EM&V GROUP A

Third-Party Commercial Programs Impact Evaluation, Program Year 2022 Report

California Public Utilities Commission

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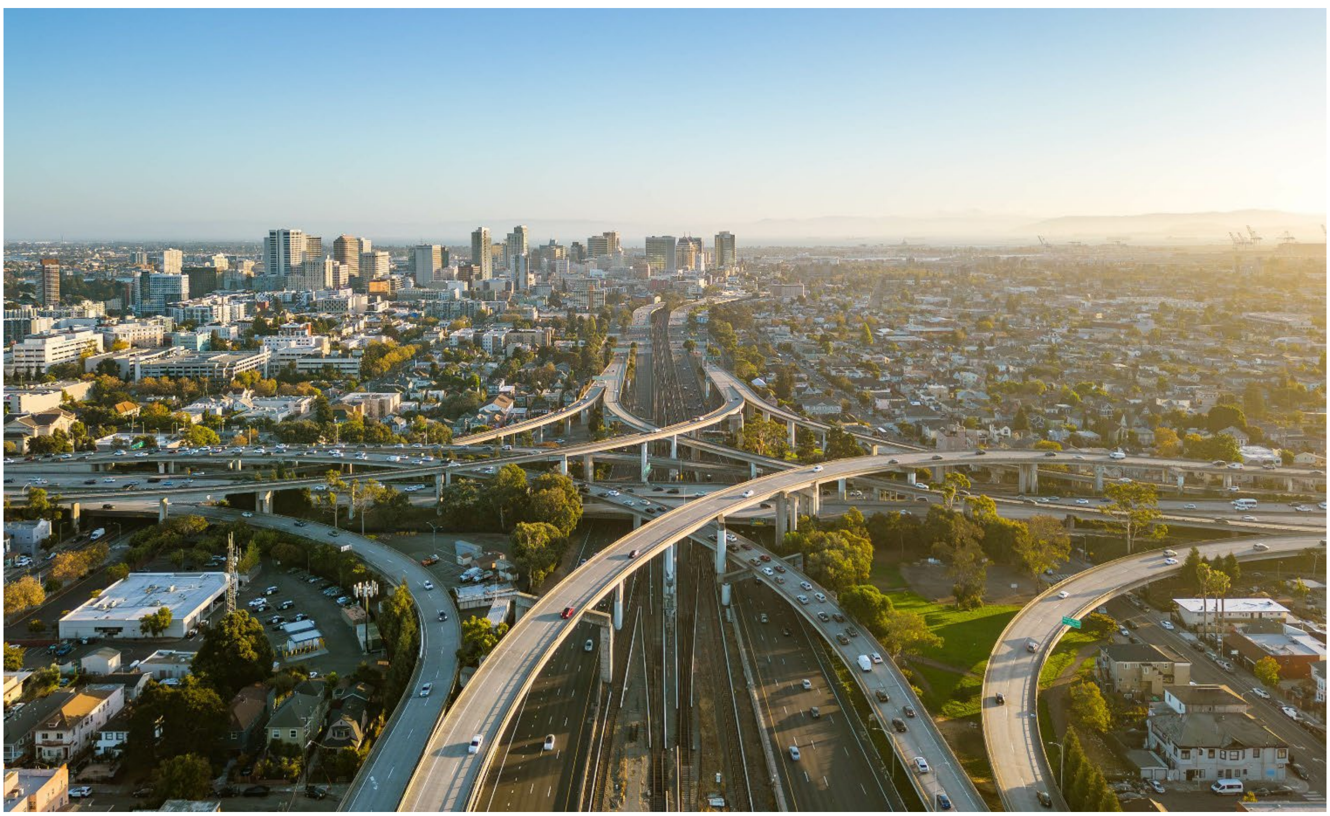

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Table of contents

List of figures

List of tables

Glossary of key terms, abbreviations, and acronyms

California Database for Energy Efficiency Resources (DEER) – Refers to the Database for Energy Efficient Resources. This database contains information on energy-efficient technologies and measures. DEER estimates the energy savings potential for these technologies in residential and non-residential applications. DEER is used by California Energy Efficiency (EE) Program Administrators (PAs), private sector implementers, and the EE industry across the country to develop and design energy efficiency programs.[1] Available at eTRM: https://www.caetrm.com/.

California Energy Data and Reporting System (CEDARS) – Refers to the database that securely manages California Energy Efficiency Program data reported to the California Public Utilities Commission (CPUC) by Investor-Owned Utilities (IOUs), Regional Energy Networks (RENs), and certain Community Choice Aggregators.[2]

California Public Utility Commission (CPUC)[3] – A state agency created by constitutional amendment in 1911 to regulate the rates and services of privately owned utilities and transportation companies. The CPUC is an administrative agency that exercises legislative and judicial powers; its decisions and orders may be appealed only to the California Supreme Court. The primary duties of the CPUC are to regulate privately owned utilities and secure adequate service to the public at rates that are just and reasonable to customers and shareholders of the utilities, including rates for electricity transmission lines and natural gas pipelines. The CPUC also provides electricity and natural gas forecasting, analysis, and planning of energy supply and resources. Its headquarters are in San Francisco.

Contractor – A commercial entity that installs the measures offered by EE programs.

Cost effectiveness – An indicator of the relative performance or economic attractiveness of any energy efficiency investment or practice when compared to the costs of energy produced and delivered in the absence of such an investment. In the energy efficiency field, the present value of the estimated benefits produced by an energy efficiency program as compared to the estimated total program's costs, from the perspective of either society as a whole or of individual customers, to determine if the proposed investment or measure is desirable from a variety of perspectives, e.g., whether the estimated benefits exceed the estimated costs.[4]

Downstream program – An energy efficiency program with a delivery mechanism that provides incentives and technologies directly to participating customers.

Direct install program – An energy efficiency program where a contractor installs energy-saving technologies or upgrades in participating customer homes for no or low cost.

Disadvantaged community (DAC) – Refers to the areas throughout California that most suffer from a combination of economic, health, and environmental burdens.[5]

End user – A program participant who benefits directly from the EE program.

Energy Efficiency (EE) – Activities or programs that encourage customers to invest in more efficient equipment or controls that reduce energy use while maintaining a comparable level of service.

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1 CPUC. "Resolution E-5152." deerresources.com, August 5, 2021. http://www.deeresources.com/files/DEER2023/Resolution%20E-5152%20DEER2023%20Complete.pdf

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

3 CPUC. "California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals." April 2006. (PDF) California Energy Efficiency Evaluation Protocols: Technical, Methodological and Reporting Requirements for Evaluation Professionals (researchgate.net)

4 Ibid

5 CPUC. "Disadvantaged Communities." cpuc.gov, 2021. https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/disadvantaged-communities

eTRM - The eTRM is a repository of California's deemed measures, including supporting values and documentation. https://www.caetrm.com/

Free-ridership – Program participants who would have installed the program measure or equipment in the absence of the program.

Gross realization rate (GRR) – the ratio of evaluated savings to claimed savings, without any adjustments for program influence.

Gross savings – Gross savings count the energy savings from installed energy efficiency measures (EEMs) irrespective of whether those savings are from free-riders, i.e., those customers who would have installed the measure(s) even without the financial incentives offered under the program.

Hard-to-reach (HTR) customer – The criteria for residential HTR customers is the combination of a geographic prerequisite plus at least one of the following criteria: primary language, income, or housing type. HTR commercial customers also include factors such as business size and lease status. [6]

Heat pump – An air conditioning unit that is capable of heating by refrigeration, transferring heat from one (often cooler) medium to another (often warmer) medium and which may or may not include a capability for cooling. This reverse-cycle air conditioner usually provides cooling in summer and heating in winter.[7]

Heating, Ventilation, and Air Conditioning (HVAC) system – The equipment, distribution network, and terminals that provide either collectively or individually the processes of heating, ventilating, or air conditioning to a building.[8]

Implementer – A program implementer is a third-party entity contracted by a program administrator (PA) to design, implement, and deliver third-party programs.

Innovative – Within the context of third-party energy efficiency programs, an "innovative" program must ultimately increase the uptake of cost-effective energy efficiency by advancing a technology, marketing strategy, or delivery approach in a manner different from previous efforts.[9]

Integrated demand-side management (IDSM) – A strategy used to design and deliver a portfolio of demand-side management (DSM) programs to customers. DSM encompasses a range of plans and technologies strategically used to manage and alter energy consumption levels and patterns among customers.

Investor-owned utilities (IOUs) – A private company that provides a utility, such as water, natural gas, or electricity, to a specific service area. California investor-owned utilities are regulated by the CPUC.[10]

Key performance indicator (KPI) - A quantifiable measure of performance used to track progress toward goals and objectives.

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6 Specific details can be found here: Statewide Deemed Workpaper Rulebook

7 CPUC. "California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals." April 2006. (PDF) California Energy Efficiency Evaluation Protocols: Technical, Methodological and Reporting Requirements for Evaluation Professionals (researchgate.net)

8 CPUC. "California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals." April 2006. (PDF) California Energy Efficiency Evaluation Protocols: Technical, Methodological and Reporting Requirements for Evaluation Professionals (researchgate.net)

9 CPUC. "Energy Efficiency Programs Implementation Plan Template Guidance." cpuc.gov, May 2020. https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/i/6442466376-implementation-plan-template-may2020.pdf

10 CPUC. "California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals." April 2006. (PDF) California Energy Efficiency Evaluation Protocols: Technical, Methodological and Reporting Requirements for Evaluation Professionals (researchgate.net)

Measure – A technology or equipment whose installation and operation at a customer's premise reduces energy use.

MMBtu – The sum of kWh and therm savings converted to a common unit of measure.

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

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

Nonresidential – Used to describe facilities used for business, commercial, agricultural, institutional, and industrial purposes.[11]

Process evaluation – A systematic assessment of an energy efficiency program for the purposes of documenting program operations at the time of the examination and identifying and recommending improvements that can be made to the program to increase the program's efficiency or effectiveness for acquiring energy resources while maintaining high levels of participant satisfaction.[12]

Program Administrator (PA) – An entity tasked with the functions of portfolio management of energy efficiency programs and program choice.

Program Administrator Cost (PAC) – Measures the net costs of a program as a resource option based on the costs incurred by the PA (including incentive costs) and excluding any net costs incurred by the participant. The benefits are similar to the TRC test, but costs are defined more narrowly.

Stratified sampling – Stratified sampling is a type of sampling approach in which the total population is divided into smaller subgroups, or strata, to complete the sampling process. The strata are formed based on some common characteristics in the population data. After dividing the population into strata, samples are chosen randomly from each stratum in a way that is proportional to the stratum's size within the total population.

Third–party programs – Programs that are suggested, devised, executed, and delivered by personnel under contract to a utility program administrator but not part of the utility itself.

Technical resource manual (TRM) – A resource that contains information about energy efficiency measures that is used to plan, implement, track, report on, and evaluate the impact of these measures.

Total resource cost (TRC) – Measures the cost effectiveness of a program. A TRC value greater than or equal to one indicates cost effectiveness.

Total system benefit (TSB) – A dollar value metric that expresses a utility's energy efficiency program portfolio's lifecycle energy, capacity, and GHG benefits. This metric encourages conservation at high–value times and locations, beyond economic energy savings.

Unit Energy Savings (UES) – Refers to the quantification of energy conserved per unit when a specific energy-saving measure is implemented. It is calculated by subtracting the energy performance value of the measure (expressed in kWh for electrical energy, kW for power demand, and therms for thermal energy) from the baseline performance value, which

[11] Ibid
[12] Ibid

represents the energy usage without the energy-saving measure. This calculation provides a normalized value of energy savings per unit, making it easier to compare the effectiveness of different measures on a consistent scale.

1 EXECUTIVE SUMMARY

On behalf of the California Public Utilities Commission (CPUC), DNV, also referred to as the evaluator, evaluated three third-party commercial programs (3PCPs) for program year (PY) 2022. 3PCPs are energy efficiency programs devised and implemented by personnel under contract to a utility program administrator (PA)[13] but who are not part of the utility itself.

1.1 Evaluation background

California has seen a rise in third-party program implementation across the energy efficiency landscape. According to recent CPUC policy,[14] at least 60% of Investor-owned utilities' (IOUs')[15] energy efficiency portfolio budgets must be designed and delivered by third parties. Table 1-1 below details the DNV-evaluated third-party commercial programs for PY2022.

Table 1-1. Third-party commercial programs evaluated for PY2022

Utility & implementer	Program	Description
PG&E; Ecology Action	NetOne Commercial Efficiency Program	A four-year, downstream[16] commercial program offering energy efficiency services, technical support, and incentive processing for upgrades in refrigeration, HVAC, lighting, and meter-based energy-saving measures.[17]
SCE; Willdan	Commercial Energy Efficiency Program	A downstream commercial program that encourages energy efficiency measures like improved lighting, insulation, and efficient HVAC systems to boost adoption rates. Leverages partners targeting hard-to-reach (HTR) and disadvantaged communities [18](DAC) customers.
SDGE; TRC	Commercial Large Customer Services (>20KW) Program	A downstream commercial program providing implementation services for electric and gas clients with a monthly demand of over 20 kW, including marketing, outreach, engineering, operations, customer service, and data management.

These 3PCPs were selected for evaluation because they reported 31.8% of deemed,[19] excluding codes and standards and lifecycle net electric savings in PY2022, and include energy-efficient (EE) technologies that have not been evaluated in recent years. DNV conducted an impact and process evaluation to better understand how these programs are performing against their stated goals. The impact evaluation helped us quantify program savings, and the process evaluation focused on assessing the effectiveness of the programs' overall performance, with a particular emphasis on engagement with DACs. Table 1-2 presents the PY2022 reported savings by evaluated PA.

13 A program administrator is an entity tasked with the functions of portfolio management of energy efficiency programs and program choice.

14 CPUC. D. 18-01-004. "Decision Addressing Third Party Solicitation Process for Energy Efficiency Programs." cpuc.ca.gov, 2016. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M166/K232/166232537.PDF

15 A private company that provides a utility, such as water, natural gas, or electricity, to a specific service area. California investor-owned utilities are regulated by the CPUC.

16 Downstream is a delivery mechanism that provides incentives and technologies directly to customers.

17 A product whose installation and operation at a customer's premises reduces the customer's on-site energy use, compared to what would have happened otherwise.

18 Disadvantaged communities (DACs) refer to areas throughout California that most suffer from a combination of economic, health, and environmental burdens. See https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/disadvantaged-communities

19 A generalized prescriptive estimate of energy impacts and associated costs for specific technologies and their applications. These values are documented as measure packages within the CA eTRM (caetrm.com)

Table 1-2. PY2022 deemed savings claims[20] by program administrator

Program Administrator	# of claims	First year MW electric demand		First year MWh electric energy		Lifecycle MWh	First Year MMBtu gas energy		Lifecycle MMBtu
		Gross[21]	Net[22]	Gross	Net	Net	Gross	Net	Net
PG&E	652	2.66	1.60	12,784	7,693	47,662	31,746	19,080	96,158
SCE	2,525	5.46	3.60	38,087	24,978	119,626	30,620	23,214	204,513
SDGE	909	1.35	0.81	6,907	4,144	25,027	7,773	4,691	27,697
Total	**4,086**	**9.46**	**6.01**	**57,778**	**36,816**	**192,315**	**70,139**	**46,985**	**328,368**

The primary focus of the research is on the auto closers, anti-sweat heater controls, medium-temperature case doors, and heat pump water heaters measures (Figure 1-1), which together account for approximately 90.7% of positive electric lifecycle MWh net energy savings. Auto Closer for Refrigerated Storage Door installations account for 49.1% and anti-sweat heater controls account for 29.9% of the positive electric lifecycle MWh net energy savings, respectively. Additionally, medium-temperature case doors represent approximately 56.7%, and heat pump water heaters account for 40.1% of the positive gas lifecycle MMBTU net energy savings. The study aims to enhance understanding of the impact of these specific measures on energy conservation and provide a roadmap for future energy efficiency initiatives.

Figure 1-1. Commercial Third-Party Program measures

Auto Closer for Refrigerated Storage Door

Anti-Sweat Heater Controls

Medium-Temperature Case Doors

Heat Pump Water Heater

The 'Auto closer for refrigerated storage door' is a device installed on walk-in coolers and freezers to automatically seal the door after being accessed. This technology is paramount in reducing energy waste, as it minimizes the time the door remains open, thus preventing the escape of chilled air and decreasing the workload on refrigeration systems. The 'Anti-sweat heater controls' are engineered to optimize energy use in refrigerated display cases by adjusting heater output in response to ambient humidity levels, hence averting the formation of condensation on glass surfaces. 'Medium-temperature case doors' involve the retrofitting of open refrigerated display cases with glass doors, a strategy that effectively curtails warm air infiltration and reduces the cooling load. Notably, this measure is responsible for the lion's share of gas savings in this study. The 'Heat pump water heater' represents a move towards more efficient water heating methods, signaling both a reduction in natural gas use and a transition to efficient electric-based heating, suggesting long-term benefits in energy consumption and decarbonization of this energy end-use. Additionally, the 'Other' category includes measures like ECM retrofits, LED lighting upgrades, energy-efficient commercial ice machines, and fan motor improvements. These initiatives,

20 Claims are one or more unique applications of a specific technology and efficiency level. Within the context of downstream delivery type, claims are specific to a unique project.

21 Gross savings are a measure of change in energy use due to energy efficiency programs, regardless of why customers participated.

22 Net savings are the savings attributable to an energy efficiency program. NTGR is the degree to which participating customers would have installed the technology or equipment without the program benefits. Gross savings are multiplied by the NTGR to arrive at net savings.

while smaller in individual impact, collectively complement the primary technologies and contribute meaningfully to overall energy efficiency.

1.2 Evaluation objectives & approach

To assess the effectiveness of the energy-efficiency programs, DNV's evaluation employed a dual approach, examining both gross and net savings (Figure 2-1). The gross evaluation methodology utilized the same calculation approaches as the measures utilized in the California Energy Efficiency Technical Reference Manual (eTRM) while following the California Energy Efficiency Evaluation Protocols[23] in analyzing both gross and net savings for reported measures with precision.

To evaluate gross savings, DNV's methods included conducting onsite visits, as well as in-depth interviews with customers involved in the programs. These efforts were aimed at verifying the installation and operating conditions of program measures, alongside reviewing the savings assumptions indicated within the eTRM. This process was supplemented by examining the implementer's quality assurance and quality control (QA/QC) procedures to ensure that the data collected on savings parameters were reliable.

The calculation of Net-to-Gross Ratios (NTGRs) followed the CPUC-approved NTG method, which involved querying program participants about how the absence of the program might alter the implementation of their energy-efficient measures across three variables: timing, efficiency, and quantity. When it came to assessing efficiency measures, the evaluator's approach varied based on the availability of baseline measures for comparison. For instance, with measures like auto closers and anti-sweat heater controls where no baseline comparison was available, DNV did not query the efficiency dimension. Conversely, for other measures such as water heaters and LEDs, where efficiency could be directly compared with a baseline, such questions were integral to the evaluation strategy. Through this approach, DNV ensured that the estimations reflected the true performance and impact of the energy-efficient measures under scrutiny.

1.3 Evaluation results

This section provides an overview of the performance of the 3PCPs, focusing on gas and electric savings achieved at utility customer sites through the specific measures. It contrasts evaluated gross and net savings with those reported by program administrators, utilizing both the Gross Realization Rate (GRR) and Net Realization Rate (NRR) as benchmarks for measure efficacy. GRR, expressed as a percentage, indicates the degree to which evaluated savings align with initial claims—a figure above 100% suggests the program outperformed expectations, while below 100% indicates the opposite. The NRR further refines this picture by considering the extent of savings attributable directly to the program, after adjusting for savings that would have occurred independently. Subsequent sections will unpack the performance details across various measure packages,[24] spotlighting the accuracy of savings estimations and the modifications informed by field evaluations and thorough interviews. This analysis not only examines the savings claims but also enhances understanding of how GRR and NRR reflect the actual effectiveness of the programs relative to their projected impacts on energy savings.

23 The TecMarket Works Team. "California Energy Efficiency Evaluation Protocols: Technical, Methodological, and Reporting Requirements for Evaluation Professionals." CPUC, April 2006. https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/energy-efficiency/energy-efficiency-evaluation

24 Measure packages contain estimates on energy savings (deemed savings values) of different technologies used in residential and non-residential settings. Energy efficiency programs use deemed savings values to make savings claims. Database for Energy Efficient Resources (DEER) available at eTRM: https://www.caetrm.com/ provides deemed savings and other measure package information

1.3.1 Impact evaluation

Table 1-3 below summarizes the program's performance in providing gas and electric savings at the utility customer's sites. The table presents evaluated gross and net savings compared with the PA-reported net savings, and the associated GRR and NRR.

Table 1-3. Gross and net energy saving results by measure package name

Measure package name	Reported gross savings	Evaluated gross savings	GRR	Reported net savings	Evaluated net savings	Reported NTGR	Evaluated NTGR	NRR
Electric Energy (MWh)								
Auto Closer for Refrigerated Storage Door	23,769	23,976	101%	14,824	22,777	62%	95%	154%
Anti-Sweat Heater Controls	22,438	25,758	115%	15,114	25,758	67%	100%	170%
Medium-Temperature Case Doors	7,813	7,813	100%	4,721	7,657	60%	98%	162%
Heat Pump Water Heater	-938	-938	100%	-986	-938	105%[25]	100%	95%
All other measures[26]	4,695	4,696	100%	3,142	3,945	67%	84%	126%
Overall	**57,778**	**62,400**	**108%**	**36,816**	**60,524**	**64%**	**97%**	**164%**
Gas Energy (MMBtu)								
Auto Closer for Refrigerated Storage Door	-170	-141	83%	-105	-134	62%	95%	128%
Anti-Sweat Heater Controls	-20,133	-21,882	109%	-13,561	-21,882	67%	100%	161%
Medium-Temperature Case Doors	71,856	71,856	100%	43,447	70,419	60%	98%	162%
Heat Pump Water Heater	15,368	15,368	100%	15,368	15,368	100%	100%	100%
All other measures[27]	3,216	3,216	100%	1,836	3,248	57%	101%	177%
Overall	**70,139**	**66,518**	**95%**	**46,985**	**65,188**	**67%**	**98%**	**139%**

1.3.1.1 Gross savings

DNV conducted 44 site visits and 10 in-depth-interviews (IDIs) covering a total of 73 claims. Figure 1-2 details the GRRs for electric energy savings (measured in MWh) across the three PAs, demonstrating that the GRRs exceed 100% for each PA, with a high level of precision in the measurement outcomes. In contrast, it delineates the GRRs for gas energy savings (measured in MMBtu) by PA. Notably, the GRR for SCE did not reach 100%, attributed primarily to the effects of HVAC interactions on specific refrigeration measures. Specifically, the auto-closer for low-temperature storage doors in climate zone (CZ) 09 would increase the gas consumption in the tracking model, due to HVAC interaction with the refrigeration system, but the evaluated model indicates it will have gas savings. This ended up with a negative realization rate for this climate zone and reduced the overall GRR to less than 100%.

[25] The reported NTGRs include a 5% market effects adder (which is why the water heater reported NTGR is greater than 100%) while the evaluated NTGRs do not yet include this 5% adder and are added at a later reporting stage.

[26] Other measures include enhanced ventilation for packaged HVAC equipment, high/low bay LEDs, type B and C LED tubes, and commercial reach-in refrigerators or freezers.

[27] Ibid.

Figure 1-2. Evaluated gross realization rate results by program administrator

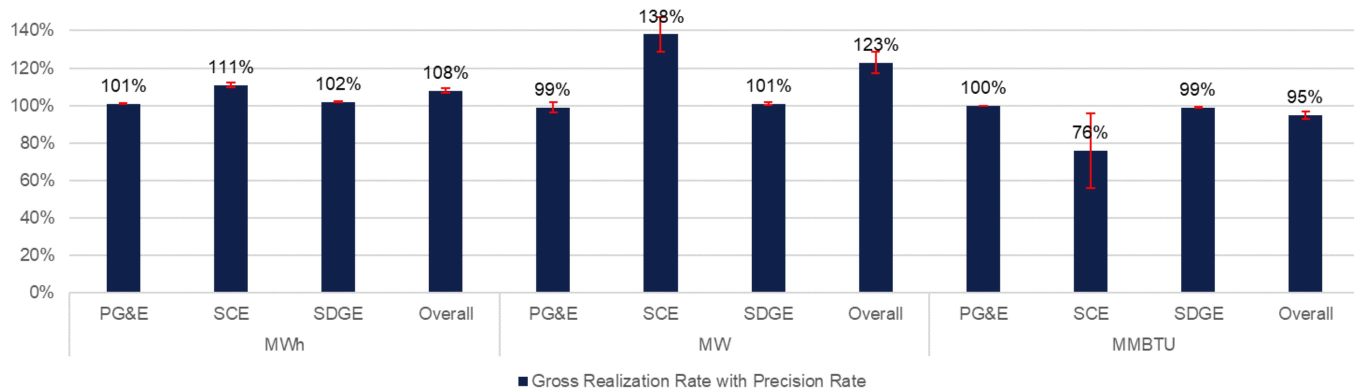
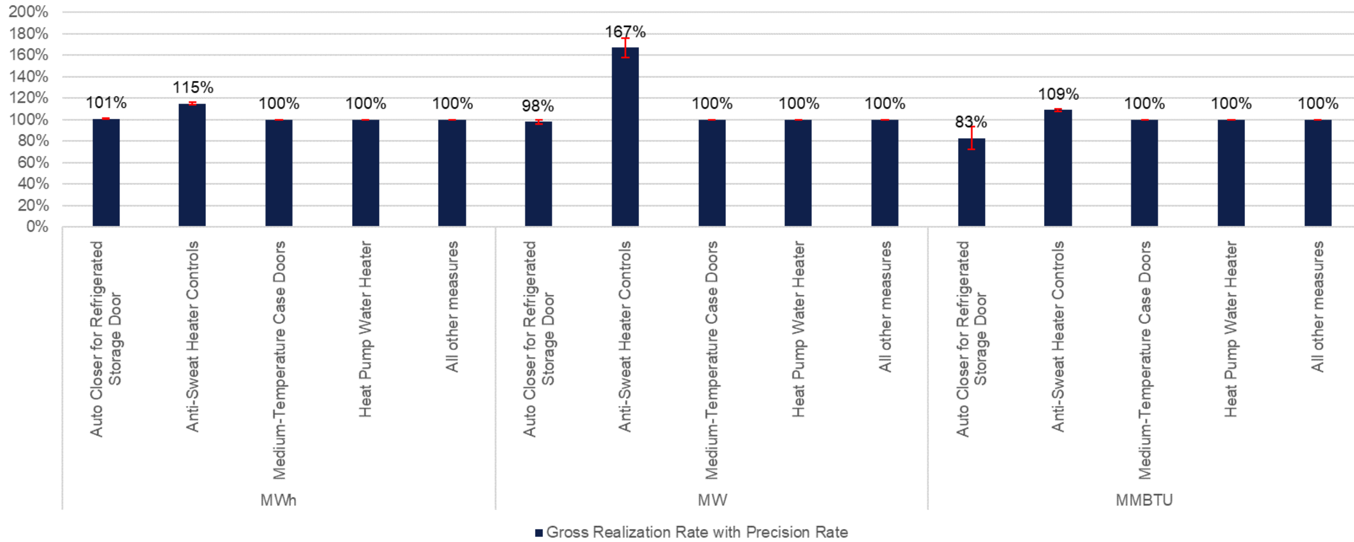


Figure 1-3 provides a breakdown of electric and natural gas savings by measure package, indicating minimal differences in the GRR.

- **Auto Closer for Refrigerated Storage Doors**: The evaluator conducted 13 visits across three PA territories and the deployment of occupancy loggers captured and revealed discrepancies in door open frequency and open duration time compared to eTRM estimates. DNV deployed occupancy loggers (recording devices) within both cooler and freezer environments. The data indicated discrepancies between the actual findings and eTRM. Adjustments made to the energy model for coolers and freezers resulted in a slight savings adjustment: a decrease of 0.1% for coolers and an increase of 1.5% for freezers. Furthermore, an error was found in the current eTRM, which incorrectly listed savings in linear feet instead of the correct metric, per door.
- **Anti-sweat Heater Control**: This evaluation involved 14 site visits across SCE and SDGE service territories, revealing higher relative humidity (RH) levels than expected. This adjustment to the model predicts greater savings in electric consumption for heaters, along with the associated greater gas savings from HVAC interaction. Therefore, this measure ends with 115% GRR for electric savings and 109% for gas savings.
- **Medium-Temperature Case Doors:** The evaluation team conducted 13 site visits with a thorough verification process that encompassed assessing the quantity and dimensions of the installed doors, case temperature, the type of case lighting, and the presence of night covers in the baseline scenario. Additionally, it was confirmed that the operation of the refrigeration system aligned with the pre-established assumptions. Despite challenges in obtaining detailed customer information on infiltration reduction and refrigeration efficiency improvements, critical for savings calculations, the primary parameters used in the savings algorithm matched the eTRM standards, achieving a GRR of 100% and a relative precision of zero.
- **Heat pump water heaters**: The evaluation of HPWHs involved verifying the previous water heater type and collecting specifications of the new heat pump water heater, such as capacity, efficiency, and hot water temperature setpoint through four site visits. Most collected parameters aligned with the tracking data expectations. The analysis used the same DEER building prototype as the eTRM calculator, resulting in a GRR of 100% and a relative precision of zero.
- **Additional measures**: Furthermore, the research team conducted 10 IDIs focused on variable frequency drives (VFDs) and lighting measures. These interviews were aimed at verifying the conditions present before the implementation of measures, the details of the measure installation process, and confirming that the current operation of these measures meets the program's requirements.

Figure 1-3. Evaluated gross realization rate results by measure package name



1.3.1.2 Net savings

The evaluation team estimated the NTGRs for 76 claims[28] and calculated NTGRs both for the program overall as well as broken down by PA and measure type. Across the board, the NTGRs for this program were very high with a NTGR of 97% for kWh and 98% for therms. The qualitative survey responses indicated that program participants highly valued the program incentives as project drivers. It is also worth noting that the refrigeration measures – such as the auto closers and the anti-sweat heater controls – are not as well known, or as widely promoted by contractors, as other energy efficiency measures such as lighting retrofits. The relative obscurity of these measures reduces the chances that customers would initiate these improvements either on their own accord or in response to a vendor sales pitch.

At the program level, the relative precisions at the 90% confidence intervals were in the 0.6%-4% range, much lower than the conventional relative precision target of 10% for evaluation studies. These good precision rates were mainly due to the low variance in the estimated NTGRs across the survey respondents. Almost all the respondents were “telling a similar story,” both in their responses to specific NTG scoring questions, and in response to open-ended qualitative questions as to the importance of the program information and incentives in their project decision-making. This consistency in the survey responses resulted in similar NTGR estimates which, in turn, produced better levels of relative precision.

Figure 1-4 breaks down the electric energy (MWh) savings, electric demand (MW) savings, and gas energy (MMBtu) NTGRs by PA. The chart compares the evaluated NTGRs with the projected NTGRs that the PAs had reported in their program plans. The chart also includes lines representing the confidence intervals surrounding the NTGR point estimates. The chart shows that the evaluated NTGRs for PG&E and SCE were very high (99%-100%) and much higher than the NTGRs that the PA had reported in their planning numbers.

While the electric NTGRs for SDGE were lower (76-78%) than those for the other PAs, it is important to note that the high relative precisions for these NTGRs mean that when the confidence intervals are applied, the SDGE NTGRs could be as

[28] The number of claims differed slightly between the gross and net savings samples mainly due to some differences in the survey targets. While there were cases where the site contact (e.g., a store manager) was involved in the project decision-making and could therefore answer both the gross and net savings survey questions, in most cases the project decision-making was done at a corporate level. Therefore, for the net survey the evaluation team usually interviewed a single individual who had been responsible for the project decision-making of multiple sites who was usually different than the site contact. Another reason for the slight differences between the gross and net sample sizes was due to the treatment of claims which the team had determined to have zero savings. These sites were included in the gross sample counts but removed from the net sample counts.

high as those for PG&E and SCE (although these NTGRs could also be much lower). The high relative precision for the SDGE NTGR was due to great variability in the four total NTGR responses, with one respondent giving the program full attribution (100%), one respondent giving the program partial attribution (50%), and two respondents giving the program no attribution (0% NTGR).

Figure 1-4. Reported and evaluated NTRG results by program administrator, with precision rate

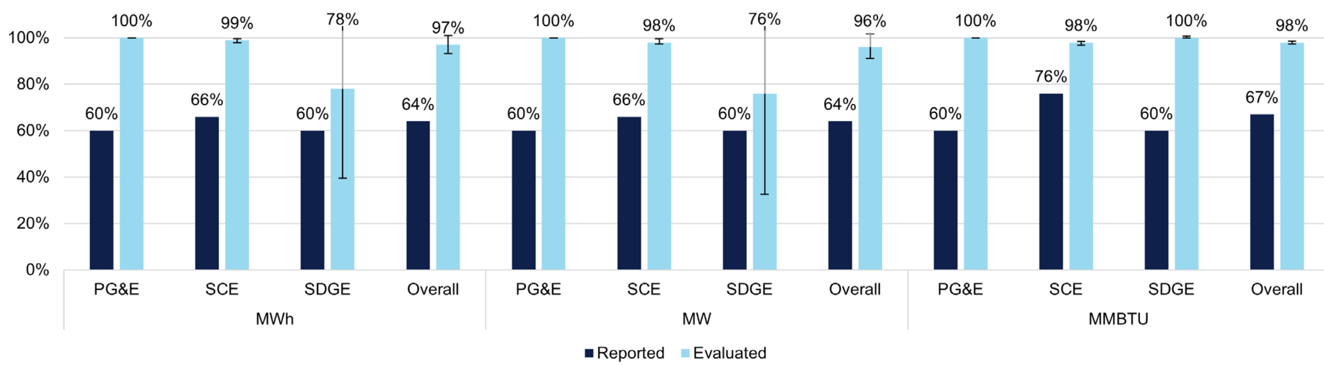
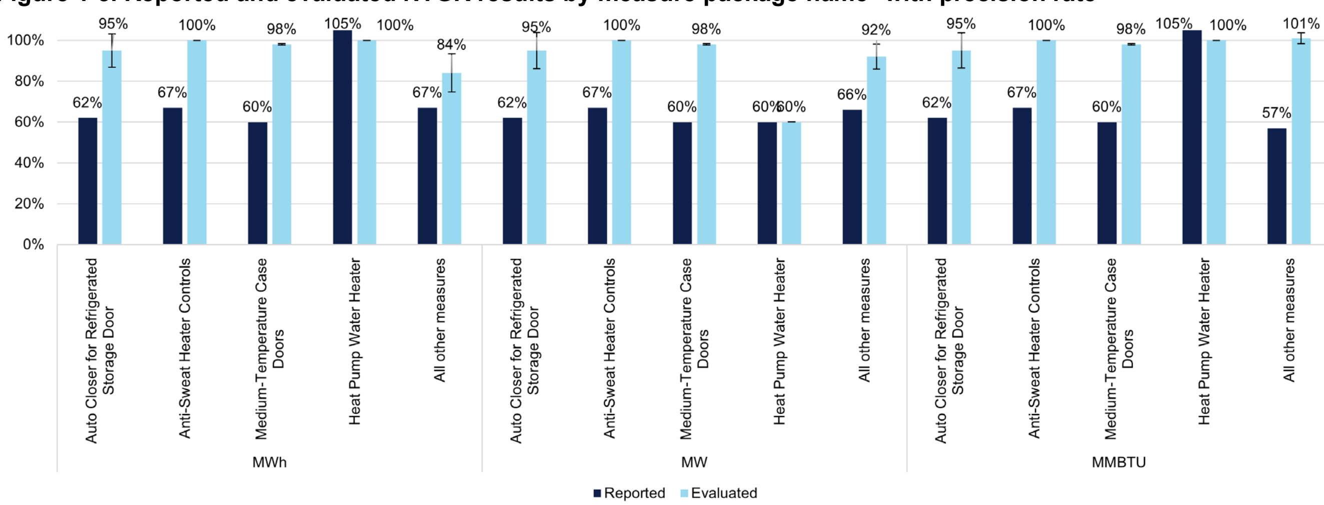


Figure 1-5 shows the electric energy (MWh) savings, electric demand (MW) savings, and gas energy (MMBtu) NTGRs broken down by measure package name. All the NTGRs were very high with the lowest in the range (84%) being for the group of ‘All other measures.’ The LEDs were the measures in the ‘All other measures’ group which had the lowest NTGRs. For example, the NTGR of the tubular LEDS (TLEDs) was only 35%. The wide availability of LEDs in general, the relatively low cost of TLEDs, and the robust activity of lighting contractors promoting LED retrofits are likely explanations for these lower NTGRs.

Figure 1-5. Reported and evaluated NTGR results by measure package name* with precision rate



*HPWH evaluated net electric demand savings were passed through because we did not capture any survey responses that corresponded to HPWH measures with demand savings reported.

1.3.2 Cost effectiveness and total system benefit

Table 1-4 provides an overview of the cost-effectiveness and total system benefits (TSB) from the evaluation of the energy-efficiency programs administered by PG&E, SCE, and SDGE. The evaluation reveals that the evaluated Total Resource Cost (TRC) and Program Administrator Cost (PAC) exceed the reported figures for all Program Administrators, with PG&E

and SCE observing an enhancement, and SDGE showing a modest improvement. It's noteworthy that the evaluated TRC for SCE, despite an increase, does not meet the cost-effectiveness benchmark of 1.0, underscoring an area for potential program enhancement.

Regarding TSB, the evaluation underscores a relative increase over the reported values, which is attributed to the uplift in benefit values stemming from the higher evaluated gross savings and NTGRs. The gains in TSB are particularly notable, given that there were no alterations to costs and Effective Useful Lives (EULs) within the scope of this evaluation. This highlights that the observed increases in TSB are not due to cost adjustments but rather the intrinsic value derived from the programs themselves. Customer feedback emphasized several aspects of this intrinsic value, including the adequacy of incentives, the relevance and effectiveness of the measures, and the alignment with customer budgets and timelines. Participants appreciated the incentives, which motivated them to complete energy efficiency projects, and reported no significant issues with the measures, indicating overall satisfaction with the program offerings.

Table 1-4. Cost effectiveness and total system benefit results

Program Administrator	TRC		PAC		Budget	TSB	
	Reported	Evaluated	Reported	Evaluated	Reported	Reported	Evaluated
PG&E	0.83	1.21	1.49	2.18	$5,019,491	$7,393,229	$10,818,138
SCE	0.54	0.77	0.73	1.05	$20,357,034	$14,636,135	$21,331,854
SDGE	1.03	1.22	1.25	1.48	$2,900,008	$3,555,419	$4,230,549

1.3.3 Process evaluation

DNV assessed the performance and operational integrity of energy efficiency programs. Through the analysis of Program Implementation Plans (PIPs) and insights from implementer interviews, this section aims to assess how these programs measure up against their budgetary and performance benchmarks, shed light on the nuanced challenges and accomplishments of the programs, and reveal discrepancies in reporting metrics to the realization of savings and cost-effectiveness goals.

The reader should note that there was an issue with SCE's implementer's original contract being too ambitious. The contract budget was reduced to approximately 40% of its original value. The goals and performance in this section represent those of the final, reduced contract.

1.3.3.1 Program performance assessment

DNV compared the program practices as reported by program implementers via in-depth interviews to those documented in the PIPs. In all three cases, actual practices varied substantially from those in the PIPs. Two goals of the 3PP approach are to foster innovation and reach a wider range of customers. The PIPs described comprehensive programs that offered a wide range of energy efficiency measures to small, medium, and large customers, using a variety of delivery methods. However, in practice, the programs tended to focus on traditional approaches of pursuing projects with large customers with whom they had pre-existing relationships. Furthermore, the programs provided a very narrow range of measures, mostly automated refrigerator door closers. The program managers said this approach was necessary for cost-effectiveness.

DNV examined program PIPs and conducted interviews with program implementers for information about program performance relative to budgets and key performance indicators. Table 1-5 summarizes the programs' filed budgets, spending, net energy savings, and cost-effectiveness ratios. Overall results were mixed: two of the three programs exceeded their net savings goals (PG&E and SCE), especially for electric demand, and two of the programs also exceeded their cost effectiveness goals (PG&E and SDGE). This is generally a positive set of results due to higher than expected and unusually high NTGRs calculated during the evaluation. Filed savings and cost-effectiveness results were below target for all of the programs. This shows the importance of programs continuing to enroll customers that would not otherwise install energy efficiency measures.

Detailed spending varied across the three programs. The PG&E and SDGE programs both reported using about 47% of their spent budget for customer incentives, approximately 40% for implementation, and the final 13% for administration and marketing. In contrast, the SCE program spent 38% of its spent budget on incentives, 50% on implementation, and the other 12% on administration and marketing.

Table 1-5. Program KPI Achievements

KPI	PG&E	SCE[29]	SDGE
Budget	$4,670,317	$24,814,000	$13,812,695
Spending (% of budget)	$4,586,884 (98%)	$19,786,301 (80%)	$2,445,982 (18%)
Net kWh Savings vs. goal	112%	111%	28%
Net kW Savings vs. goal	243%	256%	47%
Net Gas Savings vs. goal	110%	Goal not documented	10%
Cost-effectiveness Goal (TRC)	1.34	0.70	Goal not documented
Cost-effectiveness Filed (TRC)	0.83	0.51	0.68
Cost-effectiveness Evaluated (TRC)	1.21	0.77	1.22

Several factors contribute to the difficulty of achieving cost-effectiveness. First, these programs were still ramping up. The SCE and PGE programs were in the first year of their implementation while the SDGE program was in the second year. Related to this ramp-up, program implementers reported that the transfer of the programs from the IOUs to third-party implementers caused a loss of brand recognition and market momentum that the IOU-run programs had established. In particular, the SCE implementer reported there is strict language in their contract restricting cobranding with and how much they can mention SCE. Starting over and rebuilding that momentum slowed down program participation. Furthermore, DNV observed from interview responses that the coordination between the 3PP programs and other programs such as those directly offered by the IOUs or those offered through RENs in the same geographical areas was minimal. This could have resulted in confusion in the market and unintended competition between energy efficiency programs. It was primarily the implementers who reported customer confusion regarding the association with specific utility programs. Customers often struggled to identify which utility program they were participating in. Implementers also highlighted issues with competing for the same customers as the RENs. In these overlapping geographical areas, better coordination among implementers is necessary. Improved communication to customers will help clarify the roles of different entities and ensure customers understand which program serves their needs. Specifically, there needs to be more coordination and clarification about the various roles, ensuring that RENs augment areas where the IOU programs do not reach. Clear communication about the roles and responsibilities of each party will be essential in addressing this confusion.

Program managers also reported that recent changes to the way cost-effectiveness is calculated hindered their ability to achieve scores above 1.0. Specifically, they cited that cost-effectiveness must now be calculated at the customer level rather than at the building level. They reported that these requirements forced them to focus on a narrow set of measures,

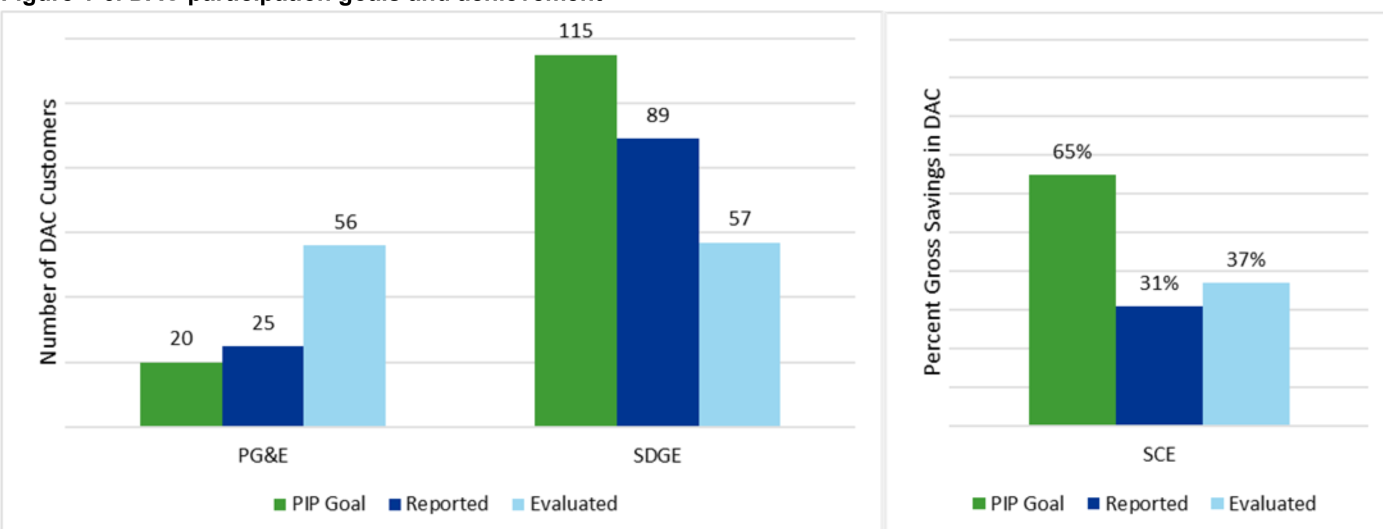
[29] Data in this column reflects Willdan's final, revised contract from 04/02/2023.

and expressed worry that additional changes to measure codes, measure packages, and regulatory policy would further constrict the range of measures that can be delivered cost-effectively.

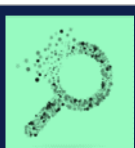
1.3.3.2 Participant assessment

DNV examined the number of participants residing in DAC areas based on geocoding of program tracking data. We were unable to assess HTR status. Program data did not list HTR status, and there was not enough information in the tracking data for DNV to impute a value. There were also not enough completed surveys for DNV to use to assess HTR status. Figure 1-6 shows the DAC participation goals from program PIPs, reported values, and evaluated values. Note, PG&E and SDGE set goals based on the number of participants while SCE's goal was based on the proportion of savings. DAC participation achievements were mixed. The PG&E program exceeded its goal. SDGE achieved a similar number of DAC participants as PG&E, but this was approximately half their original goal. Similarly, SCE achieved about half its goal of DAC savings.

Figure 1-6. DAC participation goals and achievement



1.4 Recommendations and considerations

 **Key findings**	 **Implications and recommendations**
1. The GRRs for electric energy savings attributed to PAs exceeded 100%. This outcome can primarily be attributed to adjustments in relative humidity levels for anti-sweat heater controls. The recalibration of passage time and duration parameters for auto-closer measures in refrigeration cases is another impact factor but not a high-profile update.	To enhance the accuracy of savings estimations, especially for significant refrigeration measures, it is recommended to incorporate the data collected during the evaluation into the update process for measure packages. This should include more detailed information on types, efficiencies, and operational parameters of refrigeration and HVAC systems.

 **Key findings**	 **Implications and recommendations**
2. Third-party implementers reported a lack of brand recognition and market momentum from past utility-run initiatives due to PAs not allowing effective affiliation or co-branding.	Allow programs to reference the utilities and past utility-run programs.
3. The project contact data provided by the PAs and implementation contractors often did not contain accurate key project decision-makers even after the evaluation team had specifically requested such decision-maker names. Consequently, this led to many NTG surveys having incomplete information.	Ensure PAs and implementation contractors provide contact details for end-user sites and decision-makers. This streamlines evaluations by facilitating simultaneous communication, avoiding delays when site contacts aren't key decision-makers, and reducing the need for additional data requests.
4. Actual program practices as reported in implementer interviews are inconsistent with what is written in the PIPs.	Review PIP at least annually to assess it against actual practice and justify variance from written plan through amendments.
5. The third-party run programs are recognized for their potential to drive innovation. However, the analysis indicates that these programs frequently capitalize on established relationships and existing savings opportunities.	For future third-party program designs, the CPUC should enforce the use of the updated definition of innovation as documented in the latest version of the Energy Efficiency Programs Implementation Plan Program Guidance[30] (May 2020 as of the publication of this report). It's implied that the IOUs must align their program designs with the updated definition. This recommendation aims to ensure consistency and clarity across all third-party program designs.
6. Coordination between third-party programs and existing utility-operated programs is minimal, despite the participant crossover between multiple commercial programs. This lack of interaction fails to recognize the diverse experiences of participants when engaging with PAs and third parties, leading to a disjointed program experience.	Establish a collaboration framework to facilitate more frequent information sharing, checks and balances, and coordination between utility-run and third-party-run programs.
7. Program attribution was very high with overall program NTGRs being 97% for electric energy savings and 98% for gas energy savings. Survey respondents emphasized the	Continue the program's focus on refrigeration technologies that are less commonly known or adopted in the marketplace since these technologies will likely continue to

[30] CPUC. "Implementation Plan Template Guidance - Version 2.1." cpuc.ca.gov, May 2020. https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/i/6442466376-implementation-plan-template-may2020.pdf

 **Key findings**	 **Implications and recommendations**
importance of the program incentives in project implementation. The program's focus on refrigeration technologies that are less commonly known or adopted in the marketplace likely also contributed to these high NTGRs.	have high NTGRs until market adoption becomes more common. Minimize the promotion of widely-marketed energy-saving technologies like TLEDs, which have lower evaluated NTGRs (e.g., 35% for TLEDs), since the market already supports them without program help.
8. Programs met savings and cost-effectiveness goals on the strength of the high evaluated NTGRs. As filed with reported NTGRs, no program met goals.	All else being equal, continuing to enroll customers that would not otherwise install energy efficiency measures will be important for programs to meet their goals.

2 INTRODUCTION

This section details the third-party commercial programs (3PCPs) that DNV evaluated in program year (PY)2022 on behalf of the California Public Utilities Commission (CPUC), along with the evaluation's purpose and objectives.

2.1 Evaluation background

DNV (or the evaluator) conducted an impact and process evaluation for three 3PCPs, PY2022: Pacific Gas & Electric's (PG&E's) Commercial Efficiency Program, Southern California Edison's (SCE's) Commercial Energy Efficiency Program, and SDGE's Commercial Large Customer Services. Table 2-1 provides an overview of these programs. These 3PCPs include small commercial refrigeration, lighting, HVAC, and food service measures, or energy-efficient technologies, that have not been evaluated in recent years.

According to the California Public Utilities Commission (CPUC or the Commission) decision D. 18-01-004, by the end of 2022, at least 60% of the energy efficiency portfolio budgets of the Investor-Owned Utilities (IOUs) must be planned and executed by third-party implementers. Third-party programs are defined as those suggested, devised, executed, and delivered by personnel under contract to a utility program administrator (PA) but not part of the utility itself. The Commission intended for this change to reduce program delivery costs and stimulate innovation in program design and delivery, outreach strategies for hard-to-reach (HTR) customers, and competitive bidding.

2.2 Evaluation purpose & objectives

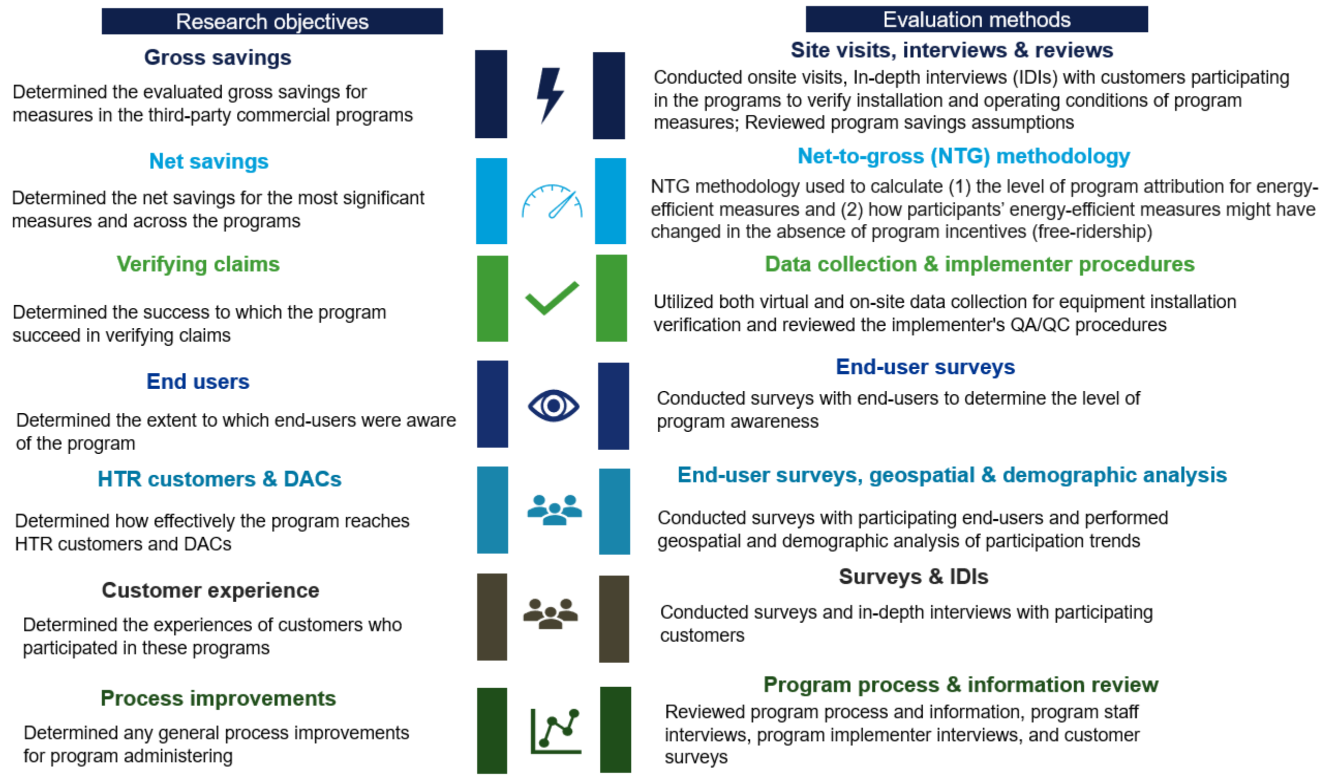
To better understand how third-party commercial programs deliver inventive energy-efficient solutions, DNV assessed their effectiveness in critical areas such as energy savings, net-to-gross ratios (NTGRs), Total System Benefit (TSB), and the quality of their program tracking data and marketing and outreach strategies. Third-party commercial programs can reach a diverse range of customers including those defined as HTR or a part of a disadvantaged community (DAC). Therefore, the evaluation also focuses on the functionality and effectiveness of these programs within the HTR and DAC sectors, notably in how they meet the many aspects of equitable program participation.

DNV's evaluation objectives were to answer the following research questions:

- What are the ex post gross savings for evaluated measures in the third-party commercial programs?
- What are the ex post net savings for evaluated measures in the third-party commercial programs?
- To what extent did the program succeed in verifying claims?
- How effectively does the program reach HTR customers and disadvantaged communities?
- What are the experiences of customers who participate in these programs?
- What, if any, general process improvements for program administering could be recommended?

Figure 2-1 summarizes this study's research objectives and evaluation methods.

Figure 2-1. 3PCP evaluation objectives & approach



2.3 Evaluated programs

Table 2-1 below lists detailed information about the evaluated 3PCPs for PY2022.

Table 2-1. Commercial third-party programs included in the PY2022 Evaluation

Program name(s) & ID	Detailed program description
Program name(s): Pacific Gas & Electric (PG&E)- Commercial Efficiency Program or NetOne Commercial Efficiency Program **Program ID: PGE_Com_003**	**Program summary:** A four-year downstream program that promotes energy efficiency and energy consumption reduction in commercial settings. **Program measures:** Provides a direct install approach for custom and deemed measures and incorporates Normalized Metered Energy Consumption (NMEC) into its process flow. **Software tools:** Uses Energy Orbit, a Salesforce-based platform for customer relationship management (CRM), project development and management, incentive and energy savings calculations, and ongoing monitoring and reporting. **Quantitative program targets (2021-2024):** 385 total number of customers served by 2024 with 77 Disadvantaged Community (DAC) projects. The program also strives to deliver incentives worth $9,891,444 during this timeframe. **Evaluation, Measurement & Verification (EM&V):** Takes a structured approach to the Evaluation, Measurement & Verification (EM&V) process. Stores all applicable data points into the program's tracking data system which includes data validation mechanisms and is

Program name(s) & ID	Detailed program description
	programmed to prohibit incomplete or false project records from moving forward in the process. **Third-party implementer:** Ecology Action
Program name(s): Southern California Edison (SCE)- Commercial Energy Efficiency Program or the Willdan Commercial Energy Efficiency Program **Program ID: SCE_3P_2020RCI_005**	**Program summary & measures**: A downstream commercial program that offers a variety of custom and deemed measures such as refrigeration system retrofits, low-charge ammonia, refrigeration compressor controls, insulating refrigeration lines, walk-in cooler suction line insulation, evaporator coil fan, optimized refrigeration evaporator fan controls, oversized air-cooled condenser, night curtains, walk-in electronically commutated motor (ECM), and a site-level whole building comprehensive retrofit measure. **Quantitative program targets (2022-2026):** Targets include the total number of projects or customers served, deemed projects, custom projects, HTR customers served, and DAC projects. Total number of projects is expected to reach 10,725 by 2026, with 9,196 deemed projects, 195 custom projects, 3,988 HTR customers served, and 1,832 DAC projects. **Program budget and savings information:** Allocates budgets for administration, marketing/outreach, incentive/rebate, and direct implementation. The total budget for the program from 2022 to 2026 is expected to be $141,654,000. By 2026 the program aims to achieve a gross demand reduction of 42,345 kW and gross energy savings of 490,000,000 kWh. **Data collection for ex ante savings estimates and NMEC models**: Uses SCE utility data, other independent variables (e.g., occupancy rates), building occupancy schedule, equipment specifications, schedules, sequences, equipment operating parameters, and weather data for creating site-level normalized metered energy consumption (NMEC) energy use models and ex ante savings estimates. **Program cost-effectiveness**: For 2022, the expected annual average TRC from the program implementation manual is 0.7. The filed TRC was 1.27, while the Claim (up to 2022) is 0.54. The program's cost-effectiveness, measured using the Total Resource Cost (TRC) test, is expected to average 1.13 from 2023 to 2026. **Third-party implementer:** Willdan
Program name(s): San Diego Gas & Electric (SDGE)- Commercial Large Customer Services (>20KW) Program or the Comprehensive Energy Management Solutions Program **Program ID: SDGE4004**	**Program summary:** A downstream commercial program that promotes energy efficiency and energy consumption reduction in large commercial settings. **Program measures:** Includes custom and deemed measures such as air conditioners, anti-sweat heater controls, auto closer for refrigerated storage doors, bare suction pipe insulation, circulating block heaters, cogged V-belts for HVAC fans, convection ovens, conveyor broilers, conveyor ovens, dishwashers, display case doors, domestic hot water loop temperature controller, EC motor retrofit for a walk-in cooler or freezer, and enhanced ventilation for packaged HVAC. **EM&V:** Follows a structured and secure EM&V process. Stores all applicable data points into the program’s tracking system which is programmed to prevent incomplete or

Program name(s) & ID	Detailed program description
	inaccurate project records from entering into the process. Uses a developed Measurement and Verification (M&V) plan that covers M&V requirements and details for all NMEC projects. **Key Performance Indicators (KPIs):** Tracks KPIs such as program performance, savings to goal (kWh, kW, therms), TRC Ratio, passed inspections, financials/savings, savings claimed, budget spent, savings/budget alignment, customer satisfaction, reporting accuracy, HTR/DAC penetration, and innovation. **Workforce education and training:** Engages SDGE's Workforce Education & Training (WE&T) program to promote the creation of a skilled and esteemed workforce. Program team encourages customers and Trade Professionals to provide job access to Disadvantaged Workers through the application process, and regularly works with local associations, training organizations, and colleges to support the recruitment and training of a diverse industry workforce. **Workforce standards:** Program emphasizes skilled and knowledgeable personnel to perform the installation, modification, and maintenance of HVAC measures and provides relevant installation, maintenance, and operational training to meet energy savings goals. **Third-party implementer:** TRC

2.4 Third-party commercial program savings

Table 2-2 and Table 2-3 below present the PY2022 deemed savings claims by program ID and measure package name.

Table 2-2. PY2022 deemed savings claims by program ID

Program ID	No. of Sites	No. of Claims	First Year MW electric demand		First Year MWh electric energy		Lifecycle MWh	First Year MMBtu gas energy		Lifecycle MMBtu
			Gross	Net	Gross	Net	Net	Gross	Net	Net
PG&E_Comm_003	380	652	2.66	1.60	12,784	7,693	47,662	31,746	19,080	96,158
SCE_3P_2020RCI_00 5	1,243	2,525	5.46	3.60	38,087	24,978	119,626	30,620	23,214	204,513
SDGE4004	516	909	1.35	0.81	6,907	4,144	25,027	7,773	4,691	27,697
Total	**2,139**	**4,086**	**9.46**	**6.01**	**57,778**	**36,816**	**192,315**	**70,139**	**46,985**	**328,368**

Table 2-3. PY2022 deemed savings claims by measure package name

Measure Package Name	No. of Sites	No. of Claims	First Year MW electric demand		First Year MWh electric energy		Lifecycle MWh	First Year MMBtu gas energy		Lifecycle MMBtu
			Gross	Net	Gross	Net	Net	Gross	Net	Net
Auto Closer for Refrigerated Storage Door	1,426	2,485	5.29	3.30	23,769	14,824	99,318	-170	-105	-702

Measure Package Name	No. of Sites	No. of Claims	First Year MW electric demand		First Year MWh electric energy		Lifecycle MWh	First Year MMBtu gas energy		Lifecycle MMBtu
			Gross	Net	Gross	Net	Net	Gross	Net	Net
Anti-Sweat Heater Controls	579	929	2.10	1.41	22,438	15,114	60,454	-20,133	-13,561	-54,242
Medium-Temperature Case Doors	77	77	1.07	0.65	7,813	4,721	23,607	71,856	43,447	217,236
LED, Tube, Type B, and Type C	113	143	0.41	0.28	2,544	1,724	10,709	-1,187	-795	-4,862
Enhanced Ventilation for Packaged HVAC	22	22	0.31	0.19	932	571	2,857	2,719	1,664	8,318
LED, Tube	85	176	0.09	0.06	533	366	1,782	-387	-272	-1,302
ECM Retrofit for a Walk-in Cooler or Freezer	110	168	0.04	0.03	311	231	1,156	0	0	0
LED, High, or Low Bay	12	12	0.01	0.01	79	72	868	-15	-13	-159
Heat Pump Water Heater, Commercial	1	5	0.01	0.01	121	73	727	0	0	0
Exhaust Hood Demand Controlled Ventilation, Commercial	1	1	0.01	0.00	62	37	557	141	85	1,273
Evaporative Pre-Cooler System and Controls for Packaged HVAC Unit	1	6	0.10	0.06	103	62	309	0	0	0
VSD for HVAC Fan Controls, Commercial	4	4	0.01	0.01	101	61	304	-45	-27	-135
Package Terminal Air Conditioner or Heat Pump, Under 24 kBtu/hr	2	2	0.01	0.00	17	10	155	0	0	0
Reach-In Refrigerator or Freezer, Commercial	15	15	0.00	0.00	7	4	53	0	0	0
Software-Controlled Switch Reluctance Motor	3	3	0.00	0.00	3	2	34	-2	-1	-22
Ice Machine, Commercial	2	2	0.00	0.00	3	2	17	0	0	0
Fryer, Commercial	5	5	0.00	0.00	0	0	0	788	473	5,670
Fan Motor Retrofit for a Refrigerated Display Case	1	1	0.00	0.00	0	0	0	0	0	0
Pool Cover, Commercial	1	1	0.00	0.00	0	0	0	1,204	722	3,612
Heat Pump Water Heater, Commercial, Fuel Substitution	7	7	0.00	0.00	-99	-99	-993	1,180	1,180	11,802
Large Heat Pump Water Heater, Commercial and Multifamily, Fuel Substitution	10	22	0.00	0.00	-960	-960	-9,599	14,188	14,188	141,883
Total	**2,139**	**4,086**	**9.46**	**6.01**	**57,778**	**36,816**	**192,315**	**70,139**	**46,985**	**328,368**

3 METHODOLOGY

This section provides detailed information on DNV's study approach for the Commercial Third-Party Program impact and process evaluation.

3.1 Data collection and sampling

This section provides the data DNV used to estimate gross and net program savings, define HTR/DAC customers, assess program performance, and characterize program participation. DNV also provides the sample design and selection used for different analyses and the primary data collection effort to support these.

3.1.1 Data sources

Table 3-1 below summarizes the various data sources and the purpose of their inclusion in the proposed evaluations.

Table 3-1.Summary of data sources and purpose in evaluation

Data sources	Description	Purpose in analysis
Program tracking data	PA Program data includes a number of records, savings per record, program type, name, measure packages, measure description, incentives, etc.	Identify program participants, installed measures, and claimed (ex ante) savings
Program information	Participant information (account number, contact name, email, phone number), measures, program information (budget spending, marketing, and outreach)	Gross savings verification, program performance assessment, participation analysis
Customer information system (CIS) data	PA CIS data on customer characteristics including housing type, zip code, climate zones, etc.	Program performance assessment, participation analysis
CalEnviroScreen	Measure of economic, health, and environmental burden from the California EPA	Program performance assessment, participation analysis
U.S. Census data	Block group-level data on income, language, geographic region (urban/rural), rental status	Program performance assessment, participation analysis
Telephone/web surveys	Includes surveys of customers, property managers, retailers, and other market actors	Inform net-to-gross ratios and net savings; Verify installation; Program performance assessment, participation analysis, Customer experience
In-depth interviews	Interviews of PA program staff and implementers to gather information on program design and performance including marketing and outreach efforts, program status (budget spent, customers reached, measures installed)	Verify installation and program performance assessment, participation analysis
On-site Inspections	Confirmations through physical inspections and measurements to verify the installation and effectiveness of implemented measures	Verify installation, program performance assessment, participation analysis, and efficacy of measures implemented

The data sources listed above are defined as follows:

- **Program tracking data**: DNV extracted program participation information from the tracking data filed by PAs with the CPUC in the California Energy Data and Reporting System(CEDARS). This data was analyzed, cleaned, and reformatted as needed. The impact evaluation team reviewed PA monthly reports and program tracking data to validate reported claims.
- **Customer information system (CIS) data:** DNV acquired additional participant information from utility customer information tables to understand participation patterns.
- **Program information:** DNV requested additional participant details, specifics on measures that have been installed, and overall program information for the purpose of evaluation. Data related to replaced equipment was only collected in cases where the project was categorized as an 'Accelerated Replacement'. This data collection facilitated a deeper understanding of participation patterns and enabled a more targeted evaluation of program performance.
- **U.S. Census data:** DNV used U.S. Census data to supplement participant information and map it to program areas to understand participation characteristics and program performance.
- **CalEnviroScreen:** DNV used this metric calculated by CalEPA to define DACs for program performance assessment and evaluated DAC participation in 3PPs.
- **Telephone/web surveys:** DNV conducted surveys with various stakeholders to benchmark program performance, characterize participants, and gain insight into customer experiences.
- **In-depth interviews (IDIs)**: DNV conducted detailed interviews with PA staff, program implementers, and select contractors to understand program design and execution, and inform the evaluator's data collection and program performance assessment efforts.
- **On-site inspections**: DNV conducted inspections (on-site) for a sample of measures installed across the service territories.

3.2 Gross savings analysis

The evaluation of these PY2022 programs focused on the functionality of these programs, including program delivery, targeting, and data tracking. DNV also concentrated efforts on understanding barriers and opportunities in these areas, given that most of the evaluated programs were in their second year of operation. Since the evaluation concentrated on program performance, DNV used standard rigor to estimate gross savings. DNV estimated gross savings and realizations based on measure package validation and installation verification.

For measure package validation DNV used the CEDARS tracking data and information from program documentation obtained through data requests. DNV used these two sources to gather:

1. Site and contact information
    a. Site-specific information including meter number, address, building type, climate zone, and zip code where program measures were installed
    b. Participating customer information including utility account number, name, phone number, and email address
    c. Property owner/manager contact information (name, number, email address), if applicable
    d. Installation contractor/sub-contractor information (ID, name, number, email address), if applicable
2. Measure code and description
    a. Manufacturer, model, and efficiency of replaced technology
    b. Measure quantity or measure size (capacity, etc.)
    c. Measure age and condition

3. Information on installed measures
    a. Measure Code and Description
    b. Manufacturer, model, and efficiency of installed technology
    c. Measure quantity or measure size (capacity, etc.)
    d. Installation date
4. Parameters that affect energy savings including unit energy savings (UES) and effective useful life (EUL)
5. Source of the parameters used to calculate claimed energy savings including DEER, measure packages, and eTRM
6. Energy use of participating sites

DNV used the information gathered to assess the reasonableness of the claimed savings estimates. Based on the information, DNV determined if the appropriate ex-ante sources (eTRM and measure packages) were applied for each claimed measure. If the correct sources were used, DNV verified that the claimed savings used the correct parameters (UES and EUL). DNV also updated savings calculations based on correct sources and values, where needed.

DNV reviewed tracking data claimed quantities for reasonableness and verified installation rates of program measures from a combination of web, telephone, and video surveys among contractors and end users.

DNV used the verified UES and installation rates and/or quantities to calculate total first-year gross savings and compared these to total first-year claimed savings to obtain realization rates. DNV also determined the reasonableness of first-year gross claimed savings by calculating the expected percent savings per measure for each site based on the total claimed savings relative to the annual energy consumption of the site. DNV used verified EUL values to calculate lifetime gross savings for each installed measure. These values were aggregated to the program level to compare program-specific energy impacts to program savings goals.

3.2.1 Auto closer for refrigerated storage door

3.2.1.1 Measure background and Technical Resources Manual (TRM) methodology

The Auto Closer for Refrigerated Storage Doors (Measure ID: SWCR005-02) is a measure designed to reduce the amount of time that the door of a walk-in cooler or freezer is open, thereby reducing infiltration and refrigeration loads. This measure is specified as the installation of an automatic door closer on a walk-in cooler or a walk-in freezer door that was not previously equipped with one.

The Auto Closer for Refrigerated Storage Doors measure can significantly reduce energy consumption in walk-in coolers and freezers by reducing air infiltration. Energy modelling can be used to quantify these savings by incorporating the above parameters and comparing the measure case to the baseline conditions.

The building energy simulation model DOE-2.2R (via eQUEST Refrigeration 3.65) was used to derive base case and measure case unit energy consumption (UEC). The unit energy savings (UES) were calculated as the difference between the modeled total (whole building) energy consumption of the base case and measure case models.

The measure reduced the infiltration into the coolers and freezers by 40%. This assumption was based on the DEER2005 Update Report, which modeled this measure by assuming that the auto door closer leads to a 40% reduction in infiltration loading of the refrigerated space. The unit energy savings (UES) were calculated as the difference between the modeled base case and measure case total unit energy consumption (UEC).

The baseline conditions for these parameters can be inferred from the document. For example, the base case infiltration rates for the cooler and freezer spaces were specified as 0.0708333 CFM/FT.^{2} The measure case reduces these rates to 0.0425000 CFM/FT^2, representing a 40% reduction in infiltration loading of the refrigerated space.

The base case and measure case UEC were aggregated across four vintages (2003, 2007, 2011, and 2015) that represent the median existing commercial building stock using the DEER2020 commercial building weights and model post-processing methodology. The peak demand reduction was calculated as the difference in the base case and measure case average demand.

3.2.1.2 Data collection and savings adjustment

DNV conducted 13 site visits across different PAs to verify the several key parameters used in the energy model. Among all visited sites, there were 7 medium-temperature and 8 low-temperature refrigerated storage cases. In addition, DNV deployed HOBO occupancy loggers during the site visit to capture passages per hour and passage time for the impacted refrigerated spaces. Table 3-2 summarizes the differences between TRM assumption and DNV's collected information, with how DNV determined to apply the information in the evaluation.

Table 3-2. Comparison of key parameters between TRM and DNV- collected value.

Parameter	Explanation	TRM assumption	Collected value (Average)	Action
Door height and width	The dimensions of the door are crucial for determining the amount of air that can infiltrate when the door is open.	7 ft height x 5 ft width	7 ft height x 5 ft width	Keep the TRM value
Door flow factor	This is a multiplier that affects the amount of airflow when the door is open.	0.8	N/A	Keep the TRM value
Passages per hour	How often the door is open, which affects the amount of air that can infiltrate.	7.32 passages per hour	1.37 for freezer, and 3.73 for cooler[31]	Update eQUEST model with collected value
Passage time	How long the door is open, which affects the amount of air that can infiltrate.	30 sec	61.96 sec for freezer, and 95.98 sec for cooler	Update eQUEST model with collected value
Door control effectiveness	Represents the effectiveness of the door control in reducing air infiltration.	92%	N/A	Keep the TRM value
Refrigerated storage area	Size of the refrigerated storage case.	Cooler: 1,769 ft^2 Freezer: 921.1 ft^2	Cooler: 128 ft^2 Freezer: 133 ft^2	Keep the TRM value, see explanation below

Referring to the data presented in the preceding Table 3-2, DNV implemented updates to the eQUEST model inputs by modifying the passages per hour and passage time. The model preserved the infiltration reduction rate at 40% from the

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[31] Based on the logger data that evaluators deployed during the site visit

baseline to the measured scenario across the evaluated models. The update did not extend to parameters related to the refrigerated storage area. This decision was due to the direct linkage of this variable to the broader characteristics of the building and the capacity of its refrigeration system. To enhance the precision and reliability of updates concerning the refrigerated storage area, the team advocates for an expanded effort in data collection and a more thorough calibration of the eQUEST model.

3.2.2 Anti-sweat heater controls

3.2.2.1 Measure background and Technical Resources Manual (TRM) methodology

The anti-sweat heater (ASH) controls measure (Measure ID: SWCR001-02) is an energy-saving initiative that targets refrigerated display cases. The base case for this measure is a standard, fixed ASH for reach-in low-temperature and medium-temperature display cases that operate at full power, 100% of the time. Anti-sweat heater (ASH) controls are designed to prevent condensation, also known as "sweating," on the glass surface of refrigerated display cases.

These controls are based on humidity, with the heaters installed at various locations on a refrigerated display case, including the case mullion, door frame, and glass edge. In standard installations, ASHs operate at full power, 100% of the time. However, ASH controls monitor the dew point temperature of ambient air and adjust the duty cycle of the ASHs accordingly. This means that when the air is dry and the dew point temperature is low, the ASHs will operate at a low-duty cycle. Conversely, when the air is humid and the dew point temperature is high, the ASHs will operate at a 100% duty cycle. This adjustment of the ASH duty cycle according to the measured dew point temperature allows for energy savings and reduced ASH electric demand.

The measure involves equipping these display cases with humidity-sensing controls that reduce the power supplied to the heaters as the store dew point temperature decreases. Power reduction typically occurs when relative humidity levels reach 55% and lower, with power reduction decreasing by at least 2% for every percentage the humidity falls below 55%. Equivalent technologies that can reduce or turn off ASHs based on the amount of condensation formed on the inner glass pane may also qualify.

Here are the baseline conditions and measures in the eTRM listing:

- **Baseline conditions:** The base case specification for each measure offering was a standard, fixed anti-sweat heater (ASH) for reach-in low-temperature (freezer, case temperature below 32 °F) and medium-temperature (cooler, case temperature at or above 32 °F) display case that operated at full power, 100% of the time.
- **Energy usage**: Batch processing was performed to simulate the baseline and measure energy usage for all climate zones and vintages. The total energy savings were calculated as the difference between the total (whole building) energy consumption of the base case and measure case models.
- **Unit energy savings**: The UES values (kWh/yr per len-ft.) were calculated by dividing the total energy savings by the total line-up length of each refrigerated display case.

Energy modeling can be leveraged to perform a savings impact evaluation on the ASH controls measure. This involves simulating the baseline and measure energy usage for all climate zones and vintages. The total energy savings were calculated as the difference between the total energy consumption of the base case and measure case models. The unit energy savings (UES) values were calculated by dividing the total energy savings by the total line-up length of each refrigerated display case. The DEER2020 vintage weights for the grocery building types were then applied to compute the weighted average value across all vintages from 1975 to 2020 for any vintage for each climate zone.

The peak demand reduction estimates of this measure were based upon modeled energy use and savings values that reflected updated refrigeration use in the Database for Energy Efficient Resources (DEER) Grocery building prototypes. See Electric Savings for an explanation of this methodology.

MASControl3, the measure analysis software for DEER2020, was used to generate energy usage and savings for the Grocery building prototypes. MASControl3 uses the DOE-2.2-R52o simulation engine with the eQUEST Refrigeration interface and provides processing scripts for computing DEER peak demand and applying DEER2020 vintage weights. The scripts for the 4 p.m. to 9 p.m. peak period were used to generate the peak demand reduction.

3.2.2.2 Data collection and savings adjustment

DNV conducted 14 site visits covering 14 claims across different PAs to verify the several key parameters used in the energy model. Among all visited sites, there were 6 medium-temperature and 10 low-temperature refrigerated cases.[32] In addition, DNV deployed HOBO temperature & RH% loggers during the site visit to capture the case temperature and relative humidity percentage for the impacted refrigerated case fixtures. Table 3-3 summarizes the differences between TRM assumption and DNV's collected information, with how DNV determined to apply the information in the evaluation.

Table 3-3. Comparison of key parameters between TRM and DNV-collected value.

Parameter	Explanation	TRM assumption	Collected value (Average)	Action
Number of doors in the line-up	The number of doors on the refrigerated display cases can affect the total energy consumption and potential savings from the anti-sweat heater controls.	Freezer: 109 Cooler: 78	Freezer: 75 Cooler: 67	Updated with collected data
Typical door length	The length of the doors can influence the amount of surface area that the anti-sweat heaters need to cover, which can affect energy consumption.	2.6 ft per door	2.6 ft per door	Keep the TRM value
Case temperature setpoint	Target temperature that the refrigeration systems aim to maintain within the display or storage case. Higher setpoints may reduce the need for these heaters to prevent condensation.	Freezer: -5°F Cooler: 35°F	Varied based on different sites, but the average is same as TRM	Keep the TRM value
Relative humidity levels	The levels of humidity in the store can affect the operation of the anti-sweat heater controls. The controls are designed to reduce power as humidity decreases.	Max RH: 60% Min RH: 35%	Varied based on different sites, up to 90%	Update the maximum RH to 90% to reflect the actual operation status
Operation of the anti-sweat heater controls	Observing the operation of the anti-sweat heater controls in different humidity conditions can provide insights into their effectiveness and potential energy savings.	From fixed control to base on humidity ratio	From fixed control to base on humidity ratio	Keep the TRM value

[32] Some sites have multiple case doors installed with Anti-sweat heater control measure.

In the ex-ante case, the program used psychrometric chart to convert the RH% into humidity ratio as the input variable for maximum humidity ratio in the original eQUEST model. DNV used the same approach by updating the maximum humidity ratio based on the 90% RH.

3.2.3 Medium-temperature case doors

3.2.3.1 Measure background and Technical Resources Manual (TRM) methodology

The medium-temperature-case-doors measure (Measure ID: SWCR015-01) is a strategy implemented in commercial refrigeration to enhance energy efficiency. It involves modifications to various components of the refrigeration system, including case infiltration load, case conduction and radiation load, case lighting, case temperature setpoint, and defrost schedule. These modifications result in significant reductions in energy consumption, thereby leading to energy savings.

The base case is defined as a medium-temperature, open, vertical refrigerated display case, equipped with night covers on for six hours per night. In addition, the base case offers two options: with or without LED lighting fixtures. The measure case is defined as the retrofit of glass doors on a medium-temperature, open-vertical, refrigerated display case.

Energy modelling can be a powerful tool for evaluating the savings impact of the medium-temperature-case-doors measure. The electric unit energy savings (UES) for this measure were derived from detailed computer simulations based on the DOE-2.2R energy analysis program. DOE-2.2R calculates hour-by-hour building and refrigeration system energy consumption over an entire year (8760 hours) using the California Energy Commission (CEC) Title 24 weather data for a representative city in each of the 16 California climate zones. The models utilized test data from the Southern California Edison (SCE) Research and Thermal Test Center (RTTC) and an ASHRAE study to represent changes in display case infiltration, conduction, and refrigeration load for open cases versus cases with doors.

The base and measure case models were developed from DEER 2020 grocery models, with remote compressors and air-cooled condensers, except for CEC climate zones 15 and 16 where an evaporative-cooled condenser was used in the model.

Table 3-4. Variable inputs for base case and measure case models.

Parameter	Explanation	Base case	Measure case	Notes
Case infiltration load	The amount of heat gained from air infiltration into the refrigerated case.	1,306.5 Btu/h	261.3 Btu/h	Reduced by 80%.
Case conduction and radiation load	The heat gained through the case walls due to conduction and radiation.	217.75 Btu/h	91.45 Btu/h	Reduced by 58%.
Case lighting	Unit energy consumed by the lighting in the refrigerated cases.	LED: 0.004 kW/ft Non-LED: 0.018kW/ft	0.004 kW/ft	All LED
Case temperature setpoint	The target supply temperature setpoint of the local evaporator pressure regulator or temperature sensor.	31°F	35°F	Allows for proper cooling and maintains product integrity without overcooling

Parameter	Explanation	Base case	Measure case	Notes
Defrost schedule	The frequency of defrosting the refrigerated case.	4 cycles per day	2 cycles per day	Less defrost required due to less infiltration of moisture into the case

The electric UES was calculated as the difference between the modelled base case and the measure case annual UEC. The difference was divided by the number of units of measure implementation that were modelled (length of the display case line-up). Similarly, the unit peak demand saving was calculated as the average of the electrical power draw between 4:00 p.m. to 9:00 p.m. in conformance with the Database for Energy Efficiency Resources (DEER) peak definition for each climate zone, divided by the number of units of measure implementation that were modelled.

3.2.3.2 Data collection and savings adjustment

DNV conducted 13 site visits across different PAs to verify the several key parameters used in the energy model, for both baseline and measure cases. For the night cover installation status in the base case, 6 sites confirmed their cases were equipped with night covers before, 3 sites reported negatively, and 4 sites didn't know. However, one of the no night cover sites stated it was because their store operated 24 hours per day. The evaluator also surveyed the defrost schedule during the site visit. 6 sites stated the defrost schedule was set as automatic mode, 5 sites stated they still used 4 cycles per day[33], and 2 sites didn't know the defrost schedule. Table 3-5 summarizes the differences between the TRM assumption and DNV's collected information, with how DNV determined to apply the information in the evaluation.

Table 3-5. Comparison of key parameters between TRM and evaluator collected value.

Parameter	TRM assumption	Collected value	Action
Night cover	Equipped with night cover in the base case.	Equipped: 6 sites Not equipped: 3 sites Don't know: 4 sites	Keep the TRM value, see explanation below.
Case lighting	LED or non-LED	ALL with LED	Keep the TRM value.
Case temperature setpoint	Baseline: 31°F Measure: 35°F	Measure: between 28°F and 40°F	Keep the TRM value.
Defrost schedule	Baseline: 4 cycles/day Measure: 2 cycles/day	Auto: 6 sites 4 cycles/day: 4 sites Don't know: 2 sites	Keep the TRM value.

The TRM assumes night covers are equipped in the base case, aligning with the data from 6 sites reported. Although 3 sites reported not having night covers and 4 sites were uncertain, most of them did not need night covers as much as the TRM assumed since the sites operated for longer hours than in the TRM. Similarly, the higher defrost schedule of those sites reflected the longer operation time. In addition, the range for collected case temperature aligned with the case temperature setpoint that the TRM assumes. Therefore, the evaluator did not change any input variables in the DOE model based on the information above.

[33] One of the four sites was operated 24/7, and other four sites were operated 19 to 20 hours per day.

3.2.4 Heat pump water heater

3.2.4.1 Measure background and Technical Resources Manual (TRM) methodology

The Heat Pump Water Heater (HPWH) measures included three packages: Heat Pump Water Heater, Commercial, Fuel Substitution (SWWH027-02), Large Heat Pump Water Heater, Commercial and Multifamily, Fuel Substitution (SWWH028-01), and Heat Pump Water Heater, Commercial (SWWH031-01). They were all designed to replace electric-resistance, natural gas, or less efficient heat pump water heaters with energy-efficient, electric heat pump water heater variants, thereby advancing the decarbonization of domestic water heating loads.

Heat pump water heaters stand apart in their performance compared to traditional domestic water heating methods. They operate using a direct expansion (DX) heat pump mechanism to transfer heat to the water.[34]They encompass both individual unit storage heat pump water heaters and central hot water heating systems designed for larger applications like multifamily, commercial, and industrial buildings. These central systems can be categorized into:

- Integrated heat pump with tanks: Simple and versatile, they can function either standalone or as clustered units for central systems.
- Split heat pump with tanks: With separated heat pump and tank systems, they provide installation flexibility.
- Standalone heat pumps: The most expansive systems, they lack a tank but are specified based on design needs.

Key components of these central systems included multiple water heaters, storage tanks, expansion tanks, mixing valves, circulation pumps, heat exchangers, and backup electric resistance heaters. It's noteworthy that when transitioning from a large-capacity natural gas heater to heat pumps, plumbing adjustments might be necessary, especially if a single gas heater is replaced with multiple heat pump variants.

The baseline system for these measures encompassed not only conventional electric-resistance and natural gas water heaters but also included existing code-compliant electric heat pump water heaters. In terms of fuel substitution, the comparative baseline was established using federal minimum code-compliant gas storage or instantaneous water heaters, further emphasizing the transition to more energy-efficient systems.

- For SWWH027-02, the base case was defined as a natural gas storage or instantaneous ("tankless") domestic hot water heater that met the minimum federal code (see Code Requirements). The measure assumed pre-existing (accelerated replacement) baseline technologies and standard/code (normal replacement) baseline technologies are described in the calculator.
- For SWWH028-01, the base case was federal code-compliant storage natural gas domestic hot water heaters. The measure assumed that the existing case and standard case baselines were the same.
- For SWWH031-01, the base case was defined as an electric storage water heater with a 30, 40, or 50-gallon storage volume. The measure assumed that the existing case and standard case baselines used the same code-compliant equipment. The minimum base case efficiencies aligned with the Code of Federal Regulations standards.

The unit energy consumption (UEC) and UES were derived from the DEER water heater energy use calculator, version 4.2, a macro-enabled Excel workbook developed by consultants of the California Public Utilities Commission (CPUC) Energy Division to standardize the inputs and savings calculations for water heating measures. Version 4.2 of the calculator utilizes hourly output from the DEER2014 DOE-2 building prototypes for hot water loads (in gallons per minute, by building type) and ambient conditions (incoming "mains" water temperature, ambient indoor space temperature) to estimate hourly energy use for a variety of water heaters. The UES values for a heat pump water heater are available in the 2021 version of the

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[34] eTRM CA Energy Efficiency Measure Data. "California Electronic Technical Reference Manual." https://www.caetrm.com/measure/SWWH027/02/

Database of Energy Efficient Resources (DEER). The DEER UES values include system sizing assumptions ranging from 30 to 120 nominal gallons.

The measure case includes efficient heat pump water heaters.

- For SWWH027-02 and SWWH031-01, the measure case efficiency is expressed as the uniform energy factor (UEF). The minimum qualifying measure efficiencies are based on calculator and exceed the California Title 20 and Code of Federal Regulations standards.
- For SWWH028-01, the measure case is large efficient heat pump water heaters or central water heating systems with storage volumes >=75 gallons. Efficiency requirements for water heaters less than 100 gallons use the UEF metric. The minimum qualifying measure efficiencies exceed the California Title 20 and Code of Federal Regulations standards.

3.2.4.2 Data collection and savings adjustment

DNV conducted site visits at four locations, covering seven claims (three for SWWH027-02 and four for SWWH028-01) within the SCE territory to verify several key parameters of this measure. **Table** 3-6 lists the collected information for each site.

Table 3-6. General site information and equipment specs.

Site	Measure group	Type of building	Pre-existing water heater	Installed capacity	Installed efficiency
SCE-100097262	SWWH027-02: 1 claim	Senior Living Facility	Nature gas storage	50 gallons	3.88 UEF
SCE-100097566	SWWH027-02: 1 claim	Senior Living Facility	Nature gas storage	50 gallons	3.88 UEF
	SWWH028-01: 1 claim	Senior Living Facility	Nature gas storage	120 gallons	4.20 COP
SCE-100097575	SWWH027-02: 1 claim	Senior Living Facility	Nature gas storage	50 gallons	3.88 UEF
SCE-100097623	SWWH028-01: 3 claims	Hotel	Nature gas storage	120 gallons	4.20 COP

At all sites, new heat pump water heaters were installed in conditioned spaces. These installations did not utilize ducting but relied on the indoor air of the spaces for heat exchange.

The information DNV collected aligned well with the assumptions from the TRM and was consistent with the proposed cases as well. The installed heat pump water heaters fell within the correct categories, and their efficiencies exceeded the minimum requirements.

Given the limited sample size for this measure and the amount of information that could be collected during the visits, DNV decided not to make any adjustments to the current version 4.2 of the calculator. This decision was made cautiously, considering the alignment of the collected data with TRM assumptions and the satisfactory efficiency levels of the installed.

3.2.5 Other measures

In addition, DNV conducted in-depth interviews (IDIs) for the other four measures covered in this program. These interviews were designed to verify the measure eligibility, installation and operation status, and potential areas for program improvement. Table 3-7 is the list of measures surveyed and evaluated.

Table 3-7. General site information and equipment specs.

Measure name	Measure package ID and version number	Number of sites	Number of claims
Reach-In Refrigerator or Freezer, Commercial	SWCR018-02	1	1
Enhanced Ventilation for Packaged HVAC	SWHC023-02	4	4
LED, Tube, Type B, and Type C	SWLG018-02	4	16
LED, High, or Low Bay	SWLG011-03	1	1

3.2.5.1 Reach-in refrigerator or freezer, commercial (SWCR018-02)

This measure is to purchase a new or replacement with an energy-efficient commercial reach-in solid and glass door refrigerator or freezers, in vertical and chest configurations. In all categories, the refrigeration system must be built-in (packaged).

The base case measure included standard-efficiency, reach-in solid and glass door refrigerators and freezer and was defined by the U.S. Department of Energy (DOE) federal requirements. The measure case was an ENERGY STAR®-qualified commercial reach-in refrigerator or freezer that replaced a standard efficiency unit of the same configuration and capacity. Measure offerings were defined by configuration and internal volume (V), as specified in the ENERGY STAR Commercial Refrigerators and Freezers Program Requirements.

The annual UES was calculated as the difference between the baseline and measure case unit energy consumption (UEC) for each refrigerator and freezer configuration.

The evaluator conducted IDI for one SDGE site with a single claim. The customer confirmed the installed equipment was a commercial solid door reach-in freezer, which was consistent with what the tracking data recorded.

3.2.5.2 Enhanced ventilation for packaged HVAC (SWHC023-02)

This measure is to add a variable frequency drive (VFD) to an existing packaged single-zone direct expansion (DX) HVAC unit with an outdoor air economizer to provide cooling when conditions permit. “Single zone” means that the system is controlled by a single thermostat and does not employ zone dampers, bypass dampers, or any other means of air volume control required for multiple spaces.

The base case was defined as the existing single-zone DX HVAC unit with a function economizer without a VFD. The measure case was the addition of a VFD to an existing packaged single-zone DX HVAC unit with an economizer. The VFD operated at a minimum of two discrete speeds based on ventilation and cooling or heating demand.

The UES and demand reduction were derived from baseline and measure case building energy use simulations using eQUEST version 3.65-7175 energy modeling software. The base case was developed based on DEER 2020 prototypes, using MASControl3 software. All modeling was performed using the CZ2010 weather files.

The evaluator conducted IDI for four craft store sites owned by the same party, covering four claims. The customer contact confirmed the installation of VFDs, and the impacted roof top unit (RTU) was still in good operating condition. Based on the collected information, the evaluator did not update the savings estimations for this measure.

3.2.5.3 LED, Tube, Type B, and Type C (SWLG018-02)

The Design Lights Consortium (DLC) defines UL Type B lamps, also known as internal driver/line voltage lamps, as LED “tubes” that “employ lamp holders to connect to the fixture being retrofitted, but do not operate utilizing the existing fluorescent ballast. Thus, they require rewiring the existing fixture to bypass the ballast and send line voltage directly to the lamp holders." Similarly, DLC defines UL Type C lamps, also known as external-driver lamps as LED "tubes" that "employ lamp holders to connect to the fixture being retrofitted, do not operate utilizing the existing fluorescent ballast, and require rewiring of the existing fixture to replace the ballast with an external driver. The lamp holders are then wired to receive only the low-voltage electricity that is supplied by that external driver."

This measure is to install high efficacy DLC-compliant UL Type B or UL Type C LED lamp and driver systems for specific building /space types. The measure case efficacy is 160 LPW for both Type B and Type C offerings. Lamp and driver systems with different numbers of lamps must be used for the Type C measure offerings because of the impacts of the external LED driver on the measure cost. However, individual lamps will still be used for Type B measure offerings since they do not require an external driver.

The existing case baseline is defined as a 4-foot linear fluorescent T8 lamp or fixtures with 2-lamp, 3-lamp, or 4-lamp fluorescent lamp and ballast systems. The base case was determined using the 2018-19 program application data and is considered an existing condition. The analysis of this measure utilized the existing condition baseline (a 4-foot T8 linear fluorescent lamp) to calculate the baseline energy savings.

The annual electric unit energy savings (UES) of the LED T8 lamp was calculated as the difference between the baseline and measure case annual electric unit energy consumption (UEC). The calculation of annual electric unit energy consumption (UEC) of the LED T8 lamp (baseline and measure case) is a function of lamp wattage, number of lamps in the fixture, hours of operation, and interactive effects.

The evaluator conducted IDI for four sites including convenience store, veterinary, and small business facilities, covering 16 claims in total. All customer contacts confirmed the pre-existing situations were linear fluorescent lamps with manual light switches. Most of the customer contacts didn't provide detailed information but one small business owner stated that 152 T5 fluorescents were replaced with 140 100-watt LED fixtures and 20 T5s were replaced with 20 65-watt LED fixtures. He also mentioned motion sensors were also added to have better control of their lighting system.

Based on the collected information, the evaluator did not update the savings estimations for this measure.

3.2.5.4 LED, high or low bay (SWLG011-03)

This measure is the replacement of a less efficient LED high-bay or low-bay fixture with a more efficient one.

The evaluated version of this measure updated the efficacy ratings for the measure case to reflect product improvements since 2019. In 2019, the measure case efficacy was established through a comparison of two data sources: the 50th percentile efficacies from Lighting Facts for 2018 and the minimum efficacies outlined in Version 4.4 of the DesignLights Consortium (DLC) Technical Standard. This Version 03 update aims to maintain the energy savings observed in 2019-20 while incorporating improvements in the base case efficacy. Following updates to the base case, the measure case efficacies were adjusted to levels necessary to preserve energy savings. These updated efficacies were then compared against the DLC database as of May 2020, revealing that approximately 45% of high bay products listed met at least the Tier 1 efficacy levels defined in this measure update.

Given the variability in products across different lumen bins, the efficacy of measure case fixtures ranges from 130 to 155 lumens per watt (LPW), with an average efficacy of 145 LPW. The base case was a combination of TLED and LED, and the composition varies by the statewide measure offering ID. The efficacy for baseline TLED and LED was based on different lumens ranges.

3.3 Net savings analysis

DNV fielded a net-to-gross survey with the participating end-users to derive a net-to-gross ratio (NTGR). DNV followed the sample design approach described in subsection 3.3.1. The team produced estimates of the NTGRs using survey responses following an analysis approach described in subsection 3.3.2. For more details on the NTGR approach, please refer to Appendix D: Net-to-gross approach.

3.3.1 Net design and selection

The primary focus of the research was on auto closers, anti-sweat heater controls, and medium-temperature case doors because these measures accounted for approximately 93% of electric first-year gross savings. Additionally, medium-temperature case doors represented approximately 80% of the positive gas first-year gross savings. DNV designed the sample with an error ratio of 0.3, an overall electric precision target of 90/10, a high-impact measure package precision target of 90/20, and a program/IOU target of 90/20.

Initially, DNV collapsed twenty-one measure packages into four-measure strata and an "other" category stratum for the purpose of sampling. DNV then removed seven claims with zero electric savings from the sample as they represented less than 2% of the first year's gas impacts. This exclusion left 3,765 claims in the final frame for evaluation.

Table 3-8 shows the expected relative precision and sample sizes for PG&E, SCE, and SDGE based on the error ratio and precision targets mentioned above. It also shows the underlying populations of program claims that the evaluation team used to develop the target sample sizes. Finally, the table compares the target sample sizes with the achieved samples. This comparison reveals that DNV was able to complete enough surveys to exceed the target numbers of NTGRs for PG&E, SCE, and the program overall while falling one short for SDG&E (19 completes vs. a target of 20).

Table 3-8. Program-level precision and sample sizes

Program IOU	Expected Relative Precision ER = 0.3		Sample target	Sample achieved	Population
	Electric	Gas			
PG&E	18%	17%	14	17	652
SCE	14%	19%	25	40	2,213
SDG&E	17%	10%	20	19	900
Overall	**10%**	**13%**	**59**	**76**	**3,765**

Table 3-9 shows electric and gas precision levels and sample sizes for the aggregated measure categories described above. For this measure category sample design, DNV used the same target error ratio of 0.3 that it had used for the PA sample design. For the high-impact measure package, DNV assigned a precision target of 90/20 and used Lifecycle Net Fuel savings for estimating the sample sizes. The population totals in the last column of the table show the predominance of the auto closer and anti-sweat heater control measures in the program.

Finally, the table compares the target sample sizes for the measure categories with the achieved samples. The comparison shows that the impact evaluation exceeded these targets for all measure categories except the anti-sweat heater controls where it fell short by one case (12 targeted and 11 completed).

Table 3-9. Measure category-level precision and sample sizes

Measure category	Expected relative precision ER=0.3		Sample target	Sample achieved	Population
	Electric	Gas			
Auto closer for refrigerated storage door	16%	17%	13	16	2,439
Anti-sweat heater controls	19%	20%	12	11	928
Medium-temperature case doors	19%	19%	13	15	77
Water heater	18%	20%	7	13	34
OTHER	20%	20%	14	21	287
Overall	**10%**	**13%**	**59**	**76**	**3,765**

Table 3-10 breaks down the relative precisions and sample sizes by both PAs and measure categories. The table adheres to the PA precision target of 90/20 and includes data on electric and gas measures, again based on the target error ratio of 0.3. Finally, the table shows that of the 13 substrata, the evaluation achieved or exceeded the target sample sizes in 7 of them.

Table 3-10. Measure category by program/IOU-level precision and sample sizes

Measure category by program/IOU	Expected relative precision ER=0.3		Sample target	Sample achieved	Population
	Electric	Gas			
PG&E - Auto Closer for Refrigerated Storage Door	26%	28%	4	13	593
PG&E - Medium-Temperature Case Doors	18%	19%	6	0	32
PG&E – OTHER	24%	25%	4	4	27
SCE - Auto Closer for Refrigerated Storage Door	26%	27%	4	0	1,010
SCE - Anti-Sweat Heater Controls	21%	21%	7	3	911
SCE - Medium-Temperature Case Doors	35%	35%	2	10	38
SCE - Water Heater	19%	20%	6	13	33
SCE – OTHER	29%	34%	6	14	221
SDG&E - Auto Closer for Refrigerated Storage Door	25%	27%	5	3	836
SDG&E - Anti-Sweat Heater Controls	22%	22%	5	8	17
SDG&E - Medium-Temperature Case Doors	12%	12%	5	5	7
SDG&E - Water Heater	0%	0%	1	0	1
SDG&E – OTHER	30%	81%	4	3	39
Overall	**10%**	**13%**	**59**	**76**	**3,765**

In summary, the sampling design targeted 59 claims and 76 were achieved. The evaluation also just narrowly missed achieving all the PA and measure category strata targets. However, for the more granular sampling strata broken down by both PA and measure category the evaluation was less consistent in achieving strata-level targets. A more in-depth description of the sampling design and the rationale behind it appears in Appendix C: Sample design and selection.

3.3.2 The net data collection and analysis approach

DNV's calculation of NTGRs followed the CPUC-approved NTG method, which involved querying program participants about how the absence of the program might alter the implementation of their energy-efficient measures across three variables: quantity, efficiency, and timing. Combining these aspects allows for the estimate of net kWh, kW, and therm savings attributable to each measure as these savings are dependent on the number of measures installed (quantity), the efficiency of the measures (efficiency), and when the measures were installed (timing).

The quantity question asks about the number of units that would have been installed without the program. This question is relevant to measures where program allows more than one installation per participating site. The program receives credit if the respondents indicate they would have installed fewer measures without the program.

The efficiency question is relevant to the efficient measures that the program encouraged to be installed. The program receives full credit for the measure if the respondents indicate they would have installed nothing but the standard efficiency measure instead of the efficient program measure.

The timing question seeks to determine the time frame within which each measure would have been installed without the program. The program receives full credit for any measure that would not have been installed at all, and it receives partial credit for accelerating the installation compared to when respondents claim they would have installed the measure.

When it came to assessing efficiency measures for this program, the evaluator's approach varied based on the availability of baseline measures for comparison. For instance, with measures like auto closers and anti-sweat heater controls where no baseline comparison was available, the surveys did not query the efficiency dimension. Conversely, for other measures such as water heaters and LEDs, where valid baseline efficiency examples exist, the survey did ask about efficiency. Through this tailored approach, the evaluator ensured that the NTGRs reflected the true performance and impact of the energy-efficient measures under scrutiny.

Besides this tailored survey design, DNV also designed the data collection approach to increase the reliability of the NTGRs. A key aspect of this approach involved issuing queries to the PAs to double-check that DNV had the names and contact information of the project decision-makers. This was very important because most participants were chain grocery stores for which the decision to participate in the program occurred at a corporate level. In such cases, while a site-level contact might be perfectly adequate for providing the information needed for the gross savings analysis, such a contact would not adequately serve for the net savings analysis because they were not involved in the project decision-making.

This program participant structure in which a limited number of contacts accounted for the decision-making of most of the participating sites shaped the data collection approach in other ways. Because each NTG interview was more consequential than a typical evaluation in which most decisionmakers only account for a single site, DNV opted to use either in-person interviews (e.g., during an onsite visit) or telephone interviews for most of the NTG data collection. These interviews allowed for the back-and-forth questioning needed to understand to what degree the NTG question responses might differ for specific sites. Capturing these nuances would be difficult to replicate with a web survey which did not allow for this interactivity. However, the team did use web surveys for a few project decision-makers who each only accounted for one or two sites. Table 3-11 shows how the NTG data collection activities were broken down by PA and data collection method.

Table 3-11. Type of data collection by program administrator, number of claims

Program Administrator	On-site	Phone interview	Web survey	Total
PG&E	0	17	0	**17**
SCE	26	14	0	**40**
SDGE	16	0	3	**21**
Overall	**42**	**31**	**3**	**76**

3.4 Cost effectiveness and total system benefit

The value of energy savings varies throughout the day. Decision 21-05-031 by the CPUC allows for DNV to assess the monetary value of time-dependent program benefits and energy savings. Further, the CPUC adopted the Total System Benefit (TSB) as the standard measure to evaluate the advantages of energy efficiency throughout various times of day. TSB is a metric designed to maximize energy potential and demand and reduce greenhouse gas via energy efficiency programs and measures. Since 2022, PAs are required to report TSB alongside kilowatt-hours (kWh), kilowatts (kW), and therms savings. Starting in 2024, TSB will be the only metric used to evaluate energy efficiency programs.

DNV conducted a cost-effectiveness (CE) and TSB analysis for each commercial third-party program using the Cost Effectiveness Tool (CET) available on the CEDARS website.

The analysis consisted of the following research questions:

- What are calculated TSB values based on reported values? How do these compare to calculated TSB values based on evaluated values?
- Are 3PCPs designed to deliver energy savings when the savings are most likely to benefit the grid?

3.5 Program performance assessment

To better understand the overall functionality and effectiveness of these third-party commercial programs, DNV examined marketing and outreach plans, conducted interviews with program managers and implementers, and reviewed program tracking databases.

DNV's program performance assessment answered the following research topics:

- What was the budget? How much was spent?
- How are program costs distributed? What percentage of program costs are allocated to incentives and implementation versus marketing/outreach and administrative costs?
- What was the target for energy savings? How much energy has been saved?
- Were the programs cost-effective (TRC > 1.0)? How did program cost effectiveness (TRC) compare to the program goals?
- Do the programs have well-defined and documented program theories, implementation plans, and quality controls?
- What strategies are being used for marketing and outreach?
- How effectively are the administrators tracking program data? Do they have contact information for all participating entities such as contractors, retailers, property managers, and other market actors? How efficiently and accurately is program progress reported to the non-lead Program Administrators (PAs)?

DNV examined the program PIPs for information about program theory, design, and goals.

DNV conducted an in-depth interview with each implementer to understand how they were actually executing the programs. This included questions about program marketing approaches, customer targeting, measures, QA/QC, and long-term customer relations management. During and after these interviews, DNV requested additional program documentation related to budget spending and KPIs.

DNV's impact analysis provided calculations for reported and evaluated net savings and cost-effectiveness scores. DNV compared these values to each other and to the programs' goal values recorded in the PIPs.

The evaluation team asked three industry experts, each with over 15 years of industry experience, to assess the innovations listed in the PIPs. These assessments focused on how innovative the described practices are for the industry generally and for California specifically. The experts discussed each innovation until they reached a consensus.

3.6 Participant assessment

DNV aimed to better understand each program's participants via a participant assessment that answered the following research questions:

- How many HTR/DACs were targeted for participation? How many are participating?
- What percentage of participants are from Hard-to-Reach/Disadvantaged Communities (HTR/DACs)?
- What percentage of energy savings are from HTR/DACs participants?
- Level of satisfaction (overall and by different aspects of the program)
- Barriers encountered (overall and by different categories)

DNV included participant satisfaction and participation barriers questions on the participant surveys. DNV completed surveys with 16 respondents representing 43 sites.

DNV geocoded installation addresses are listed in program tracking data to determine the number of participants residing in DAC areas. The evaluation was unable to assess HTR status. Program data did not list HTR status, and there was not enough information in the tracking data for DNV to impute a value. There were also not enough completed surveys for DNV to use to assess the HTR status for the participant population as a whole.

4 RESULTS

4.1 Gross savings analysis

DNV conducted 44 site visits and 10 in-depth-interviews (IDIs) covering a total of 73 claims. In addition, DNV assessed the savings estimation methodology for all evaluated measures in California eTRM and updated the savings for the auto closer for refrigerated storage door and anti-sweat heater control measures, based on the collected logger data and site survey information.

Table 4-1 presents the gross energy savings results across three program administrators, breaking down the data into three categories: electric energy (measured in MWh), electric demand (measured in MW), and gas energy (measured in MMBtu). The analysis includes the number of claims evaluated, reported, and evaluated gross savings, evaluated gross realization rate (GRR), and the evaluated GRR relative precision. For electric energy, the overall evaluated savings exceeded reported savings by 8%. In electric demand, the savings were significantly higher than reported, showing a 23% increase. However, for gas energy, the evaluated savings were 5% lower than reported.

Notably, SCE showed a remarkable 138% evaluated GRR in electric demand, along with a relatively high precision uncertainty. Conversely, SCE's Gas Energy evaluated savings were 24% lower than reported, highlighting the variability and challenges in accurately predicting energy savings across different energy types and program administrators. The variability in SCE's evaluated energy results is primarily attributed to the impact of HVAC interactions with specific refrigeration measures. In particular, the auto-closer for low-temperature storage doors in Climate Zone (CZ) 09 demonstrated positive gas savings, attributed to the interactive effects with the HVAC system, as per the model's evaluation. However, tracking data indicated negative claimed gas savings for the same measure. This discrepancy resulted in a negative realization rate for CZ 09, consequently lowering the overall GRR to below 100%. Additionally, the fluctuation of evaluated demand and gas impact contributes to the uncertainty surrounding SCE's overall performance metrics.

Table 4-1. Gross energy savings results by program administrator

Program Administrator	# of claims evaluated	Reported gross savings	Evaluated gross savings	Evaluated GRR	Evaluated GRR relative precision*
		Electric Energy (MWh)			
PG&E	14	12,784	12,933	101%	± 0.1%
SCE	36	38,087	42,438	111%	± 1.4%
SDGE	23	6,907	7,054	102%	± 0.4%
Overall	**73**	**57,778**	**62,583**	**108%**	± **2.0%**
		Electric Demand (MW)			
PG&E	14	2.66	2.64	99%	± 2.7%
SCE	36	5.46	7.56	138%	± 9.0%
SDGE	23	1.35	1.36	101%	± 0.6%
Overall	**73**	**9.46**	**11.59**	**123%**	± **5.9%**
		Gas Energy (MMBtu)			
PG&E	14	31,746	31,756	100%	± 0.0%
SCE	36	30,620	23,359	76%	± 20.0%
SDGE	23	7,773	7,702	99%	± 0.3%
Overall	**73**	**70,139**	**66,518**	**95%**	± **2.0%**

*Relative precision values with 90% confidence

Table 4-2 highlights the performance of different measure packages, with the same focus on electric energy, electric demand, and gas energy metrics across all PAs. The evaluated savings for Anti-Sweat Heater Controls measure are greater than the tracking values in both electric energy and demand categories. On the other hand, the Auto Closer for the Refrigerated Storage Door measure shows less favorable outcomes, particularly in gas energy efficiency. Collectively, these energy-saving measures demonstrated commendable achievements, especially in electricity conservation, where they exceeded expectations. Nonetheless, the results in gas energy conservation slightly missed the mark, indicating variability in the effectiveness of these measures across different energy sectors.

For the auto closer for refrigerated storage door, the findings indicated a discrepancy between the reported data and the empirical data gathered. Specifically, it was determined that the actual frequency of door passages for both coolers and freezers had been overestimated in the eTRM, whereas the actual duration of door openings was underestimated. DNV updated the relevant variables in the energy model ensuring adjustments were reflective of real-world conditions across all climatic zones under consideration. Subsequent analysis revealed adjustments in the anticipated annual energy savings: a marginal decrease of 0.1% for coolers and a notable increase of 1.5% for freezers compared to the preliminary (reported) projections. Furthermore, a critical oversight was identified within the current eTRM regarding the unit of measurement for savings. The original documentation erroneously listed savings in terms of linear feet, whereas the accurate metric should be per door.

In the assessment of anti-sweat heater controls, temperature and relative humidity (RH) sensors were deployed to monitor environmental conditions within these cases. The gathered data confirmed that temperature ranges were consistent with pre-study (reported) estimates. However, it was observed that the actual operational relative humidity levels reached up to 90%, surpassing the assumptions made in the eTRM model. This revelation necessitated an adjustment to the maximum RH ratio within the model, indicating a potential for greater reductions in heater consumption than initially projected for the evaluated measures.

For the Medium-Temperature Case Doors measure, DNV conducted a thorough verification process that encompassed assessing the quantity and dimensions of the installed doors, case temperature, the type of case lighting, and the presence of night covers in the baseline scenario. Additionally, it was confirmed that the operation of the refrigeration system aligned with the pre-established assumptions. Despite this, a significant number of customers were unable to provide detailed information regarding infiltration reduction or refrigeration system efficiency related to the case door measures, both of which influence the savings calculation algorithm. Nevertheless, based on the data collected, all principal parameters within the savings algorithm were consistent with those specified in the eTRM, resulting in a GRR of 100% and a Relative Precision Ratio of zero.

For the Heat Pump Water Heater measures, the evaluation entailed verifying the type of water heater previously installed with the customer and gathering detailed specifications of the installed heat pump water heater, including capacity, efficiency, hot water temperature setpoint, and compressor size, among others. The majority of the parameters collected matched those anticipated in the tracking data.[35]The analysis maintained the same DEER building prototype as utilized in the eTRM calculator. Consequently, the GRR for this measure also stood at 100%, with a Relative Precision Ratio of zero.

Furthermore, DNV conducted 10 IDIs focused on variable frequency drives (VFDs) and lighting measures. These interviews were aimed at verifying the conditions present before the implementation of measures, the details of the measure installation process, and confirming that the current operation of these measures meets the program's requirements.

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[35] Tracking data provides information that PAs track and file with regulators about energy efficiency activities including the type and quantities of technologies delivered and associated savings.

Table 4-2. Gross energy savings results by measure package name

Measure package name	# of claims evaluated	Reported gross savings	Evaluated gross savings	Evaluated GRR	Evaluated GRR relative precision*
Electric Energy (MWh)					
Auto closer for refrigerated storage door	15	23,769	23,976	101%	± 0.1%
Anti-sweat heater controls	16	22,438	25,759	115%	± 1.2%
Medium-temperature case doors	13	7,813	7,813	100%	± 0.0%
Water heater	7	-938	-938	100%	± 0.0%
All other measures[36]	22	4,695	4,695	100%	± 0.0%
Overall	**73**	**57,778**	**62,400**	**108%**	± **1.2%**
Electric Demand (MW)					
Auto closer for refrigerated storage door	15	5.29	5.20	98%	± 1.9%
Anti-sweat heater controls	16	2.10	3.50	167%	± 9.4%
Medium-temperature case doors	13	1.07	1.07	100%	± 0.0%
Water heater	7	0.01	0.01	100%	± 0.0%
All other measures[37]	22	0.99	0.99	100%	± 0.0%
Overall	**73**	**9.46**	**11.59**	**123%**	± **5.9%**
Gas Energy (MMBtu)					
Auto closer for refrigerated storage door	15	-170	-141	83%	± 10.8%
Anti-sweat heater controls	16	-20,133	-21,882	109%	± 1.3%
Medium-temperature case doors	13	71,856	71,856	100%	± 0.0%
Water heater	7	15,368	15,368	100%	± 0.0%
All other measures[38]	22	3,216	3,216	100%	± 0.0%
Overall	**73**	**70,139**	**66,518**	**95%**	± **2.0%**

*Relative precision values with 90% confidence

4.1.1 Pacific Gas and Energy (PG&E)- NetOne Commercial Efficiency Program

In PG&E territory, DNV conducted 10 site visits and four IDIs for three measures. The evaluated gross savings results are presented in Table 4-3 below. Across the 14 sites and claims assessed, the overall performance indicates high levels of precision in energy savings, with minimal deviations from the expected values for most measures. Because the gas energy savings achieved through the auto closer for refrigerated storage door are significantly lower compared to the other two measures, especially enhanced ventilation for packaged HVAC, the overall gas savings GRR remains at 100% and the overall gas relative precision rate is ±0.03%, showing 0.0% in the table due to the decimal formatting.

[36] Ibid.
[37] Ibid.
[38] Ibid.

Table 4-3. Evaluated Sites and Claims for PG&E

Measure name	Number of sites	Number of claims	Electric energy GRR	Electric energy relative precision	Peak demand GRR	Peak demand relative precision	Gas energy GRR	Gas energy relative precision*
Auto closer for refrigerated storage door	4	4	102%	± 0.0%	99%	± 4.3%	85%	± 7.9%
Medium-temperature case doors	6	6	100%	± 0.0%	100%	± 0.0%	100%	± 0.0%
Other: Enhanced ventilation for packaged HVAC	4	4	100%	± 0.0%	100%	± 0.0%	100%	± 0.0%
Total	**14**	**14**	**101%**	± **0.1%**	**99%**	± **2.7%**	**100%**	± **0.03%**

*Relative precision values with 90% confidence

4.1.1.1 Auto closer for refrigerated storage door

For the auto closer for refrigerated storage door measure, the average metered passages per hour and passage time for PG&E claims are 3.59 times per hour and 113.4 seconds per time for cooler, and 2.81 times per hour and 91.2 seconds per time for freezer, respectively. The actual average passages per hour for both cooler and freezer are lower than Technical Resources Manual (TRM) assumed in Table 3-2, regardless of the case temperature. On the other hand, the actual passage time for both cooler and freezer is higher than the TRM assumed. This indicates that the on-site staff intended to work inside the refrigerated case for a longer time and reduce the number of times they entered it, rather than staying for shorter periods but entering and leaving the refrigerated space frequently.

4.1.1.2 Medium-temperature case doors

For medium-temperature case doors, the observed case temperature is between 35°F and 40°F, which is in line with the TRM-assumed value. Five out of six sites stated the refrigerated cases had night cover equipment before the measure installation. The other site did not have night cover in the pre-existing case since it is a 24/7 open convenience store. In addition, all six sites had LED case lighting in the base case.

4.1.1.3 Enhanced ventilation for packaged HVAC

Enhanced ventilation for packaged HVAC is the only sample measure marked as an other category in PG&E territory. For all four sites, the VFD was installed in the roof top unit (RTU) with gas heating and electric cooling.

4.1.2 Southern California Edison (SCE)-Commercial Energy Efficiency Program

In SCE territory, DNV conducted 17 site visits and three IDIs for five measures. The evaluated gross savings results are presented in Table 4-4 below. As section 4.1 stated above, the low gas energy GRR for SCE is primarily due to the fluctuation from the HVAC interaction effect between the tracking number and evaluated result, on Auto Closer for Refrigerated Storage Door measure. Another notable impact is the peak demand GRR for the anti-sweat heater controls measure is very high, which also affects the overall peak demand GRR at the program administration level.

Table 4-4. Evaluated Sites and Claims for SCE

Measure name	Number of sites	Number of claims	Electric energy GRR	Electric energy relative precision	Peak demand GRR	Peak demand relative precision	Gas energy GRR	Gas energy relative precision*
Auto closer for refrigerated storage door	4	5	100%	± 0.3%	98%	± 2.7%	79%	± 31.5%
Anti-sweat heater controls	7	7	115%	± 1.2%	168%	± 9.5%	109%	± 1.3%
Medium-temperature case doors	2	2	100%	± 0.0%	100%	± 0.0%	100%	± 0.0%
Heat pump water heater	4	7	100%	± 0.0%	100%	± 0.0%	100%	± 0.0%
Other: LED, Tube, Type B, and Type C	3	15	100%	± 0.0%	100%	± 0.0%	100%	± 0.0%
Total	**20**	**36**	**111%**	**± 1.4%**	**138%**	**± 9.0%**	**76%**	**± 20.0%**

*Relative precision values with 90% confidence

4.1.2.1 Auto closer for refrigerated storage door

For the auto closer for refrigerated storage door measure, the average metered passages per hour and passage time for SCE claims is 4.41 times per hour and 96.8 seconds per time for cooler, which is in the same range as PG&E's result. However, the freezer metered passages per hour and passage time are 0.65 times per hour and 47.4 seconds. The actual average passages per hour for the freezer are significantly lower than what the TRM assumed in Table 3-2, and the passage time is also lower than TRM-assumed value.

4.1.2.2 Anti-sweat heater controls

During the visit to the anti-sweat heater controls sites, DNV metered the case temperature and relative humidity (RH) and found that the majority of the case RH can be up to 90%, compared to the 60% maximum RH setting in the model. This update reduced the door heater consumption and even lowered the peak use of the equipment. In addition, DNV confirmed all refrigeration systems are multiple-stage with remote condensers.

4.1.2.3 Medium-temperature case doors

For Medium-Temperature Case Doors, the observed case dimension and temperature are consistent with TRM assumptions.

4.1.2.4 Heat pump water heaters

DNV conducted four site visits covering 7 claimed heat pump water heaters and found that all of them were replacements of old gas-fired water heaters. We confirmed the water tank capacity, refrigerant type, heating temperature setpoint, and compressor size for all units. All heat pump water heaters were installed in a conditioned space without additional ducting added.

LED, Tube, Type B, and Type C are the only sampled measures in the SCE territory. We conducted three IDIs covering 15 claims. All customers indicated that they had used fluorescent lighting in their pre-existing setups and confirmed the number of installed lighting fixtures.

4.1.3 San Diego Gas & Electric (SDGE)- Commercial Large Customer Services (>20KW) Program

In the SDGE territory, DNV conducted 17 site visits and three IDIs for six measures. The evaluated gross savings results are presented in Table 4-5 below. Noteworthy findings include the Anti-Sweat Heater Controls showing a higher electric energy GRR of 111% and gas energy GRR of 107%, albeit with moderate relative precision variations. Across the 20 sites and 23 claims evaluated, the overall performance indicates consistent levels of energy savings with minimal deviations from expected values.

Table 4-5. Evaluated Sites and Claims for SDGE

Measure name	Number of sites	Number of claims	Electric energy GRR	Electric energy relative precision	Peak demand GRR	Peak demand relative precision	Gas energy GRR	Gas energy relative precision*
Auto closer for refrigerated storage door	5	6	100%	± 0.0%	99%	± 0.1%	83%	± 0.1%
Anti-sweat heater controls	7	9	111%	± 2.3%	120%	± 7.1%	107%	± 1.6%
Medium-temperature case doors	5	5	100%	± 0.0%	100%	± 0.0%	100%	± 0.0%
Other: LED, Tube, Type B and Type C	1	1	100%	± 0.0%	100%	± 0.0%	100%	± 0.0%
Other: LED, High or Low Bay	1	1	100%	± 0.0%	100%	± 0.0%	100%	± 0.0%
Other: Reach-in refrigerator or freezer, commercial	1	1	100%	± 0.0%	100%	± 0.0%	100%	± 0.0%
Total	**20**	**23**	**102%**	± **0.4%**	**101%**	± **0.6%**	**99%**	± **0.3%**

*Relative precision values with 90% confidence

4.1.3.1 Auto closer for refrigerated storage door

All sampled Auto Closer for Refrigerated Storage Door measures in SDGE were installed in the medium temperature cases. The average metered passages per hour and passage time for SDGE claims are 3.37 times per hour and 92.4 seconds per time. These results are similar to the collected data in SCE along with the same impact on energy savings. The SDGE gas GRR for auto closer measure is only 83% due to the HVAC interactive effects from the refrigeration system.

4.1.3.2 Other measures

DNV evaluated three different measures in other categories in the SDGE service territory and has confirmed the installation and operation for all proposed equipment with the customer through three IDIs.

4.2 Net savings analysis

The evaluation team estimated the NTGRs for 76 claims and calculated NTGRs both for the program overall as well as broken down by PA and measure type. Across the board, the NTGRs for this program were very high with a NTGR of 97% for kWh and 98% for therms.

The qualitative survey responses indicated that the program participants highly valued the program incentives as project drivers. It is also worth noting that the refrigeration measures – such as the auto closers and the anti-sweat heater controls – are not as well known, or as widely promoted by contractors, as other energy efficiency measures such as lighting retrofits. The relative obscurity of these measures reduces the chances that customers would initiate these improvements either on their own accord or in response to a vendor sales pitch.

At the program level, the relative precisions at the 90% confidence intervals were in the 0.6%-4% range, much lower than the conventional relative precision target of 10% for evaluation studies. These good precision rates were mainly due to the low variance in the estimated NTGRs across the survey respondents. Almost all of them were "telling a similar story", as to the importance of the program information and incentives in their project decision-making.

Table 4-6 breaks down the electric energy (MWh) savings, electric demand (MW) savings, and gas energy (MMBtu) NTGRs by PA. It shows that the evaluated NTGRs for PG&E and SCE were very high (99%-100%). While the NTGR for SDGE was lower (78%), the high relative precision for this NTGR means that it could be theoretically as high as the NTGRs for PG&E and SCE (although it could also be much lower). The high relative precision for the SDG&E NTGR was due to high variability in the NTGR responses with one respondent giving the program full attribution (100%), one respondent giving the program partial attribution (50%), and two respondents giving the program no attribution (0% NTGR).

Table 4-6. Net energy savings results by program administrator

Program Administrator	# of claims sampled	Reported NTGR	Evaluated NTGR	Evaluated net savings	Evaluated NTGR relative precision*
Electric Energy (MWh)					
PG&E	17	60%	100%	12,933	± 0.0%
SCE	40	66%	99%	42,014	± 0.9%
SDGE	19	60%	78%	5,502	± 49.2%
Overall	**76**	**64%**	**97%**	**60,706**	**± 4.0%**
Electric Demand (MW)					
PG&E	17	60%	100%	2.64	± 0.0%
SCE	40	66%	98%	7.44	± 1.2%
SDGE	19	60%	76%	1.03	± 57.0%
Overall	**76**	**64%**	**96%**	**11.16**	**± 5.5%**
Gas Energy (MMBtu)					
PG&E	17	60%	100%	31,756	± 0.0%
SCE	27	76%	98%	22,892	± 0.8%
SDGE	17	60%	100%	7,702	± 0.4%
Overall	**61**	**67%**	**98%**	**65,188**	**± 0.6%**

*Relative precision values with 90% confidence

Table 4-7 shows the electric energy (MWh) savings, electric demand (MW) savings, and gas energy (MMBtu) NTGRs broken down by measure package name. All the NTGRs were very high with the lowest in the range (84%) being for the group of All other measures. The LEDs were the measures in the "All other measures group" which had the lowest NTGRs. For example, the NTGR of the tubular LEDS (TLEDs) was only 35%. The wide availability of LEDs in general, the relatively low cost of TLEDs, and the robust activity of lighting contractors promoting LED retrofits are likely explanations for these lower NTGRs.

Table 4-7. Net energy savings results by measure package name

Measure package name	# of claims sampled	Reported NTGR	Evaluated NTGR	Evaluated net savings	Evaluated NTGR relative precision*
Electric Energy (MWh)					
Auto Closer for Refrigerated Storage Door	16	62%	95%	22,777	± 8.6%
Anti-Sweat Heater Controls	11	67%	100%	25,758	± 0.0%
Medium-Temperature Case Doors	15	60%	98%	7,657	± 0.4%
Heat Pump Water Heater	13	105%	100%	-938	± 0.0%
All other measures	21	67%	84%	3,945	± 11.1%
Overall	**76**	**64%**	**97%**	**60,524**	**± 4.0%**
Electric Demand (MW)					
Auto Closer for Refrigerated Storage Door	16	62%	95%	4.94	± 9.3%
Anti-Sweat Heater Controls	11	67%	100%	3.50	± 0.0%
Medium-Temperature Case Doors	15	60%	98%	1.05	± 0.4%
Heat Pump Water Heater	13	60%	60%**	0.01	-
All other measures	21	66%	92%	0.91	± 6.7%
Overall	**76**	**64%**	**96%**	**11.16**	**± 5.5%**
Gas Energy (MMBtu)					
Auto Closer for Refrigerated Storage Door	16	62%	95%	-134	± 9.0%
Anti-Sweat Heater Controls	11	67%	100%	-21,882	± 0.0%
Medium-Temperature Case Doors	15	60%	98%	70,419	± 0.4%
Heat Pump Water Heater	13	105%	100%	15,368	± 0.0%
All other measures	6	57%	101%[39]	3,248	± 2.6%
Overall	**61**	**67%**	**98%**	**65,188**	**± 0.6%**

*Relative precision values with 90% confidence
**HPWH evaluated net electric demand savings were passed through

4.3 Cost effectiveness and total system benefit

4.3.1 Cost effectiveness

DNV's analysis of the energy efficiency programs administered by PG&E, SCE, and SDGE revealed significant findings in terms of cost-effectiveness, as measured by Total Resource Cost (TRC) and Program Administrator Cost (PAC). Table 4-8 shows that for all Program Administrators (PAs), the evaluated TRC and PAC values exceeded their reported figures, indicating an overall enhancement in cost-effectiveness through the administered programs.

PG&E and SCE observed enhancements in their cost-effectiveness metrics, with PG&E's TRC increasing from 0.83 to 1.21 and SCE's from 0.54 to 0.77. Although SCE's evaluated TRC improved, it still did not meet the cost-effectiveness

[39] This NTGR is over 100% due to impacts of some measures in this category having negative therm savings and a portion of these negative savings being removed from program attribution by the NTG analysis.

benchmark of 1.0, signaling a critical area for potential program refinement. SDGE showed a modest improvement in its cost-effectiveness metrics, with its TRC increasing from 1.03 to 1.22.

4.3.2 Total system benefit

The evaluation also underscores a relative increase in Total System Benefits (TSB) for all PAs over their reported values. This increase is primarily attributed to the uplift in benefit values, which is derived from the higher evaluated gross savings and Net-to-Gross Ratios (NTGRs).

Importantly, this gain in TSB occurred without any alterations to costs and Effective Useful Lives (EULs) within the scope of this evaluation. This highlights that the observed increases in TSB are not due to adjustments in program costs but rather reflect the intrinsic value derived from the energy efficiency programs themselves. Customer feedback underscored several aspects of this intrinsic value. Participants appreciated the incentives, which significantly motivated them to complete energy efficiency projects. The program's focus shifted from LED lighting to refrigeration measures, effectively encouraging participants to undertake new projects. Customers reported no significant issues with the measures, and the energy savings met expectations. These factors highlight that the program offerings included measures that fit within customer budgets and timelines, providing sufficient incentives to achieve an acceptable return on investment (ROI). The intrinsic value, therefore, is derived from the relevance and effectiveness of the measures and the adequacy of the incentives offered.

The evaluation's emphasis on Total System Benefits (TSB) aligns with the CPUC's adoption of TSB as a standard measure for evaluating energy efficiency. The observed increases in TSB without cost adjustments highlight the programs' capacity to deliver value, particularly in terms of energy savings and demand reduction. These findings are particularly relevant in light of the CPUC's Decision 21-05-031, which emphasizes the importance of assessing the monetary value of time-dependent program benefits and energy savings.

Table 4-8. Cost effectiveness and total system benefit

Program Administrator	TRC		PAC		Budget	TSB	
	Reported	Evaluated	Reported	Evaluated	Reported	Reported	Evaluated
PG&E	0.83	1.21	1.49	2.18	$5,019,491	$7,393,229	$10,818,138
SCE	0.54	0.77	0.73	1.05	$20,357,034	$14,636,135	$21,331,854
SDGE	1.03	1.22	1.25	1.48	$2,900,008	$3,555,419	$4,230,549

4.4 Program performance assessment

Budgets and KPIs

DNV examined program PIPs and conducted interviews with program implementers for information about program performance relative to budgets and key performance indicators. Table 4-9 summarizes the programs' filed budgets, spending, net energy savings (evaluated net savings ÷ net savings goal in PIP), and cost-effectiveness ratios. Overall results were mixed: two of the three programs exceeded their net savings goals (PG&E and SCE), especially for electric demand, and two of the programs also exceeded their cost effectiveness goals (PG&E and SDGE). This is generally a positive set of results due to evaluated NTGRs that were usually high and much higher than ex ante estimates. Filed savings and cost-effectiveness results were below target for all of the programs. This shows the importance of programs continuing to enroll customers that would not otherwise install energy efficiency measures.

Detailed spending varied across the three programs

The PG&E and SDGE programs both reported using about 47% of their spent budget for customer incentives, approximately 40% for implementation, and the final 13% for administration and marketing. In contrast, the SCE program spent 38% of its spent budget on incentives, 50% on implementation, and the other 12% on administration and marketing.

Table 4-9. Program KPI achievements

KPI	PG&E	SCE	SDGE
Budget	$4,670,317	$24,814,000	$13,812,695
Spending (% of budget)	$4,586,884 (98%)	$19,786,301 (80%)	$2,445,982 (18%)
Net kWh savings vs. goal	112%	111%	28%
Net kW savings vs. goal	243%	256%	47%
Net gas savings vs. goal	110%	Goal not documented	10%
Cost-effectiveness goal (TRC)	1.34	0.70	Goal not documented
Cost-effectiveness filed (TRC)	0.83	0.51	0.68
Cost-effectiveness evaluated (TRC)	1.21	0.77	1.22

Several factors contribute to the difficulty of achieving cost-effectiveness. First, these programs were still ramping up. The SCE program was in the first year of its implementation while the PGE and SDGE programs were in the second years. Related to this ramp-up, program implementers reported that the transfer of the programs from the program administrators to third-party implementers caused a loss of brand recognition and market momentum that the utility-run programs had established. In particular, SCE's implementer reported there is strict language in their contract restricting cobranding and how much they can mention SCE. Starting over and rebuilding that momentum slowed down program participation. Furthermore, DNV observed from interview responses that the coordination between the 3PP programs and other programs that may be implemented in the same geographical areas was minimal. This could have resulted in confusion in the market and unintended competition between energy efficiency programs.

Program design

The overarching finding for program design is that the program design as documented in the PIP is inconsistent with the way the program is actually being implemented based on interviews with program managers. This is not inherently a problem – no program is implemented exactly according to the plan. However, for the sake of retrospective process evaluation, decisions to deviate from the plan should be documented and justified in the documentation. Ideally, there should be an update of some sort that documents what the actual program implementation process was.

Two goals of the 3PP approach are to foster innovation and reach a wider range of customers. The PIPs described comprehensive programs that offered a wide range of energy efficiency measures to small, medium, and large customers, using a variety of delivery methods. However, in practice, the programs tended to focus on traditional approaches of pursuing projects with large customers with whom they had pre-existing relationships. Furthermore, the programs provided a very narrow range of measures, mostly automated refrigerator door closers. The program managers said this approach was necessary for cost-effectiveness.

4.4.1 Pacific Gas and Energy (PG&E)- NetOne Commercial Efficiency Program

This section provides more detailed findings specific to the PG&E program.

4.4.1.1 Program budgets and spending

The program spent 98% of the budget it filed for PY2022 (Table 4-10). Budget numbers directly available in CEDARS (filing) and those in the one version of the PIP on CEDARS are inconsistent. DNV requested filed and actual spending numbers from PG&E's implementer in a separate data request. The filed numbers provided as part of that data request were consistent with those available directly in CEDARS. Therefore, DNV calculated the percent spent column based on the data from that supplemental data request.

Approximately 47% of the program budget went to customer incentives. It underspent on non-incentive implementation, by approximately the same amount as it overspent on customer incentives. Although PG&E's implementer did not verify, this spending pattern suggests that customers needed higher incentives to motivate them to install the measures and that the program made up the difference by working more efficiently during installation. This would represent an example of flexible incentives working as designed.

Table 4-10. Detailed budget - PG&E

Budget item	PIP	Filing	Actual	% spent	% of total budget
Administration	$453,846	$467,032	$484,281	103%	11%
Marketing	$272,308	$280,219	$290,568	103%	6%
Implementation	$1,679,147	$2,288,455	$1,646,556	72%	36%
Incentives to customers	$3,159,902	$1,634,611	$2,165,479	132%	47%
Total	**$5,565,203**	**$4,670,317**	**$4,586,884**	**98%**	**100%**

4.4.1.2 Assessment of KPIs

The program had key performance indicators (KPIs) for savings, cost effectiveness, number of HTR/DAC customers served, and several quality metrics. Table 4-11 shows the program performance goals and achievements for PY2022 that DNV evaluated (HTR/DAC goals are covered in the Participant Assessment section). On the strength of a higher-than-expected NTGR, the program beat its goals for net energy and demand savings. The high NTGR also helped the program achieve an evaluated cost-effectiveness score above 1.0, although this was not as high as the filed goal.

Table 4-11. Evaluated KPIs – PG&E

KPI	Net goal	Net claimed	Net evaluated	Net evaluated as % of goal
kWh	11,518,056	7,693,000	12,933,000	112%
kW	1,088	1,600	2,640	243%
Therm	287,962	1,908,000	317,560	110%
Cost effectiveness (TRC)	1.34	0.83	1.21	90%

4.4.1.3 Implementer barriers

Program managers did not report any program barriers relevant to deemed measures for PY2022.

4.4.1.4 Program design

DNV assessed the program design, including program theory, implementation plans, quality control and assurance, measurement and verification plans, marketing and outreach, the quality of the program tracking data, and how well spending matched budgets.

Innovations

Table 4-12 reproduces the innovations listed in the PIP, DNV's assessment of whether those innovations are innovative in the industry generally and in California specifically, and DNV's assessment of whether the programs implemented each innovation in PY2022.

Table 4-12. PG&E's program innovations and DNV's assessment

Innovation in PIP	Innovative for the broader market?	Innovative for CA?	Implemented in PY2022
1. Promotes DR-enabling controls for lighting and HVAC and is moving towards integrating IDSM and NMEC solutions.	No. DR and EE are integrated in other markets. Periodically adding new technologies to measure lists is industry standard practice	Yes. DR, NMEC, and EE have been structurally separated in CA in the recent past.	No. The program focused on a limited range of EE measures. There was very little uptake of NMEC.
2. The program will work to include BRO measures such as Energy Management System, Building Energy Information Management, Retro-commissioning, and Benchmarking. Implementing these opportunities requires the ability to easily report and claim NMEC savings.	No. Integrated offers are industry standard practice. However, NMEC and related technologies are not widely used.	Yes. These measures have traditionally been part of custom programs. and offering them alongside deemed measures is new.	No. The program focused on a limited range of EE measures.
3. Holistic, customer relationship management approach to enterprise-level customers, supporting them across properties and measures.	No. Enterprise customer relationship management is industry standard practice.	No. The utilities had key account representatives when they ran the programs internally.	Partial. The program focused on a relatively small number of enterprise-level customers each with multiple sites. However, it focused on only a few EE measures rather than a comprehensive approach with many EE and DR measures.
4. Provide full suite of services including: account management, project management, engineering, pricing support, procurement, invoice management, and reporting that leverages established partner and vendor networks.	No. Industry-standard practice for custom programs targeting large customers.	Yes. Using custom-program-oriented approaches for a program that primarily uses deemed measures is new.	Yes. According to the IDI with program staff, the program offers on-bill financing, project management, incentive process, and keeping customers informed of new programs and policies. The IDIs also indicated that the program uses an established partner contractor network to complete most of the installations.
5. For larger projects, act as customer liaison to allow trade allies to focus on installation work.	Yes. Many programs foster the practice of trade allies conducting marketing and customer relations.	Yes for programs with deemed measures.	The evaluation did not acquire sufficient information to vet this innovation.
6. Support trade allies who drive sales to smaller customers.	No. It is a common industry practice to use trade allies to reach smaller customers	No. Utility-run programs have included upstream and midstream program designs that utilize distributors and trade allies for marketing.	The evaluation did not acquire sufficient information to vet this innovation.

Innovation in PIP	Innovative for the broader market?	Innovative for CA?	Implemented in PY2022
7. Expedite rebate payments to net 30-day terms to eliminate trade ally cash flow constraints from delayed payments.	Yes. The evaluation team is not aware of this practice in other jurisdictions.	Yes. The evaluation team is not aware of this practice happening previously in CA.	The evaluation did not acquire sufficient information to vet this innovation.
8. Negotiate pricing directly with manufacturers	Yes. Upstream programs often negotiate directly with manufacturers for advantageous prices, but this is less common in downstream programs.	Yes. Upstream programs often negotiate directly with manufacturers for advantageous prices, but this is less common in downstream programs.	The evaluation did not acquire sufficient information to vet this innovation.

Program theory

The program theory is acceptable, but the logic model in the PIP does not illustrate it. The program theory states that each customer is unique and the program is designed to be as flexible as possible. This is not at all reflected in the program logic model, which does not depict any market barriers. The logic model lists a series of general program activities disconnected from any barriers. It would be suitable for a logic model to begin with a barrier that all customers are unique and then show how a flexible approach overcomes that barrier. Another approach would be to list a set of different barriers that different customers could encounter and connect those barriers to the program activities. This latter approach is accomplished in the plan with a supplemental table that is several pages removed from the logic model. However, the activities in the logic model do not align with the program activities in that table or the process flow diagram.

Implementation Plans

While the PIP contains a process flow for individual projects, there is no description of a plan for the program as a whole. In-depth interviews revealed that program managers implemented the first year of the program with a much narrower focus than what is implied in the PIP. The PIP states the implementer will focus on each customer's priorities rather than trying to install all measures at once. IDIs confirmed that implementers did not attempt to pursue comprehensive measures. They considered a wide range of measures and customer segments before narrowing in on refrigeration measures in large grocery stores as the most cost-effective, easiest-to-obtain savings. Marketing similarly started broad before evolving to focus on relationships with existing, large customers.

The PIP lists a wide range of program-incentivized measures, but program tracking data shows that the program focused on a few measures in PY2022. The measure with the greatest amount of savings in PY2022 – automatic door closers – is not listed in the PIP.

The PIP provides a process flow diagram for individual projects. The flow diagram depicts a typical capital improvement project. However, there is no descriptive text accompanying the diagram or providing more in-depth description of each step. The flow diagram does not illustrate what would happen if a project varied from assumptions. For example, there is a step for post-installation inspection, but no indication of what would happen if the inspection revealed issues.

Marketing & outreach

The PIP describes a marketing approach, not a concrete plan. It said the implementer will divide the market into large and small customers. It will pursue large customers using a key account and relationship-based approach. It will rely on trade allies and PG&E reps to market to the small customers.

Program managers reported that they did not engage in any specific marketing campaigns in 2021 in part because they did not need to. They were able to achieve their savings goals from customers with whom they or their trade allies had existing relationships. This approach included no specific outreach to HTR or DAC customers (and the program still exceeded its 2021 goal for HTR/DAC participants).

PG&E's implementer indicated they collaborated regularly with PG&E account reps, and that the account reps helped them reach specific end-users. They also reported creating marketing collateral for automatic door closers and explored some materials for VFDs.

Program managers reported that they were highly successful at converting repeat customers (70-80%) and customers reached through trade allies (80%). Direct outreach to new customers was not as successful at conversions (30%). Leads from PG&E sales reps also had low conversion rates (10%), but the program managers appreciated the help the reps provided.

Quality controls and M&V plans

The PIP describes a pre- and post-investigation procedure for direct install and custom measures. These procedures are reasonable and include a description of what actions will take place if variances are found. In the IDIs, program staff indicated that a team at PG&E double-checks deemed measure savings calculations. Program staff also stated they do post-installation photographs and walkthroughs, and end-users fill out a work-completion form.

Program staff said they do not collect customer satisfaction surveys, to reduce an already heavy paperwork burden for customers. Program staff said they have enough interaction with their customers that they are confident they would know when one is dissatisfied. Customer satisfaction scores are not listed as a KPI in the PIP.

Program staff indicated that they do not have contracts with trade allies, so they cannot require trade allies to comply with the evaluation.

Program tracking data

When interviewed, program managers said they only collect end-user information that is required to fill out program paperwork. PG&E's implementer was able to provide evaluators with participant contact information. This information did not include economic sector information, but it can be inferred in many cases from email addresses and the measures installed.

4.4.2 Southern California Edison (SCE)-Commercial Energy Efficiency Program

This section provides more detailed findings specific to the SCE program.

4.4.2.1 Program budgets and spending

The program spent 80% of the budget it filed for PY2022 (Table 4-13). The latest version of the PIP and information directly accessible in CEDARS for filed budgets were consistent with each other. When asked for the detailed actual spent budget breakdown, SCE's implementer replied that its contract was based on dollars per kWh saved and that it did not track its budget by the requested categories. It reported spending approximately 80% of the overall budget and applied that ratio to each of the individual budget categories that were filed with its PIP and in CEDARS. Approximately 38% of the program budget went to customer incentives (Table 4-13).

Table 4-13. Detailed budget - SCE

Budget item	PIP	Filing	Actual	% spent	% of total budget
Administration	$1,553,243	$1,553,243	$1,238,532	80%	6%
Marketing	$1,401,707	$1,401,707	$1,117,700	80%	6%
Implementation	$12,474,955	$12,474,955	$9,947,337	80%	50%
Incentives to customers	$9,384,095	$9,384,095	$7,482,733	80%	38%
Total	**$24,814,000**	**$24,814,000**	**$19,786,301**	**80%**	**100%**

4.4.2.2 Assessment of KPIs

The program had key performance indicators (KPIs) for savings, cost effectiveness, percent of HTR/DAC savings, and several quality metrics. Table 4-14 shows the program performance goals and achievements for PY2022 that DNV evaluated (HTR/DAC goals are covered in the Participant Assessment section). On the strength of a higher-than-expected NTGR, the program beat its goals for net energy, demand savings, and cost effectiveness. Despite having a better-than-planned cost-effectiveness score, it was still below 1.0.

Table 4-14. Evaluated KPIs – SCE

KPI	Net goal	Net claimed	Net evaluated	Net evaluated as % of goal
kWh	38,000,000	29,459,828	42,014,000	111%
kW	2,907	3,602	7,440	256%
Therm	Not listed	232,140	228,920	N/A
Cost effectiveness (TRC)	0.70	0.54	0.77	110%

4.4.2.3 Implementer barriers

Program managers reported that the worst barrier was the lack of program awareness because it is a new program. They also reported that broadcast marketing is ineffective because there is no brand recognition. SCE’s implementer reported there is strict language in their contract restricting cobranding with and how much they can mention SCE, and that starting over and rebuilding that momentum slowed down program participation.

Program managers reported that the cost effectiveness requirements leave them with only a small set of viable measures. They also indicated they are worried that policy changes will further constrict the range of measures they can offer: “So I think one of the biggest challenges programs face today is to be able to try to achieve a TRC target in a changing landscape of measure codes, measure packages, regulatory policy, getting updated. It leaves you with a very small set of measures.”

4.4.2.4 Program design

DNV assessed the program design, including program theory, implementation plans, quality control and assurance, measurement and verification plans, marketing and outreach, the quality of the program tracking data, and how well spending matched budgets.

Innovations

Table 4-15 reproduces the innovations listed in the PIP, DNV’s assessment of whether those innovations are innovative in the industry generally and in California specifically, and DNV’s assessment of whether the programs implemented each innovation in PY2022.

Table 4-15. SCE’s program innovations & DNV’s assessment

Innovation in PIP	Innovative for the broader market?	Innovative for CA?	Implemented in PY2022
1. Implementer acts as a single point of contact for participants	No. Programs serving large customers often provide account management representatives that act as single points of contact.	No. The utilities have had account managers for years.	The evaluation did not acquire sufficient information to vet this innovation.
2. Integrate EE with DR measures	No. DR and EE are integrated in other markets. Periodically adding new technologies	Yes. DR, NMEC, and EE have been structurally separated in CA in the recent past.	No. Program focused on a narrow range of EE measures.

Innovation in PIP	Innovative for the broader market?	Innovative for CA?	Implemented in PY2022
	to measure lists is industry standard practice		
3. Online platform that tracks all data	Yes, if implemented as described. Many programs provide project-tracking databases, though few of them have advanced analytic capabilities as described in the PIP.	Yes, if implemented as described. Many programs provide project-tracking databases, though few of them have advanced analytic capabilities as described in the PIP.	No. An online system that tracks all data would make responding to evaluation data requests easy. SCE's implementer was evasive when asked for certain specific data, did not provide 8 out of 14 KPIs, and took several weeks to provide the data to evaluators.
4. Simple, customer-friendly offer that provides path to no incentives	Partially. Financing and technical support are commonly offered by energy efficiency programs. Flexible incentives are less common.	Partially. Financing and technical support are commonly offered by energy efficiency programs. Flexible incentives are less common.	Yes. However, the implementers indicated they more often had to flex incentives up rather than down.
5. Utilize machine learning to identify customers	Partially. Machine learning and advanced analytic methods are widely available, but it is unknown how broadly they are used by implementers.	Yes. DNV is not aware of other California programs that have used methods such as this.	No. Program manager interviews suggested that customer recruitment was done by identifying existing relationships.
6. Small business do-it-yourself to increase enrollment and lower implementation costs	Yes. The evaluation team is unaware of this approach being used in other jurisdictions.	Yes. The evaluation team is unaware of this approach being used previously in CA.	No. In PY2022, the program focused on larger customers.
7. Journey to ZNE	No. This is very similar to a key account manager approach. Long-term customer relation management for large customers is common.	No. This is very similar to a key account manager approach, which the utilities have used for years.	No. Program focused on narrow range of measures and indicated a very modest attempt to set up customers for additional measures in future program years

Program theory

According to the in-depth interview, the program's design philosophy was to create something flexible that could pivot with the market. In the PIP, the progression from market barriers to strategy to tactics to best practices is well-organized and easy to follow. The logic model is satisfactory – it has all the necessary components, is clear, and it is consistent with the other parts of the document.

Implementation plans

The PIP provides an implementation plan in the form of a table that lists program stages, high-level activities that will take place during those stages, dates for each stage, and the percent of savings expected to be achieved in each stage. This table meets the requirements for a program implementation plan.

The project process flow is typical for a general capital project. Swimlanes, or an indication of who performs the action at each step in the process flow, would make it more informative.

The PIP contains a broad list of program measures and states that comprehensiveness is a goal of the program. However, program tracking records indicate that the actual range of measures installed was narrow, mostly refrigeration. Program managers indicated this was a conscious decision made during the first year of the program. While the program design was to roll up several different utility-run programs that covered a wide range of measures, they focused on cost-effectiveness for the first year of the program, by identifying deemed measures with high savings. This led them to focus on refrigeration measures. They did not actively pursue comprehensiveness and did not indicate in the interview that they tracked additional opportunities for first-year participants. However, program managers did indicate they attempted to educate customers about heat pump water heaters to try to prime the market for future program years.

Marketing & outreach

The PIP lists a wide range of marketing approaches. Program managers indicated that they focused on relationship-based selling. They reported that they attempted some widescale marketing at the beginning of the year, but found it to be ineffective, so they shifted strategy. Program managers also reported leveraging subcontractors and their trade ally network to bring them projects with large customers, and SCE's implementer provides aid with the application and engineering. They also indicated that they use door-to-door audits for small, HTR customers.

The program design and practice is to customize offers to what the end-user is interested in, rather than pursue comprehensive energy efficiency improvements. The program managers did not indicate that they cross-marketed, encouraged participation in, or coordinated with other PG&E programs.

Quality controls and M&V plans

The PIP documents a quality assurance procedure both before and after installation. Program managers verified the post-installation QA procedure consisted of sending pictures to SCE engineers to verify measure and eligibility requirements.

Program tracking data

For this program, in-depth interviews with program implementers did not cover any questions about tracking data.

4.4.3 San Diego Gas & Electric (SDGE)- Commercial Large Customer Services (>20KW) Program

This section provides more detailed findings specific to the SDGE program.

4.4.3.1 Program budgets and spending

The program spent only 18% of the budget it filed for PY2022 (Table 4-16). Budget numbers directly available in CEDARS (filing) and those in the one version of the PIP on CEDARS are consistent.

Approximately 47% of the program budget went to customer incentives. Considering the plan was to spend approximately 75% of the budget on incentives, the actual spending is proportionally much less than planned. In contrast, the implementation spending was much higher than planned. This pattern suggests it was more difficult to install measures than the program planning anticipated.

Table 4-16. Detailed budget - SDGE

Budget item	PIP	Filing	Actual	% spent	% of total budget
Administration	$828,762	$828,762	$146,291	18%	6%
Marketing	$414,381	$414,381	$89,033	20%	4%
Implementation	$3,139,965	$3,139,965	$1,057,933	34%	43%
Incentives to customers	$9,429,587	$9,429,587	$1,160,824	12%	47%
Total	**$13,812,695**	**$13,812,695**	**$2,445,982**	**18%**	**100%**

4.4.3.2 Assessment of KPIs

The program had key performance indicators (KPIs) for savings, cost effectiveness, percent of HTR/DAC savings, and several quality metrics. Table 4-17 shows the program performance goals and achievements for PY2022 that DNV evaluated (HTR/DAC goals are covered in the Participant Assessment section). On the strength of a higher-than-expected NTGR, the program beat its goals for net energy and demand savings. Evaluated cost effectiveness was over 1.0, but short of goal.

Table 4-17. Evaluated KPIs – SDGE

KPI	Net goal	Net claimed	Net evaluated	Net evaluated as % of goal
kWh	19,505,377	4,144,000	5,502,000	28%
kW	2,185	810	1,030	47%
Therm	757,399	46,910	77,020	10%
Cost effectiveness (TRC)	1.64	1.03	1.22	74%

4.4.3.3 Implementer barriers

The program manager reported that Energy Efficiency as a Service never got participation. Worse, the company they were partnering with for the service changed business models. Thus, while the EEaS concept was innovative, it appears to not have traction for the type of customers and types of measures covered in PY2022. It is possible that a different kind of measure (perhaps one that requires higher initial investment) and/or with a different customer segment (small customers who may have a harder time securing their own financing) would be interested in EEaS.

The other significant barrier mentioned by program managers was the time it takes for projects to get approval.

4.4.3.4 Program design

DNV assessed the program design, including program theory, implementation plans, quality control and assurance, measurement and verification plans, marketing and outreach, the quality of the program tracking data, and how well spending matched budgets.

Innovations

Table 4-18 reproduces the innovations listed in the PIP, DNV's assessment of whether those innovations are innovative in the industry generally and in California specifically, and DNV's assessment of whether the programs implemented each innovation in PY2022.

Table 4-18. SDGE's program innovations & DNV's assessment

Innovation in PIP	Innovative for the broader market?	Innovative for CA?	Implemented in PY2022
1. Flex incentives - offer incentives based on what customer needs	Yes. Flexible incentives are not common in programs with deemed savings.	Yes. Flexible incentives are not common in programs with deemed savings.	Yes. However, the implementers reported they had to flex incentives up more often than expected
2. Efficiency as a Service (EaaS)/Pay as you save program design	Partial. On-bill financing and pay-as-you-save approaches are common. The additional EaaS approach is new.	Partial. On-bill financing and pay-as-you-save approaches are common. The additional EaaS approach is new.	No. PMs reported nobody was interested in this, and the implementing trade ally went into a different business model.
3. Data-driven targeting	Partially. Machine learning and advanced analytic	Yes. The evaluation team is not aware of	No. Program manager interviews suggested that

Innovation in PIP	Innovative for the broader market?	Innovative for CA?	Implemented in PY2022
	methods are widely available, but it is unknown how broadly they are used by implementers.	other California programs that have used methods such as this.	customer recruitment was done by identifying existing relationships.
4. Savings persistence monitoring	No. The description for this innovation is very similar to a key account manager approach, which is common practice for large customers.	No. The description for this innovation is very similar to a key account manager approach, which is common practice for large customers.	Not evaluated. This innovation will take several years of program operations to assess.
5. Normalized metered energy consumption (NMEC)	Partial. NMEC and EE are not often integrated in other markets. Periodically adding new technologies to measure lists is industry standard practice	Yes. DR, NMEC, and EE have been structurally separated in CA in the recent past.	No. The program focused on a limited range of EE measures. There was very little uptake of NMEC.
6. Measure graduation[40]	Yes. The evaluation team is not aware of a semi-custom approach like the one described being used in other jurisdictions.	Yes. The evaluation team is not aware of a semi-custom approach like the one described being used in other CA programs.	No. KPIs indicated no measure graduations

Program theory

The PIP lists market barriers and explains how the program's approaches will address them. The logic model is good. It is very clear about what leads to what and is easy to follow. Of the three PIPs, this one has the best logic model.

Implementation Plans

The PIP does not contain a process flow or plan for the program overall.

Program managers reported that the key difference of this program from past, utility-run programs is that it combines deemed and customer measures into a "one stop shop." The program's primary goal is to deliver cost effective savings from large customers. It uses the standard suite of program tools to do so – incentives, audits, technical support, and funneling into other programs. Equity (HTR/DAC) targets are not a major focus of this program because it targets large customers.

While the PIP lists a wide range of measures and (inconsistently) suggests that comprehensiveness is a program goal, the program focused on a narrow range of measures in PY2022. The program focused on refrigerator door closers because those were the measures that made the most sense for their customers. Program managers indicated that they did not pursue comprehensiveness in audits or walkthroughs. Instead, they focused on measures with good paybacks.

The PIP contains project process flows for deemed, direct install, custom, and NMEC measures. These flows illustrate typical capital improvement projects. They are acceptable. A minor improvement would be to add swimlanes or an indication of who takes each action.

Marketing & outreach

[40] Measure graduation is described in the PIP as: To accommodate projects with expedited schedules, the program will introduce simplified custom applications, along with approved calculation tools, defined influence documentation, and clear M&V requirements that accelerate the approval process. The Custom Express platform will be utilized to cost-effectively expand proliferation of traditional custom measures beyond large customers, enable data collection for full workpaper development and ultimately, graduate the measure to the deemed platform.

The PIP describes approaches to marketing but does not document an actual marketing plan. It discusses leveraging subcontractors and trade allies for marketing, offering concierge-type services and a trusted advisor, and mass marketing.

Project managers indicated that the program primarily used relationship-based outreach and marketing. They said they have a written marketing plan, and that it focuses on relationship-based selling. They attempted some broadcast marketing early on but did not continue it.

Their mass marketing focused on grocery stores, hotels/motels, hospitals, and nursing homes/care facilities. The majority of contacts (80%) were reached through "digital display". Much smaller numbers came through search engine marketing (16%) and email (4%).

Quality controls and M&V plans

The PIP describes a quality assurance team and that the program will establish protocols for data quality in the program tracking data.

Program tracking data

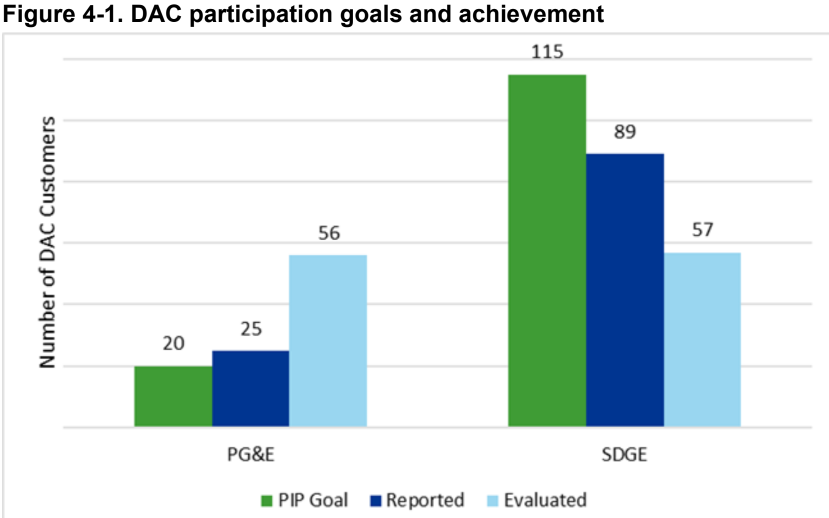
Program implementers indicated that they do not record audit information in the tracking database. Instead, the information from the audit is provided to customers for their own use/benefit.

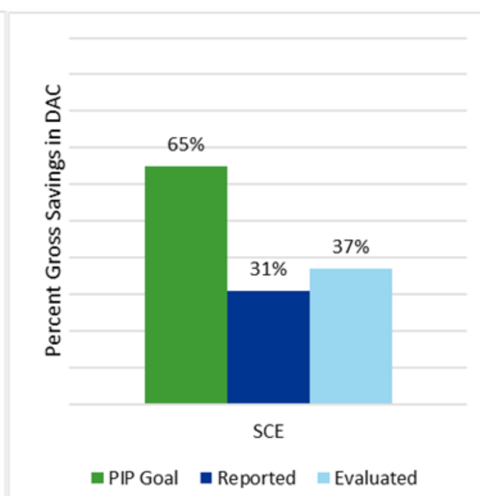
4.5 Participation assessment

DNV examined the number of participants residing in DAC areas based on geocoding of program tracking data. The evaluator was unable to assess HTR status. Program data did not list HTR status, and there was not enough information in the tracking data for DNV to impute a value. There were also not enough completed surveys for DNV to use to assess HTR status.

Figure 4-1 shows the DAC participation goals from program PIPs, reported values, and evaluated values. Note, PG&E and SDGE set goals based on the number of participants while SCE's goal was based on the proportion of savings. DAC participation achievements were mixed. The PG&E program exceeded its goal. SDGE achieved a similar number of DAC participants as PG&E, but this was approximately half their original goal. Similarly, SCE achieved about half its goal of DAC savings.

Figure 4-1. DAC participation goals and achievement





When asked about energy equity, program implementers reported that they focused on achieving DAC/HTR customer participation based on what was in their contracts. Two of the three failed to achieve these goals. It should be noted that these programs were designed and contracted prior to recent CPUC prioritization of energy equity goals.[41]

4.5.1 Pacific Gas and Energy (PG&E)- NetOne Commercial Efficiency Program

According to program implementers, most (65%) of the projects were with customers in the grocery sector. The rest (35%) were in commercial or retail sectors. Completed projects primarily (50-60%) came from repeat customers. Trade allies supplied another 20-30%, PG&E leads contributed 5-10%, and other marketing had almost no effect.

4.5.1.1 Customer barriers

PG&E's implementer said they take care of all of the applications to make participation as easy as possible for customers.

Program managers reported that for deemed measures, lack of access to financing is the greatest barrier. The PIP says the program will offer access to on-bill financing and other financing.

Survey respondents did not report any specific barriers.

4.5.1.2 Satisfaction

DNV completed surveys with two respondents who represent 13 sites. Both respondents were highly satisfied (5 on a 5-point scale) with the program requirements, the contractor, the variety of equipment offered, the program paperwork, and the program overall.

One was neutral (3 on a 5-point scale) with the energy savings, saying they were a little lower than expected. The other did not answer satisfaction for the energy savings but said that the savings were a fraction of the cost of upgrading the equipment.

4.5.2 Southern California Edison (SCE)-Commercial Energy Efficiency Program

4.5.2.1 Customer barriers

For customers, program managers said that small businesses cannot afford copays because they were just coming out of COVID restrictions. They mentioned that the ability to flex incentives up or down helped them close deals (by flexing up) and that they had to flex up more often than they anticipated.

Survey respondents did not report any specific barriers.

4.5.2.2 Satisfaction

DNV completed surveys with 8 respondents, representing 21 sites. Overall, survey respondents were satisfied or very satisfied (4 or 5 on the 5-point scale) with program requirements, the contractor, equipment variety, program paperwork, and the program overall. Respondents reported two specific issues affecting their satisfaction with the program:

- One survey respondent reported that the program contractor made a bad error with the electrical system and had to try multiple times to get it right.
- Another respondent said that their energy costs are 10 times more now that they have installed the new equipment.

[41] CPUC Environment and Social Justice Plan. ESJ Action Plan (D.21-05-031, 14)

4.5.3 San Diego Gas & Electric (SDGE)- Commercial Large Customer Services (>20KW) Program

4.5.3.1 Customer barriers

One participant reported they had to be assertive to get the contractor to work with the utility to ensure that their business was eligible for the program.

4.5.3.2 Satisfaction

DNV surveyed six respondents representing 19 sites. Two of the respondents were highly satisfied (5 on a five-point scale) with the program requirements, the contractor, the equipment variety, program paperwork, and the program overall. One respondent was not at all satisfied (1 on a 5-point scale) with the energy savings or the program overall. This respondent did not provide an additional explanation for their lack of satisfaction.

5 RECOMMENDATIONS AND CONSIDERATIONS

 Key findings	 Implications and recommendations
1. The GRRs for electric energy savings attributed to PAs exceeded 100%. This outcome can primarily be attributed to adjustments in relative humidity levels for anti-sweat heater controls. The recalibration of passage time and duration parameters for auto-closer measures in refrigeration cases is another impact factor but not a high-profile update.	To enhance the accuracy of savings estimations, especially for significant refrigeration measures, it is recommended to incorporate the data collected during the evaluation into the update process for measure packages. This should include more detailed information on types, efficiencies, and operational parameters of refrigeration and HVAC systems.
2. Third-party implementers reported a lack of brand recognition and market momentum from past utility-run initiatives due to PAs not allowing effective affiliation or co-branding.	Allow programs to reference the utilities and past utility-run programs.
3. The project contact data provided by the PAs and implementation contractors often did not contain accurate key project decision-makers even after the evaluation team had specifically requested such decision-maker names. Consequently, this led to many NTG surveys having incomplete information.	Ensure PAs and implementation contractors provide contact details for end-user sites and decision-makers. This streamlines evaluations by facilitating simultaneous communication, avoiding delays when site contacts aren't key decision-makers, and reducing the need for additional data requests.
4. Actual program practices as reported in implementer interviews are inconsistent with what is written in the PIPs.	Review PIPs at least annually to assess them against actual practice and justify variance from written plan through amendments, including updating logic models.
5. The third-party run programs are recognized for their potential to drive innovation. However, the analysis indicates that these programs frequently capitalize on established relationships and existing savings opportunities.	For future third-party program designs, the CPUC should enforce the use of the updated definition of innovation as documented in the latest version of the Energy Efficiency Programs Implementation Plan Program Guidance[42] (May 2020 as of the publication of this report). It's implied that the IOUs must align their program designs with the updated definition. This recommendation aims to ensure consistency and clarity across all third-party program designs.

[42] CPUC. "Implementation Plan Template Guidance - Version 2.1." cpuc.ca.gov, May 2020. https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/i/6442466376-implementation-plan-template-may2020.pdf

 **Key findings**	 **Implications and recommendations**
6. Coordination between third-party programs and existing utility-operated programs is minimal, despite the participant crossover between multiple commercial programs. This lack of interaction fails to recognize the diverse experiences of participants when engaging with PAs and third parties, leading to a disjointed program experience.	Establish a collaboration framework to facilitate more frequent information sharing, checks and balances, and coordination between utility-run and third-party-run programs.
7. Program attribution was very high with overall program NTGRs being 97% for electric energy savings and 98% for gas energy savings. Survey respondents emphasized the importance of the program incentives in project implementation. The program's focus on refrigeration technologies that are less commonly known or adopted in the marketplace likely also contributed to these high NTGRs.	Continue the program's focus on refrigeration technologies that are less commonly known or adopted in the marketplace since these technologies will likely continue to have high NTGRs until market adoption becomes more common. Minimize the promotion of widely-marketed energy-saving technologies like TLEDs, which have lower evaluated NTGRs (e.g., 35% for TLEDs), since the market already supports them without program help.
8. Programs met savings and cost-effectiveness goals on the strength of the high evaluated NTGRs. As filed with ex ante NTGRs, no program met goals.	All else being equal, continuing to enroll customers that would not otherwise install energy efficiency measures will be important for programs to meet their goals.

6 APPENDICES

6.1 Appendix A: Standardized High-Level Savings

High-level savings

6.2 Appendix B: Standardized Per-Unit Savings

Per-unit savings

6.3 Appendix C: Measures by program

Table 6-1. Measures by PA

PA and Program Name	Measure Package Name	No. of Sites	No. of Claims	First Year MW electric demand		First Year MWh electric energy		Lifecycle MWh	First Year MMBtu gas energy		Lifecycle MMBtu
				Gross	Net	Gross	Net	Net	Gross	Net	Net
PG&E Commercial Efficiency Program	Auto Closer for Refrigerated Storage Door	321	593	1.89	1.14	8,635	5,192	34,783	-87	-53	-352
	Medium-Temperature Case Doors	32	32	0.44	0.26	3,054	1,832	9,161	29,018	17,411	87,055
	Enhanced Ventilation for Packaged HVAC	22	22	0.31	0.19	932	571	2,857	2,719	1,664	8,318
	Exhaust Hood Demand Controlled Ventilation, Commercial	1	1	0.01	0.00	62	37	557	141	85	1,273
	VSD for HVAC Fan Controls, Commercial	4	4	0.01	0.01	101	61	304	-45	-27	-135
SCE Commercial Large Customer Services (>20KW) Program	Auto Closer for Refrigerated Storage Door	458	839	1.08	0.65	4,589	2,753	18,446	-26	-16	-105
	Anti-Sweat Heater Controls	10	17	0.12	0.07	1,212	727	2,908	-1,075	-645	-2,580
	Medium-Temperature Case Doors	7	7	0.10	0.06	726	436	2,178	6,829	4,097	20,487
	LED, Tube, Type B, and Type C	10	11	0.04	0.02	298	179	1,166	-13	-8	-51
	ECM Retrofit for a Walk-in Cooler or Freezer	3	5	0.01	0.01	66	39	197	0	0	0
	LED, High or Low Bay	2	2	0.00	0.00	8	7	84	-4	-4	-45
	Reach-In Refrigerator or Freezer, Commercial	15	15	0.00	0.00	7	4	53	0	0	0
	Software-Controlled Switch Reluctance Motor	3	3	0.00	0.00	3	2	34	-2	-1	-22
	Ice Machine, Commercial	2	2	0.00	0.00	3	2	17	0	0	0
	LED, Tube	1	1	0.00	0.00	3	2	9	-1	-1	-3
	Pool Cover, Commercial	1	1	0.00	0.00	0	0	0	1,204	722	3,612
	Fryer, Commercial	5	5	0.00	0.00	0	0	0	788	473	5,670
	Heat Pump Water Heater, Commercial, Fuel Substitution	1	1	0.00	0.00	-6	-6	-65	73	73	732
SDG&E Comprehensive Commercial Program	Anti-Sweat Heater Controls	569	912	1.98	1.34	21,226	14,386	57,546	-19,058	-12,916	-51,663
	Auto Closer for Refrigerated Storage Door	647	1,053	2.33	1.52	10,545	6,879	46,088	-56	-37	-245
	Medium-Temperature Case Doors	38	38	0.53	0.32	4,033	2,454	12,269	36,009	21,939	109,694
	LED, Tube, Type B, and Type C	103	132	0.37	0.26	2,246	1,545	9,543	-1,174	-787	-4,812

PA and Program Name	Measure Package Name	No. of Sites	No. of Claims	First Year MW electric demand		First Year MWh electric energy		Lifecycle MWh	First Year MMBtu gas energy		Lifecycle MMBtu
				Gross	Net	Gross	Net	Net	Gross	Net	Net
	LED, Tube	**84**	**175**	**0.09**	**0.06**	**530**	**365**	**1,773**	**-386**	**-271**	**-1,299**
	ECM Retrofit for a Walk-in Cooler or Freezer	107	163	0.03	0.03	246	192	960	0	0	0
	LED, High or Low Bay	10	10	0.01	0.01	72	65	784	-10	-10	-115
	Heat Pump Water Heater, Commercial	1	5	0.01	0.01	121	73	727	0	0	0
	Evaporative Pre-Cooler System and Controls for Packaged HVAC Unit	1	6	0.10	0.06	103	62	309	0	0	0
	Package Terminal Air Conditioner or Heat Pump, Under 24 kBtu/hr	2	2	0.01	0.00	17	10	155	0	0	0
	Fan Motor Retrofit for a Refrigerated Display Case	1	1	0.00	0.00	0	0	0	0	0	0
	Heat Pump Water Heater, Commercial, Fuel Substitution	6	6	0.00	0.00	-93	-93	-928	1,107	1,107	11,070
	Large Heat Pump Water Heater, Commercial and Multifamily, Fuel Substitution	10	22	0.00	0.00	-960	-960	-9,599	14,188	14,188	141,883
	Total	**2,139**	**4,086**	**9.46**	**6.01**	**57,778**	**36,816**	**192,315**	**701**	**46,985**	**328,368**

6.4 Appendix D: Net-to-gross approach

This section lays out DNV's general approach to estimating NTGRs used to calculate net savings.

6.4.1 Approach

Self-report surveys have been a major component of previous NTGR methods for California residential programs. DNV's plan for PY2022 is to develop data collection instruments for 3PC programs using past instruments to calculate NTGR. We will review and make modifications to these instruments as well as include additional questions as necessary, for example, due to program-specific designs or data availability. Instrument design will begin in August 2023, and training and fielding will begin in October.

Participant self-reports ask about program awareness and the project decision-making processes and then ask what the timing, efficiency, and quantity of the installed measure(s) would have been absent from the program. Key limitations of this method include a long and complex survey with questions that participants may find difficult to understand.

6.4.2 Overview of NTGR estimation steps

The steps for net savings methods based on primary data collection from customers and market actors to be used for the residential programs include the following:

- Sample selection
- Instrument Design and Testing
- Survey fielding and data collection
- Data cleaning steps specific to net savings sequences
- Calculate net savings ratios
- Summarize results, describe implications, and make recommendations.

6.4.3 Detailed tasks

Task 1: Survey development.

Overview: DNV will ask program participants how the program affected the timing, efficiency, and quantity of the installed measures.

Detailed description: DNV's standard approach to self-report surveys is to use questions that explore how the programs affected the timing, efficiency, and quantity of installed measures:

- In the absence of the services offered by the program, would you have installed the measure at the same time, earlier, or later?
- In the absence of the services offered by the program, would you have installed equipment of the same efficiency, lesser efficiency, or greater efficiency?
- In the absence of the services offered by the program, would you have installed the same quantity of (or size) equipment, less, or more?

Task 2. Test the approach. DNV's basic QA/QC procedures include reviewing completed instruments to confirm skip logic, readability, reliability, internal validity, external validity, clarity, length, and flow. DNV's team will provide draft data collection instruments to CPUC staff and other stakeholders for review and incorporate all feedback into a final version. We will not proceed with data collection until the CPUC staff approves the final instruments. We also conduct “soft launches” to test the survey before fully launching.

During analysis, we will conduct sensitivity analyses. At a minimum, these include the identification of statistical outliers that have an extreme influence on the final results. We will use specific rather than general prompts of alternative efficiency levels to mitigate potential respondent unawareness of intermediate efficiency levels.

Task 3. Survey fielding and data collection. The data collection will be conducted following guidelines that will be developed under that deliverable for fieldwork management.

Task 4. Data cleaning. In a survey, two types of questions can generate verbatim responses: open-ended questions and those that include an “other” response to catch responses that are not included in a pre-coded set of responses. Questions that include pre-codes and an “other” response will go through two rounds or stages of coding. The first round is for what is called ‘back-coding.’ Back-coding is to see if the verbatim responses were not true “other” responses, but miscoded answers. For example, if there is a pre-code for “Electronics Store” and the other response for a respondent is “Best Buy” that needs to be back-coded into the “Electronics Store” category. Once the back-coding has been done, then the post- coding can occur. Post-coding is the process of looking at provided responses (for either open-ended or “other” responses), clustering the responses to create new response categories, and assigning a code to these.

We provide additional detail on DNV’s approach for a standard participant self-report survey. In DNV’s method, each of the components of attribution: Timing, Efficiency, and Quantity, have a question sequence that follows the same pattern:

$XXXX$.	What would you have done without the program?
$XXXX\_00$.	Why do you say that?
$XXXX$.	<If Xa=program effect> How different would the project have been?

Quality control for each component of attribution consists of comparing the final component attribution score (t, e, q) to the open-ended response for the “$XXXX\_00$. Why do you say that?” question. Interviewers are trained to probe if the response to the open-ended question is inconsistent with the scored response to $XXXX$.

During the analysis phase, the analyst will put measures into three bins: full attribution, partial attribution, and full free rider for each component. The analyst works a bin at a time to compare each verbatim open-ended response to the score for the attribution component. Assessing verbatim responses by bin reduces analyst error and speeds up the review. If an open-ended response appears inconsistent with the score received, the case is elevated to subject matter expert (SME) review.

The attribution score calculated via the timing, efficiency, and quantity questions is also checked against the following for consistency. Inconsistent scores are referred to SME review.

- The answer to a closed-ended overall attribution question
- The answer to an open-ended summary of the program’s influence question
- Answers to questions about the timing of program awareness relative to the project timing

Analysts are instructed to have a low bar (“when in doubt flag for review”). SME review consists of reviewing the entire survey, including all responses to all measures when the survey covers multiple measures. If the SME determines that the flagged score (whether of a component or overall) is not clearly contradicted by the overall story told by the respondent throughout the interview, the SME makes no change. If the flagged score is clearly contradicted (approximately 1% of cases in DNV’s experience), the SME decides among three options:

- Drop the measure from the sample (for very muddled responses, much more common with computer-aided telephone interviews [CATI] than IDI)
- Replace the inconsistent response with a "Don't Know" (effectively using the average if it is clear that there should be some attribution for the component, but unclear how much)
- Adjust the flagged score to reflect the intent of the respondent more accurately (employed in cases where there is overwhelming evidence of intent, for instance, the open-ended response says clearly what the score should be)

Task 5. Score surveys. When we use surveys or IDIs as the basis for determining NTGRs, developing the scoring algorithm or analysis method is done as part of the survey design. This process will lay out how we will score each response to each question, and how those scores will be combined to generate the free-ridership score (or other metric).

DNV's basic self-report scoring algorithm is based on the three free-ridership dimensions of timing, efficiency, and quantity.

- **Timing,** $FFFF_{tttttttttttt}$: This reflects the effect the program had on *when* the equipment was installed. The acceleration period corresponds to the number of months between when the equipment was installed and when it would have been installed in the absence of the program.
- **Efficiency Attribution,** $FFFF_{eeeeeetteetteetteeee}$: This measures the effect the program had on the efficiency of the equipment installed. The efficiency attribution measures the proportion of savings attributable to the program for increasing the efficiency of the equipment above what would have been installed otherwise. This factor is based on responses to attribution questions in the participant survey.
- **Quantity Attribution,** $FFFF_{qqqqqqtttttttttee}$**:** This measures the effect the program had on the quantity of the equipment installed. The quantity attribution measures the proportion of savings attributable to the program for increasing the quantity of equipment above what would have been installed otherwise. This factor is based on responses to attribution questions in the participant survey.

Each free-rider dimension receives a score between 0 (no free-ridership) and 1 (complete free-rider). We combine these scores by multiplying and then subtracting the product from 1 to compute program attribution.

$$FFFF_{ttttttttt} = FFFF_{ttttttttttt} * FFFF_{eeeeeetteetteetteeee} * FFFF_{qqqqttttttttttee}$$

$$AAAAAAAAAAXXAAAAAAoonn = (1 - FFFF_{ttttttttt})$$

The use of multiplication at the free-ridership level means that if free-ridership is zero for any of the dimensions applicable to the measure, the total free-ridership will also be zero and the program will receive full credit for the measure. On the other hand, a respondent must be a full free-rider along all applicable dimensions to result in a total free-ridership of one.

Details on the scoring algorithms.

We use process flow diagrams to illustrate how we score survey responses to generate NTGRs. The questions and the scoring values provided are used as examples and do not necessarily represent actual survey questions and scoring values that DNV will use to calculate PY2022 NTGRs.

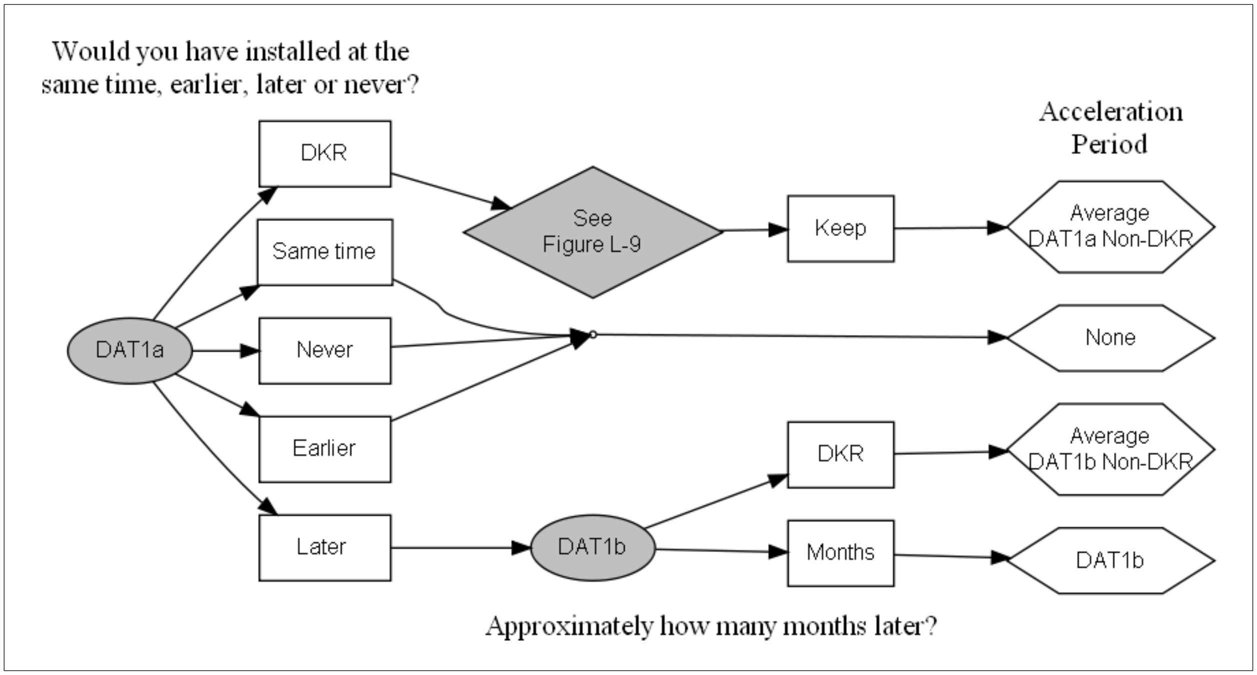
Figure 6-1 shows a decision tree for scoring responses to two timing-related NTG questions, DAT1a and DAT1b. The two questions are as follows:

DAT1a: "I'd like to know about the effect, if any that program incentives had on the timing of your decision to install the [equipment type]. I'm referring to your decision to install any [equipment type], not just a high-efficiency one. Would have installed the [equipment type] at the same time, earlier, later, or never?"

DAT1b: "Approximately how many months later?" (DAT1b is only asked if DAT1a is "Later".)

In the decision tree, "DKR" refers to "Don't Know" and "Refused."

Figure 6-1. Decision tree for timing[43]



The measure is considered accelerated if the respondent indicates that the measure would have been installed less than 24 months later without program influence. The acceleration period is determined based on the answer to DAT1b. If the respondent is unable to answer DAT1b, the measure is assigned the average acceleration period across all accelerated measures in the same measure package.

If the respondent answers DAT1a with Don't Know or Refused but does provide answers to inform the Quantity and Efficiency Attributions, then the measure is assigned the average Timing Attribution for all measures in the same measure package.

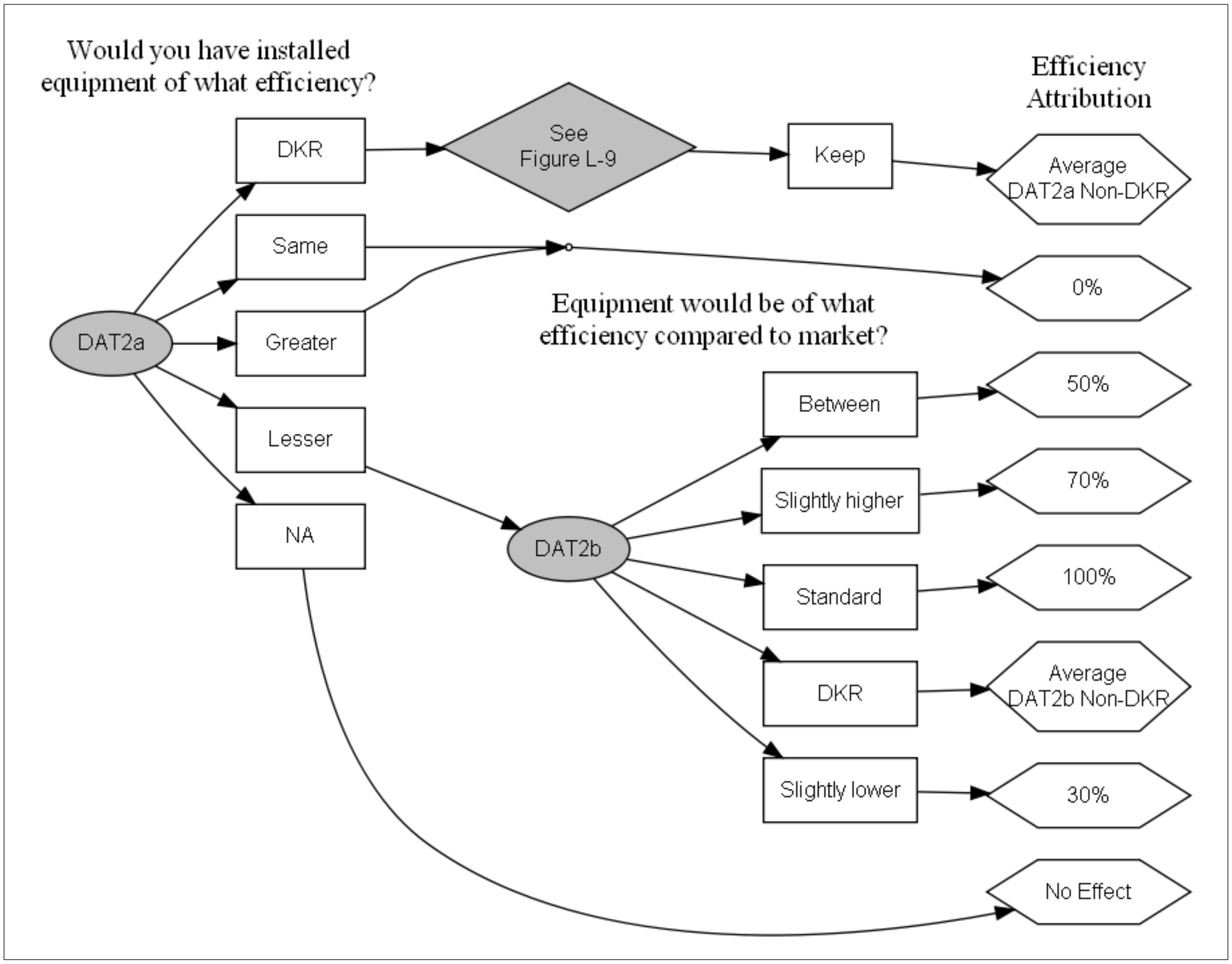
Figure 6-2 shows a decision tree for scoring responses to two efficiency-related NTG questions, DAT2a and DAT2b. The two questions are as follows:

DAT2a: "Without the program, would you have installed [equipment type] of the same efficiency, lesser efficiency, or greater efficiency?"

DAT2b: "Without the program, would you have installed a [equipment type] that was "standard efficiency on the market at that time," "slightly higher than standard efficiency," "between standard efficiency and the efficiency that you installed," or "slightly lower than the high efficiency that was installed?" (DAT2b is only asked if DAT2a is "Lesser".)

43 Figure 6-1 and Figure 6-2 are obtained from a prior DNV report and refer to a Figure L-9 currently not in this document. Please note that the process flow described in each figure can be understood without reference to Figure L-9.

Figure 6-2. Decision tree for efficiency attribution



The program receives non-zero Efficiency Attribution if the respondent indicates that they would have installed a less efficient measure without the influence of the program. The magnitude of the Efficiency Attribution is determined based on the answer to DAT2b, as shown in Table 6-2. For measures with limited efficiency options, such as faucet aerators and showerheads, DAT2a and DAT2b can be combined, and respondents asked if they would have installed the same efficiency or standard efficiency equipment.

Table 6-2. Efficiency attribution assignments

Coarse cut (DTA2a)	Finer cut (DTA2b)	Efficiency attribution, E
Lesser	Standard efficiency or according to code	100%
	Slightly higher than standard efficiency	70%
	Between standard efficiency and the installed efficiency	50%
	Slightly lower than the high efficiency that was installed	30%
	Don't know/refused	Average of the above cases for the measure package
Same	NA	0%
Greater	NA	0%
Don't know **Refused**	NA	Average of all respondents for the measure package

If the respondent answers DAT2a with Greater or Same, then the survey skips to the next section and there is zero Efficiency Attribution. If the respondent answers DAT2a with Don't Know or Refused but does provide answers to inform the Quantity and Timing attributions, then the measure is assigned the average Efficiency Attribution for all measures in the same measure package.

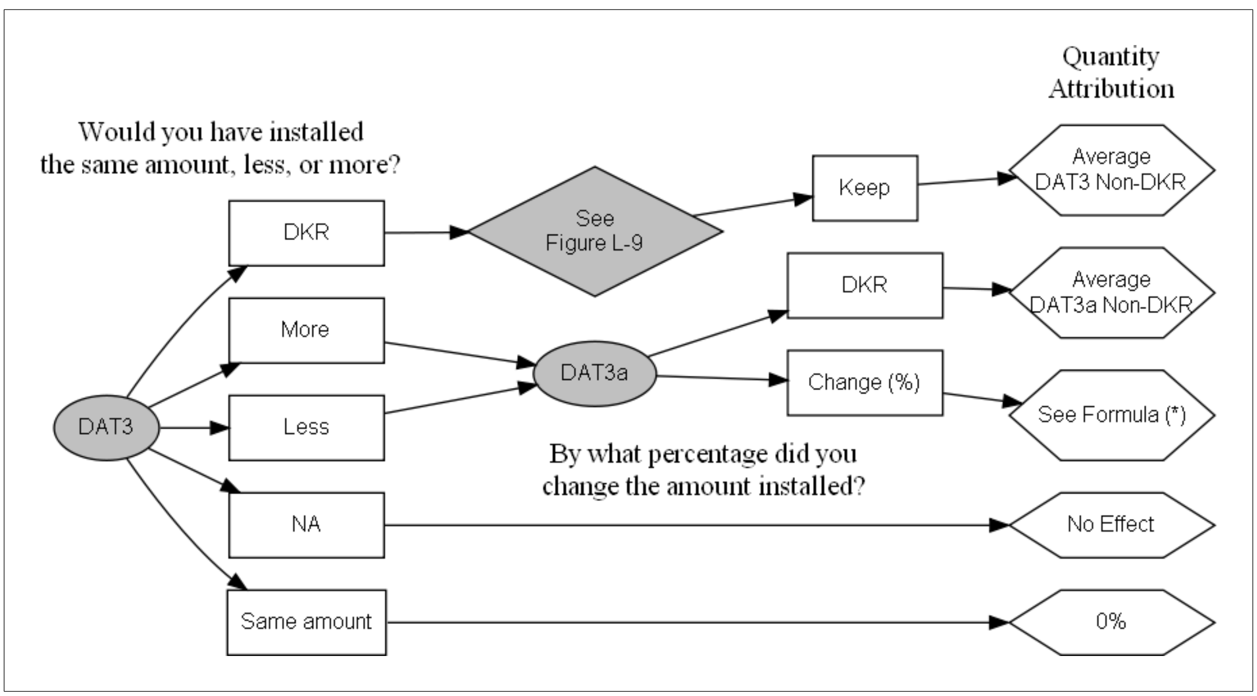
For some measures, efficiency is not applicable. These are measures for which there are no variable efficiency levels associated with the equipment. Examples of measures that fit into this category include ECM motors, programmable thermostats, lighting controls, and variable frequency drives. For such measures, DAT2a and DAT2b are not asked. Other measures, such as showerheads and faucet aerators have only two possible efficiency levels: standard and efficient. For these measures, efficiency attribution depends only on the response to DAT2a and is either 100 or zero percent.

Figure 6-3 shows a decision tree for scoring responses to two quantity-related NTG questions, DAT3a and DAT3b. The two questions are as follows:

DAT3: "I'd like to know about the effect, if any, that program incentives and services had on the quantity of [equipment] that you installed. Without the program would you have installed the same amount, less, more, or none at all?"

DAT3a: "By what percentage did you change the quantity of [equipment type] installed because of the program?" (DAT3a is only asked if DAT3 is "Less".)

Figure 6-3. Decision tree for quantity attribution



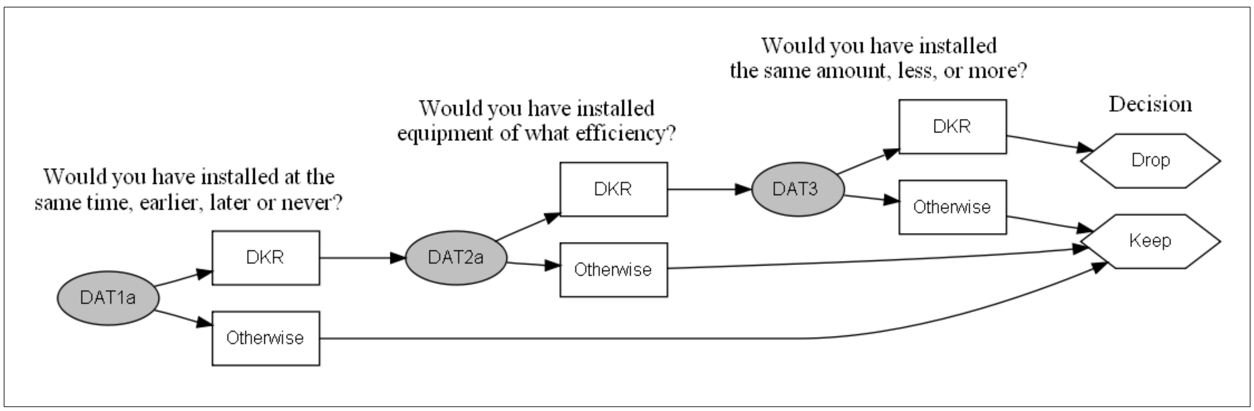
The program could have caused the participant to install a lesser or greater number of units or equipment capacity. If the participant installed more units because of the program, we assume that it was an increase in project scope that would not have happened otherwise. If the participant installed fewer units (or capacity) because of the program, we assume that the equipment was “right-sized” for greater efficiency. The respondent provides quantity change information directly. The quantity attribution is:

$FFFF_{qqqqqqttttttttee}$ = | *(Amount installed / Amount would have installed without program) - 100%*|.

If the respondent answers DAT3 with Same Amount, then the survey skips to the next section and there is zero Quantity Attribution. If the respondent answers DAT3 or DAT3a with Don’t Know or Refused but does provide answers to inform the Efficiency and Timing Attributions, then the measure is assigned the average Quantity Effect for all measures in the same sector.

Some respondents are unable or unwilling to answer the relevant questions in the survey attribution sequence. If a participant is unable or unwilling to answer all of the attribution questions, then the participant is dropped from the attribution analysis. However, the respondent information will still be included as part of the installation rate. Figure 6-4 shows a decision tree that indicates the relationship between the question responses and how they affect the attribution. If a measure goes to the “Keep” decision then the ultimate resolution of each effect is shown in Figure 6-1, Figure 6-2, and Figure 6-3.

Figure 6-4. NTG case retention decision tree for don't know/refused



Task 6. Calculate net savings estimates. When using methods based on participant self-report surveys, we compute an attribution score for each survey respondent, multiply their gross savings by that attribution to calculate net savings, and then use sample expansion to produce population-level net savings. Population-level NTGRs are computed by dividing population net savings by population gross savings.

Task 7. Make recommendations for program improvements. Our approach to NTG takes the program design, logic, and mechanisms into consideration, and at its core, NTG is about assessing the programs’ effect on the market. Thus, it is an inherent quantification of the interaction of the programs and the market. Not only is it useful for assessing how well certain elements work, but it also provides insights into what is likely and unlikely to work given current and future market conditions. As such, an output of our NTG analyses will be to make recommendations to the programs about program design, where to set incentive levels, how to set ex ante NTGRs, and which products to incentivize.

6.5 Appendix E: Stakeholder comments and evaluator responses

Table 6-3. Stakeholder comments on the study and evaluator response

#:	Subject:	Entity:	Question or Comment:	Evaluator Response:
1	PG&E Feedback on Draft Report	PGE	PG&E appreciates the opportunity to review and provide comments on this draft report. It was well-written and well-organized. PG&E also appreciates the continued shift from a measure-level evaluation to a program-level evaluation and looks forward to this approach on-going.	Thank you for your comment.
2	Explanation of Customer Feedback and Intrinsic Value in Energy Efficiency Program	PGE	Can the evaluation team provide more information in terms of customer feedback, comments, etc. which explain how customer respondents identified "intrinsic value"? For example, does "intrinsic value" mean that program offerings included measures that fit into budget and timelines available to execute EE projects? Or that incentives were sufficient enough to provide an acceptable ROI? Or are there other examples that customers indicated as "intrinsic value" that the evaluation team can cite?	The primary drivers behind the observed increases in Total System Benefits (TSB) were changes in net-to-gross (NTG) ratios, with gross savings achieving about 100% realization rates. Customer feedback highlighted several aspects of the program's intrinsic value. Participants appreciated the incentives, which significantly motivated them to complete energy efficiency projects. The program's focus shifted from LED lighting to refrigeration measures, effectively encouraging participants to undertake new projects. Customers reported no significant issues with the measures, and the energy savings met expectations. Although the evaluation did not assess the Effective Useful Lives (EULs) or costs of the measures, it focused on the attribution of savings. These factors underscore the program's intrinsic value, driven by the relevance and effectiveness of the measures and the adequacy of the incentives.
3	Clarification on Market Actor Confusion	PGE	Can the evaluation team confirm which market actors were confused: customers or implementers? Can the evaluation team also provide some examples of comments that clarify this 'confusion in the market' that was	The evaluation team can confirm that it was primarily the implementers who reported confusion among customers regarding the association of the utility with specific programs. Customers often

#:	Subject:	Entity:	Question or Comment:	Evaluator Response:
			expressed? Comments regarding any confusion may help to determine how IOUs/PAs can address the issue and who needs to be better communicated to.	struggled to identify which utility program they were participating in. Implementers also highlighted issues with competing for the same customers as the RENs. In the same geographic areas, better coordination among implementers is necessary. Improved communication to customers will help clarify the roles of different entities and ensure customers understand which program serves their needs. Specifically, there needs to be more coordination and clarification about the various roles, ensuring that RENs augment areas where the IOU program doesn't reach. Clear communication about the roles and responsibilities of each party will be essential in addressing this confusion.
4	Clarification on NTG Data Collection Approach for PG&E Program	PGE	In Table 3-11, PG&E noticed that no on-site visits were used to collect net-to-gross (NTG) data for its program (but instead used phone interviews). From the report, it appears that this approach may have been due to the fact that "most participants were chain grocery stores for which the decision to participate in the program occurred at a corporate level" and that a site-level contact "would not adequetly serve for the the net savings analysis because they were not involved in the project decision-making" (Report pg. 31). Can the evaluation team confirm or clarify that this was the case for PG&E's program?	The evaluation team can confirm that we did not conduct on-site visits for NTG data collection for PG&E's program. This decision was based on the fact that most participants were chain grocery stores, such as Safeway, where decisions to participate in the program were made at a corporate level. Consequently, site-level contacts were not involved in the decision-making process and would not have provided useful data for the net analysis.
5	PG&E's Feedback on Draft Report	PGE	PG&E appreciates seeing the responses and results throughout the report that illustrate positive results from goal achievement to cost effectiveness and that cite engaging	Thank you for your comment.

#:	Subject:	Entity:	Question or Comment:	Evaluator Response:
			repeat customers, existing relationships, and targeted measures (that likely fit into customer timelines and rates of return).	
6	PG&E's On-Bill Financing Offerings and Additional Financing Options	PGE	PG&E would like to clarify that its On-Bill Financing offerings do not currently permit inclusion of deemed measures rebates on an OBF loan. However, the deemed rebate can be forgone and the deemed measure cost can be included in the loan to support the Customers project if the bill impact remains neutral. PG&E Program Implementers (NetOne, and others) do also make customers aware of other financing offerings, specifically GoGreen Financing (https://www.gogreenfinancing.com/), which focuses on SMB customers and has limitations to customer size which may prevent larger non-residential customers from being eligible.	N/A
7	Response to SDG&E's Recommendation on Contact Details for End-User Sites and Decision-Makers	SDGE	This recommendation states "Ensure PAs and implementation contractors provide contact details for end-user sites and decision-makers." SDG&E recommends including post implementation survey given to the customer as part of the installation process. This would potentially help mitigate the risk of not gathering information from the key decision maker in the chance they are no longer with the site prior to the evaluation starting. As done in previous evaluations, SDG&E will continue to support evaluators with providing updated contact information as needed.	The evaluation team agrees that this approach would supplement the implementer contact data and help mitigate the risk of not gathering information from key decision-makers who may no longer be with the site before the evaluation starts. However, we would like to clarify that the primary issue was not that the decision-makers had left, but rather that the provided contacts were not the individuals involved in the decision-making process that evaluators needed to speak with. The post-implementation survey will be a useful addition, ensuring that the relevant information from the correct decision-makers is collected.

#:	Subject:	Entity:	Question or Comment:	Evaluator Response:
8	Clarification on Inconsistencies Between Implementer Interviews and PIPs	SDGE	Can you please provide an example of the inconsistencies between the implementer interviews and what was written in the PIPs.	The PIPs contained extensive language about being comprehensive in their approach, aiming to address various market barriers through a wide range of measures. However, the actual implementation practices focused on a very narrow set of measures among a small subset of customers. Specifically, while the PIP listed a broad spectrum of measures and suggested comprehensiveness as a program goal, the program in PY2022 primarily focused on refrigerator door closers. This decision was driven by the measures' suitability for their customer base and the pursuit of good paybacks, rather than a comprehensive audit or a wide range of measures. This is just one example of the inconsistencies; the report contains a detailed list of PIP inconsistencies for further reference.
9	Clarification on Recommendation Regarding Updated Definition of Innovation	SDGE	This recommendation states "For future third-party program designs, the CPUC should enforce the use of the updated definition of innovation as documented in the latest version of the Energy Efficiency Programs Implementation Plan Program Guidance30 (May 2020 as of the publication of this report)." SDG&E seeks clarification if this recommendation is directed at the CPUC or if it is meant for the IOUs	This recommendation is directed at the CPUC, as it involves regulatory guidance that the CPUC should enforce. It’s implied that the IOUs, must align their program designs with the updated definition. This recommendation aims to ensure consistency and clarity across all third-party program designs.

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