gas increases from 93% to 94%. First year and lifecycle gas GRRs were not impacted by the removal of zero-savers. PY2022 saw similar trends, as the GRR for electric demand increases from 44% and 42% to 75% and 74% for first-year and lifecycle, respectively. The GRR for electric energy increases from 32% and 34% to 51% and 57% for first-year and lifecycle, respectively. The GRR for natural gas increases from 45% and 17% to 94% and 101%, respectively.

Table 4-24. Impact of zero-savers on overall GRR (unweighted)

	With zero-savers			Without zero-savers		
Savings unit	First-year	Lifecycle	n	First-year	Lifecycle	n
PY2023						
kW	61%	80%	45	104%	101%	41
kWh	70%	75%	55	93%	88%	57
Therm	93%	86%	17	94%	86%	15
PY2022						
kW	44%	42%	71	75%	74%	56
kWh	32%	34%	71	51%	57%	56
Therm	45%	17%	40	94%	101%	35

5 CONCLUSIONS AND RECOMMENDATIONS

This section presents conclusions and recommendations at a statewide level applicable to all PAs. Many of the conclusions and recommendations presented below are similar to those made in prior evaluation studies.

The detailed conclusions and recommendations of this evaluation are organized into the following sections:

- Overall conclusions and recommendations
- Gross impact findings and recommendations by the following research areas:
  - Custom – Non-Lighting
  - Custom - Lighting
- Net impact findings and recommendations

5.1 Overall conclusions and recommendations

DNV developed the conclusions and recommendations presented here from all impact evaluation activities. They represent the most impactful recommendations based on our assessment as evaluator. Overall, the evaluation found that GRRs improved year-over-year, largely attributable to an improvement in the application of MATs, refinements in the application of project baselines, and adherence to CPUC eligibility rules.

Conclusion 1: Operating conditions continue to be the primary driver of changes in gross realization rates. In PY2023, 30 electric projects saw changes in operating conditions, as did 17 gas projects, driving an overall 3% increase of first-year electric GRRs and an 8% decrease of first-year gas GRRs. PY2022 had 22 changed electric projects and six changed gas projects, resulting in a reduction of the overall first-year electric GRR by 7% and a 1% reduction for first-year gas GRRs. Changes to operating conditions include updated trend data or onsite data collection that informs different operating parameters (hours of use, setpoints, efficiency, etc.), which are largely outside the control of PAs or implementers.

Conclusion 2: This study found a more consistent application of MATs than in previous evaluations. The PY2023 evaluation found seven instances of Normal Replacement (NR) projects that needed to be overturned to Accelerated Replacement (AR) and one instance of an AR project overturned to NR. The PY2022 evaluation found a subset of 20 occurrences of inappropriate baseline applications (due to incorrect MAT designation), resulting in a reduction of 22% of first-year electric savings and 15% of first-year gas savings. This reduction in overall changes to MATs indicates that the PAs are working closely with customers to ensure they are applying appropriate baselines and MATs. The PAs also appear to have improved their ability to capture the preponderance of evidence (POE)[47] required for an AR designation.

Recommendation 1: The PAs should continue recent improvements in applying appropriate MATs to each claim, using MAT definitions in the Statewide Custom Project Guidance Document version 1.4 to determine the appropriate MAT. Additionally, PAs should conduct pre- and post- installation reviews, use the California Technical Forum (CalTF) and custom workpapers, and continue to engage with the CPUC and stakeholders to ensure they apply the correct MATs.

Conclusion 3: The incidence of zero-saver projects is decreasing. The PY2023 evaluation has six projects (out of 68) with no savings (i.e., zero-savers). The PY2022 evaluation found 16 of 72 to have no or negative savings, driven largely by ineligible measures (14 occurrences). In PY2023, of the six projects our evaluation found to have no savings, we adjusted four due to inoperable measures, one due to an inappropriate baseline, and one due to being “other.” The reduction in zero-saver projects may reflect improved measure performance, better installation practices, or enhanced project verification efforts.

Recommendation 2: The PAs should continue to adjust programs to adhere to statewide guidance and make other program improvements to reduce zero-savers when possible. If PAs perform pre-inspections during pre-installation verification and ensure proper measure eligibility screening, they can further reduce zero-saver projects. Better installation quality control

[47] POE is the standard required to demonstrate that the replacement of inefficient equipment or processes with more energy efficient alternatives more likely than not resulted from an EE program offering and likely would not have happened otherwise.

(such as ensuring installation is in alignment with the design and equipment specifications) and implementation contractor training can further minimize errors before savings claims are submitted. Furthermore, continued training of third-party implementers in specific CPUC program eligibility criteria can also be expected to reduce zero saver occurrences.

Conclusion 4: MAT application also improved for lighting projects. The PY2023 evaluation found seven lighting projects incorrectly claimed an AR MAT instead of NR, leading to discrepancies in savings. By contrast, the PY2022 evaluation overturned AR baselines to NR for a high fraction of the lighting-only projects sampled (15 of 39) for evaluation. This year's improved alignment between claimed and evaluated MATs suggests that PAs have improved their vetting of AR projects.

Recommendation 3: The PAs should continue completing the AR questionnaire for all AR projects, ensure supporting evidence is documented as defined in Resolution E:5115, and probe participants during the project planning phase to verify that baselines qualify as AR before claiming savings, by, for example, confirming that existing equipment is operational and that the program has influenced the decision to replace the equipment.

Conclusion 5: High-Opportunity Projects or Programs (HOPPs) report incremental savings changes that confound impact evaluations. The evaluation found that five of eight HOPPs projects forecasted negative first-year electric savings, and three of eight projects forecasted negative first-year gas savings. Because some of these projects had positive evaluated first-year savings, the calculated realization rates were negative. This negative realization rate was not reflective of overall statewide gas or electric performance; therefore, DNV removed the HOPPs projects from the overall results.

Recommendation 4: HOPPs should only be evaluated after Year 3 savings have been claimed, as early-year savings can be highly variable and misleading due to incremental savings adjustments. In the first year, projects may report negative savings due to forecasted operational changes, retrofits, or phased implementations, leading to unreliable realization rates that do not accurately reflect long-term performance. Waiting until Year 3 can allow evaluators to assess the final adjusted savings impacts, ensuring a more accurate and meaningful evaluation of HOPPs project effectiveness.

Conclusion 6: The evaluation identified inconsistencies in savings claims and effective useful lives (EULs) for HOPPs projects, which could impact future year claims. Specifically, Year 3 savings claims did not follow PA guidance, as they reported the entire project's savings with a 3-year EUL rather than the incremental difference from the prior year. Also, due to limited access to prior year savings data, DNV could not verify past claims, raising concerns that the final-year savings claim could result in a significantly negative value.

Recommendation 5: PAs should clarify the correct savings claim methodology for HOPPs projects to ensure Year 3 claims only account for incremental changes of initial claims and increase the accuracy of savings reporting. Future discrepancies could be limited if project tracking allowed verification of prior-year claims, aligning evaluations with the intended methodology.

Conclusion 7: Interior lighting savings required adjustments due to MAT classification, HOU/CDF differences, and HVAC effects. Interior lighting projects exhibited larger discrepancies, with major adjustments stemming from incorrect MAT classifications, significant variations in hours of use (HOU) and coincident demand factors (CDF) compared to DEER assumptions, and the omission of HVAC interactive effects in savings calculations.

Recommendation 6: The PAs should work to enhance MAT classification accuracy by thoroughly assessing pre-existing equipment conditions and replacement intent. Additionally, they should work to improve claim accuracy by incorporating more site-specific data on lighting operation and HVAC effects into savings estimates.

5.2 Gross savings conclusions and recommendations

In this section we provide conclusions and recommendations based on three categories: Custom non-lighting, Custom lighting, and SBD.

5.2.1 Non-lighting

The below conclusions and recommendations are specific to non-lighting projects.

Conclusion 8: The PAs are improving their baseline selection, though some incorrect or outdated baseline information was observed. Consistent with the PY2020/2021 and PY2022 evaluations, some projects used baseline information based on old and/or inaccurate information. The PY2023 evaluation found 5 instances for electric projects and 2 instances for gas projects in which baselines required adjustment based on project specific findings. Conversely, the PY2022 evaluation found 14 instances for electric projects and one instance for gas projects with inappropriate baselines. Given similar sample sizes (68 for PY2023, 72 for PY2022), this finding indicates that the PAs are improving their baseline selection.

Recommendation 7: PAs should continue to ensure projects are using appropriate baselines and standard practices (SPs) at the time of project approval. If available SP studies are used, the PAs should ensure the studies are less than five years old at the time of project application and approval. Per Energy Efficiency Industry Standard Practice (ISP) Guidance document version 3.1,[48] market studies should be less than five years old. If an SP is greater than five years old, the PA should reassess the SP for continued applicability or replace with an updated standard practice.

Conclusion 9: Improvement in project extension documentation has resulted in fewer ineligible projects. The PY2022 evaluation found that projects did not always document extensions as required in the customer agreement. DNV found that some projects had been installed past the approved installation date without contract extensions and/or lacked continuing measurement requirements in the customer agreement, resulting 14 electric and 2 gas projects receiving zero savings. The PY2023 evaluation found only 1 instance in which a project was not installed within the permitted timeline and no extensions were filed or provided.

Recommendation 8: PAs should continue to ensure that projects are installed before the approved installation date and savings claimed within the approved installation year. If projects cannot be installed before the approved installation date, provide written extensions on an annual basis before the expiration of the agreement. At this time, the PAs should also ensure that equipment has not been ordered by seeking evidence such as a copy of the dated purchase order or require invoices that show the date of purchase order. PAs should formalize the customer agreement extension process to ensure that all parties follow proper procedures when extensions are granted.

Conclusion 10: The evaluations deemed one project a zero-saver because the site removed the implemented ABAC and IML control systems within three months of installation. The site reverted to the pre-existing DO control system due to operational issues. Specifically, the ABAC system excessively reduced oxygen levels in the wastewater treatment process, resulting in biological die-back in the treatment tanks. This led to reduced treatment efficiency, as evidenced by increased TSS levels and diminished live cell counts observed in the effluent analysis. Consequently, the IML system was also discontinued, as it was reliant on the ABAC controls for functionality.

Recommendation 9: Prior to implementing advanced control systems like ABAC and IML, PAs should ensure adaptive control strategies that maintain critical oxygen levels to sustain biological activity. PAs should engage with site operators during the design and commissioning phases to address operational challenges early. Additionally, establishing post-

48 CPUC. "Custom Projects Review Guidance Documents." https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/custom-projects-review-guidance-documents

installation monitoring protocols to detect adverse impacts promptly would enable swift corrective action before full-scale implementation.

Conclusion 11: For one project, the evaluation team observed higher fan-motor current (amp) draw for both supply and exhaust AHU fans during the post installation period, contrary to expectations (lower current would be expected). Despite a steady decline in building electricity consumption—averaging 15% lower in 2024 compared to 2019, likely due to reduced occupancy and internal load—the evaluation found that AHU fans were consuming more power. This condition is counter-intuitive, as reduced building loads should typically result in lower fan energy use. Further investigation confirmed that the AHUs were not operating with the intended control strategies from the RCx project.

Recommendation 10: PAs should ensure the customer receives proper education on equipment and controls, especially for BRO-RCx based measures. This will maximize savings and reduce the chance of equipment and control sequences being changed drastically or reverted to pre-installation conditions. Additionally, PAs should **e**nsure that all equipment (e.g. AHUs) is operating with the set control strategies as specified in the RCx project scope.

Conclusion 12: PAs sometimes used short-term or limited data to inform annual savings. Consistent with the PY2020/2021 and PY2022 evaluations, there were several instances where PAs used short-term metered data (1 week), or spot measurements from limited parameters to extrapolate savings. This methodology is not necessarily accurate in determining savings as limited data does not inform on potential changes in load over longer durations and seasons.

Recommendation 11: PAs should consider conducting a longer-term pre- and post- installation M&V that represents a typical operation to develop more accurate savings estimates. The PAs should also normalize for production fluctuations (and other variables like weather where applicable) between pre- and post-installation periods. PAs should give consideration to the level of customer incentive and specific project circumstances.

Conclusion 13: One BRO project received zero savings because the pre-existing system configuration could not sustain the required load, as identified during the CPR review. After normalizing pre-existing conditions to reflect current load requirements, the evaluation found that the system would need 1,876 HP to meet the demand, which exceeds the available on-site capacity of 1,795 HP. A site visit with the customer only further supported this finding, as the customer confirmed they did not have enough equipment that would have met load in the baseline. As such, the project did not have any evaluated savings.

Recommendation 12: Projects should include a clear demonstration that the pre-existing system is capable of sustaining the required load without the need for optimization solely to meet service levels. Projects which implement optimization primarily to restore or maintain basic operational capacity—rather than to enhance energy efficiency—should be categorized appropriately and not submitted as BRO projects. Furthermore, a load requirement analysis and capacity verifications should ensure eligibility compliance if conducted early in the project development phase.

Conclusion 14: For one project, a site visit confirmed that the building was vacant, with occupants already relocated to other buildings on the same campus. As a result, the project site was not operational, and the HVAC system was running without any control strategies in place. Further evaluation of the 24x7 fan speed profiles revealed no evidence of fan speed setbacks, contrary to claims in the PA's post-project report. The supply fans were not utilizing setbacks during unoccupied periods, which was a key component of the proposed energy-saving measures. Due to these findings, the evaluation did not approve savings for the claimed measures.

Additionally, the monthly electricity consumption analysis from January 2019 through September 2024 showed a steady decline in building usage, with 2024's average monthly consumption at about 74% of 2019 levels. This reflects reduced occupancy and internal loads. However, the AHU fans were drawing higher current, which is counter-intuitive under these conditions. This confirmed that the AHUs were not operating with the intended control strategies outlined in the RCx project.

Recommendation 13: PAs should ensure that sites are properly implementing and actively maintaining operational control strategies, including fan speed setbacks, even in buildings with reduced occupancy. Projects may also implement real-time monitoring and automated control systems to maintain energy efficiency regardless of building usage levels to ensure savings are achieved. Additionally, before claiming savings, conduct a verification process to confirm that energy-saving measures are fully functional and delivering the expected results. For future RCx projects, ensure comprehensive commissioning and ongoing performance validation to prevent similar discrepancies.

Conclusion 15: For two Savings by Design projects, the evaluation identified discrepancies between the claimed savings models and the tracking savings data. The evaluator used IESVE version 2024, while the original project model was built in IES v2019, which may have contributed to inconsistencies. Despite reviewing various iterations of the IESVE models provided in the utility documentation, the evaluator was unable to reconcile forecasted savings estimates with the tracking savings within an acceptable range. The evaluator ultimately selected for evaluation the latest model provided by the PA because it showed savings results closer in kW and therms, although there was still a substantial difference in kWh savings.

Recommendation 14: Ensure that future projects use consistent software versions between initial modeling and evaluation phases to minimize discrepancies. Additionally, implement a rigorous model validation process before project submission, ensuring that forecasted savings are aligned with reasonable expectations based on tracking data.

We also recommended:

- Documenting model assumptions and calibration procedures clearly.
- Providing transparent version control for modeling software and files.
- Conducting peer reviews of energy models to ensure alignment with actual performance data.

When significant discrepancies arise, as in this case, PAs should consider re-modeling or re-calibration to achieve greater accuracy and confidence in savings claims.

5.2.2 Lighting

The below conclusions and recommendations are specific to lighting projects.

Conclusion 16: One PA claimed Measure Application Type MAT=NR but used MAT=AR in the Modified Lighting Calculator and claimed Total Direct savings for interior lighting.

Recommendation 15: Ensure that CEDARS claims, including MAT, match MLC inputs and outputs. Use the Total Direct+Indirect Claimable savings from the MLC, which include HVAC interactive effects.

Conclusion 17: **The number of lighting-only participants whose contact information was no longer current was higher than in past evaluations.** In some cases, the site had been sold prior to Custom project installation, and no one with knowledge of the project was available to answer questions. In other cases, the contact person still worked at the site, but the information provided was not specific to the contact (i.e. phone number and/or email address provided were generic to the site, rather than to the person.) We also found cases where the contact was still employed by the business, and the information was correct, but they never responded to multiple outreach requests, even after we asked for help from the PA.

Recommendation 16: PAs should ensure that the contact information provided as part of the data request is actionable by the evaluator (contact name, phone number, email address all current). Mark any projects with outdated contact information as such. Project contacts should expect to be contacted by evaluators, and the PAs should encourage them to cooperate.

Conclusion 18: DEER HOU and CDF parameters for interior lighting, as referenced in the MLC, were closer to prototypical DEER HOU and CDF than in previous evaluations. Specifically: 18 out of the 26 lighting-only projects installed either some, or all interior lighting. For eight sites the evaluator found HOU and CDF within 25% of DEER values—as compared to three sites out of 15 in PY22. For the other ten, evaluation-adjusted HOU or CDF were either more than 25% different (6 higher and 4 lower) than DEER. Some adjustments—both upward and downward—were in the 30% range. We found that interior lighting at sites that operate very long hours(shopping malls, manufacturing, and warehouses) have actual HOU and CDF much higher than DEER values for these building types.

Recommendation 17: ETRM/MLC teams should expand DEER options to include at least one business type with or 24/7 operation.

5.3 Net savings conclusions and recommendations

Conclusion 19: The Custom programs are making progress in screening for projects that value the incentives, although some work remains.

One recommendation from the PY2022 evaluation report was for the Custom programs to pursue “better identification of projects for which incentives serve as the ‘tipping point.’” The Custom programs evidently made some progress in this area since the average importance rating for the rebates in PY2023 was 7.7 up from 7.3 in PY2022.

However, screening for projects that value incentives could still be improved. For example, the PY2023 gas NTGRs were primarily driven by three large projects which had NTGRs in the 20%-37% range. When asked about the relative importance of the program incentives on the project decision-making using a 0-10 importance scale, one project only gave an importance rating of three and the other project gave an importance rating of five.

More evidence for the need for better screening for projects that value incentives can be found in the analysis we summarize in subsection 4.3.4 that compares the project drivers for the highest NTGR projects to the project drivers for the lowest NTGR projects. Only 23% of the project decision-makers with lower NTGR projects considered the program rebates important (scores of 8-10 on the 0-10 importance scale). In contrast, 79% of the project decision-makers with higher NTGR projects considered the program rebates important.

Similarly, only little more than half (57%) of the project decision-makers with lower NTGR projects said that project Payback or ROI considerations were important. In contrast, 85% of the project decision-makers with higher NTGR projects considered project Payback/ROI considerations important. If a project decision-maker says that payback/ROI considerations are not important, then program incentives are unlikely to be very influential. And since the financial incentives are usually the CIAC programs’ main selling points, if an end user does not value these incentives, or does not think the project’s Payback/ROI are important consideration for the projects moving forward, they are not going to give the programs much credit in the NTG scoring.

Recommendation 18: Program implementers should use screening questions that will gauge how much the projects value incentives. A useful screening question would be the same one from the NTG interview guide where we ask participants how important “payback or return on the project” was as a project driver using a Likert scale. If the project decision-makers give a relatively high importance rating, then that is a promising sign that the program and its incentives will be influential. Conversely, if they give a relatively low importance rating, then this is a warning sign that the program and its incentives are less likely to be influential.

Conclusion 20: The Custom programs are making progress in getting involved earlier in the project decision-making, but there is room for improvement. One of the net savings recommendations from the PY2022 CIAC evaluation was to “improve project screening practices to ensure that the decisions to go forward with the project were not already made.” The

PY2023 Custom program made significant progress in this area. In PY2022 88% of decision-makers for the projects in the lowest NTGR quartile said that they had decided to install the energy efficient measures before learning of the incentives and financing. In PY2023 this percentage dropped to 43%.

However, while this is a significant improvement, the fact remains that nearly half of these low NTGR projects received program incentives for energy efficient measures that their project decision-makers said had already been greenlighted. In addition, as noted, project decision-makers for all three of the large gas projects which had NTGRs in the 20%-37% range said that their companies decided to install the energy efficient measures before becoming aware of the program incentive and on-bill financing.

Recommendation 19: Program implementers should use screening questions that will gauge whether a project has already been "greenlighted." PG&E's RP 2.1 NTG screening tool has a series of "showstopper" screeners which PG&E staff are required to ask the project decision-maker about before approving a large project for CIAC incentives. These screeners include:

- "[Whether] the customer purchased the efficient measure before being contacted by PA staff or program implementers (PI) for this specific project, under the condition that no additional stakeholders on behalf of PA had communicated information that swayed the customer in seeking PA program support or funding."
- "[Whether] the customer already decided on selecting a technology/equipment to install prior to any PA or PI engagement."
- "[Whether] the customer already installed the equipment before PA pre-install approval or no exception was obtained appropriately."

If the project decision-maker responds to any of these screeners in the affirmative, PG&E staff are encouraged to avoid funding these projects. The evaluation team encourages broader use of these types of screeners by all the PAs and program implementers.[49]

[49] It is our understanding that PG&E only uses the RP 2.1 NTG screening tool for projects with greater than $100,000 in incentives and it is unclear whether PG&E uses similar screeners for projects smaller than these.

APPENDIX A. PROJECT INELIGIBILITY CRITERIA

Table A-1 provides the criteria used in the PY2023 evaluation to determine project ineligibility. This table is based directly on the ineligibility criteria established in previous evaluations and may be updated with additional eligibility criteria, based on reviews of program-specific documents.

Table A-1. Project ineligibility criteria

Ineligibility criteria	Evaluation practice	Exceptions/discussion	Source
Tracking data shows measure installation before the program year being evaluated	Remove from the sample frame	Custom projects other than those from the NMEC, HOPPs, or Strategic Energy Management (SEM) programs for which extended measurements are required and carried into multiple program years, will be considered ineligible if the installation did not occur in the program year being evaluated. Custom project installations that occurred in Q4 of the program year immediately preceding the program year being evaluated will remain in the sample frame subject to the evaluation practice described next.	Energy Efficiency Policy Manual;[50] PG&E Resource Savings Rulebook[51]
Measure installed in Q4 of the program year immediately preceding the program year being evaluated did not require measurements to true up savings	Measure ineligible for evaluation	When measurements are required to true up savings claims the M&V requirements must be specified and described in the customer agreement to allow the measure savings to be claimed in a different program year.	Statewide Custom Project Guidance Document Version 1.4[52]
Measure installed prior to project approval	A measure installed prior to project approval is ineligible.	Some programs such as PG&E's Advanced Pumping Efficiency Program (APEP) allow application for incentive after the project is complete and requires submission of pre- and post-test results, savings calculations, and paid invoices. Some DI projects that are identified and implemented rapidly might not have documentation to support sequential approval and installation.	Statewide P&P manual[53]

[50] https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/e/6442465683-eepolicymanualrevised-march-20-2020-b.pdf
[51] https://www.pge.com/assets/pge/docs/about/doing-business-with-pge/PGE-Resource-Savings-Rulebook.pdf
[52] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/custom-projects-review-guidance-documents
[53] https://www.sdge.com/sites/default/files/2021Customized%20PolicyProcedureManualVERSION1.pdf

Ineligibility criteria	Evaluation practice	Exceptions/discussion	Source
Equipment ordered prior to project approval without the PA authorization	If equipment was ordered prior to project approval, the project is ineligible.	If there is documentation by the PA or implementor dated prior to equipment ordering that allowed equipment ordering prior to project approval, then the project is eligible.	Statewide P&P manual[54]
Installation time limit exceeded	If the measure was not installed within the allowed installation time specified as program requirement and/or customer agreement for installation, the project is ineligible.	If there is documentation by the PA for authorizing installation time extension(s) in a timely manner, then the project is eligible.	Statewide P&P manual[55]
Non-regressive efficiency	If installed equipment has the same or lower efficiency than the existing equipment, the measure is ineligible.	(1) The proposed equipment exceeds standard practice or code, and (2) there is clear evidence that without support, the efficiency level would fall to the standard practice or code minimum.	D. 12-05-015[56]
Fuel substitution test failure	If the project included fuel substitution and required a fuel substitution test (three-prong test prior to August 1, 2019, and two-prong test starting August 1, 2019) and failed required test, then ineligible.	If the test result was not provided, the evaluator will attempt to complete the test to confirm compliance.	Statewide Custom Project Guidance Document Version 1.4[57]
Deemed claims and non-permanent measures	Not eligible as custom savings claims	Deemed savings may be claimed with a custom project for customer convenience provided deemed incentives have been paid. Deemed measures for which custom incentives are paid shall be considered ineligible.	Statewide Custom Project Guidance Document Version 1.4[58]

[54] https://www.sdge.com/sites/default/files/2021Customized%20PolicyProcedureManualVERSION1.pdf
[55] https://www.sdge.com/sites/default/files/2021Customized%20PolicyProcedureManualVERSION1.pdf
[56] https://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/166830.PDF
[57] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/custom-projects-review-guidance-documents
[58] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/custom-projects-review-guidance-documents

Ineligibility criteria	Evaluation practice	Exceptions/discussion	Source
Non-PPP Charge paying customers	If the customer does not pay PPP charges for the sampled fuel, or savings are for fuel not sourced from a California IOU or the project is installed by a departing load customer, the project is ineligible.	No exceptions.	Statewide Custom Project Guidance Document Version 1.4[59]
Lack of Required Permits	If there is no documentation of permit closure, per SB-1414, for measure that require the PA to obtain proof of permit closure, then the claim is ineligible. SB-1414.	No exceptions	SB-1414[60]
Code Year Inconsistent with the Permit Date	If the baseline code year used is inconsistent with the permit date, project savings will be calculated using the applicable code year based on the permit date.	No exceptions	Statewide Custom Project Guidance Document Version 1.4;[61] Statewide P&P manual;[62] E-4818[63]

[59] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/custom-projects-review-guidance-documents
[60] http://www.leginfo.ca.gov/pub/09-10/bill/sen/sb_1401-1450/sb_1414_bill_20100427_amended_sen_v96.html
[61] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/custom-projects-review-guidance-documents
[62] https://www.sdge.com/sites/default/files/2021Customized%20PolicyProcedureManualVERSION1.pdf
[63] https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M179/K264/179264220.PDF

Ineligibility criteria	Evaluation practice	Exceptions/discussion	Source
Rulebook and Program Rule violations	If the installed measures are not allowed per program rules, such as LED products not listed in the statewide Qualified Products List, = or no permanent measure, then the measure is ineligible.	If a deemed measure for which there is a PA program offering, claims deemed savings but uses a custom incentive, the measure is considered ineligible and will receive zero savings. If the entire claim consists of one or more ineligible deemed measures, savings will be set to zero only for the identified ineligible deemed measure, not the entire claim. If a deemed measure for which there is a PA program offering claims custom savings but uses a deemed incentive, the savings will be corrected in evaluations to the appropriate CPUC approved measure package deemed value.	Statewide Custom Project Guidance Document Version 1.4;[64] Statewide P&P manual[65]
SBD whole building project without required measures	SBD whole building project that does not have at least three measures applicable to two of the end uses of lighting, envelop and mechanical systems are ineligible.	No exceptions	SavingsByDesign Participant Handbook[66]
SBD whole building projects without required minimum savings	SBD whole building projects that do not have savings that exceed code baseline by 10% or more are ineligible.	No exceptions	SavingsByDesign Participant Handbook[67]
Participant declines to participate in evaluation	A participant declines two times to participate in the CPUC EM&V studies. Savings will be zeroed out as D.10.04.029 requires participants to fulfil EM&V obligations. Substitute samples will not be drawn.	No exceptions	D.10.04.029

64 https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/custom-projects-review-guidance-documents
65 https://www.sdge.com/sites/default/files/2021Customized%20PolicyProcedureManualVERSION1.pdf
66 https://www.sdge.com/sites/default/files/documents/2020%20SBD%20Handbook_12262019.pdf
67 https://www.sdge.com/sites/default/files/documents/2020%20SBD%20Handbook_12262019.pdf

APPENDIX B. IESR HIGH LEVEL SAVINGS TABLES

Table B-1. Gross lifecycle savings (MWh)

PA	Standard report group	Ex ante gross	Ex post gross	GRR	% Ex ante gross pass through	Eval GRR
MCE	CUSTOM – Lighting	8,061	3,180	0.39	0.0%	0.39
MCE	CUSTOM – Other	38	19	0.50	0.0%	0.50
MCE	**Total**	**8,099**	**3,199**	**0.39**	**0.0%**	**0.39**
PGE	CUSTOM – Lighting	4,146	4,329	1.04	0.0%	1.04
PGE	CUSTOM – Other	29,451	18,387	0.62	0.0%	0.62
PGE	SBD – Other	1,297	743	0.57	0.0%	0.57
PGE	**Total**	**34,894**	**23,459**	**0.67**	**0.0%**	**0.67**
RCEA	CUSTOM – Lighting	666	293	0.44	0.0%	0.44
RCEA	**Total**	**666**	**293**	**0.44**	**0.0%**	**0.44**
SCE	CUSTOM – Lighting	8,427	8,667	1.03	0.0%	1.03
SCE	CUSTOM – Other	11,553	7,391	0.64	0.0%	0.64
SCE	OBF – Lighting	18,611	18,972	1.02	0.0%	1.02
SCE	OBF – Other	0	0			
SCE	SBD – Lighting	0	0			
SCE	SBD – Other	2,907	3,116	1.07	0.0%	1.07
SCE	**Total**	**41,498**	**38,146**	**0.92**	**0.0%**	**0.92**
SCG	CUSTOM – Other	0	0			
SCG	**Total**	**0**	**0**			
SCR	CUSTOM – Lighting	2,233	1,792	0.80	0.0%	0.80
SCR	CUSTOM – Other	1,072	1,125	1.05	0.0%	1.05
SCR	**Total**	**3,304**	**2,917**	**0.88**	**0.0%**	**0.88**
SDGE	SBD – Lighting	5,208	5,427	1.04	0.0%	1.04
SDGE	SBD – Other	7,189	7,490	1.04	0.0%	1.04
SDGE	**Total**	**12,397**	**12,917**	**1.04**	**0.0%**	**1.04**
	Statewide	***100,859***	***80,931***	***0.80***	***0.0%***	***0.80***

Table B-2. Net lifecycle savings (MWh)

PA	Standard report group	Ex ante net	Ex post net	NRR	% Ex ante net pass through	Ex ante NTG	Ex post NTG	Eval ex ante NTG	Eval ex post NTG
MCE	CUSTOM – Lighting	7,142	1,884	0.26	0.0%	0.89	0.59	0.89	0.59
MCE	CUSTOM – Other	24	12	0.50	0.0%	0.65	0.65	0.65	0.65
MCE	**Total**	**7,166**	**1,896**	**0.26**	**0.0%**	**0.88**	**0.59**	**0.88**	**0.59**
PGE	CUSTOM – Lighting	3,904	998	0.26	0.0%	0.94	0.23	0.94	0.23
PGE	CUSTOM – Other	19,309	10,064	0.52	0.0%	0.66	0.55	0.66	0.55
PGE	SBD – Other	1,167	416	0.36	0.0%	0.90	0.56	0.90	0.56
PGE	**Total**	**24,380**	**11,479**	**0.47**	**0.0%**	**0.70**	**0.49**	**0.70**	**0.49**
RCEA	CUSTOM – Lighting	614	51	0.08	0.0%	0.92	0.17	0.92	0.17
RCEA	**Total**	**614**	**51**	**0.08**	**0.0%**	**0.92**	**0.17**	**0.92**	**0.17**
SCE	CUSTOM – Lighting	8,090	1,878	0.23	0.0%	0.96	0.22	0.96	0.22
SCE	CUSTOM – Other	7,578	3,973	0.52	0.0%	0.66	0.54	0.66	0.54
SCE	OBF – Lighting	15,870	3,524	0.22	0.0%	0.85	0.19	0.85	0.19
SCE	OBF – Other	0	0						
SCE	SBD – Lighting	0	0						
SCE	SBD – Other	1,599	1,023	0.64	0.0%	0.55	0.33	0.55	0.33
SCE	**Total**	**33,137**	**10,399**	**0.31**	**0.0%**	**0.80**	**0.27**	**0.80**	**0.27**
SCG	CUSTOM – Other	0	0						
SCG	**Total**	**0**	**0**						
SCR	CUSTOM – Lighting	1,629	887	0.54	0.0%	0.73	0.50	0.73	0.50
SCR	CUSTOM – Other	697	698	1.00	0.0%	0.65	0.62	0.65	0.62
SCR	**Total**	**2,326**	**1,585**	**0.68**	**0.0%**	**0.70**	**0.54**	**0.70**	**0.54**
SDGE	SBD – Lighting	4,152	1,674	0.40	0.0%	0.80	0.31	0.80	0.31
SDGE	SBD – Other	4,980	2,311	0.46	0.0%	0.69	0.31	0.69	0.31
SDGE	**Total**	**9,132**	**3,985**	**0.44**	**0.0%**	**0.74**	**0.31**	**0.74**	**0.31**
	Statewide	***76,756***	***29,394***	***0.38***	***0.0%***	***0.76***	***0.36***	***0.76***	***0.36***

Table B-3. Gross lifecycle savings (MW)

PA	Standard report group	Ex ante gross	Ex post gross	GRR	% Ex ante gross pass through	Eval GRR
MCE	CUSTOM – Lighting	0.1	0.2	4.48	0.0%	4.48
MCE	CUSTOM – Other	0.0	0.0	7.44	0.0%	7.44
MCE	**Total**	**0.1**	**0.2**	**4.52**	**0.0%**	**4.52**
PGE	CUSTOM – Lighting	0.0	0.2	5.44	0.0%	5.44
PGE	CUSTOM – Other	1.5	2.2	1.51	0.0%	1.51
PGE	SBD – Other	0.1	2.7	18.62	0.0%	18.62
PGE	**Total**	**1.6**	**5.0**	**3.09**	**0.0%**	**3.09**
RCEA	CUSTOM – Lighting	0.0	0.0	2.19	0.0%	2.19
RCEA	**Total**	**0.0**	**0.0**	**2.19**	**0.0%**	**2.19**
SCE	CUSTOM – Lighting	0.0	0.0			
SCE	CUSTOM – Other	0.2	2.1	8.57	0.0%	8.57
SCE	OBF – Lighting	0.3	1.3	4.97	0.0%	4.97
SCE	OBF – Other	0.0	0.0			
SCE	SBD – Lighting	0.0	0.0			
SCE	SBD – Other	0.0	0.8	17.72	0.0%	17.72
SCE	**Total**	**0.6**	**4.3**	**7.57**	**0.0%**	**7.57**
SCG	CUSTOM – Other	0.0	0.0			
SCG	**Total**	**0.0**	**0.0**			
SCR	CUSTOM – Lighting	0.0	0.4	12.74	0.0%	12.74
SCR	CUSTOM – Other	0.1	0.2	3.49	0.0%	3.49
SCR	**Total**	**0.1**	**0.7**	**6.68**	**0.0%**	**6.68**
SDGE	SBD – Lighting	0.2	2.4	14.99	0.0%	14.99
SDGE	SBD – Other	0.2	2.4	15.61	0.0%	15.61
SDGE	**Total**	**0.3**	**4.8**	**15.30**	**0.0%**	**15.30**
	Statewide	***2.7***	***15.0***	***5.61***	***0.0%***	***5.61***

Table B-4. Net lifecycle savings (MW)

PA	Standard report group	Ex ante net	Ex post net	NRR	% Ex ante net pass through	Ex ante NTG	Ex post NTG	Eval ex ante NTG	Eval ex post NTG
MCE	CUSTOM – Lighting	0.6	0.1	0.25	0.0%	10.25	0.58	10.25	0.58
MCE	CUSTOM – Other	0.0	0.0	0.50	0.0%	9.75	0.65	9.75	0.65
MCE	**Total**	**0.6**	**0.1**	**0.26**	**0.0%**	**10.25**	**0.58**	**10.25**	**0.58**
PGE	CUSTOM – Lighting	0.1	0.0	0.20	0.0%	5.16	0.19	5.16	0.19
PGE	CUSTOM – Other	3.5	1.3	0.37	0.0%	2.40	0.59	2.40	0.59
PGE	SBD – Other	1.8	1.5	0.82	0.0%	12.77	0.56	12.77	0.56
PGE	**Total**	**5.5**	**2.8**	**0.52**	**0.0%**	**3.37**	**0.56**	**3.37**	**0.56**
RCEA	CUSTOM – Lighting	0.1	0.0	0.08	0.0%	4.86	0.19	4.86	0.19
RCEA	**Total**	**0.1**	**0.0**	**0.08**	**0.0%**	**4.86**	**0.19**	**4.86**	**0.19**
SCE	CUSTOM – Lighting	0.0	0.0						
SCE	CUSTOM – Other	0.9	1.3	1.53	0.0%	3.52	0.63	3.52	0.63
SCE	OBF – Lighting	1.0	0.3	0.28	0.0%	3.61	0.20	3.61	0.20
SCE	OBF – Other	0.0	0.0						
SCE	SBD – Lighting	0.0	0.0						
SCE	SBD – Other	0.4	0.3	0.75	0.0%	8.59	0.36	8.59	0.36
SCE	**Total**	**2.2**	**1.9**	**0.85**	**0.0%**	**3.96**	**0.45**	**3.96**	**0.45**
SCG	CUSTOM – Other	0.0	0.0						
SCG	**Total**	**0.0**	**0.0**						
SCR	CUSTOM – Lighting	0.3	0.2	0.85	0.0%	7.59	0.50	7.59	0.50
SCR	CUSTOM – Other	0.1	0.1	1.11	0.0%	1.95	0.62	1.95	0.62
SCR	**Total**	**0.4**	**0.4**	**0.93**	**0.0%**	**3.90**	**0.54**	**3.90**	**0.54**
SDGE	SBD – Lighting	1.9	0.7	0.38	0.0%	11.82	0.30	11.82	0.30
SDGE	SBD – Other	1.6	0.7	0.46	0.0%	10.34	0.30	10.34	0.30
SDGE	**Total**	**3.5**	**1.4**	**0.42**	**0.0%**	**11.09**	**0.30**	**11.09**	**0.30**
	Statewide	***12.2***	***6.7***	***0.55***	***0.0%***	***4.57***	***0.45***	***4.57***	***0.45***

Table B-5. Gross lifecycle savings (MTherms)

PA	Standard report group	Ex ante gross	Ex post gross	GRR	% Ex ante gross pass through	Eval GRR
MCE	CUSTOM – Lighting	-42	-14	0.33	0.0%	0.33
MCE	CUSTOM – Other	-1	0	0.50	0.0%	0.50
MCE	**Total**	**-43**	**-14**	**0.34**	**0.0%**	**0.34**
PGE	CUSTOM – Lighting	-7	-7	1.13	0.0%	1.13
PGE	CUSTOM – Other	1,179	1,177	1.00	0.0%	1.00
PGE	SBD – Other	333	127	0.38	0.0%	0.38
PGE	**Total**	**1,505**	**1,297**	**0.86**	**0.0%**	**0.86**
RCEA	CUSTOM – Lighting	-9	-2	0.23	0.0%	0.23
RCEA	**Total**	**-9**	**-2**	**0.23**	**0.0%**	**0.23**
SCE	CUSTOM – Lighting	0	0			
SCE	CUSTOM – Other	19	17	0.88	0.0%	0.88
SCE	OBF – Lighting	-12	-12	0.95	0.0%	0.95
SCE	OBF – Other	0	0			
SCE	SBD – Lighting	0	0			
SCE	SBD – Other	3	15	4.81	0.0%	4.81
SCE	**Total**	**10**	**20**	**1.99**	**0.0%**	**1.99**
SCG	CUSTOM – Other	1,789	1,693	0.95	0.0%	0.95
SCG	**Total**	**1,789**	**1,693**	**0.95**	**0.0%**	**0.95**
SCR	CUSTOM – Lighting	0	0	0.81	0.0%	0.81
SCR	CUSTOM – Other	0	0			
SCR	**Total**	**0**	**0**	**0.81**	**0.0%**	**0.81**
SDGE	SBD – Lighting	484	590	1.22	0.0%	1.22
SDGE	SBD – Other	-16	-19	1.22	0.0%	1.22
SDGE	**Total**	**468**	**571**	**1.22**	**0.0%**	**1.22**
	Statewide	***3,721***	***3,565***	***0.96***	***0.0%***	***0.96***

Table B-6. Net lifecycle savings (MTherms)

PA	Standard report group	Ex ante net	Ex post net	NRR	% Ex ante net pass through	Ex ante NTG	Ex post NTG	Eval ex ante NTG	Eval ex post NTG
MCE	CUSTOM – Lighting	-36	-9	0.25	0.0%	0.86	0.63	0.86	0.63
MCE	CUSTOM – Other	-1	0	0.50	0.0%	0.65	0.65	0.65	0.65
MCE	**Total**	**-36**	**-9**	**0.25**	**0.0%**	**0.85**	**0.63**	**0.85**	**0.63**
PGE	CUSTOM – Lighting	-6	-1	0.20	0.0%	0.96	0.17	0.96	0.17
PGE	CUSTOM – Other	762	578	0.76	0.0%	0.65	0.49	0.65	0.49
PGE	SBD – Other	299	37	0.12	0.0%	0.90	0.29	0.90	0.29
PGE	**Total**	**1,055**	**614**	**0.58**	**0.0%**	**0.70**	**0.47**	**0.70**	**0.47**
RCEA	CUSTOM – Lighting	-8	0	0.04	0.0%	0.92	0.15	0.92	0.15
RCEA	**Total**	**-8**	**0**	**0.04**	**0.0%**	**0.92**	**0.15**	**0.92**	**0.15**
SCE	CUSTOM – Lighting	0	0						
SCE	CUSTOM – Other	11	8	0.72	0.0%	0.55	0.45	0.55	0.45
SCE	OBF – Lighting	-9	-2	0.28	0.0%	0.70	0.21	0.70	0.21
SCE	OBF – Other	0	0						
SCE	SBD – Lighting	0	0						
SCE	SBD – Other	2	4	2.53	0.0%	0.55	0.29	0.55	0.29
SCE	**Total**	**4**	**10**	**2.58**	**0.0%**	**0.37**	**0.48**	**0.37**	**0.48**
SCG	CUSTOM – Other	984	555	0.56	0.0%	0.55	0.33	0.55	0.33
SCG	**Total**	**984**	**555**	**0.56**	**0.0%**	**0.55**	**0.33**	**0.55**	**0.33**
SCR	CUSTOM – Lighting	0	0	0.18	0.0%	0.70	0.15	0.70	0.15
SCR	CUSTOM – Other	0	0						
SCR	**Total**	**0**	**0**	**0.18**	**0.0%**	**0.70**	**0.15**	**0.70**	**0.15**
SDGE	SBD – Lighting	447	171	0.38	0.0%	0.92	0.29	0.92	0.29
SDGE	SBD – Other	-14	-6	0.39	0.0%	0.90	0.29	0.90	0.29
SDGE	**Total**	**432**	**165**	**0.38**	**0.0%**	**0.92**	**0.29**	**0.92**	**0.29**
	Statewide	***2,430***	***1,334***	***0.55***	***0.0%***	***0.65***	***0.37***	***0.65***	***0.37***

Table B-7. Gross first-year savings (MWh)

PA	Standard report group	Ex ante gross	Ex post gross	GRR	% Ex ante gross pass through	Eval GRR
MCE	CUSTOM – Lighting	672	565	0.84	0.0%	0.84
MCE	CUSTOM – Other	3	3	1.11	0.0%	1.11
MCE	**Total**	**674**	**567**	**0.84**	**0.0%**	**0.84**
PGE	CUSTOM – Lighting	682	716	1.05	0.0%	1.05
PGE	CUSTOM – Other	7,065	4,058	0.57	0.0%	0.57
PGE	SBD – Other	102	52	0.51	0.0%	0.51
PGE	**Total**	**7,850**	**4,827**	**0.61**	**0.0%**	**0.61**
RCEA	CUSTOM – Lighting	137	79	0.57	0.0%	0.57
RCEA	**Total**	**137**	**79**	**0.57**	**0.0%**	**0.57**
SCE	CUSTOM – Lighting	1,514	1,557	1.03	0.0%	1.03
SCE	CUSTOM – Other	2,375	1,161	0.49	0.0%	0.49
SCE	OBF – Lighting	3,673	4,512	1.23	0.0%	1.23
SCE	OBF – Other	0	0			
SCE	SBD – Lighting	0	0			
SCE	SBD – Other	191	213	1.12	0.0%	1.12
SCE	**Total**	**7,752**	**7,442**	**0.96**	**0.0%**	**0.96**
SCG	CUSTOM – Other	0	0			
SCG	**Total**	**0**	**0**			
SCR	CUSTOM – Lighting	218	130	0.60	0.0%	0.60
SCR	CUSTOM – Other	357	375	1.05	0.0%	1.05
SCR	**Total**	**575**	**505**	**0.88**	**0.0%**	**0.88**
SDGE	SBD – Lighting	361	352	0.97	0.0%	0.97
SDGE	SBD – Other	482	469	0.97	0.0%	0.97
SDGE	**Total**	**843**	**821**	**0.97**	**0.0%**	**0.97**
	Statewide	***17,832***	***14,242***	***0.80***	***0.0%***	***0.80***

Table B-8. Net first-year savings (MWh)

PA	Standard report group	Ex ante net	Ex post net	NRR	% Ex ante net pass through	Ex ante NTG	Ex post NTG	Eval ex ante NTG	Eval ex post NTG
MCE	CUSTOM – Lighting	595	334	0.56	0.0%	0.89	0.59	0.89	0.59
MCE	CUSTOM – Other	2	2	1.11	0.0%	0.65	0.65	0.65	0.65
MCE	**Total**	**597**	**336**	**0.56**	**0.0%**	**0.89**	**0.59**	**0.89**	**0.59**
PGE	CUSTOM – Lighting	646	401	0.62	0.0%	0.95	0.56	0.95	0.56
PGE	CUSTOM – Other	4,636	2,287	0.49	0.0%	0.66	0.56	0.66	0.56
PGE	SBD – Other	92	29	0.32	0.0%	0.90	0.56	0.90	0.56
PGE	**Total**	**5,374**	**2,717**	**0.51**	**0.0%**	**0.68**	**0.56**	**0.68**	**0.56**
RCEA	CUSTOM – Lighting	126	48	0.38	0.0%	0.92	0.60	0.92	0.60
RCEA	**Total**	**126**	**48**	**0.38**	**0.0%**	**0.92**	**0.60**	**0.92**	**0.60**
SCE	CUSTOM – Lighting	1,454	1,199	0.82	0.0%	0.96	0.77	0.96	0.77
SCE	CUSTOM – Other	1,567	624	0.40	0.0%	0.66	0.54	0.66	0.54
SCE	OBF – Lighting	3,114	3,267	1.05	0.0%	0.85	0.72	0.85	0.72
SCE	OBF – Other	0	0						
SCE	SBD – Lighting	0	0						
SCE	SBD – Other	105	70	0.67	0.0%	0.55	0.33	0.55	0.33
SCE	**Total**	**6,239**	**5,160**	**0.83**	**0.0%**	**0.80**	**0.69**	**0.80**	**0.69**
SCG	CUSTOM – Other	0	0						
SCG	**Total**	**0**	**0**						
SCR	CUSTOM – Lighting	158	69	0.44	0.0%	0.73	0.53	0.73	0.53
SCR	CUSTOM – Other	232	233	1.00	0.0%	0.65	0.62	0.65	0.62
SCR	**Total**	**390**	**302**	**0.77**	**0.0%**	**0.68**	**0.60**	**0.68**	**0.60**
SDGE	SBD – Lighting	289	108	0.37	0.0%	0.80	0.31	0.80	0.31
SDGE	SBD – Other	335	145	0.43	0.0%	0.69	0.31	0.69	0.31
SDGE	**Total**	**624**	**253**	**0.41**	**0.0%**	**0.74**	**0.31**	**0.74**	**0.31**
	Statewide	***13,350***	***8,815***	***0.66***	***0.0%***	***0.75***	***0.62***	***0.75***	***0.62***

Table B-9. Gross first-year savings (MW)

PA	Standard report group	Ex ante gross	Ex post gross	GRR	% Ex ante gross pass through	Eval GRR
MCE	CUSTOM – Lighting	0.1	0.0	0.76	0.0%	0.76
MCE	CUSTOM – Other	0.0	0.0	1.11	0.0%	1.11
MCE	**Total**	**0.1**	**0.0**	**0.77**	**0.0%**	**0.77**
PGE	CUSTOM – Lighting	0.0	0.0	1.10	0.0%	1.10
PGE	CUSTOM – Other	1.5	0.6	0.44	0.0%	0.44
PGE	SBD – Other	0.1	0.2	1.22	0.0%	1.22
PGE	**Total**	**1.6**	**0.8**	**0.52**	**0.0%**	**0.52**
RCEA	CUSTOM – Lighting	0.0	0.0	0.70	0.0%	0.70
RCEA	**Total**	**0.0**	**0.0**	**0.70**	**0.0%**	**0.70**
SCE	CUSTOM – Lighting	0.0	0.0			
SCE	CUSTOM – Other	0.2	0.4	1.51	0.0%	1.51
SCE	OBF – Lighting	0.3	0.3	1.30	0.0%	1.30
SCE	OBF – Other	0.0	0.0			
SCE	SBD – Lighting	0.0	0.0			
SCE	SBD – Other	0.0	0.1	1.18	0.0%	1.18
SCE	**Total**	**0.6**	**0.8**	**1.38**	**0.0%**	**1.38**
SCG	CUSTOM – Other	0.0	0.0			
SCG	**Total**	**0.0**	**0.0**			
SCR	CUSTOM – Lighting	0.0	0.0	0.93	0.0%	0.93
SCR	CUSTOM – Other	0.1	0.1	1.16	0.0%	1.16
SCR	**Total**	**0.1**	**0.1**	**1.08**	**0.0%**	**1.08**
SDGE	SBD – Lighting	0.2	0.2	0.98	0.0%	0.98
SDGE	SBD – Other	0.2	0.2	0.98	0.0%	0.98
SDGE	**Total**	**0.3**	**0.3**	**0.98**	**0.0%**	**0.98**
	Statewide	***2.7***	***2.1***	***0.78***	***0.0%***	***0.78***

Table B-10. Net first-year savings (MW)

PA	Standard report group	Ex ante net	Ex post net	NRR	% Ex ante net pass through	Ex ante NTG	Ex post NTG	Eval ex ante NTG	Eval ex post NTG
MCE	CUSTOM – Lighting	0.0	0.0	0.52	0.0%	0.85	0.58	0.85	0.58
MCE	CUSTOM – Other	0.0	0.0	1.11	0.0%	0.65	0.65	0.65	0.65
MCE	**Total**	**0.0**	**0.0**	**0.52**	**0.0%**	**0.85**	**0.58**	**0.85**	**0.58**
PGE	CUSTOM – Lighting	0.0	0.0	0.91	0.0%	0.96	0.79	0.96	0.79
PGE	CUSTOM – Other	1.0	0.4	0.41	0.0%	0.65	0.60	0.65	0.60
PGE	SBD – Other	0.1	0.1	0.76	0.0%	0.90	0.56	0.90	0.56
PGE	**Total**	**1.1**	**0.5**	**0.46**	**0.0%**	**0.68**	**0.60**	**0.68**	**0.60**
RCEA	CUSTOM – Lighting	0.0	0.0	0.50	0.0%	0.92	0.66	0.92	0.66
RCEA	**Total**	**0.0**	**0.0**	**0.50**	**0.0%**	**0.92**	**0.66**	**0.92**	**0.66**
SCE	CUSTOM – Lighting	0.0	0.0						
SCE	CUSTOM – Other	0.2	0.2	1.46	0.0%	0.65	0.63	0.65	0.63
SCE	OBF – Lighting	0.2	0.3	1.29	0.0%	0.72	0.72	0.72	0.72
SCE	OBF – Other	0.0	0.0						
SCE	SBD – Lighting	0.0	0.0						
SCE	SBD – Other	0.0	0.0	0.78	0.0%	0.55	0.36	0.55	0.36
SCE	**Total**	**0.4**	**0.5**	**1.33**	**0.0%**	**0.68**	**0.65**	**0.68**	**0.65**
SCG	CUSTOM – Other	0.0	0.0						
SCG	**Total**	**0.0**	**0.0**						
SCR	CUSTOM – Lighting	0.0	0.0	0.70	0.0%	0.71	0.53	0.71	0.53
SCR	CUSTOM – Other	0.0	0.0	1.11	0.0%	0.65	0.62	0.65	0.62
SCR	**Total**	**0.1**	**0.1**	**0.96**	**0.0%**	**0.67**	**0.59**	**0.67**	**0.59**
SDGE	SBD – Lighting	0.1	0.0	0.36	0.0%	0.83	0.30	0.83	0.30
SDGE	SBD – Other	0.1	0.0	0.42	0.0%	0.70	0.30	0.70	0.30
SDGE	**Total**	**0.2**	**0.1**	**0.39**	**0.0%**	**0.76**	**0.30**	**0.76**	**0.30**
	Statewide	***1.9***	***1.2***	***0.65***	***0.0%***	***0.70***	***0.58***	***0.70***	***0.58***

Table B-11. Gross first-year savings (MTherms)

PA	Standard report group	Ex ante gross	Ex post gross	GRR	% Ex ante gross pass through	Eval GRR
MCE	CUSTOM – Lighting	-3	-2	0.70	0.0%	0.70
MCE	CUSTOM – Other	0	0	1.11	0.0%	1.11
MCE	**Total**	**-4**	**-3**	**0.71**	**0.0%**	**0.71**
PGE	CUSTOM – Lighting	-1	-2	1.10	0.0%	1.10
PGE	CUSTOM – Other	274	281	1.02	0.0%	1.02
PGE	SBD – Other	23	8	0.37	0.0%	0.37
PGE	**Total**	**296**	**288**	**0.97**	**0.0%**	**0.97**
RCEA	CUSTOM – Lighting	-2	-1	0.31	0.0%	0.31
RCEA	**Total**	**-2**	**-1**	**0.31**	**0.0%**	**0.31**
SCE	CUSTOM – Lighting	0	0			
SCE	CUSTOM – Other	6	6	0.97	0.0%	0.97
SCE	OBF – Lighting	-3	-4	1.49	0.0%	1.49
SCE	OBF – Other	0	0			
SCE	SBD – Lighting	0	0			
SCE	SBD – Other	0	1	5.02	0.0%	5.02
SCE	**Total**	**4**	**4**	**0.85**	**0.0%**	**0.85**
SCG	CUSTOM – Other	169	198	1.17	0.0%	1.17
SCG	**Total**	**169**	**198**	**1.17**	**0.0%**	**1.17**
SCR	CUSTOM – Lighting	0	0	0.60	0.0%	0.60
SCR	CUSTOM – Other	0	0			
SCR	**Total**	**0**	**0**	**0.60**	**0.0%**	**0.60**
SDGE	SBD – Lighting	35	40	1.14	0.0%	1.14
SDGE	SBD – Other	-1	-1	1.14	0.0%	1.14
SDGE	**Total**	**34**	**38**	**1.14**	**0.0%**	**1.14**
	Statewide	***497***	***524***	***1.05***	***0.0%***	***1.05***

Table B-12. Net first-year savings (MTherms)

PA	Standard report group	Ex ante net	Ex post net	NRR	% Ex ante net pass through	Ex ante NTG	Ex post NTG	Eval ex ante NTG	Eval ex post NTG
MCE	CUSTOM – Lighting	-3	-2	0.52	0.0%	0.86	0.63	0.86	0.63
MCE	CUSTOM – Other	0	0	1.11	0.0%	0.65	0.65	0.65	0.65
MCE	**Total**	**-3**	**-2**	**0.53**	**0.0%**	**0.85**	**0.63**	**0.85**	**0.63**
PGE	CUSTOM – Lighting	-1	-1	0.90	0.0%	0.96	0.79	0.96	0.79
PGE	CUSTOM – Other	184	138	0.75	0.0%	0.67	0.49	0.67	0.49
PGE	SBD – Other	21	2	0.12	0.0%	0.90	0.29	0.90	0.29
PGE	**Total**	**203**	**139**	**0.68**	**0.0%**	**0.69**	**0.48**	**0.69**	**0.48**
RCEA	CUSTOM – Lighting	-2	0	0.16	0.0%	0.92	0.49	0.92	0.49
RCEA	**Total**	**-2**	**0**	**0.16**	**0.0%**	**0.92**	**0.49**	**0.92**	**0.49**
SCE	CUSTOM – Lighting	0	0						
SCE	CUSTOM – Other	4	3	0.80	0.0%	0.55	0.45	0.55	0.45
SCE	OBF – Lighting	-2	-3	1.45	0.0%	0.70	0.68	0.70	0.68
SCE	OBF – Other	0	0						
SCE	SBD – Lighting	0	0						
SCE	SBD – Other	0	0	2.64	0.0%	0.55	0.29	0.55	0.29
SCE	**Total**	**2**	**1**	**0.30**	**0.0%**	**0.46**	**0.17**	**0.46**	**0.17**
SCG	CUSTOM – Other	93	65	0.70	0.0%	0.55	0.33	0.55	0.33
SCG	**Total**	**93**	**65**	**0.70**	**0.0%**	**0.55**	**0.33**	**0.55**	**0.33**
SCR	CUSTOM – Lighting	0	0	0.46	0.0%	0.70	0.53	0.70	0.53
SCR	CUSTOM – Other	0	0						
SCR	**Total**	**0**	**0**	**0.46**	**0.0%**	**0.70**	**0.53**	**0.70**	**0.53**
SDGE	SBD – Lighting	32	11	0.36	0.0%	0.92	0.29	0.92	0.29
SDGE	SBD – Other	-1	0	0.36	0.0%	0.90	0.29	0.90	0.29
SDGE	**Total**	**31**	**11**	**0.36**	**0.0%**	**0.92**	**0.29**	**0.92**	**0.29**
	Statewide	***325***	***214***	***0.66***	***0.0%***	***0.65***	***0.41***	***0.65***	***0.41***

APPENDIX C. IESR PER UNIT SAVINGS TABLES

Table C-1. Per unit (quantity) gross energy savings (kWh)

PA	Standard report group	Pass through	% ER ex ante	% ER ex post	Average EUL (yr)	Ex post lifecycle	Ex post first-year	Ex post annualized
MCE	CUSTOM – Lighting	0	0.0%	0.0%	12.0	2,278.2	404.5	189.8
MCE	CUSTOM – Other	0	0.0%	0.0%	15.0	18,683.3	2,788.5	1,245.6
PGE	CUSTOM – Lighting	0	93.1%	93.1%	11.7	6.0	1.0	0.5
PGE	CUSTOM – Other	0	4.9%	4.9%	4.7	2.4	0.5	0.6
PGE	SBD – Other	0	0.0%	0.0%	14.0	2.7	0.2	0.2
RCEA	CUSTOM: Lighting	0	100.0%	100.0%	12.2	6,648.0	1,789.5	538.3
SCE	CUSTOM – lighting	0	100.0%	100.0%	12.0	2,166,637.4	389,188.5	180,553.1
SCE	CUSTOM – Other	0	0.0%	0.0%	7.5	150,844.3	23,694.2	31,316.5
SCE	OBF – Lighting	0	99.2%	99.2%	11.9	76,499.3	18,191.5	6,375.1
SCE	OBF – Other	0	0.0%	0.0%	1.0	0.0	0.0	0.0
SCE	SBD – Lighting	0	0.0%	0.0%	7.8	0.0	0.0	0.0
SCE	SBD – Other	0	0.0%	0.0%	15.7	1,038,814.5	71,017.0	68,043.2
SCG	CUSTOM – Other	0	0.0%	0.0%	9.8	0.0	0.0	0.0
SCR	CUSTOM – Lighting	0	22.6%	22.6%	12.0	7.4	0.5	0.6
SCR	CUSTOM – Other	0	0.0%	0.0%	3.0	3.1	1.0	1.0
SDGE	SBD – Lighting	0	0.0%	0.0%	12.9	775,246.0	50,215.6	53,732.9
SDGE	SBD – Other	0	0.0%	0.0%	11.5	576,170.5	36,106.6	38,635.6

Table C-2. Per unit (quantity) gross energy savings (therms)

PA	Standard report group	Pass through	% ER ex ante	% ER ex post	Average EUL (yr)	Ex post lifecycle	Ex post first-year	Ex post annualized
MCE	CUSTOM – Lighting	0	0.0%	0.0%	12.0	-10.0	-1.8	-0.8
MCE	CUSTOM – Other	0	0.0%	0.0%	15.0	-451.2	-67.3	-30.1
PGE	CUSTOM – Lighting	0	93.1%	93.1%	11.7	0.0	0.0	0.0
PGE	CUSTOM – Other	0	4.9%	4.9%	4.7	0.2	0.0	0.0
PGE	SBD – Other	0	0.0%	0.0%	14.0	0.5	0.0	0.0
RCEA	CUSTOM – Lighting	0	100.0%	100.0%	12.2	-48.1	-13.4	-3.9
SCE	CUSTOM – Lighting	0	100.0%	100.0%	12.0	0.0	0.0	0.0
SCE	CUSTOM – Other	0	0.0%	0.0%	7.5	347.3	128.0	115.8
SCE	OBF – Lighting	0	99.2%	99.2%	11.9	-47.5	-15.1	-4.0
SCE	OBF – Other	0	0.0%	0.0%	1.0	0.0	0.0	0.0
SCE	SBD – Lighting	0	0.0%	0.0%	7.8	0.0	0.0	0.0
SCE	SBD – Other	0	0.0%	0.0%	15.7	4,986.2	325.3	311.6
SCG	CUSTOM – Other	0	0.0%	0.0%	9.8	282,196.4	33,009.9	26,727.8
SCR	CUSTOM – Lighting	0	22.6%	22.6%	12.0	0.0	0.0	0.0
SCR	CUSTOM – Other	0	0.0%	0.0%	3.0	0.0	0.0	0.0
SDGE	SBD – Lighting	0	0.0%	0.0%	12.9	84,334.4	5,648.7	6,056.4
SDGE	SBD – Other	0	0.0%	0.0%	11.5	-1,474.7	-97.5	-104.6

Table C-3. Per unit (quantity) net energy savings (kWh)

PA	Standard report group	Pass through	% ER ex ante	% ER ex post	Average EUL (yr)	Ex post lifecycle	Ex post first-year	Ex post annualized
MCE	CUSTOM – Lighting	0	0.0%	0.0%	12.0	1,349.5	239.6	112.5
MCE	CUSTOM – Other	0	0.0%	0.0%	15.0	12,144.1	1,812.6	809.6
PGE	CUSTOM – Lighting	0	93.1%	93.1%	11.7	1.4	0.6	0.1
PGE	CUSTOM – Other	0	4.9%	4.9%	4.7	1.3	0.3	0.3
PGE	SBD – Other	0	0.0%	0.0%	14.0	1.5	0.1	0.1
RCEA	CUSTOM – Lighting	0	100.0%	100.0%	12.2	1,160.5	1,080.2	93.7
SCE	CUSTOM – Lighting	0	100.0%	100.0%	12.0	469,610.2	299,675.1	39,134.2
SCE	CUSTOM – Other	0	0.0%	0.0%	7.5	81,081.3	12,736.0	16,833.1
SCE	OBF – Lighting	0	99.2%	99.2%	11.9	14,211.5	13,173.7	1,184.4
SCE	OBF – Other	0	0.0%	0.0%	1.0	0.0	0.0	0.0
SCE	SBD – Lighting	0	0.0%	0.0%	7.8	0.0	0.0	0.0
SCE	SBD – Other	0	0.0%	0.0%	15.7	340,883.2	23,304.0	22,328.1
SCG	CUSTOM – Other	0	0.0%	0.0%	9.8	0.0	0.0	0.0
SCR	CUSTOM – Lighting	0	22.6%	22.6%	12.0	3.7	0.3	0.3
SCR	CUSTOM – Other	0	0.0%	0.0%	3.0	2.0	0.7	0.7
SDGE	SBD – Lighting	0	0.0%	0.0%	12.9	239,146.1	15,490.4	16,575.4
SDGE	SBD – Other	0	0.0%	0.0%	11.5	177,735.7	11,138.1	11,918.2

Table C-4. Per unit (quantity) net energy savings (therms)

PA	Standard report group	Pass through	% ER ex ante	% ER ex post	Average EUL (yr)	Ex post lifecycle	Ex post first-year	Ex post annualized
MCE	CUSTOM – Lighting	0	0.0%	0.0%	12.0	-6.3	-1.1	-0.5
MCE	CUSTOM – Other	0	0.0%	0.0%	15.0	-293.3	-43.8	-19.6
PGE	CUSTOM – Lighting	0	93.1%	93.1%	11.7	0.0	0.0	0.0
PGE	CUSTOM – Other	0	4.9%	4.9%	4.7	0.1	0.0	0.0
PGE	SBD – Other	0	0.0%	0.0%	14.0	0.1	0.0	0.0
RCEA	CUSTOM – Lighting	0	100.0%	100.0%	12.2	-7.1	-6.6	-0.6
SCE	CUSTOM – Lighting	0	100.0%	100.0%	12.0	0.0	0.0	0.0
SCE	CUSTOM – Other	0	0.0%	0.0%	7.5	157.1	57.9	52.4
SCE	OBF – Lighting	0	99.2%	99.2%	11.9	-9.7	-10.2	-0.8
SCE	OBF – Other	0	0.0%	0.0%	1.0	0.0	0.0	0.0
SCE	SBD – Lighting	0	0.0%	0.0%	7.8	0.0	0.0	0.0
SCE	SBD – Other	0	0.0%	0.0%	15.7	1,442.4	94.1	90.1
SCG	CUSTOM – Other	0	0.0%	0.0%	9.8	92,434.2	10,812.5	8,754.8
SCR	CUSTOM – Lighting	0	22.6%	22.6%	12.0	0.0	0.0	0.0
SCR	CUSTOM – Other	0	0.0%	0.0%	3.0	0.0	0.0	0.0
SDGE	SBD – Lighting	0	0.0%	0.0%	12.9	24,395.5	1,634.0	1,751.9
SDGE	SBD – Other	0	0.0%	0.0%	11.5	-426.6	-28.2	-30.3

APPENDIX D. ELECTRIC PROJECT DISCREPANCIES

Table D-1. Discrepancy details for PY2023 CIAC electric projects

DNV Project ID	Sampling weight	Measure type	First-year (kWh)			Reason for discrepancy
			Forecasted	Evaluated	GRR	
EE_CALC_5899092	2.0	Lighting Retrofit / Exterior Lighting	303,761	303,761	100%	None.
a0E3t00000V4DKK	7.0	Lighting Retrofit/New-Interior-LED-General/Area Lighting	15,322	1,872	12%	**Inappropriate Baseline** - The PA used an MAT of AR for MLC inputs. The evaluation team verified an MAT of NR. MLC inputs changed from AR to NR resulting in lower savings.
a0E3t00000V4Ca3	3.0	Lighting Retrofit/New-Exterior-LED-Pole Mounted	25,830	25,833	100%	None.
a0E3t00000V4CRK	2.5	Lighting Retrofit/New-Exterior-LED-Wall Mounted	99,341	58,638	59%	**Operating Conditions -** The PA used an MLC with AR inputs and claimed the project as NR with EUL=12. The evaluation confirmed the MAT as AR, but HOU/CDF are >25% lower than DEER HOU/CDF.
PRJ - 02093188	2.5	Retro-commissioning - VFD Controls	210,635	125,351	60%	**Operating Conditions** - The evaluation found the post-case fan speed operating above 80%, whereas the applicant used 75% speed in the ex-ante calculations. This resulted in a reduction in energy savings.
PRJ - 02199208	1.0	Retro-commissioning - schedule and controls optimization	861,403	440,451	51%	**Operating Conditions** – The applicant reported post project operating schedule is from 6 am to 6 pm; however, the ex-post trends show a longer operating time from 4 am to 10 pm in the post installation case. This resulted in lower ex post kWh savings.
PRJ - 03749006	2.7	Lighting Retrofit/New-Interior-LED and Pole Mount	1,804	1,804	100%	None.

DNV Project ID	Sampling weight	Measure type	First-year (kWh)			Reason for discrepancy
			Forecasted	Evaluated	GRR	
PRJ - 03714212	1.0	Retro-commissioning - schedule and controls optimization	981,737	818,415	83%	**Inoperable Measure -** Based on one year's worth ex post trends, the evaluation verified that EEM 4, 5, 7, 9, and 11 were fully implemented, EEM 1 and 12 were partially implemented and EEM 2 and 8 were not implemented. This resulted in 83% GRR for electric savings, 108% GRR for peak demand reduction, and 113% GRR for therms savings.
PRJ - 03569424	1.0	Process retrofit new waste water	1,563,351	-	0%	**Inappropriate Baseline -** This project is ineligible as the pre-existing configuration could not sustain required load, as stated during CPR review of this project. After normalizing pre-existing conditions to current load requirements, the required input horsepower (HP) to meet that load is 1,876, which is higher than what is available on-site (1,795 HP). Therefore, this is not a valid BRO project as the optimization was needed to meet the customer level of service.
PRJ - 03040382	2.7	Lighting retrofit new exterior led pole mounted	306,635	306,635	100%	None.
DI-NR-220614-0377	2.0	Lighting Retrofit/New-Interior LED Highbay	18,542	23,314	126%	**Operating Conditions** - The evaluation updated the HOU to 2,855 and the CDF to 0.565 based on as-found conditions; these are >25% higher than DEER HOU=2,150 and CDF=0.304
DI-NR-221123-0739	10.5	Lighting Retrofit/New-Interior LED Highbay	4,059	1,885	46%	**Operating Conditions** - The evaluated HOU/CDF were found to be more than 25% lower than DEER HOU/CDF.
DI-NR-220714-0415	2.0	Lighting Retrofit/New-Interior LED Highbay	9,368	8,276	88%	**Operating Conditions -** The MLC was adjusted with site conditions: HOU=1,235 /CDF=0.119 (HOU a little higher than DEER HOU=1,100, CDF lower than DEER CDF=0.226.

DNV Project ID	Sampling weight	Measure type	First-year (kWh)			Reason for discrepancy
			Forecasted	Evaluated	GRR	
DI-NR-220830-0484	10.5	Lighting Retrofit/New-Interior LED Highbay	6,708	404	6%	**Inappropriate Baseline** - The evaluation team found the lighting on site to be 40 years old and failing to provide the desired level of service; the customer would have replaced with the same LED technology at same time; therefore, the MAT was adjusted from AR to NR.
PRJ - 02036084	1.3	Integrated non-residential whole building (SBD) approach	202,166	214,056	106%	**Operating Conditions** - The evaluation updated the heating setpoints for AC zones from 74 to 70 to reflect site condition, resulting in a slight increase in savings.
PRJ - 03921086	1.4	Retro-commissioning Reset Controls - HVAC schedule	281,117	336,408	120%	**Operating Conditions** - The evaluation updated the HVAC Calculator tool by incorporating post trend data obtained from the BMS. This resulted in a reduction in energy savings (both electric and gas savings).
PRJ - 04028744	1.0	Retro-commissioning Reset Controls - HVAC Set point	358,145	175,657	49%	**Operating Conditions -** The customer provided occupancy rates for the last 12 months, showing a 13% increase in overall occupancy and a decrease in the unrented rate. This led to higher fan and system run times, which reduced the savings.
PRJ - 04243826	2.7	Lighting Retrofit/New-Int LED Highbay	105,743	105,743	100%	None.
a0E3t00000U6FKv	3.0	Lighting Retrofit/New-Exterior-LED-Other	37,611	37,611	100%	None.
a0E3t00000U6FKw	2.5	Lighting Retrofit/New-Exterior-LED-Wall Mounted	47,550	51,992	109%	**Operating Conditions -** The PA used an MAT of AR in the MLC, then claimed first year savings as NR. The evaluation confirmed the MAT as AR. The evaluation adjusted the MLC input with as found site conditions: HOU=2,709 /CDF=0.467, resulting in an increase in savings.

DNV Project ID	Sampling weight	Measure type	First-year (kWh) Forecasted	Evaluated	GRR	Reason for discrepancy
a0E3t00000U6Hpf	3.0	Lighting Retrofit/New-Interior-LED-General/Area Lighting	24,802	23,731	96%	**Operating Conditions -** A site visit found 46 LEDs installed compared to the 48 claimed. The PA claimed an MAT of NR but claimed savings as an MAT of AR. The evaluation confirmed the MAT of AR.
a0E3t00000Uv3Xa	7.0	Lighting Retrofit/New-Interior-LED-General/Area Lighting	1,983	1,963	99%	**Inappropriate Baseline** - The evaluation found that the PA used an MLC with AR inputs, and claimed the project as NR with and EUL equal to 12 years. The evaluation confirmed the MAT as AR.
a0E3t00000Uv3XY	7.0	Lighting Retrofit/New-Interior-LED-General/Area Lighting	2,399	2,493	104%	**Inappropriate Baseline -** The evaluation found that the PA used an MLC with AR inputs, and claimed the project as NR with and EUL equal to 12 years. The evaluation confirmed the MAT as AR.
WISE-18-000030	1.0	Blower replacement	591,035	871,877	148%	**Operating Conditions -** The applicant used 28 days of post data to estimate the installed case average kW. And the evaluator used 6 month of post data to estimate the kW, resulting in an increase in savings.
EE_CALC_5857118	9.0	Retro-commissioning - commercial pump system overhaul	94,745	151,676	160%	**Operating Conditions -** The PA model used a post test conducted on 7/26/23 for the kWh/AF while the evaluator used the average kWh/AF from Jul23-Jun24 in the Well production report which provided a more accurate post case kWh/AF which was 44.37kWh/AF lower than the PA model. The PA model baseline was also slightly lower than the 2019-2020 Production report indicated and the PA model AF production was also lower than the 2019-2020 Production report indicated.

DNV Project ID	Sampling weight	Measure type	First-year (kWh) Forecasted	Evaluated	GRR	Reason for discrepancy
10733346	1.3	Systems-Interior Lighting (LED)	242,601	178,740	74%	**Measure Count -** An adjustment was made to the baseline and proposed lighting power density for Building A: The claimed baseline LPD was 0.91w/ft2 and proposed was 0.666 w/ft2. The evaluated baseline LPD was 1.061 W/ft2 and proposed was 0.763 W/ft2.
PRJ - 01085877	3.3	Integrated non-residential whole building (SBD) approach	58,629	53,501	91%	**Operating Conditions -** The occupancy schedule was adjusted based on BAS verification. VAV zone setpoints (heating, cooling) were adjusted based on VAV zone settings from BAS verifications.
PRJ - 01828610	1.3	Integrated non-residential whole building (SBD) approach	(132,613)	(265,237)	200%	**Tracking Data Discrepancy** - Negative kWh savings most likely indicates electrification. The evaluator was unable to match forecasted savings within acceptable range with the tracking savings. The evaluation used the latest model provided by PA to evaluate. Ex post adjustment includes: setpoint adjustment (avg setpoint from BAS summary applied to all zones) and occupancy schedule update based on site verification
PRJ - 02595322	2.5	Retro-commissioning reset controls setting HVAC setpoint change	427,038	478,815	112%	**Calculation Method** - The post-implementation utility consumption data was updated with recent data, spanning November 2023 through October 2024. The claimed savings calculation used a partial year, February 2023 through June 2023. The baseline energy consumption remained the same.
PRJ - 03263294	2.5	Process Retrofit New Fan VFD	60,990	60,990	100%	None.
PRJ - 03099468	1.3	Process Retrofit New Fan VFD	122,019	122,019	100%	None.

DNV Project ID	Sampling weight	Measure type	First-year (kWh) Forecasted	First-year (kWh) Evaluated	First-year (kWh) GRR	Reason for discrepancy
PRJ - 03856676	1.3	Process Retrofit New Waste Water Controls	444,240	-	0%	**Inoperable Measure -** The project has been deemed a zero saver as the impacted system was reverted to pre-existing conditions within 3 months of implementation. Per discussion with the site-contact, the ABAC and IML controls were removed shortly after they were installed and DO control was put back into operation (pre-existing control) as the site could not operate their system with the installed controls. The installed ABAC system cut down oxygen in the wastewater system so much that the biology in the tank would die back, preventing the wastewater process from treating the sewage. The site observed the TSS (Total Suspended Solids) levels and analyzed effluent under a microscope to find significantly reduced live cells. The site contact indicated that the IML system is no longer in operation after reverting the ABAC controls to pre-existing DO operation.
PRJ - 02725732	1.4	Retro-commissioning reset controls setting HVAC setpoint change	9,422	5,097	54%	**Operating Conditions -** The discrepancies in average duct static pressure values for AHU-3 and AHU-4, along with the supply fan speed of AHU-4, reduced energy savings. For AHU-3, the applicant's analysis showed a minimum average duct static pressure of 0.6 in-WC, compared to 0.9 in-WC in the evaluated trend data. For AHU-4, the evaluated trend data indicated minimum and maximum average duct static pressures of 1.1 and 1.5 in-WC, while the applicant's analysis reported 1 and 1.3 in-WC, respectively.

DNV Project ID	Sampling weight	Measure type	First-year (kWh) Forecasted	Evaluated	GRR	Reason for discrepancy
PRJ - 04180484	1.0	Retro-commissioning recode controls HVAC set point change	839,200	-	0%	**Inoperable Measure -** The site visit found the building site was vacant and the customer has already moved the building occupants to the other buildings owned by the customer on the same campus. Thus, the project site was not operational, and the building HVAC system was operating without any set controls. Since the evaluation found that the 24x7 fan speed profiles do not show any fan speed setback as claimed in the PA's post-project report and that the supply fans were not using setbacks during unoccupied periods. As a result, the evaluation did not approve savings for the claimed measures.
PRJ - 03896068	1.4	Retro-commissioning recode controls HVAC schedule change	108,327	-	0%	**Inoperable Measure -** Since the evaluation data analysis found higher fan-motor current (amp) draw for both supply and exhaust fans during the post installation period, the evaluation did not approve savings for the claimed measures. Even though the post installation period monthly electricity usage is about 85% that of monthly electricity usage in 2019 because of reduced occupancy and the facility operations moved to other buildings, the building HVAC usage has increased during the post period compared to its baseline usage.
EE_CALC_5857031	9.0	Retro-commissioning commercial pump system overhaul	261,450	-	0%	**Other -** The installation was completed in September 2023, which exceeds the allowed timeline from the approval date (November 2019). Without any documented extension, this project is deemed ineligible and classified as a Zero Saver
EE_CALC_5894685	2.0	Lighting Retrofit/Exterior Port Lighting	1,132,952	1,132,952	100%	None.

DNV Project ID	Sampling weight	Measure type	First-year (kWh) Forecasted	Evaluated	GRR	Reason for discrepancy
PRJ - 04255174	2.5	Process retrofit - new compressed air system configuration	223,376	219,826	98%	**Operating Conditions -** Proposed VSD compressor has a 106-psi pressure setpoint instead of applicant reported 96.6 psi setpoint. Higher setpoint means increased energy consumption of the proposed compressor, resulting in lower energy savings.
EE_CALC_5856931	1.0	Fluid pump - VFD - add-on equipment	324,349	336,736	104%	**Calculation Method -** The discrepancy in kWh energy impacts is attributable to the average pump flow (gpm). The evaluated average gpm is lower than the applicant reported post installation gpm, resulting in higher evaluated savings than applicant reported.
SCR-PUBL-B4-0066T000017ad0YQAQ	2.0	Pump Overhaul	75,122	78,867	105%	**Operating Conditions -** The evaluation found that there was a ~21% increase in average as-found GPM. However, operating hours were unchanged.
SCR-PUBL-B4-0066T000018UYelQAG	3.0	Lighting Retrofit/ Integrated LED	54,584	29,393	54%	**Operating Conditions -** The MLC inputs were updated with HOU=1,117 and CDF=0.19 (replacing DEER HOU=2,060 and CDF=0.27.) based on site verification.
10926251	3.3	Integrated non-residential whole building (SBD) approach	94,143	97,615	104%	**Operating Conditions -** The evaluation adjusted the HVAC schedules and setpoint: the original model schedules and setpoints were Mon-Fri 7am to 10pm, Sat 8 am to 1pm, cooling setpoint 75F and heating 70F. The parameters were updated to Mon-Fri: 5am to 4pm, cooling setpoint 75F and heat: 68F based on BMS screenshot.
11032338	3.3	Cool Roof / Interior LED lighting, parking garage lighting	407,044	354,312	87%	**Operating Conditions -** Interior lighting power density value was updated from 0.274 to 0.374 w/sf.

DNV Project ID	Sampling weight	Measure type	First-year (kWh) Forecasted	Evaluated	GRR	Reason for discrepancy
10841241	1.0	Retro-commissioning - BRO-RCx	(398,994)	(402,168)	101%	**Calculation Method -** The evaluation updated weather data assumptions. These drove savings down, however, updates made to AHU schedules and supply fan sizes increased savings.
10945041	1.8	Retro-commissioning - Monitoring Based Retro-commissioning - BRO-RCx	(103,470)	146,652	-142%	**Calculation Methods -** The forecasted model used engineering calculations to estimate savings associated with moving laundry offsite. However, the evaluation accounted for these impacts in their model, which found that moving the laundry didn't save as much energy as the engineering calculations suggested. This resulted in overall savings attributed to the project increasing. We should note that the analysis of the residuals performed by the forecasted team seems to suggest that moving laundry offsite only saves 110 kWh per day. However, the actual savings used came from engineering calculations that were not provided, which showed about 770 kWh per day saved. Our analysis found savings of about 250 kWh/day saved

DNV Project ID	Sampling weight	Measure type	First-year (kWh)			Reason for discrepancy
			Forecasted	Evaluated	GRR	
10978709	1.8	Retro-commissioning - BRO-RCx	(49,958)	-	0%	**Inoperable Measure -** The evaluation found three primary reasons for no savings. 1. The second floor is vacant, and its HVAC unit (AC-2) is operated only three hours per day to maintain the minimum space conditioning. There is no scheduled operation for AC-1 that serves the first floor as this floor operation is 24x7. 2. Based on the ex post trend analysis of OAT and SAT, no correlation exists between the SAT and OAT. The evaluation data analysis developed OAT bins from 50F to 80F at 2-degree intervals and estimated the SAT temperature range for each OAT bin. This data analysis verified that the SAT range varied between 10 F and 22 F for any given OAT. It appears that the building zones have process loads which does not allow the SAT to reset based on any logic or the HVAC unit was operated without any set controls. 3. Since the first-floor operation is 24x7, the boiler operation was also 24x7 since 3/18/24.
EE_CALC_5856892	1.3	Integrated non-residential whole building (SBD) approach	52,297	56,883	109%	**Tracking Data Discrepancy -** The model rerun results were slightly different from the SBD documents claimed savings
EE_CALC_5899819	9.0	Retro-commissioning - Pump system overhaul	255,369	41,612	16%	**Operating Conditions -** The facility's well-water pump-motor is the only electric load of the site electric meter. Thus, the evaluation analysis utilized the AMI data to determine the evaluated savings. The evaluated savings analysis was based on the AMI data. The baseline period for the evaluation analysis was 2021 and 2022 and the evaluation period was nine months of 2024 (Jan through Sep 2024).

DNV Project ID	Sampling weight	Measure type	First-year (kWh) Forecasted	Evaluated	GRR	Reason for discrepancy
PRJ - 01056576	1.4	Retro-commissioning reset controls setting HVAC air flow rebalance	104,298	126,449	121%	**Calculation Method -** The evaluation team leveraged additional trend data collected during the evaluation period that covers the summer periods (Sept 2023 - Sept 2024) and the forecasted post-implementation data did not (Oct 2022 - Jan 2023). This additional data allowed the bin analysis to use actual averaged load data rather than extrapolating linear trends developed using the limited shoulder-winter data, resulting in a higher savings estimate.
a0E3t00000Uv3XW	1.0	HVAC Retrofit/New-Envelope-Windows-Install Window Film	2,789	2,789	100%	None.
PRJ - 00109428	1.3	Process retrofit new waste water	174,554	186,244	107%	**Operating Conditions -** The PA model used data from 4/1/2023-12/1/2023 while the evaluator updated the PA model based on 1/1/2024-12/31/2024 data provided by the site.
EE_CALC_5922962	3.0	Lighting Retrofit / Outdoor PoleArm-Mounted Area and Roadway Luminaires	104,660	100,718	96%	**Operating Conditions -** The evaluation confirmed an MAT of AR but CDF is >25% higher than DEER CDF (late afternoon/evening work at the site.) The evaluation substituted both field-based HOU/CDF in MLC.
EE_CALC_5922965	9.3	Lighting Retrofit / Architectural flood and spot luminaires	85,108	109,483	129%	**Operating Conditions -** The evaluation confirmed an MAT of AR but HOU/CDF are >25% higher than DEER HOU/CDF. The evaluation substituted field-based HOU/CDF in MLC, resulting in an increase in savings.
EE_CALC_5924207	2.5	Lighting Retrofit / Exterior wall mounted luminaires	157,756	270,136	171%	**Operating Conditions - The evaluation updated the** MLC with HOU=5,240 and CDF=0.598, which are more than 25% higher than DEER HOU=2,790 and CDF=0.312.
EE_CALC_5906615	2.5	Lighting Retrofit / direct linear ambient luminaires	957,253	957,253	100%	None.
EE_CALC_5916111	3.0	Lighting Retrofit / Exterior wall mounted luminaires	107,177	107,177	100%	None.

DNV Project ID	Sampling weight	Measure type	First-year (kWh)			Reason for discrepancy
			Forecasted	Evaluated	GRR	
EE_CALC_5913811	9.3	Lighting Retrofit / Architectural flood and spot luminaires	62,666	62,666	100%	None.
EE_CALC_5921698	9.3	Lighting Retrofit / Outdoor PoleArm-Mounted Area and Roadway Luminaires	9,270	9,270	100%	None.
EE_CALC_5929417	3.0	Lighting Retrofit / Other	131,949	229,671	174%	**Operating Conditions -** The evaluation confirmed an MAT of AR but HOU/CDF are >25% higher than DEER HOU/CDF. The evaluation used field-based HOU/CDF in MLC. The discrepancy is due to the HOU/CDF adjustment PLUS the EUL and RUL caps due to fixed measure life (50,000 hours for LED and 20,000 hours for T8s, respectively) and high HOU.

APPENDIX E. GAS PROJECT DISCREPANCIES

Table E-1. Discrepancy details for PY2023 CIAC gas projects

DNV Project ID	Sampling weight	Measure type	First year (Therms)			Reason for discrepancy
			Forecasted	Evaluated	GRR	
a0E3t00000V4DKK	7.0	Lighting Retrofit/New-Interior-LED-General/Area Lighting	(175)	(16)	9%	**Inappropriate Baseline** - The PA used an MAT of AR for MLC inputs. The evaluation team verified an MAT of NR. MLC input changed from AR to NR resulting in lower savings.
a0E3t00000V4CRK	2.5	Lighting Retrofit/New-Exterior-LED-Wall Mounted	(731)	(430)	59%	**Operating Conditions -** The PA used an MLC with AR inputs and then claimed the project as NR with EUL=12. The evaluation confirmed the MAT as AR but HOU/CDF are >25% lower than DEER HOU/CDF.
PRJ - 02199208	1.0	Retro-commissioning - Schedule and Controls Optimization	4,282	91	2%	**Operating Conditions** – The applicant reported post project operating schedule is from 6 am to 6 pm; however, the evaluation period trends show operation from 4 am to 10 pm in the post installation case. This resulted in lower evaluated kWh savings.
PRJ - 03749006	2.7	Lighting Retrofit/New-Interior-LED and Pole Mount	(35)	(35)	100%	None.
PRJ - 03714212	1.0	Retro-commissioning - schedule and controls optimization	19,840	22,376	113%	**Inoperable Measure -** Based on one year's worth ex post trends, the evaluation verified that EEM 4, 5, 7, 9, and 11 were fully implemented, EEM 1 and 12 were partially implemented and EEM 2 and 8 were not implemented. This resulted in 83% GRR for electric savings, 108% GRR for peak demand reduction, and 113% GRR for therms savings.
DI-NR-221123-0739	10.5	Lighting Retrofit/New-Interior LED Highbay	(140)	(69)	50%	**Operating Conditions** - The evaluated HOU/CDF were found to be more than 25% lower than DEER HOU/CDF.

DNV Project ID	Sampling weight	Measure type	First year (Therms)			Reason for discrepancy
			Forecasted	Evaluated	GRR	
DI-NR-220714-0415	2.0	Lighting Retrofit/New-Interior LED Highbay	(22)	(25)	113%	**Calculation Method** - The PA submitted a corrected MLC. The evaluation used the savings from the corrected MLC resulting in slighting higher savings.
DI-NR-220830-0484	10.5	Lighting Retrofit/New-Interior LED Highbay	(148)	(7)	5%	**Inappropriate Baseline** - The evaluation team found the lighting on site to be 40 years old and failing to provide desired level of service; the customer would have replaced with same LED technology at same time; therefore, the MAT was adjusted from AR to NR.
PRJ - 02036084	1.3	Integrated non-residential whole building (SBD) approach	11,189	9,081	81%	**Operating Conditions** - The evaluation updated the heating setpoints for AC zones from 74 to 70 to reflect site condition, resulting in a slight increase in savings.
PRJ - 02864636	1.4	Retro-commissioning Reset Controls - HVAC Set point	20,337	19,668	97%	**Calculation Method -** The evaluation used normalized CZ2022 weather data instead of applicant used CZ2010 and updated the calculation with 2024 trends, which although remained the same, had minor discrepancies compared to 2023, resulting in an overall lower estimated savings.
PRJ - 03921086	1.4	Retro-commissioning Reset Controls - HVAC schedule	10,808	10,938	101%	**Operating Conditions** - The evaluation updated the HVAC Calculator tool by incorporating post trend data obtained from the BMS. This resulted in a reduction of energy savings (both electric and gas savings).
PRJ - 04243826	2.7	Lighting Retrofit/New-Int LED Highbay	(816)	(816)	100%	None.

DNV Project ID	Sampling weight	Measure type	First year (Therms)			Reason for discrepancy
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PRJ - 03880864	1.0	Boiler Hot Water Steam System Retrofit / New distribution system insulation	34,422	39,407	114%	**Calculation Method -** Based on the facility contact's feedback, the evaluation revised the annual operating hours of the boilers to 7,800 hours/year. This is because the boilers are taken offline for about 40 days annually for maintenance. During the remaining 7,800 hours, the boilers either produce steam or at hot idle mode. Further, the evaluation revised the surface temperature of three boiler plant components from 366 F to 353 F as the maximum bare surface temperature at 125 psig steam pressure is 353 F.
a0E3t00000U6FKw	2.5	Lighting Retrofit/New-Exterior-LED-Wall Mounted	(405)	(447)	110%	**Operating Conditions -** The PA used an MAT of AR in MLC, then claimed Capped Direct first year savings as NR. The evaluation confirmed the MAT as AR. The evaluation adjusted the MLC input with as found site conditions: HOU=2,709 /CDF=0.467, resulting in an increase in savings.
a0E3t00000U6Hpf	3.0	Lighting Retrofit/New-Interior-LED-General/Area Lighting	(204)	(193)	95%	**Operating Conditions -** A site visit found 46 LEDs installed compared to the 48 claimed. The PA claimed an MAT of NR but claimed savings from MLC as MAT of AR. The evaluation confirmed the MAT of AR.
a0E3t00000Uv3Xa	7.0	Lighting Retrofit/New-Interior-LED-General/Area Lighting	(20)	(20)	100%	None.
a0E3t00000Uv3XY	7.0	Lighting Retrofit/New-Interior-LED-General/Area Lighting	(13)	(13)	100%	None.
10733346	1.3	Whole Building New Construction LED Lighting, Cool Roof and low-e glazing	41,863	40,605	97%	**Measure Count -** An adjustment was made to the baseline and proposed lighting power density for Building A: The claimed baseline LPD was 0.91w/ft2 and proposed was 0.666 w/ft2. The evaluated baseline LPD was 1.061 W/ft2 and proposed was 0.763 W/ft2.

DNV Project ID	Sampling weight	Measure type	First year (Therms)			Reason for discrepancy
			Forecasted	Evaluated	GRR	
PRJ - 01828610	1.3	Integrated non-residential whole building (SBD) approach	12,774	(711)	-6%	**Tracking Data Discrepancy** - Setpoint adjustments (avg setpoint from BAS summary applied to all zones) and occupancy schedule updates based on site verification resulted in a negative realization rate.
PRJ - 01327280	1.0	HVAC Retrofit New Controls Other	159,430	133,352	84%	**Operating Conditions -** The evaluator collected trend data shows the post installation period supply fan speed, and the space temperature was higher than PA predicted during the occupied and unoccupied periods, which reduced the heating savings from this measure
PRJ - 02725732	1.4	Retro-commissioning reset controls setting HVAC setpoint change	793	1,078	136%	**Operating Conditions -** The discrepancies in average duct static pressure values for AHU-3 and AHU-4, along with the supply fan speed of AHU-4, reduced energy savings. For AHU-3, the applicant's analysis showed a minimum average duct static pressure of 0.6 in-WC, compared to 0.9 in-WC in the evaluated trend data. For AHU-4, the evaluated trend data indicated minimum and maximum average duct static pressures of 1.1 and 1.5 in-WC, while the applicant's analysis reported 1 and 1.3 in-WC, respectively.

DNV Project ID	Sampling weight	Measure type	First year (Therms) Forecasted	Evaluated	GRR	Reason for discrepancy
PRJ - 04180484	1.0	Retro-commissioning recode controls HVAC set point change	2,545	-	0%	**Inoperable Measure –** The site visit found the building site was vacant and the customer has already moved the building occupants to the other buildings owned by the customer on the same campus. Thus, the project site was not operational, and the building HVAC system was operating without any set controls. Since the evaluation found that the 24x7 fan speed profiles do not show any fan speed setback as claimed in the PA's post-project report and that the supply fans were not using setbacks during unoccupied periods. As a result, the evaluation did not approve savings for the claimed measures.
PRJ - 03896068	1.4	Retro-commissioning recode controls HVAC schedule change	909	-	0%	**Inoperable Measure -** Since the evaluation data analysis found higher fan-motor current (amp) draw for both supply and exhaust fans during the post installation period, the evaluation did not approve savings for the claimed measures. Even though the post installation period monthly electricity usage is about 85% that of monthly electricity usage in 2019 because of reduced occupancy and the facility operations moved to other buildings, the building HVAC usage has increased during the post period compared to its baseline usage.
12877213	1.3	System retrofit - steam insulation	24,469	10,378	42%	**Inoperable Measure -** Most measures did not meet T24 minimum thickness requirements. A similar project disposition was issued for CPR 766, with the application being rejected.
13445592	1.3	System retrofit - steam insulation	17,608	18,546	105%	**Calculation Methods -** The evaluation analysis adjusted the boiler efficiency value in the forecasted savings (85%) based on the recent boiler tune-up result (81.7%). This revision of boiler efficiency increased the measure savings.

DNV Project ID	Sampling weight	Measure type	First year (Therms)			Reason for discrepancy
			Forecasted	Evaluated	GRR	
SCR-PUBL-B4-0066T000018UYelQAG	3.0	Lighting Retrofit/ Integrated LED	(128)	(70)	54%	**Operating Conditions -** The MLC inputs were updated with HOU=1,117 and CDF=0.19 (replacing DEER HOU=2,060 and CDF=0.27.) based on site verification.
10926251	3.3	Integrated non-residential whole building (SBD) approach	(1,252)	(441)	35%	**Operating Conditions -** The evaluation adjusted the HVAC schedules and setpoint: the original model schedules and setpoints were Mon-Fri 7am to 10pm, Sat 8 am to 1pm, cooling setpoint 75F and heating 70F. The parameters were updated to Mon-Fri: 5am to 4pm, cooling setpoint 75F and heat: 68F based on BMS screenshot.
10841241	1.0	Retro-commissioning - BRO-RCx	(1,983)	7,390	-373%	**Calculation Method -** The evaluation updated weather data assumptions. These drove savings down, however, updates made to AHU schedules and supply fan sizes increased savings.
10945041	1.8	Retro-commissioning - Monitoring Based Retro-commissioning - BRO-RCx	(530)	(530)	100%	None.

DNV Project ID	Sampling weight	Measure type	First year (Therms)			Reason for discrepancy
			Forecasted	Evaluated	GRR	
10978709	1.8	Retro-commissioning - BRO-RCx	(316)	-	0%	**Inoperable Measure -** The evaluation found three primary reasons for no savings. 1. The second floor is vacant, and its HVAC unit (AC-2) is operated only three hours per day to maintain the minimum space conditioning. There is no scheduled operation for AC-1 that serves the first floor as this floor operation is 24x7. 2. Based on the ex-post trend analysis of OAT and SAT, no correlation exists between the SAT and OAT. The evaluation data analysis developed OAT bins from 50F to 80F at 2-degree intervals and estimated the SAT temperature range for each OAT bin. This data analysis verified that the SAT range varied between 10 F and 22 F for any given OAT. It appears that the building zones have process loads which does not allow the SAT to reset based on any logic or the HVAC unit was operated without any set controls. 3. Since the first-floor operation is 24x7, the boiler operation was also 24x7 since 3/18/24.
EE_CALC_5856892	1.3	Integrated non-residential whole building (SBD) approach	216	976	452%	**Operating Conditions -** HVAC operating and setpoint schedules were not defined and EnergyPro used the default schedules in the forecasted models. The evaluation updated the schedules with BMS system specifications, resulting in a higher realized gas savings.

DNV Project ID	Sampling weight	Measure type	First year (Therms) Forecasted	Evaluated	GRR	Reason for discrepancy
12128197	1.0	Hot Water/HVAC - Heat Recovery	62,523	48,414	77%	**Operating Conditions -** The evaluation revised some of the inputs and assumptions used in the forecasted analysis based on data collection and site level verifications. The evaluation used post installation city water flow rate to determine the heating required in the base and post-periods, included the heat recovery in the base case analysis and correctly the post case with two different heating requirements (city water heated from 62F and wastewater heated from 98.5 to the desired temperature of the hot water tank).
12646626	1.3	Steam - Process Improvement	59,700	91,140	153%	**Calculation Methods -** The evaluation adjusted two inputs to the IOU calculation method: (1) The average annual gas usage of the affected boilers (#2 and #4) was updated from 120 MMCF to 154.9 MMCF (an increase of ~30%). (2) An equation that calculates steam mass flow rate (m_dot) from energy rate (Q, boiler energy use) and delta enthalpy was updated to take in to account a difference in enthalpy between the DA water (saturated at 216F) and the steam (110 psig, 344F). The IOU calculator equation did not have a "delta" enthalpy but rather only used the enthalpy of steam (and so computed the energy required to raise a mass flow rate from 0 btu/lb to the steam enthalpy of 1191 btu/lb). The evaluator adjustment effectively increased the steam flow rate (because it lowered the "delta" enthalpy from a value of 1191 Btu/lb to 1007 Btu/lb) by ~18%. These adjustments together impacted the savings discrepancy by ~53%

DNV Project ID	Sampling weight	Measure type	First year (Therms)			Reason for discrepancy
			Forecasted	Evaluated	GRR	
PRJ - 01056576	1.4	Retro-commissioning reset controls setting HVAC air flow rebalance	47,198	49,699	105%	**Calculation Method -** The evaluation team leveraged additional trend data collected during the evaluation period that covers the summer periods (Sept 2023 - Sept 2024) and the forecasted post-implementation data did not (Oct 2022 - Jan 2023). This additional data allowed the bin analysis to use actual averaged load data rather than extrapolating linear trends developed using the limited shoulder-winter data, resulting in a higher savings estimate.
a0E3t00000Uv3XW	1.0	HVAC Retrofit/New-Envelope-Windows-Install Window Film	(67)	(67)	100%	None.
EE_CALC_5924207	2.5	Lighting Retrofit / Exterior wall mounted luminaires	(685)	(1,286)	188%	**Operating Conditions -** The evaluation updated the MLC with HOU=5,240 and CDF=0.598, which are more than 25% higher than DEER HOU=2,790 and CDF=0.312.
EE_CALC_5906615	2.5	Lighting Retrofit / direct linear ambient luminaires	(1,280)	(1,280)	100%	None.
EE_CALC_5929417	3.0	Lighting Retrofit / Other	(307)	(646)	211%	**Operating Conditions -** The evaluation confirmed an MAT of AR but HOU/CDF are >25% higher than DEER HOU/CDF. The evaluation used field-based HOU/CDF in MLC. The discrepancy is due to the HOU/CDF adjustment PLUS the EUL and RUL caps due to fixed measure life (50,000 hours for LED and 20,000 hours for T8s, respectively) and high HOU.