IMPACT & PROCESS EVALUATION REPORT

Comfortably California Statewide Third-Party Program, Program Year 2021

California Public Utilities Commission

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1 EXECUTIVE SUMMARY

This report presents the key findings of DNV's evaluation of the upstream/midstream[1] Statewide Heating, Ventilation & Air Conditioning (HVAC) program, Comfortably California, for the program year (PY) 2021 on behalf of the California Public Utilities Commission (CPUC).

Per the Comfortably California Program Implementation Plan (PIP),[2] the program offers incentives[3] for HVAC energy-saving technologies, including high-efficiency commercial unitary air conditioners, commercial heat pumps, commercial chillers, commercial space heating boilers, residential air conditioners, residential heat pumps, residential gas furnaces, and residential gravity wall furnaces.[4] The program engages and incentivizes retailers, distributors, and manufacturers with the intent of increasing equipment availability and, ultimately, sales for high-efficiency heating and air conditioning equipment for California residents and businesses.

Notably, for PY 2021, the delivery model of the program shifted from independently run Program Administrator (PA) programs to a single statewide model covering the service territories of four investor-owned utilities (IOUs) – Pacific Gas & Electric (PG&E), Southern California Edison (SCE), Southern California Gas Company (SCG), and San Diego Gas & Electric (SDG&E). As such, a designated lead PA is responsible for engaging a third-party program implementer to deliver the program uniformly across the service territories of the IOUs. SDG&E is the lead PA responsible for the Comfortably California program and CLEAResult is the third-party implementer of the program.

DNV conducted a targeted evaluation of the program, focusing on key metrics such as gross[5] and net savings[6] as well as program process and performance, to assess achievements relative to goals from an overall programmatic perspective. This Executive Summary summarizes key findings for each of these areas and provides targeted recommendations for program improvement.

Evaluation findings indicate that the vast majority of the program's energy savings claims[7] would have occurred in the absence of the program, as the program had minimal influence on end users' decision to purchase energy-efficient HVAC equipment promoted through the program. Key drivers of this finding include low levels of awareness of the program among contractors who purchased and installed equipment through the program and low program incentive amounts relative to the cost of the equipment. The PY 2021 program also lacked the data necessary to conduct a more rigorous evaluation and to ensure that the program was operating as intended. Findings determined that the program's quality assurance plan was not followed, and as a result, key data available for evaluation were far below acceptable standards. Most critically, the implementer did not ensure end user contact information was collected, nor did they collect the addresses where program installations occurred. We provide further details on these key findings, study objectives, evaluation approach, results, and recommendations in the sections below.

[1] Upstream and midstream energy efficiency programs provide incentives and conduct outreach within the 'upper' and 'middle' of a given supply channel by targeting manufacturers, distributors, and/or contractors. Downstream programs target residential and commercial end users.

[2] Program Implementation Plan. Comfortably California Program Implementation Plan. 2021. p. 2.

[3] Incentives are intended to encourage building owners to install energy efficient equipment by lowering the costs of the equipment through incentive payments – in the case of the Comfortably California program, incentives were paid to HVAC distributors.

[4] We refer to these energy efficient technologies as program "measures" or "measure packages" throughout this report.

[5] Gross savings measure changes in energy consumption that result directly from program-related actions taken by participants of an energy efficiency program, regardless of why they participated.

[6] Net savings are changes in energy use that are attributable to a particular energy efficiency program and take into consideration savings from participants who would not have purchased energy efficient technologies without the influence of the program. Savings attributable to participants who would have purchased energy efficient technologies with or without the program influence are excluded from net savings. These participants who were not influenced by the program are considered free-riders.

[7] Claims, or claimed savings, are expected energy and demand savings associated with program measures submitted by each IOU on a quarterly basis.

1.1 Study background

DNV's key research objectives in this evaluation were to:

- Determine the gross and net savings for the Comfortably California program.
- Assess the evaluability of the Comfortably California statewide program versus previous midstream/upstream HVAC programs run by the PAs before 2021.[8]
- Determine to what extent the program served hard-to-reach (HTR) end users[9] and disadvantaged communities (DAC).[10]
- Determine levels of satisfaction with the program among participating distributors and contractors.
- Determine the extent to which there are opportunities for program improvements, and which could be feasibly made.

Table 1-1 shows the reported number of energy-efficient HVAC claims made through the program in PY 2021, along with the associated energy savings. The table shows first year gross and net kW and kWh savings,[11] lifecycle net kWh savings,[12] first year gross and net therm savings, and lifecycle net therm savings for the Comfortably California program for each IOU service territory for PY 2021.

Table 1-1. Reported savings claims by IOU service territory, PY 2021

IOU	Claims	First Year kW		First Year kWh		Lifecycle Net kWh	First Year Therms		Lifecycle Net Therms
		Gross	Net	Gross	Net		Gross	Net	
PG&E	26,885	2,216	1,424	4,964,662	3,211,598	48,598,359	346,932	204,783	3,880,676
SCE		2,001	1,286	4,483,850	2,900,565	43,891,761	-	-	-
SCG		-	-	-	-	-	287,733	169,840	3,218,497
SDG&E		773	497	1,733,159	1,121,166	16,965,643	53,692	31,693	600,581
Total*		**4,990**	**3,206**	**11,181,671**	**7,233,328**	**109,455,764**	**688,357**	**406,316**	**7,699,753**

** Totals may not add up due to rounding.*

Table 1-2 shows the reported number of claims, gross kW and kWh savings, and gross therm savings for the Comfortably California program by measure[13] type for PY 2021. Large and small packaged air conditioner (AC) measures accounted for the vast majority of the gross electric savings (93%), and space heating boilers (42%) and forced air and gravity wall furnaces (39%) comprised the largest share of the gross gas (therm) savings. Heat pumps, which included both residential and commercial systems, represented 12% of the total PY 2021 Comfortably CA claims and 25% of the total first year gross kWh savings.

[8] The evaluability of a program refers to the extent to which the program collects the necessary data and other information needed to evaluate the energy savings associated with the program as well as its overall performance.

[9] Hard to reach (HTR): The criteria for commercial HTR end users are defined by a combination of a geographic requirements plus at least one of the following criteria: primary language of customer(s) is not English, business size, or leased or rented facility. Specific details can be found here: Statewide Deemed Workpaper Rulebook

[10] Disadvantaged Communities (DAC) are areas in California with customers or end users who experience a combination of economic, health, and environmental burdens. More details can be found here: Disadvantaged Communities

[11] Savings associated with a particular measure estimated to occur within the first year after its installation.

[12] Savings associated with a particular measure estimated to occur over the course of a given measure's estimated useful life.

[13] A measure, within the context of energy efficiency, is a technology, energy use practice, or behavior that results in a reduction in energy use at a given customer site.

Table 1-2. Reported savings claims by measure, PY 2021

Measure Name	Claims	Gross kW	Gross kWh	Gross Therms
Furnaces (Forced Air & Gravity Wall), Residential	13,590	375	347,578	265,209
Packaged AC (Large & Small), Commercial	9,582	4,316	10,371,710	142,975
AC & Heat Pump HVAC Equipment, Residential	3,397	300	462,383	-11,722
Space Heating Boiler, Commercial & Multifamily	316	-	-	291,895
Total*	**26,885**	**4,990**	**11,181,671**	**688,357**

** Totals may not add up due to rounding.*

1.2 Study approach

DNV estimated measure-level savings and evaluated the overall effectiveness of the Comfortably California program for PY 2021 through a gross savings analysis, net savings analysis, and review of the overall program process and performance. Because PY 2021 was the first year for statewide programs run by third-party implementers, we did not include retrospective comparisons to programs from earlier years as they did not exist under the statewide program design before 2021. DNV developed methods to determine both the evaluated gross and net savings while simultaneously conducting an overall process evaluation to assess program performance from a more holistic perspective. We detail these approaches below.

Gross savings. To develop the program's gross realization rate (GRR), or the ratio of evaluated savings to the original claimed savings without any adjustments for program influence, measures were organized into measure packages and matched with corresponding savings permutations from the Database of Energy Efficiency Resources (DEER).[14] DNV engineers aligned individual claim characteristics with DEER permutations, which allowed for a direct comparison of savings claims between sources. To assess program installations, DNV also conducted telephone surveys with participating HVAC contractors.[15] Contractors were asked questions about what portion of the incentivized equipment was installed and, if the equipment was not installed, the reasons for not installing the equipment.

Net savings. Net savings are changes in energy use that are attributable to a particular energy efficiency program. Telephone surveys were conducted with participating HVAC distributors and contractors in order to evaluate the net savings of the Comfortably California program. Distributors were asked how their sales of high-efficiency equipment sold in 2021 would have changed in the absence of the program. Contractors were asked if their 2021 sales would have changed if participating distributors had charged them a higher cost for the program equipment that they purchased in 2021.[16] If distributors or contractors said their sales would have been lower, then they were asked to approximate what percent lower their sales would have been. These survey responses were used to determine net-to-gross ratios (NTGR),[17] which measure the amount of savings that can be attributed to the program, and net savings for evaluated program savings.

Program evaluability assessment. Installation addresses and end user contact information are essential for verifying that the equipment was installed and is still operating as intended. DNV requested installation addresses and end user (customer) contact information, including names, phone numbers, and email addresses for each piece of HVAC equipment

[14] DEER is a reference guide developed and managed by the CPUC for estimating energy-savings potential for energy efficient technologies in both residential and non-residential applications.

[15] Program installations were assessed by surveying participating HVAC contractors, instead of the end users who purchased the equipment, due to the absence of contact information (see 'Program evaluability assessment' for details on data issues related to contact and address information).

[16] The 'higher costs' were calculated based on measure-specific incentive amounts that were passed on from the distributors to the contractors.

[17] The net-to-gross ratio (NTGR) is the complement of freeridership (e.g., an 80% NTGR indicates 20% freeridership). Gross savings are multiplied by the NTGR to arrive at net savings.

that was sold through the program. Upon review of these data, the evaluation team determined that the vast majority of the 26,885 claims had no installation addresses associated with them and only had the zip code where the equipment was installed. Furthermore, almost none of the claims had end user contact information. End user information is critical for evaluating the achieved energy performance of a program. Furthermore, the ability to estimate what percent of claims were installed among DAC end users diminishes significantly without having installation addresses.

This evaluation team conducted a series of interviews with SDG&E, the lead PA for the program, and CLEAResult, the third-party program implementer. Both parties stated that end user addresses and contact information were not a hard requirement of the CPUC in 2021, and this was the primary reason these data were not collected. This was done despite repeated recommendations to improve end-user data tracking information in the PY 2017,[18] PY 2018,[19] PY 2019,[20] and PY 2020[21] HVAC impact evaluation reports. However, the program did have a Quality Assurance Plan (QAP), Program Implementation Plan, and Distributor Handbook that stated that these data should be collected. Notably, the Distributor Handbook states that "The program is required to visually inspect a minimum of 10% of all projects submitted by each distributor, which will be selected at random."[22] Furthermore, the QAP states that the "implementer shall provide all available information to [SDG&E] regarding the purchase and installation of Program products that are necessary for Implementer to inspect and verify such purchase and installation at the Customer's facility, which information shall *include customer names, contact information, addresses*, product purchased and installed at such address, and applicable IOU account numbers and service territory."[23] However, the sales data spreadsheet provided in the Distributor Handbook indicates that customer name, installation address, and installation city are all optional fields, and only the installation zip code is required. There is no mention of the customer's email address or phone number in the distributor sales data spreadsheet.[24] Thus, while the program's QAP requires the collection of end user addresses and contact information, the information provided to distributors in the sales data spreadsheet conflicts with this requirement.

Both CLEAResult and SDG&E shared that in PY 2022, the end user data requirements for the program changed significantly. The program was paused for several months in 2022 to ensure end user data was being collected for all PY 2022 claims. A preliminary review of the PY 2022 claims shared with DNV confirms that end user data is now being collected. Program staff mentioned that the increased end user data requirements had a negative impact on program participation in 2022. As of January 2022, SDG&E believes the overall claims for PY 2022 will be less than a quarter of the total claims for PY 2021.

Program process and performance. In addition to energy savings, DNV evaluated the process and performance of the program to gain an increased understanding of the program delivery under statewide administration. DNV evaluated the program processes by interviewing distributors and contractors about their awareness of the program and the barriers they experience when selling high-efficiency HVAC equipment. Program performance was assessed by interviewing HVAC distributors and contractors about their satisfaction with various aspects of the program, including program training, program marketing, and outreach.

[18] DNV GL -Energy, "Impact Evaluation Report-Final, HVAC- Program Year 2017." calmac.org, 04/30/19. https://www.calmac.org/publications/CPUC_Group_A_HVAC_Sector_Report_.pdf

[19] DNV GL-Energy, "Impact Evaluation Report HVAC Sector-Program Year 2018." calmac.org, 04/20/20. https://www.calmac.org/publications/Year2_CPUC_Group_A_HVAC_Report_Final_CALMAC_20200420.pdf

[20] DNV GL-Energy, "Impact Evaluation Report Commercial HVAC Sector-Program Year 2019, calmac.org, 05/14/21. https://www.calmac.org/publications/CPUC_Group_A_Commercial_HVAC_Impact_Evaluation_Report_PY2019_Final.pdf

[21] DNV Energy Insights USA Inc (DNV), "Impact Evaluation Report-Commercial HVAC Sector-Program Year 2020, calmac.org, 04/29/22. https://www.calmac.org/publications/Group_A_YR4_ComHVAC_Impact_Report_Final_CALMACES.pdf

[22] Comfortably CA – Distributor Handbook. January 2021. p. 14.

[23] Quality Assurance Plan. Comfortably California Program. 2021. p. 11

[24] Comfortably CA – Distributor Handbook. January 2021. pp. 11-12

1.3 Results

1.3.1 Gross savings results

To determine the evaluated gross savings estimates of the Comfortably California program, DNV reviewed reported claim-level details to ensure reported savings were estimated correctly. The process involved the following steps:

1. **Program data processing**: DNV standardized, cleaned, re-categorized, and re-aligned the datasets according to the corresponding workpaper[25] and measure package within DEER.
2. **Measure package consolidation**: We then identified program participation at the claim level in the California Energy Data and Reporting System (CEDARS)[26] tracking data and applied the appropriate measure package from DEER.
3. **Measure savings assignment**: The measure savings in the DEER measure package were assigned according to the various combination of claim characteristics such as *Measure Application Type*, *HVAC System Type*, *Climate Zone*, and *Delivery Type*.
4. **Engineering analysis**: Once aligned, DNV compared the savings claims in the CEDARS tracking data to the measure savings in DEER to identify any potential discrepancies.

Installation addresses and associated contact information for each claim were not available beyond the installation zip code, which prevented a more rigorous gross savings analysis beyond the steps listed above. Ideally, the evaluation effort would visually verify a sample of measures installed through the program. Had installation addresses and associated contact information been available, the evaluation team could have conducted a more rigorous gross savings analysis with an installation verification component, which would have resulted in higher overall confidence in the evaluated gross savings results. With limited options for a detailed gross savings analysis, and because net savings results pointed to a low realization rate, DNV did not pursue a higher rigor gross savings analysis approach.

As described in the previous section, the gross realization rate (GRR) is the ratio of evaluated savings to the original claimed savings, without any adjustments for program influence. Using the limited gross savings analysis approach described above, DNV determined the GRR for kW, kWh, and therms was 100% across all measures in the Comfortably California program in PY 2021.

1.3.2 Net savings results

Net savings are the gross savings minus energy savings attributed to end users who would have purchased HVAC equipment without the program incentives. The “net-to-gross ratio” is the ratio or percent of a program’s gross savings that are attributable to program influence. A ratio equal to 100%, or 1.0, means that the installation of the high-efficiency equipment incentivized by the program would not have occurred in the absence of the program. A ratio equal to 0%, or 0.0, means that the program had no influence on the installation of the high-efficiency equipment incentivized by the program and would have occurred with or without the program.

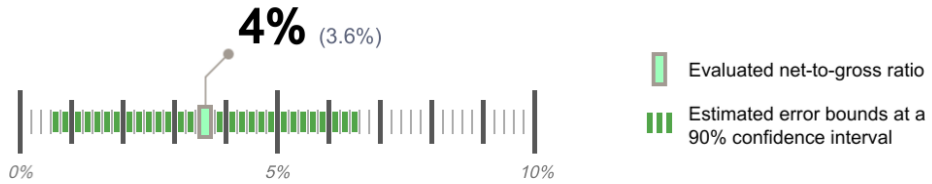
The evaluation determined an estimated net-to-gross ratio of 4% (3.6%) for the Comfortably California program, with an error bound of 2.9% at the 90% confidence level.[27] Evaluation activities found that the vast majority (96%) of the program savings would have occurred without the program (Figure 1-1).

[25] A workpaper is a technical document that provides all necessary supporting information to develop forecasted values and savings for energy efficiency measures that are not completely covered by the DEER. See the CPUC’s Workpaper Development Training document for further details: https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/w/6442459833-workpaper-development-training.pptx#:~:text=California%20Public%20Utilities%20Commission,of%20Energy%20Efficiency%20Resources%20(DEER)

[26] CEDARS is a public database that includes program data on annual budget filings, quarterly savings claims, and monthly report summaries by the PAs.

[27] This means that, with a 90% confidence level, the absolute net-to-gross ratio falls within (+/-) 2.9% of the cited value of 3.6% (rounded up to 4% for demonstrative purposes) – i.e., between 0.7% and 6.5%.

Figure 1-1. Program-level, net-to-gross ratio



Distributor and contractor survey results helped to determine the low net-to-gross ratio for the Comfortably California program in PY 2021. When survey respondents were asked about their program-incentivized equipment sold in 2021, 80% of distributors and 93%[28] of contractors stated their sales of equipment would have been the *same* even if the program did not exist. Respondents were then asked why their sales would have remained the same without the program.

Below is a selection of quotations that capture the various core themes of the survey responses:

- Distributor Responses:
  - *"[The] incentive is not high enough to affect it."*
  - *"Our entire team [was] already trained, and the incentive was low anyway."*
  - *"It was more about product availability. Whatever was manufactured was sold. It was sold before we even received it."*
- Contractor Responses:
  - *"It's a drop in the bucket, [commercial boilers] cost $100,000."*
  - *"Compared to what the system cost, it's a small amount."*
  - *"Not a huge difference in cost. Especially for commercial units."*

Table 1-3 shows first year reported net savings, evaluated net savings, and net realization rates (NRR). The net realization rate is the ratio of evaluated net savings to reported net savings. As shown, less than 10% of the program's reported net savings were realized based on evaluation results.

Table 1-3. Reported and evaluated first net savings and NRR, PY 2021

Net Savings	kW	kWh	Therms
Reported First Year	3,206	7,233,328	406,316
Evaluated First Year	268	675,841	8,048
Net Realization Rate	**8%**	**9%**	**2%**

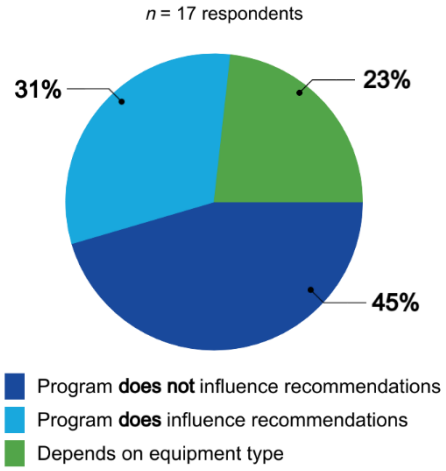
[28] Section 5.2 2 of the report details how distributor and contractor survey results were weighted by gross savings and case weights to calculate the program-level net-to-gross ratio.

1.3.3 Program awareness and influence

DNV evaluated participating distributor and contractor awareness and the influence of the program in PY 2021 to determine net savings.

Survey results revealed low program awareness from contractors. Less than half (43%) of the contractors were aware that the Comfortably California program discounted the cost of eligible high-efficiency HVAC equipment. Contractors are key market actors in terms of being in a position to recommend program-incentivized equipment to end users. With low levels of program awareness, most contractors do not have the means (e.g., program information on incentivized equipment and marketing materials) to encourage end users to purchase high-efficiency equipment incentivized by the program. These findings suggest that there is a significant need for increased program marketing and outreach to HVAC contractors.

Figure 1-2. Program influence on distributor equipment recommendations



Survey results indicate a low to moderate level of program influence on the efficiency of the equipment distributors recommend to buyers. As shown in Figure 1-2, less than a third of the distributors (31%) said the program influences the efficiency of the equipment they recommend to buyers. Nearly half of the distributors (45%) stated that the program did not influence the efficiency of the equipment they recommended, with the remaining 23% of distributors stating that it depends on equipment type. One distributor further explained that it depends because "for the heat pump, yes [the program influences the efficiency we recommend]. For furnaces, no, because of the low rebate."

Distributors were also asked to rate the influence of program (e.g., incentives, marketing, outreach, and training) on the selection of high-efficiency equipment their company typically sells, using a scale of 1 to 5 where 1 is "not at all influential" and 5 is "extremely influential." The average score was 3.0, with over a quarter (26%) of respondents saying the incentives are not at all influential, and over 40% responding to the question with a score of 1 or 2.

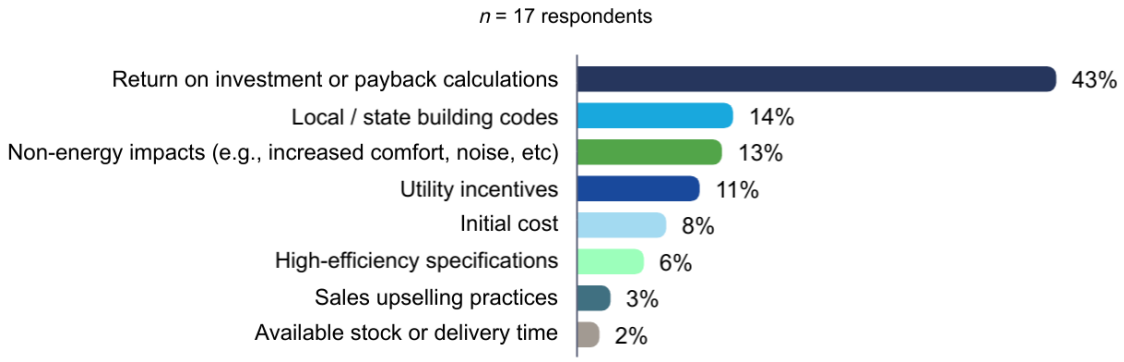
Similarly, contractors were asked to rate how influential distributors' equipment recommendations were on the decision of what to purchase and install, using the same scale of 1 to 5 measuring the degree of influence. The average score for contractors was 2.7, with just under half (47%) of the contractors providing a score of 1 or 2.

These survey results indicate a low to moderate level of program influence on distributor and contractor *recommendations* and *stocking* of high-efficiency equipment, although the low NTGR (4%) discussed in Section 1.3.2 reveals that most (96%) program *sales* would have occurred without the program. Together these results suggest that most end users' purchasing decisions are not being influenced by what is recommended or available but instead driven by other factors (e.g., reduced operation and maintenance costs) discussed in the following section.

'Return on investment' and 'operations and maintenance costs' are the strongest drivers when it comes to selling high-efficiency HVAC equipment. Figure 1-3 shows how distributors most frequently cited "return on investment or payback calculations" as the strongest driver when selling high-efficiency equipment, with only 2% of the distributors reporting 'available stock or delivery time' to be the strongest driver. Only 11% of distributors cited 'utility incentives' as the

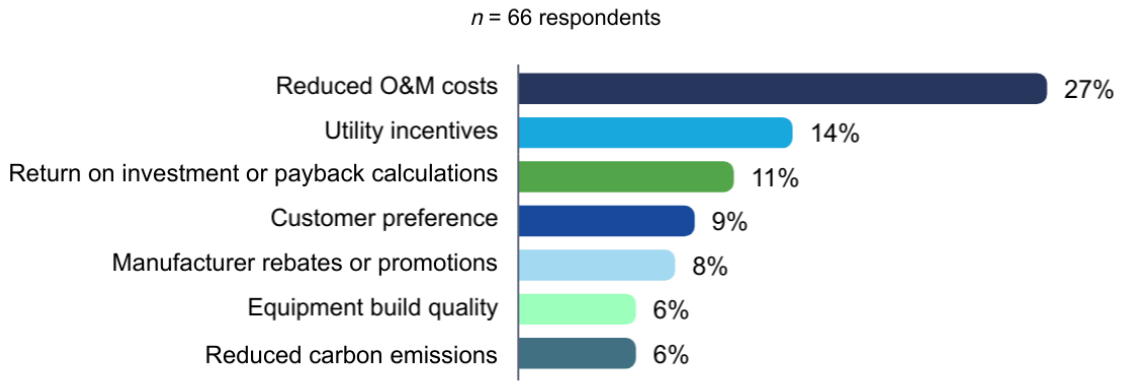
strongest driver, which suggests the incentives provided by the program were not a strong driver for selling high-efficiency equipment among HVAC distributors.

Figure 1-3. Strongest drivers to selling high-efficiency equipment according to distributors



Contractors were asked the same question, and from their perspective, 'reduced operations and maintenance (O&M) costs' was the strongest driver. Only 3% of respondents cited 'available stock or delivery time' as the primary motivating factor (see footnote 29). Although the program was designed to increase the stock of high-efficiency units, these evaluation findings suggest that overall life cycle costs are stronger motivating factors when selling high-efficiency equipment. Figure 1-4 shows surveyed contractors' strongest drivers for selling high-efficiency equipment.

Figure 1-4. Strongest drivers to selling high-efficiency equipment according to contractors[29]



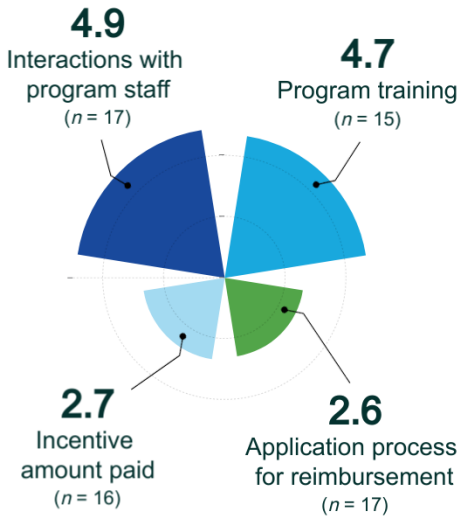
1.3.4 Program process and performance

DNV evaluators asked distributors and contractors to comment on their level of satisfaction with the Comfortably California program and to share their suggestions for improvements to the program.

Program satisfaction. Distributors and contractors, who were aware of their participation in the program, were asked to rate various aspects of the program using a 5-point scale, where 5 means "very satisfied" and 1 means "very dissatisfied."

[29] 'Other' survey responses included tax credits (4%), engineer / architect preferences (4%), initial cost (3%), available stock / delivery time (3%), non-energy impacts (i.e., increased comfort) (2%), sales engineers upselling practices (2%), and local/state building code (2%).

Figure 1-5. Distributor satisfaction



Distributors were found to have an overall satisfaction score of 3.6 when asked about various aspects of the program (Figure 1-5). They were most satisfied with 'interactions with program staff' and 'program training,' and they were least satisfied with 'the application process to receive reimbursement' and 'the incentive amount provided to distributors.' Ten out of 17 distributor respondents were dissatisfied (satisfaction score less than 3) with at least one aspect of the program. Reasons for their dissatisfaction included:

- *Low incentives (n=6)*
- *Issues with pre-approval process (n=2)*
- *Issues getting info from contractors or end users (n=2)*

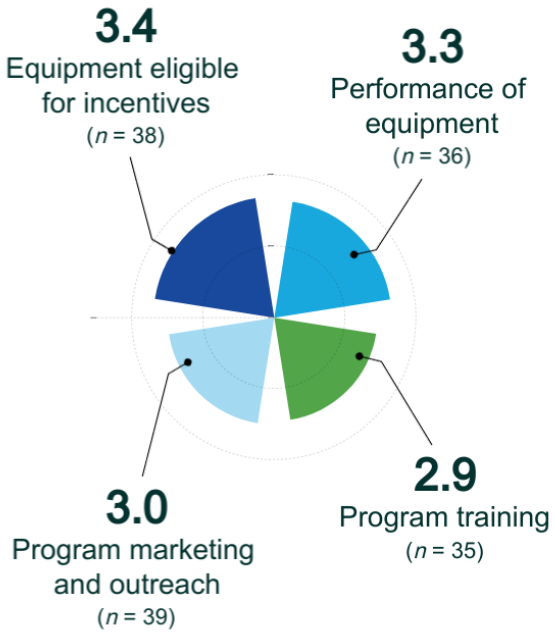
The program satisfaction findings provide additional context for the low program net-to-gross ratio discussed above in Section 1.3.2, particularly the relatively low satisfaction rating (2.7) for the incentive amounts and the high frequency (n=6) of distributor respondents stating they were dissatisfied with the program due to low incentive amounts.

Figure 1-6 shows there was less variation in satisfaction among contractor respondents compared to distributors, with an overall satisfaction score of 3.2. Only the contractors who were aware of the program were asked the series of satisfaction questions. Contractors were most satisfied with 'the type of equipment eligible for incentives' and the 'performance of equipment,' and they were least satisfied with 'program marketing and outreach' and 'program training.' Twelve out of 42 contractors were dissatisfied (satisfaction score of less than 3) with at least one aspect of the program.

Reasons for their dissatisfaction included:

- *Not being aware of the program or having to dig for the information (n=7)*
- *Low incentives (n=3)*
- *Not being aware of training (n=3)*
- *Receiving limited information from distributors (n=3)*

Figure 1-6. Contractor satisfaction



1.4 Key findings and recommendations

Table 1-4. Key findings and recommendations

Key Findings	Recommendations
The program achieved a NTGR of 4%, meaning the program had very little influence on the sale of high efficiency HVAC equipment among distributors and contractors. Key drivers of the low NTGR include low incentive amounts relative to the cost of the equipment and low levels of program awareness among contractors who are key market actors in terms of being in a position to recommend program incentivized equipment to end users.	The PAs should consider changing the current Comfortably California HVAC midstream program design. This could be done as part of the new process directed in the Bus Plan decision to assess the portfolio composition of statewide programs.
The program in PY 2021 was especially challenging to evaluate. While implementers did not record end user contact information, they also did not collect addresses where program installations occurred. The evaluation team could only verify equipment sales and installation of equipment indirectly through phone surveys with contractors.	Going forward, always collect installation addresses and end user contact information to facilitate internal program verification and evaluation verification efforts.
The program implementers failed to follow their own quality assurance plan, which stipulated that a minimum of 10% of sites where program incentivized equipment was installed must be verified. The quality assurance plan also stated that end user email addresses and phone numbers needed to be collected. The distributor sales reporting sheet listed end user address as optional, which was in conflict with the quality assurance plan.	Inspect a minimum of 10% of sites using a combination of in-person and virtual visits across a representative sample of sites.
Distributors were most satisfied with their interactions with program staff and program training and least satisfied with the incentive amounts provided by the program and the application process for receiving reimbursement.	The program should reassess the incentive amounts paid to distributors and consider increasing incentive amounts to a minimum of 65% of the measure's incremental cost. We recommend updating the base case and measure case cost assumptions to current market costs.
Distributors and contractors reported that the 'higher cost of energy efficiency HVAC equipment' is the largest barrier to adoption.	
The average incentive paid to distributors is only 15% of the incremental measure costs. Most of the measure cost amounts were sourced from outdated studies, most of which are at least five years old.	
More than half of the contractors were unaware of the program. Those contractors who were aware of the program were less than satisfied with the program training and marketing and outreach.	Program implementers should market the program, provide training, and conduct outreach efforts specifically targeted at contractors who work with participating distributors. Implementers should leave program materials with participating distributors to give to any contractor they work with who might participate in the program. Implementers should also develop a list of contractors with their contact information and conduct regular outreach with information about the program via email. The program should provide in-person or virtual trainings designed specifically for contractors to learn more about the program at least once per quarter.

2 INTRODUCTION

This report presents the key findings of DNV's evaluation of the upstream/midstream Statewide Heating, Ventilation & Air Conditioning (HVAC) program, Comfortably California, for the program year (PY) 2021 on behalf of the California Public Utilities Commission (CPUC). DNV conducted a targeted evaluation of the program, focusing on key metrics such as gross and net savings as well as program process and performance, to assess achievements relative to goals from an overall programmatic perspective.

2.1 Program overview

Per the Comfortably California Program Implementation Plan (PIP), the program offers incentives for HVAC energy-saving technologies, including high-efficiency commercial unitary air conditioners, commercial heat pumps, commercial chillers, commercial space heating boilers, residential air conditioners, residential heat pumps, residential gas furnaces, and residential gravity wall furnaces. The program engages and incentivizes retailers, distributors, and manufacturers with the intent of increasing equipment availability and, ultimately, sales for high-efficiency heating and air conditioning equipment for California residents and businesses.

For PY 2021, the delivery model of the program shifted from independently run Program Administrator (PA) programs to a single statewide model covering the service territories of four investor-owned utilities (IOUs) – Pacific Gas & Electric (PG&E), Southern California Edison (SCE), Southern California Gas Company (SCG), and San Diego Gas & Electric (SDG&E). As such, a designated lead PA is responsible for engaging a third-party program implementer to deliver the program uniformly across the service territories of the IOUs. SDG&E is the lead PA responsible for the Comfortably California program and CLEAResult is the third-party implementer of the program.

The program also offers training and marketing support to participating distributors and their contractors and dealers and offers education and training materials to end use customers. The program follows the same general logic as earlier upstream and midstream programs in that it aims to influence the market through changes in stocking and selling practices at the retailer, distributor, and manufacturer levels, thus influencing the end users and installation contractors.

2.2 Evaluation objectives

The research objectives that this evaluation aims to address are:

- What are the ex-post gross savings[30] for the Comfortably California program?
- What are the ex-post net savings for the program?
- What is the evaluability of the program compared to previous midstream/upstream HVAC programs run by PAs before 2021?
- To what extent is the program serving hard-to-reach (HTR) customers and disadvantaged communities (DACs)?
- To what extent are participating contractors and distributors satisfied with the program?
- To what extent are there opportunities for program improvements?
- Is the program effectively serving customers and realizing savings consistently across the four participating IOU service territories?
- Is it more efficient to run a midstream HVAC program using a statewide model through a third-party implementer rather than operating them locally through separate IOUs?
- Is there any market confusion with distributors and contractors enrolled in multiple programs or purchasing similar equipment offered by different programs?

30 We refer to expected program savings as ex-ante savings and evaluated program savings as ex-post savings.

We discuss which data sources and research activities inform the above research questions in Section 3.

2.3 Program savings overview

Table 2-1 shows the reported number of energy-efficient HVAC claims made through the program in PY 2021, along with the associated energy savings. The table shows first year gross and net kW and kWh savings, lifecycle net kWh savings, first year gross and net therm savings, and lifecycle net therm savings for the Comfortably California program for each IOU service territory for PY 2021.

Table 2-1. Reported savings claims by IOU service territory, PY 2021

PA	Claims	First year kW		First year kWh		Lifecycle net kWh	First year therms		Lifecycle net therms
		Gross	Net	Gross	Net		Gross	Net	
PG&E	**26,885**	2,216	1,424	4,964,662	3,211,598	48,598,359	346,932	204,783	3,880,676
SCE		2,001	1,286	4,483,850	2,900,565	43,891,761	0	0	0
SCG		0	0	0	0	0	287,733	169,840	3,218,497
SDG&E		773	497	1,733,159	1,121,166	16,965,643	53,692	31,693	600,581
Total		**4,990**	**3,206**	**11,181,671**	**7,233,328**	**109,455,764**	**688,357**	**406,316**	**7,699,753**

Table 2-2 shows the reported number of claims, gross kW and kWh savings, and gross therm savings for the Comfortably California program by measure type for PY 2021. Large and small packaged AC measures accounted for the vast majority of the gross kWh savings (93%), and space heating boilers (42%) and forced air and gravity wall furnaces (39%) comprised the largest share of the gross gas (therm) savings. Heat pumps, which included both residential and commercial systems, represented 12% of the total PY 2021 Comfortably CA claims and 25% of the total first year gross kWh savings.

Table 2-2. Reported first year gross savings by measure, PY 2021

Measure name	Claims	Gross kW	Gross kWh	Gross therms
Furnaces (Forced Air & Gravity Wall), Residential	13,590	375	347,578	265,209
Packaged AC (Large & Small), Commercial	9,582	4,316	10,371,710	142,975
AC & Heat Pump HVAC Equipment, Residential	3,397	300	462,383	-11,722
Space Heating Boiler, Commercial & Multifamily	316	-	-	291,895
Total	**26,885**	**4,990**	**11,181,671**	**688,357**

Figure 2-1 and Figure 2-2 show the reported first year gross kWh and therm savings by sector. The boiler measure was installed in commercial and multifamily sites. For the purposes of assigning a sector for this measure, we considered all of these installations as commercial. The vast majority of the reported first year gross kWh savings was in the commercial sector (93%) and nearly two-thirds of the first year gross therm savings was in the commercial sector.

Figure 2-1. Reported first year gross kWh savings by sector

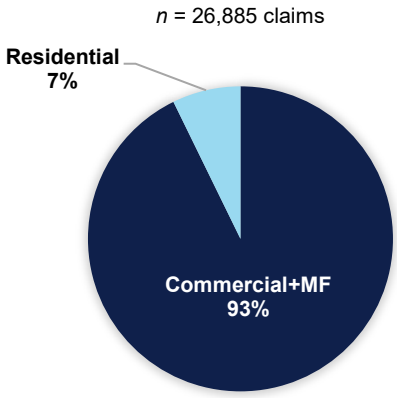


Figure 2-2. Reported first year gross therm savings by sector

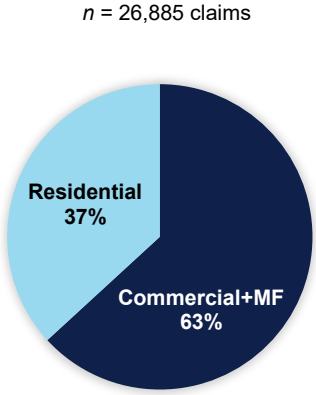


Table 2-3 shows the reported first year net kW and kWh savings, and net therm savings for the Comfortably California program by measure type for PY 2021. Large and small packaged AC measures accounted for 93% of the reported first year net savings and forced air and gravity wall furnaces accounted for the largest share of the first year net therm savings at 36%.

Table 2-3. Reported first year net savings by measure, PY 2021

Measure name	Claims	Net kW	Net kWh	Net therms
Furnaces (Forced Air & Gravity Wall), Residential	13,590	206	191,168	145,865
Packaged AC (Large & Small), Commercial	9,582	2,805	6,741,611	92,934
AC & Heat Pump HVAC Equipment, Residential	3,397	195	300,549	-7,620
Space Heating Boiler, Commercial & Multifamily	316	-	-	175,137
Total	**26,885**	**3,206**	**7,233,328**	**406,316**

2.4 Report organization

We have organized the remainder of this report as follows (Table 2-4).

Table 2-4. Report organization

Section	Description
3	**DATA SOURCES** Details the data sources used to support the evaluation as well as challenges associated with end user data provided by the lead PA.
4	**GROSS SAVINGS ANALYSIS** Provides an overview of gross savings methods and results.
5	**NET SAVINGS ANALYSIS** Provides an overview of net savings methods and results.
6	**PROGRAM PROCESS AND PERFORMANCE** Includes programmatic findings such as insights into program design, outreach and influence, market effects, overall program satisfaction, program process characteristics, and participant characterization details.
7	**CONCLUSIONS AND RECOMMENDATIONS** Provides the evaluation's conclusions and recommendations.
8	**APPENDICES** **8.1 A:** Standardized, high-level program savings data **8.2 B:** Standardized per unit savings **8.3 C:** Standardized recommendations **8.4 D:** Stratified sampling design **8.5 E:** Measure-level distributor and contractor survey results **8.6 F:** Data collection instruments used for distributor and contractor surveys

3 DATA SOURCES

This section discusses the various data sources DNV used to inform the evaluation. Section 2.1 provides a summary of the Comfortably California Statewide program. Table 3-1 below shows the research activities and data sources aligned with the evaluation's research questions. We provide further details on each source in the following subsections.

Table 3-1. Research questions and associated research activities and data sources

Research question	Research activities / data source				
	Program tracking data	Distributor survey	Contractor survey	Program staff interview	Implementer interview
What are the ex-post gross savings for the Comfortably California program?	•		•		
What are the ex-post net savings for the program?	•	•	•		
What is the evaluability of the program compared to previous midstream/upstream HVAC programs run by PAs before 2021?	•			•	•
To what extent is the program serving hard-to-reach (HTR) customers and disadvantaged communities (DACs)?	•		•		
To what extent are participating contractors and distributors satisfied with the program?		•	•		
To what extent are there opportunities for program improvements?		•	•		
Is the program effectively serving customers and realizing savings consistently across the four participating IOU service territories?	•			•	•
Is it more efficient to run a midstream HVAC program using a statewide model through a third-party implementer rather than operating them locally through separate IOUs?		•	•	•	•
Is there any market confusion with distributors and contractors enrolled in multiple programs or purchasing similar equipment offered by different programs?		•	•		

3.1 Program tracking data

The lead PA, SDG&E, uploads data for each claim associated with the Comfortably California program into the California Energy Data and Reporting System (CEDARS) on a quarterly basis. CEDARS is a public tracking database that includes program data on annual budget filings, quarterly energy savings claims, and monthly report summaries for each IOU participating in the program. The energy savings reported in the CEDARS tracking database is the starting point for the impact evaluation as this represents the energy savings expected from the program before calculating the evaluated savings. Section describes how the program tracking database is used for the gross savings analysis.

3.2 Program staff interview

DNV's evaluation team conducted a program staff interview for the Comfortably California program on October 5, 2022. Interviewees included the program manager from SDG&E (the lead PA for the program), a representative from SCG, and a representative from PG&E. As discussed in Section 2.1, SDG&E was responsible for overseeing the implementation of the Comfortably California program and the third-party program implementer, CLEAResult. Most interview questions were directed to the program manager from SDG&E, but the evaluation team also asked questions of the representatives from SCG and PG&E to better understand their roles as non-lead IOUs and their interactions with SDG&E. The primary purpose of the interview was to gain a fuller understanding of the program and the roles of program staff and to gain insight into how well the program ran in its first year under the statewide third-party model. We detail key takeaways from the program staff interviews in Section 6.1.

3.3 Implementer interview

DNV conducted the implementer interview for the Comfortably California program with the program's manager at CLEAResult on October 19 and October 21, 2022. The CLEAResult program manager joined the Comfortably California implementation team in May of 2022, so he did not have direct experience with the implementation of the PY 2021 program. However, he had extensive knowledge of the PY 2021 program and the changes that occurred between PY 2021 and 2022. The primary purpose of the implementer interview was to gain a fuller understanding of the program design, implementation of the program, quality control processes in place, and marketing and outreach conducted for the program. We detail key findings from the program implementer interview in Section 6.1 and 6.2.

3.4 Distributor survey

From November 2022 to December 2022, DNV implemented web- and phone-based surveys with distributors who participated in the PY 2021 Comfortably California program. The primary objective of the survey was to inform net savings estimates and to assess program performance and design. Data collected from these surveys provided information on program satisfaction, potential market confusion, and process-related feedback.

Responses to the surveys were captured via a data collection tool designed and deployed through Form.com. DNV adopted proven best practices in fielding these surveys, including:

- Introductory screening questions to ensure that interviewers were speaking with the person most familiar with their company's participation in the program (see Appendix F for the screening questions used for this effort)
- Training provided to interviewers on best practices for identifying the person most familiar with the program
- Using a unique traceable hyperlink with custom information for each distributor including the anonymized IDs and key measures of interest
- Providing distributors with a link to validate the legitimacy of the survey effort
- Co-branding web surveys with the CPUC logo
- Contacting non-respondents up to six times via email and phone asking them to complete the survey
- Providing all respondents with the option to opt out of the survey and opt-out of receiving an incentive

Further details on the survey sample design are included in Section 5.2.1. Results from the distributor surveys are summarized in Section 5.3 (Net savings results) and Section 6 (Program process and performance). Appendix F provides the survey instrument used to collect information for this survey.

3.5 Contractor survey

From November 2022 to January 2023, web- and phone-based contractor surveys were deployed by DNV and GC Green. The responses to this survey helped inform evaluated gross savings estimates by determining whether the program equipment was installed and operating. As with the distributor telephone surveys, DNV interviewers asked introductory screening questions to ensure that they were speaking with the person most familiar with their company's participation in the program (see Appendix F for the screening questions used for this effort). Training was provided to interviewers on best practices for identifying the person most familiar with the program. We should note that less than have of the contractors interviewed for this study were aware of their participation in the program. The survey also served as an input to net savings by determining the extent to which the program incentives influenced the sale of equipment incentivized through the program. The survey data also helped support secondary research questions by providing information on program satisfaction and process-related feedback. Additional questions were asked to evaluate participant characteristics, such as respondent firmographics that helped provide rough estimates of the proportion of hard-to-reach customers that participated in the program.

Responses to the surveys were captured via a data collection tool designed and deployed through Form.com. Each contractor respondent was offered a $30 Amazon e-gift card for participating in the survey. Beyond the incentive offerings, DNV adopted the same proven best practices in fielding these surveys as outlined in Section 3.4

Further details on the survey sample design are included in Section 5.2.1. Results from the distributor surveys are summarized in Section 5.3 (Net savings results) and Section 6 (Program process and performance). Appendix D provides detailed sample design information while Appendix F provides the survey instrument used to collect information for this survey.

3.6 End user data challenges

DNV requested end user names, phone numbers, email addresses, installation addresses, and other distributor and measure-specific data for each PY 2021 Comfortably CA claim. These end user parameters serve a vital role in the verification process. This information allows third-party evaluators to identify the IOU customer who received the ratepayer-supported measure and confirm the measure is installed and operating.

In addition to supporting the claim verification process, claim-level end user information is critical when evaluating the achieved energy performance. The building type and building age parameters alone can drastically change the appropriate deemed measure savings value that should be referenced for HVAC measures. For some of the claimed measure packages, the deemed measure claim is ineligible for new construction yet, confirming the installation occurred at an existing building is impossible when a valid installation address is not provided.

In a preliminary program data call with SDG&E, representatives acknowledged that the end user names, phone numbers, and emails would often not be available. It was not clear until subsequent calls with SDG&E that end user addresses would also be unavailable. This information enables evaluators to verify that the equipment is installed and operating and to identify key factors about the installations like building type, vintage, and configuration. For over 88% of the 26,855 claims in the CEDARS tracking data, SDG&E was unable to provide valid end user names, addresses, phone numbers, or email addresses. The placeholder address "XXX NOWHERE ST" was listed for over 22,000 claims. DNV determined valid end user contact names were provided for only 5% of the 26,855 claims. The value "NONAME" was listed as the end user contact first and last name for over 24,000 claims.

In a follow-up call with SDG&E to discuss the lack of end user information provided, SDG&E stated that, "the standard practice for midstream program design is to interact with distributors to accomplish program objectives." SDG&E also cited a

lack of specific data requirements found in measure package documentation as a primary reason for not collecting valid end user names, addresses, and relevant contact information for the measure claims. [31] This came as a surprise to evaluators because there were recommendations to improve end user data tracking information in each of the previous four HVAC impact evaluation reports conducted on behalf of the CPUC. [32,33,34,35]

DNV performed a thorough review of the measure package data requirements listed for the various claims that were filed under the Statewide Third-Party Programs. The review of the corresponding measure package data collection requirements showed that the applicable measure packages for the Comfortably California Program claims were mostly listed as "to be determined."[36] However, in the PY 2021 the Quality Assurance Plan (QAP) and Distributor Handbook, which were developed by CLEAResult, onsite verification and the collection of customer contact information appear to be a requirement as shown in the following citations:

Collection of customer contact information
Implementer shall provide all available information to [SDG&E] regarding the purchase and installation of Program products that is [sic] *necessary for Implementer to inspect and verify such purchase and installation at the Customer's facility, which information shall include customer names, contact information, addresses, product purchased and installed at such address, and applicable IOU account numbers and service territory.*[37]

On-site installation verification
The program is required to visually inspect a minimum 10% of all projects submitted by each distributor, which will be selected at random. Installations are also required to happened [sic] *within 90 days of the sale of the HVAC product.*[38]

On-site installation verification sampling
For each Partner, CLEAResult will inspect no less than 10% of the sites at which Program Measures purchased from such Partner were installed (or intended to be installed), which sites shall be selected at random.[39]

The sales data spreadsheet provided in the Distributor Handbook indicates that customer name, installation address, and installation city are all optional fields, and only the installation zip code is required. There is no mention of the customer's email address or phone number in the distributor sales data spreadsheet.[40] Thus, while the program's QAP requires the collection of end user addresses and contact information, the information provided to distributors in the sales data spreadsheet conflicts with this requirement.

Because there were no end user addresses or contact information available, DNV had to substantially modify its installation verification approach by attempting to verify this information through participating contractors.

[31] The CPUC's DEER 2022 Resolution E-5082 and DEER 2023 Resolution E-5152 did not require the collection of end user data for upstream and midstream programs in PY 2021. However, the CPUC clearly highlights concern regarding the evaluability of upstream and midstream programs and upcoming changes related to data collection requirements: "CPUC will require site-specific data for all claims and eliminate the current exception for upstream and midstream delivery types. This change is required to address recurring concerns with upstream and midstream programs and systematically capture the data needed to evaluate these programs." Public Utilities Commission of the State of California. Energy Division. Resolution E-5152. August 5, 2021. p. 21. See also CPUC Energy Division. Resolution E-5082. August 27, 2020. p. A-1-14.

[32] DNV GL-Energy, "Impact Evaluation Report-Final HVAC-Program Year 2017, calmac.org, 04/30/19. https://www.calmac.org/publications/CPUC_Group_A_HVAC_Sector_Report_.pdf

[33] DNV GL-Energy, "Impact Evaluation Report HVAC Sector-Program Year 2018, calmac.org, 04/20/20. https://www.calmac.org/publications/Year2_CPUC_Group_A_HVAC_Report_Final_CALMAC_20200420.pdf

[34] DNV GL-Energy, "Impact Evaluation Report Commercial HVAC Sector-Program Year 2019," calmac.org, 05/14/2021. https://www.calmac.org/publications/CPUC_Group_A_Commercial_HVAC_Impact_Evaluation_Report_PY2019_Final.pdf

[35] DNV Energy Insights USA Inc. (DNV), "Impact Evaluation Report-Commercial HVAC Sector-Program Year 2020, calmac.org, 04/29/23. https://www.calmac.org/publications/Group_A_YR4_ComHVAC_Impact_Report_Final_CALMACES.pdf

[36] California Technical Forum. California Electronic Technical Reference Manual. Accessed February 2023.

[37] Comfortably CA – Quality Assurance Plan. January 2021. p. 11.

[38] Comfortably CA – Distributor Handbook. January 2021. p. 14

[39] Quality Assurance Plan. Comfortably California Program. January 2021. p. 8.

[40] Comfortably CA – Distributor Handbook. January 2021. pp. 11-12

3.7 PA program verification review

After reviewing end user, contractor, and distributor data for the evaluation, DNV had multiple meetings with SDG&E and CLEAResult to better understand what level of verification was performed with the limited data available. These meetings included the program staff interviews and implementer interviews described in Section 3.1 and 3.2 above. In a follow-up meeting held after the program staff and implementer interviews, SDG&E shared a package of internal verification documents with DNV, which included a verification summary memo for the PY 2021 Comfortably California program authored by SDG&E. SDG&E published the initial draft of its own QAP on September 13, 2021 and made a more recent revision to the QAP on March 17, 2022.[41] We should note that SDG&E developed this QAP internally and it is a completely separate document from the QAP that CLEAResult developed for the program and published in January 2021 (see Section 3.6 for a discussion of CLEAResult's PY 2021 Comfortably California QAP). SDG&E's verification summary memo details its revised quality assurance and verification activities for the PY 2021 Comfortably CA Program. Key findings are summarized in the memo's executive summary:

> *Beginning in PY 2021, SDG&E implemented a new statistically based quality assurance methodology using quality engineering best practices. This methodology was used to create a Quality Assurance Plan (QAP) for the PY 2021 SW Midstream HVAC program to verify that the program was operating in accordance with specified requirements and was reporting valid savings claims. The standard practice for midstream program design is to interact with distributors to accomplish program objectives. Further, the California Public Utilities Commission (CPUC or Commission) Ex-ante guidance did not include specific data collection requirements at the time of program design and launch. As such, program verification was not designed to rely upon end user data collection. Instead, SDG&E designed a QAP that relied on contractor interviews to assess the program's effectiveness.*
>
> *Based on SDG&E's verification activities with contractors in accordance with the program's QAP, SDG&E concluded that the PY 2021 SW Midstream HVAC program was effective in reporting valid enrollments and savings claims. Issues identified during verification were investigated further using a formal Corrective and Preventive Action process, and those verification findings are reflected in reported claims. Lessons learned from PY 2021 have been incorporated in the PY 2022 program design, including the new requirement to collect end user information for enrollments.*[42]

In the meetings DNV had with SDG&E, SDG&E acknowledged that the lack of end user data presents a verification barrier. Because of this, SDG&E developed its own QAP later in 2021, which focused on contractor interviews. SDG&E shared extensive documents that both summarized and detailed the PY 2021 Comfortably CA program verification efforts they performed. DNV thoroughly reviewed these documents to assess how thorough and representative this QAP effort was with respect to the entire population of 2021 claims. Below is a summary of our findings:

- **SDG&E performed extensive phone and email outreach:** SDG&E provided a summary table showing the final disposition status (Pass/*Pass/ Fail) for the 563 claim enrollments they reviewed as part of their QAP Verification. The document tracked the outreach efforts performed by SDG&E and many of the enrollments included over five different phone or email outreach attempts to arrive at the final pass/fail disposition.
- **Verification efforts focused heavily on Residential Furnace claims**: SDG&E shared that their initial outreach for claims supported by the SWHC031-01 Residential Furnace measure package was comprised of mostly new construction installations. SDG&E initially believed this meant these claims were ineligible but later determined the new construction claims were eligible as long as they sourced the new construction savings permutation unit energy savings (UES) and not the existing building UES. To be conservative, SDG&E claimed the lower UES value for all residential

[41] SDG&E. Verification Summary for PY2021 4125 Statewide (SW) Midstream HVAC. Received November 2022. pp. 3-4.
[42] Ibid. p. 1.

furnace claims in the population except for ones where their outreach confirmed the claim was for an existing building retrofit. The verification documents SDG&E provided did not show the same level of review and scrutiny for other claims that were not residential furnace claims.

- **Pass/Fail/*Pass dispositions not clearly supported**: In the final disposition summary document SDG&E shared with DNV, there was a total of 48 claims listed as *Pass when SDG&E was unable to perform an inspection. These 48 claims spanned both commercial and residential claims. While none of the claims reviewed actually involved a physical or visual inspection, these 48 claims were passed after numerous outreach attempts indicated the contractor was unaware of the program or unwilling to participate in the interview. It was not clear why these 48 claims were ultimately passed based on DNV's review.

The quality assurance methods described in SDG&E's summary verification memo are also a significant departure from the verification and data collection requirements prescribed in the program's QAP authored by CLEAResult. As detailed in the prior section, those initial plans called for collecting customer information (names, contact information, and addresses), on-site inspections, and a 10% site inspection sampling rate. While verbal confirmations from participating contractors helped provide some assurance that the program measures were installed, the level of certainty that program measures were installed would have been significantly higher had the original verification activities been completed as planned.

3.8 PY 2022 data review

Both CLEAResult and SDG&E stated that they began collecting end user addresses and contact information for all participating end users in PY 2022 in response to discussions with the CPUC in late 2021 on the need to collect end user addresses and contact information. The program was paused for several months in 2022 to ensure that end user data was being collected for all PY 2022 claims. A preliminary review of the PY 2022 claims shared with DNV confirms that end user data is now being collected. Program staff mentioned that the increased end user data requirements had a negative impact on program participation in 2022. As of January 2023, SDG&E believes the overall claims for PY 2022 will be less than a quarter of the total claims for PY 2021.

As of February 2023, DNV has received preliminary tracking data for 957 Comfortably CA claims. SDG&E reported there are approximately 5,000 additional claims still undergoing final review which are not yet available for posting. SDG&E and CLEAResult both cited the end user data requirement as the primary barrier preventing higher participation rates among distributors. Additionally, we learned through our interviews with SDG&E and CLEAResult that the 2021 distributor with the highest volume of claims declined to participate in the 2022 program. According to CLEAResult, this distributor cited the increased end user data requirement as being overly burdensome relative to the incentive amount they receive per unit sold. We have reviewed the preliminary 957 Comfortably CA claims and determined all (100%) appear to have valid end user addresses, business or end user first and last names, phone numbers, and email addresses. Given the erroneous placeholder address "XXX NOWHERE ST" and names found in the PY2021 end user data, we closely reviewed the addresses and contact information for the 957 PY 2022 claims and determined that they all appear to be valid.[43]

It remains to be seen whether the midstream delivery structure of the Comfortably California program can simultaneously achieve the higher participation rates seen in PY 2021 and consistently collect the end user data parameters required. Given all the challenges the PAs and third-party implementer reported the end user data requirements present, DNV recommends considering a change in program design by switching to a downstream delivery model. Doing this would by default make end users aware of the program and capture their information for claim verification and tracking. This recommendation is further supported by the findings in the net savings results detailed in Section 5.3. GROSS SAVINGS ANALYSIS

[43] While we closely reviewed each claim to make sure that they were likely valid, we did not call the phone numbers or attempt to validate the email addresses to see if any bounced as this was out of scope for the PY 2021 evaluation.

3.9 Overview

This section presents evaluated energy (kWh and therm) and demand (kW) savings from program installations in PY 2021. Gross savings are based on the validation of the measure package applications used to claim program measure savings and the verification of measures installed by the program. To develop the program's gross realization rate (GRR), or the ratio of evaluated savings to the original claimed savings without any adjustments for program influence, measures were organized into measure packages and matched with corresponding savings permutations from the Database of Energy Efficiency Resources (DEER). DNV engineers aligned individual claim characteristics with DEER permutations, which allowed for a direct comparison of savings claims between tracking data claims and approved deemed savings values. To assess program installations, DNV also conducted telephone surveys with participating HVAC contractors. We asked contractors questions about what portion of the incentivized equipment was installed and, if the equipment was not installed, the reasons for not installing the equipment.

As discussed in Section 3.6, installation addresses and associated contact information for each claim were not available beyond the installation zip code. This limitation prevented a more rigorous gross savings analysis. Ideally, the gross evaluation process would verify a statistically representative sample of claims installed through the program. Had installation addresses and associated contact information been available, the evaluation team could have conducted a more rigorous gross savings analysis with an installation verification component, which would have resulted in higher overall confidence in the evaluated gross savings results. With limited options for a detailed gross savings analysis, DNV did not pursue a higher rigor gross savings analysis approach. Contractor interviews helped provide some validation that program measures did in fact get installed (discussed in Section 3.2).

3.10 Methods

To determine the evaluated gross savings estimates for the program, DNV reviewed reported claim-level details to ensure reported savings were estimated correctly. The process involved the following steps:

Tracking data processing: DNV standardized, cleaned, re-categorized, and re-aligned the datasets according to the corresponding workpaper and measure package within DEER.

Measure package consolidation: Evaluators then identified program participation at the claim-level in the CEDARS tracking data and applied the appropriate measure package from DEER.

Measure parameter assignment: The measure savings in the DEER measure package were assigned according to the various combination of claim characteristics such as *Measure Application Type*, *HVAC System Type*, *Climate Zone*, and *Delivery Type*.

Engineering analysis: Once aligned, DNV compared the savings claims in the CEDARS tracking data to the measure savings in DEER to identify any potential discrepancies.

Table shows the measure parameters mapping that DNV used to compare claimed measure packages in CEDARS with DEER permutations.

Table -2. Measure parameters mapping between CEDARS packages and DEER permutations

Item description	CEDARS	DEER

Workpaper ID containing measure	SourceDesc	Source Description
Measure Offering ID number	Offering ID	Offering ID
Identification of the context for the measure's installation/application ***(e.g., accelerated replacement, new construction, or behavioral)***	MeasAppType	Measure Application Type
Identification of a program implementation strategy or method of delivering a measure to a customer ***(e.g., direct install)***	DeliveryType	Delivery Type
Measure-level sector conforming to the sectors listed in DEER	DEER_Sector	Sector
Text codes identifying the building type and other parameters specific to a building's use ***(e.g., "Com" = Commercial buildings)***	BldgType	Building Type
Standard ex-ante building vintage	BldgVint	Building Vintage
Standard ex-ante building HVAC type	BldgHVAC	Building HVAC
Standard ex-ante building location/climate zone	BldgLoc	Building Location

3.11 Results

3.11.1 Reported savings review

Table summarizes the findings of the program's gross savings analysis for PY 2021. As shown, few measures have discrepancies between savings reported in the tracking data and savings assigned per the corresponding DEER measure package. In general, the most common differences between the program tracking data and DEER were due to the incorrect selection of building vintage and the related DEER building sector in the tracking data.

Table -3. Summary of claimed and evaluated gross savings, PY 2021

Measure ID	Measure description	Claims	Sum of claimed gross (kW)	Sum of evaluated gross (kW)	Sum of claimed gross (kWh)	Sum of evaluated gross (kWh)	Sum of claimed gross (therms)	Sum of evaluated gross (therms)
SWHC001-01	Wall Furnace, Residential	43	0	0	0	0	285	285
SWHC001-02	Wall Furnace, Residential	979	0	0	0	0	10,020	10,025
SWHC004-01	Space Heating Boiler, Commercial & Multifamily	179	0	0	0	0	142,513	142,513
SWHC004-02	Space Heating Boiler, Commercial & Multifamily	137	0	0	0	0	149,383	149,383
SWHC013-01	Unitary Air-Cooled Air Conditioner Over 65 kBtu/hr, Commercial	2,410	1,305	1,305	1,927,921	1,927,921	0	0
SWHC014-01	Unitary Air-Cooled Air Conditioner or	7,172	3,011	3,011	8,443,788	8,443,788	142,975	142,975

Measure ID	Measure description	Claims	Sum of claimed gross (kW)	Sum of evaluated gross (kW)	Sum of claimed gross (kWh)	Sum of evaluated gross (kWh)	Sum of claimed gross (therms)	Sum of evaluated gross (therms)
	HP Under 65 kBtu/hr, Commercial							
SWHC031-01	Furnace, Residential	12,568	375	375	347,578	347,870	254,904	254,889
SWHC049-01	SEER Rated AC and HP HVAC Equipment, Residential	3,397	300	300	462,383	462,383	-11,722	-11,722
Grand Total		**26,885**	**4,990**	**4,990**	**11,181,671**	**11,181,963**	**688,357**	**688,346**

With claimed savings and evaluated savings by measure type and for the program overall, we were then able to calculate the gross realization rate for the program, which is the ratio of evaluated savings to the original claimed savings, without any adjustments for program influence. Table 4 shows the gross realization rates by measure package and the program overall. Using the gross savings analysis approach described above, DNV determined the GRR for kW, kWh, and therms was 100% across all measures in the Comfortably California program in PY 2021.

Table -4. Summary of gross realization rates, PY 2021

Measure ID	Measure description	Claims	kW gross realization rate (GRR)	kWh gross realization rate (GRR)	Therms gross realization rate (GRR)
SWHC001-01	Wall Furnace, Residential	43	-	-	100%
SWHC001-02	Wall Furnace, Residential	979	-	-	100%
SWHC004-01	Space Heating Boiler, Commercial & Multifamily	179	-	-	100%
SWHC004-02	Space Heating Boiler, Commercial & Multifamily	137	-	N/A	100%
SWHC013-01	Unitary Air-Cooled Air Conditioner Over 65 kBtu/hr, Commercial	2,410	100%	100%	100%
SWHC014-01	Unitary Air-Cooled Air Conditioner or HP Under 65 kBtu/hr, Commercial	7,172	100%	100%	100%
SWHC031-01	Furnace, Residential	12,568	100%	100%	100%
SWHC049-01	SEER Rated AC and HP HVAC Equipment, Residential	3,397	100%	100%	100%
Grand Total		**26,885**	**100%**	**100%**	**100%**

Key takeaways from DNV's gross savings analysis are as follows:

- **Claimed building vintage and claimed measure application type contradict**. For a considerable number of claims the tracking "BldgVint" (building vintage) is labelled as "EX" for existing buildings, but the claimed measure application type is "NC" for new construction. The claimed savings values directly correspond with the new construction DEER permutation. Since the NC savings values match between CEDARS and DEER, we assume the "EX" building vintage value is incorrect for claims supported by the measure packages listed below.
  - Space Heating Boiler, Commercial & Multifamily (SWHC004-01)
  - Space Heating Boiler, Commercial & Multifamily (SWHC004-02)

- Furnace, Residential (SWHC031-01)
- Unitary Air-Cooled Air Conditioner Over 65 kBtu/hr, Commercial (SWHC013-01)
- Unitary Air-Cooled Air Conditioner or HP Under 65 kBtu/hr, Commercial (SWHC014-01)

- **Claimed Unit Energy Savings (UES) match DEER permutations.** The parameters defined for each claim in the CEDARS data align with the corresponding DEER permutation savings values to within 0.5%. Additionally, no errors or contradictions were identified in the CEDARS claims for the following measure packages:

  - SEER Rated AC and HP HVAC Equipment, Residential (SWHC049-01)
  - Wall Furnace, Residential (SWHC001-01)
  - Wall Furnace, Residential (SWHC001-02)

- **Claimed residential building sector but commercial savings.** CEDAR claims list the building sector as “Residential,” but the claimed UES values align with the "Commercial" building sector DEER savings permutation for the measure packages listed below.

  - Unitary Air-Cooled Air Conditioner Over 65 kBtu/hr, Commercial (SWHC013-01)
  - Unitary Air-Cooled Air Conditioner or HP Under 65 kBtu/hr, Commercial (SWHC014-01)

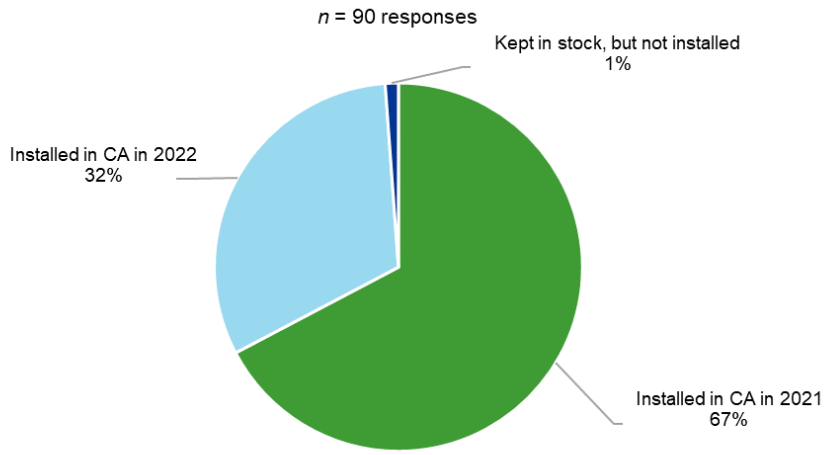
- **Effective Useful Life and Remaining Useful Life (EUL/RUL).** There were no discrepancies found between the claimed EULs and RULs found in CEDARS and what is listed in DEER.

3.11.2 Measure installations

To assess program installations, DNV conducted telephone surveys with participating HVAC contractors. We asked contractors questions about what portion of the incentivized equipment was installed and, if the equipment was not installed, the reasons for not installing the equipment. Figure -1 shows how contractors’ survey responses indicated that 99% of the time their equipment was installed in 2021 (67%) or 2022 (32%). The remaining 1% of their sales were reported to be kept in stock and not installed. Figure 8-1 in Appendix E provides a detailed measure-level breakout of these results.

Given that the vast majority of contractors installed the equipment they purchased through the PY 2021 program, we did not make any adjustments to the reported installation rate for the program.

Figure -1. Equipment installations verified by contractors



When we asked contractors why they did not install some of their equipment, responses included:

- *"Needed different [Residential furnace] equipment, so I just kept it in inventory for next time."*
- *"It [the commercial boiler] has been purchased but not installed yet."*

5 NET SAVINGS ANALYSIS

5.1 Overview

Net savings are the gross savings minus energy savings attributed to end users who would have purchased program-qualifying HVAC equipment without the program incentives. The “net-to-gross ratios” are the proportions of program gross savings, or the proportions of a program’s subcomponents (e.g., energy efficiency measures) gross savings that are attributable to program influence.

5.2 Methods

In this section, we provide a summary of the methods used to evaluate the net savings of the PY 2021 Comfortably California program. This includes a discussion of the sampling methodology for the distributor and contractor surveys, as well as a summary of the methodology used to estimate net savings. Details of the stratified sampling approach used for the contractor surveys are provided in Appendix D.

5.2.1 Sample design

DNV requested the lists of distributors and installation contractors that participated in the Comfortably California program in PY 2021 from SDG&E. The dataset included information to map each program claim to the distributor and contractor responsible for the sale and installation of the program equipment associated with that claim. This allowed the team to determine the total number of claims and associated energy savings for each distributor and contractor. The sample design approach we used ensured the samples (units from the full populations or sample frames) that were drawn were representative and provided estimates that achieved a target relative precision for a defined confidence level.

For primary data collection, our sample design was based on a stratified sampling approach. We selected sample units for study from groups of interest (e.g., sector and measure group) stratified by savings and measured in MMBtu, which is the sum of kWh and therm savings converted to a common unit of measure. We then estimated appropriate sample sizes for each program to achieve the targeted relative precision (±10%) at a desired level of confidence (90%). After we determined the required sample sizes, we chose primary sample points from the population based on the stratification plan. In addition, we selected a backup sample in case any sample points needed to be replaced. Replacement sample points are needed when a distributor or contractor in the primary sample cannot be reached or refuses to be interviewed.

Table 5-1 below shows the total number of participating HVAC distributors and their associated first year gross savings. There was a total of 42 unique HVAC distributors. Our sample design targeted the largest 15 distributors, which represented over 97% of the program’s gross savings.

Table 5-1. HVAC distributor population and gross savings summary

Distributors	First year gross savings (kWh)	First year gross savings (therms)	First year gross savings (MBtu)
42	10,102,830	648,415	168,254

Table 5-2 shows the targeted and achieved sample for the distributor survey. The achieved number of completed HVAC distributor surveys represents 40% of the distributor population and 77% of first year program savings.

Table 5-2. HVAC distributors: targeted and achieved completed surveys

Distributor population	Distributor completes targeted	Distributor surveys completed	Achieved completed surveys		
			Percent of distributors	First year savings (MBtu)	Percent of first year savings (MBtu)
42	15	17	40%	129,908	77%

Table 5-3 shows the population of participating installation contractors along with the total program savings associated with them. There was a total of 2,608 unique contractors in the dataset provided by SDG&E.

Table 5-3. HVAC contractor population and savings summary

Contractor population	First year gross savings (kWh)	First year gross savings (therms)	First year gross savings (MBtu)
2,608	11,181,671	688,357	183,291

Table 5-4 provides a summary of missing contractor contact information. It shows that more than a third (34%) of the installation contractor records did not have contractor contact information. In addition, 752 of these 892 records had distributor contact information listed instead of contractor information, which represented about 30% of the savings of the program.

Table 5-4. HVAC contractor missing information summary

Description	Contractors	First year gross savings (MBtu)	Percent of contractors	Percent of first year gross savings (MBtu)
Missing email	892	55,141	34%	30%
Total contractors	**2,608**	**183,291**	**100%**	**100%**

Table 5-5 shows the targeted and achieved sample for the contractors. The completed HVAC contractor surveys represent 3% of the contractor population and 13% of the first year gross program savings associated with these contractors.

Table 5-5. HVAC contractors: targeted and achieved completed surveys

Contractor population	Targeted number of completed surveys	Achieved surveys completed	Achieved completed surveys		
			Percent of contractors	First year gross savings (MBtu)	Percent of first year gross savings (MBtu)
2,608	55	74	3%	13,539	13%

5.2.2 Net impact evaluation approach

As noted above, net savings are the proportion of gross savings that can be attributed to the program. This study examined the influence of the program on installed measures to understand what percentage of the installations would have occurred in the absence of the program.

We assessed net savings at the program- and measure-level based on distributor and contractor survey responses to the following questions. Each respondent was asked about the sale (for distributors) or purchase (for contractors) of up to three measure groups.[44]

Distributors were asked the following questions to help quantify program influence:

- "If the Comfortably California program did not exist, do you think your sales of high efficiency [Measure type] units sold in 2021 would have been about the same, lower, or higher?"
- "Approximately what percent lower or higher do you estimate sales would be of [Measure type] if the program did not exist?"

Contractors were asked the following questions to help quantify program influence:

- "If [Distributor] charged [incentive $] more for each [Measure type] you sold in 2021, do you think your sales of [Measure type] would have been about the same, lower, or higher?"[45]
- "Approximately what percent lower or higher do you estimate sales would be of [Measure type] if the program did not exist?"

All respondents who said their sales would have been the same without the program received an "attribution score" of 0, as these responses indicate the program had no influence on their sales. If they responded "Lower" and provided a valid response estimating their percentage decrease in sales without the program, then they were assigned attribution based on the percent (e.g., if a respondent answered the first question with "Lower" and answered the follow-up question with 20%, their attribution score would be 0.2). A few respondents answered "Lower" but did not provide an approximate percentage. In these cases, we imputed the missing values using the MMBtu savings-weighted attribution scores of all respondents who had answered "Lower" and had also provided an estimated percentage for the decline in sales.

To calculate NTG ratios, HVAC distributor and contractor attribution scores were combined into "streams." In each "stream," distributors were linked with the contractors they supplied to, and distributor savings were divided up among contractors where possible. Additionally, for each distributor-contractor link, the average of the distributor and contractor attribution scores were assigned to each contractor's savings, and the contractor-savings weighted average of these resulting scores was assigned to the distributor savings that could not be accounted for by surveyed contractors. We dropped distributors who did not have sales to any of the contractors in our completed sample from the analysis to prevent outsize influence from the large amount of savings they represented.

[44] A respondent's top three measures were selected according to the share of a respondent's total savings that were accounted for by each measure group.

[45] The incentive average incentive value used in this question was based on the incentive data available in the CEDARS tracking database (discussed in Section 3.1). Because the contractor surveys were launched after the completion of the distributor surveys, we were able to calculate the average percent of the incentive that was passed on to contractors by distributors. After the completion of the contractor surveys, DNV discovered an error in its calculation of the average incentive for each measure type. Because CEDARS splits each claim into four records to assign savings to each of the 4 IOUs for statewide programs, evaluators mistakenly overestimated the number of claims in the program tracking data. This resulted in the incentives referenced in this question being approximately four times lower than what they should have been. To account for this error, we quadrupled the net-to-gross ratio calculated for contractors before combining it with the NTGR ratio for distributors. Because we did not reference incentive amounts in interviews with distributors, this error did not impact the NTGR calculations for the distributor surveys.

We calculated net-to-gross ratios based on the combined distributor and contractor attribution scores to allow for the calculation of net savings estimates (kWh, therm, and combined MMBtu) using a stratified ratio estimation approach. The ratios were calculated according to the following formula:

Equation 1. Net-to-gross ratio calculation

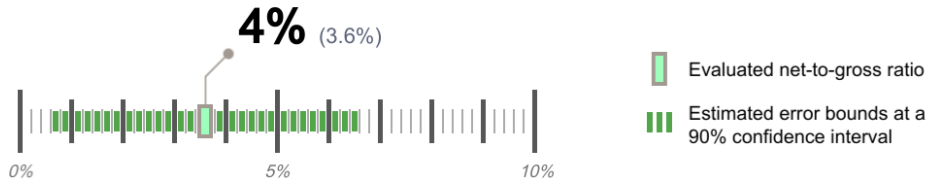
$$\widehat{B} = \frac{\sum_{i=1}^{n} w_i y_i}{\sum_{i=1}^{n} w_i x_i}$$

In this equation, x_i is the ex-ante (reported) first year gross savings, y_i is the product of the attribution score discussed above and the ex-ante gross savings, and w_i is the respondent case weight, which is equal to the inverse of the inclusion probability discussed in Section 5.2.1. The resulting net-to-gross ratios were then implicitly weighted by respondent gross savings and explicitly weighted using the case weights as an expansion variable. The statistical precision of the net-to-gross ratios was calculated based on the above statistic.

5.3 Results

The evaluation determined an estimated net-to-gross ratio of 4% (3.6%) for the Comfortably California program, with an error bound of 2.9% at the 90% confidence level. Evaluation results determined that the vast majority (96%) of the program savings would have occurred without the program (Figure 5-1).

Figure 5-1. Program-level, net-to-gross ratio



Both distributor and contractor survey results helped to determine the low net-to-gross ratio for the program in PY 2021. When we asked survey respondents about their program-incentivized equipment sold in 2021, 80% of distributors and 93% of contractors stated their sales of equipment would have been the *same* even if the program did not exist. We then asked respondents why their sales would have remained the same without the program.

Below is a selection of quotations that capture the various core themes of the survey responses:

- Distributor responses:
  - *"[The] incentive is not high enough to affect it."*
  - *"Our entire team [was] already trained, and the incentive was low anyway."*
  - *"It was more about product availability. Whatever was manufactured was sold. It was sold before we even received it."*
- Contractor responses:
  - *"It's a drop in the bucket, [commercial boilers] cost $100,000."*[46]

[46] CEDARS data shows commercial boiler incentives averaged 45% of the estimated incremental measure cost where the incremental measure cost represents the marginal price increase between the baseline case commercial boiler and measure case commercial boiler. For a more detailed discussion on measure costs and incentives, see Section 6.6.2.

– *"Compared to what the system cost, it's a small amount."*
– *"Not a huge difference in cost. Especially for commercial units."*

When asked about their program-incentivized equipment sold in 2021, only 20% of distributors and 7% of contractors said their sales would have been lower without the program. All the surveyed contractors that answered "lower" provided an approximate percentage, but 10% of the distributors answered lower without providing a value. The percentage lower values for these distributors were filled according to the imputation strategy discussed above in Section 5.2.2.

Individual measure groups had similarly low net-to-gross ratios, with several measure groups having an evaluated net-to-gross ratio of 0% based on survey responses. In other words, all the program savings for these measure groups would have occurred without the program.

Table 5-6 shows the evaluated net-to-gross ratios for each measure group in the program and for the program overall.[47] While most individual measure groups had small sample sizes relative to the population (marked in Table 5-6 with asterisks), the results for these smaller measure groups were included to show the consistency of the survey responses. The population (N) displayed in the table refers to the combined contractor and distributor population for each measure group. A finite population correction factor was applied as a variance reduction calculation to account for small population sizes within measure groups. Although some measure groups had a small sample size, the sample of distributors that were surveyed accounted for a majority (77%) of savings claimed by the program (Table 5-2), so we can be confident that the results reflect program population net-to-gross savings.

Although we are confident about each of our estimates to be within 6% or less, the associated relative precision values do not reflect the level of precision in our estimates. The relative precision, or the size of the error bound relative to the size of the evaluated net-to-gross ratio, is large for several estimates due to the low magnitude of the evaluated net-to-gross ratios. To better display the confidence achieved in the results, we show the associated relative precision of the free-ridership ratios,[48] which are the inverse of net-to-gross ratios, to demonstrate that the program has a high free-ridership rate.

Table 5-6. Measure-level net-to-gross ratio (NTGR)[49]

Measure	Population (N)	Sample (n)	Combined MMBtu		
			NTGR	NTGR Relative Precision[50]	Free-Ridership Relative Precision
Commercial Packaged AC	948	27	8.2%	38.1%	3.4%
Residential Furnace	1,047	32	0.0%	-	0.0%
Commercial Boiler*	146	12	0.2%	182.6%	0.4%
Commercial Packaged Heat Pump*	398	12	4.2%	158.4%	6.9%
Commercial Split Heat Pump*	255	10	0.0%	-	0.0%
Residential Heat Pump*	70	4	0.0%	-	0.0%
Residential Split AC*	175	5	0.0%	-	0.0%
Overall	**3,039**	**102**	**3.6%**	**77.4%**	**2.9%**

*Due to small sample sizes at the measure level, the results are not statistically representative.

[47] Measures that had no associated responses were omitted.

[48] Free-ridership refers to the proportion of end users who would have purchased and installed the same HVAC equipment in absence of the program. They are referred to as free-riders because they are receiving benefits from programs for actions they would have taken without the programs' existence. Net savings estimates remove or "net out" these free-riders' savings.

[49] DNV does not recommend utilizing the NTGR for measures marked with asterisks and displayed in light grey text. These measures were based on small sample sizes relative to the population, and thus, may not be representative of the population.

[50] The effective relative of the 0% NTGR values in this table is 0%. The RP is zero because there was no variation among survey responses (i.e., all respondents said sales would be the same without the program).Table 5-6

Table 5-7 shows the evaluated net savings for the Comfortably California program. We calculated these results based on the gross realization rates determined in Section 3 and the net-to-gross ratios determined above. More specifically, the evaluated net savings were calculated by multiplying the program total evaluated gross savings by the program-level net-to-gross ratio.

Table 5-7. Evaluated net savings

Program	Evaluated Net kWh Savings	Evaluated Net kW Savings	Evaluated Net Therms Savings
Comfortably California	675,841	268	8,048

5.4 Cost effectiveness and total system benefit

The evaluators calculated the program's cost effectiveness based on evaluated savings using the Cost Effectiveness Tool (CET) available on the CEDARS website. Table 5-8 summarizes the evaluated Comfortable California program electric and gas savings benefits and the total resource costs associated with these benefits.

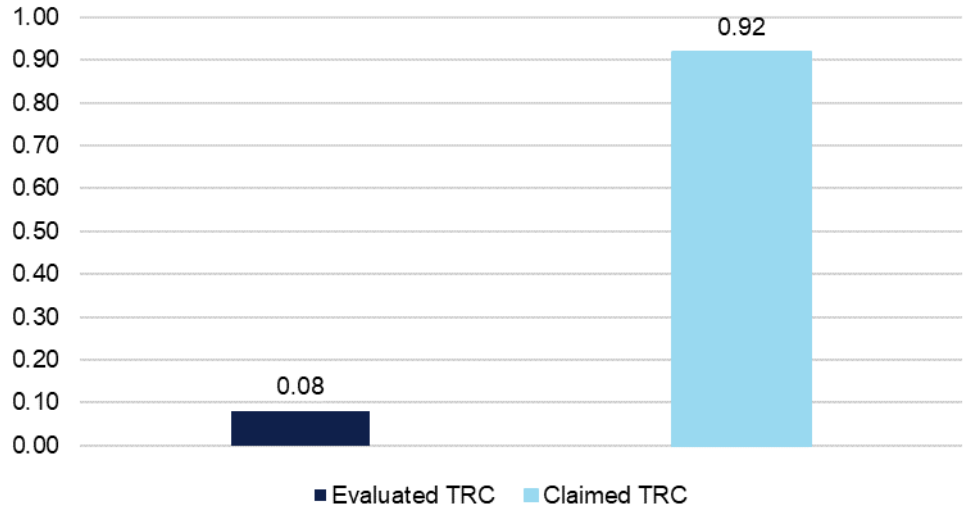
Table 5-8. Evaluated program benefits and costs, PY2021

Electric benefit	Gas benefit	Program TRC cost
$823,132	$649,691	$18,231,797

The ratio of the combined benefits to the total resource cost quantifies the cost effectiveness of the programs and is summarized by the total resource cost (TRC) ratio.[51]

We compared the evaluated TRC values with claimed TRC values for the Comfortably California program filed in CEDARS. We present these values in Figure 5-2. The claimed value filed by the program was 0.92. The evaluated TRC value is a fraction of the claimed value and reflects the low net realization rates associated with the installed measures.

Figure 5-2. Claimed and evaluated TRC ratios, PY2021



51 The Total Resource Cost (TRC) Test is a measure of cost-effectiveness that compares the net benefit of programs to their net cost. https://docs.cpuc.ca.gov/published/FINAL_DECISION/105926-03.htm

Table 5-9 shows the total system benefits (TSB) for the Comfortably California program. The evaluated gas system TSB realization rate was slightly higher than the electric TSB realization rate. The program had an overall realization rate of 9% for TSB.

Table 5-9. Total system benefits of Comfortably California program, PY2021

	Claimed	Evaluated	Realization Rate
Electric	$10,044,303	$823,132	8%
Gas	$6,718,187	$649,691	10%
Total	$16,762,491	$1,472,823	9%

6 PROGRAM PROCESS AND PERFORMANCE

6.1 Program design

During the program staff interview, DNV asked program staff interviewees to give an overview of the program and describe their roles and responsibilities. As the statewide Comfortably California lead IOU, SDG&E is responsible for overseeing the third-party implementer, CLEAResult, and making sure the program is compliant with rules and regulations. The non-lead IOUs' program staff are responsible for remitting monthly payments to help fund the program, monitoring energy savings forecasts resulting from program activity, and participating in monthly meetings with SDG&E to track program progress. SDG&E's program manager stated that the statewide program is very different from previous HVAC programs because each IOU ran their own HVAC program, which varied between IOUs. The statewide Comfortably California program is serving all four participating IOUs under the same program design. Because of this, it is difficult to compare the Comfortably California program to other HVAC programs run by individual IOUs before 2021.

When asked if the program was more efficient to run as a statewide program compared to individual programs run by IOUs, the SDG&E project manager stated that a statewide program is unique and not necessarily comparable to local programs. However, he felt that after some adjustments, the experience running the statewide program for the first year in PY 2021 was positive overall. The representative from SCG stated that although SCG is not responsible for running the program, they are still adjusting to the new program model and experiencing some growing pains. Further, she said that SCG's responsibility is not necessarily reduced. They are still responsible for making sure that the program serves their customers. Overall, she felt that it is too early to tell whether this program is more efficient than locally run programs. The representative from PG&E agreed with the other interviewees that it is difficult to compare the program with locally run programs. However, she did feel that a statewide program run by a third-party implementer is more efficient.

During the program implementer interview, DNV evaluators asked the program manager from CLEAResult for his perspective on the efficiency of running a statewide program through a third party. He believes that the model keeps things more efficient by streamlining the administration of the program throughout the state. However, he also said that the new statewide model is both "a blessing and a curse." A major benefit is that the program has a wide reach across the state while a similarly major challenge is that they have less direct support from local utilities beyond the lead PA.

6.2 Program marketing and outreach

According to the program manager at CLEAResult, marketing and outreach was primarily limited to distributors in PY 2021. As such, implementer staff called, emailed, and met directly with distributor sales staff. The program was also marketed at trade shows and other industry events. CLEAResult plans to expand its marketing and outreach efforts to contractors in PY 2023.

6.3 Program awareness and influence

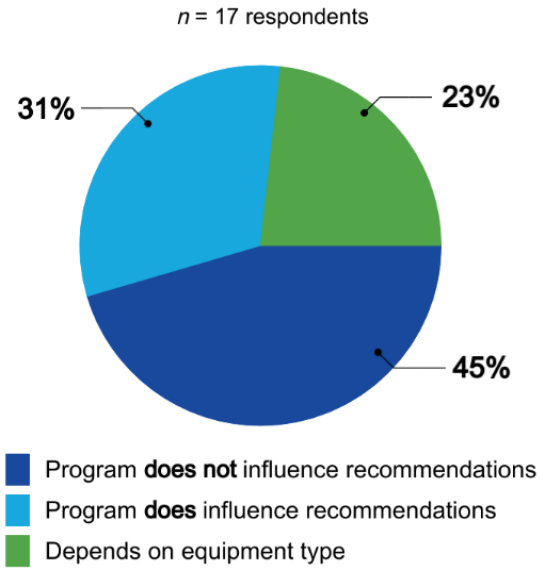
DNV evaluated participating distributor and contractor awareness and the influence of the program in PY 2021. This section details the key findings on these topics.

Survey results revealed low program awareness from contractors. Less than half (43%) of the contractors were aware that the Comfortably California program discounted the cost of eligible high-efficiency HVAC equipment. Contractors are key market actors in terms of being in a position to recommend program-incentivized equipment to end users. With low levels of program awareness, most contractors do not have the means (e.g., program information on incentivized equipment and marketing materials) to encourage end users to purchase high-efficiency equipment incentivized by the program. These findings suggest that there is a significant need for increased program marketing and outreach to HVAC contractors. Based

on a planned increase in marketing and outreach efforts to contractors in PY 2023, the program appears ready to respond to this need.

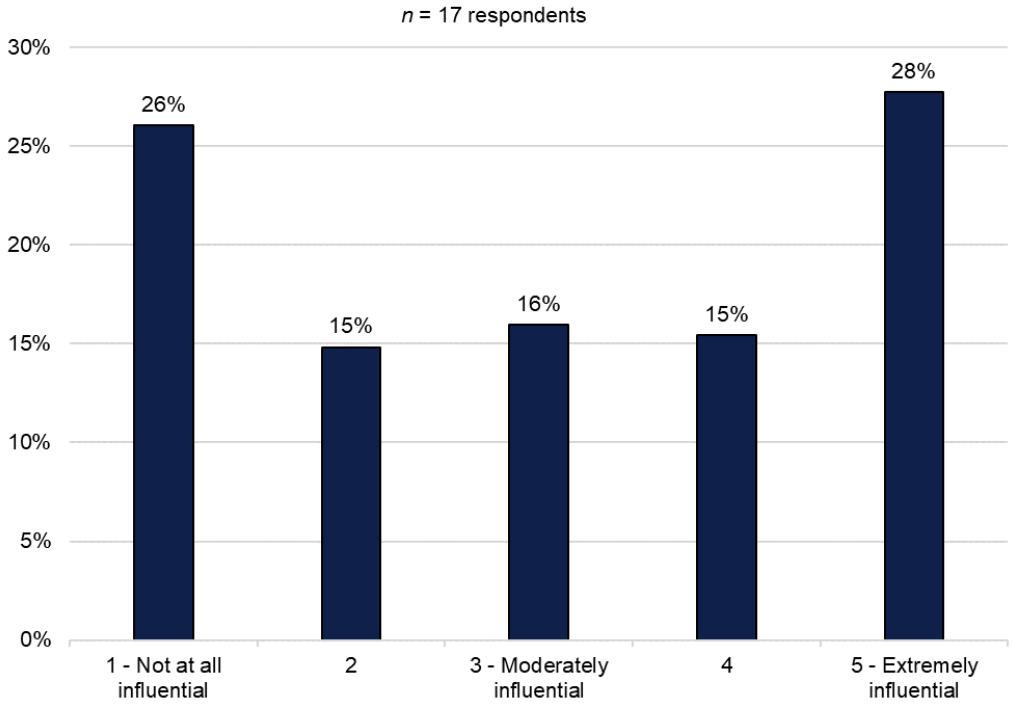
Survey results indicate a low to moderate level of program influence on the efficiency of the equipment distributors recommend to buyers. As shown in Figure 6-1, less than a third of the distributors (31%) said the program influences the efficiency of the equipment they recommend to buyers. Nearly half of the distributors (45%) stated that the program did not influence the efficiency of the equipment they recommended, with the remaining 23% of distributors stating that it depends on equipment type. One distributor further explained that it depends because "for the heat pump, yes [the program influences the efficiency we recommend]. For furnaces, no, because of the low rebate."

Figure 6-1. Program influence on distributor equipment recommendations



Distributors were also asked to rate the influence of program (e.g., incentives, marketing, outreach, and training) on the selection of high-efficiency equipment their company typically sells, using a scale of 1 to 5 where 1 is "not at all influential" and 5 is "extremely influential." The average score was 3.0, with over a quarter (26%) of respondents saying the incentives are not at all influential, and over 40% responding to the question with a score of 1 or 2.

Figure 6-2. Program influence on distributor equipment selection



Similarly, contractors were asked to rate how influential distributors' equipment recommendations were on the decision of what to purchase and install, using the same scale of 1 to 5 measuring the degree of influence. The average score for contractors was 2.7, with just under half (47%) of the contractors providing a score of 1 or 2.

These survey results indicate a low to moderate level of program influence on distributor and contractor *recommendations* and *stocking* of high efficiency equipment, although the low NTGR (4%) discussed in Section 5.3 reveals that most (96%) program *sales* would have occurred without the program. Together these results suggest that most end users' purchasing decisions are not being influenced by what is recommended or available, but instead driven by other factors (e.g., reduced operation and maintenance costs) discussed in the following section.

6.4 Market effects

DNV evaluated distributor and contractor survey responses to better understand the market effects associated with the equipment installed through the PY 2021 Comfortably California program. This section summarizes the survey responses to questions about drivers to selling high-efficiency (HE) equipment and program-qualified equipment.

Figure 6-3 shows how distributors most frequently (43%) cited "return on investment or payback calculations" as the strongest driver to selling HE equipment, with only 2% of the distributors reporting 'available stock or delivery time' to be the strongest driver. Only 11% of distributors cited 'utility incentives' as the strongest driver, although almost a third (31%) did mention utility rebates when they were subsequently asked if there were any other drivers they could think of when selling HE equipment. These results suggest the Comfortably California program incentives are not strong drivers for this equipment, although they are having a small effect on a portion of their sales. This may indicate an opportunity to increase incentive amounts, as the results of these questions do show that cost (e.g., return on investment or payback calculations) is a key driver to selling HE HVAC equipment. Figure 6-3 shows surveyed distributors' strongest drivers for selling high-

efficiency equipment, while Figure 6-4 displays their response when subsequently asked if there were any other drivers they could think of.

Figure 6-3. Strongest drivers to selling high-efficiency equipment according to distributors

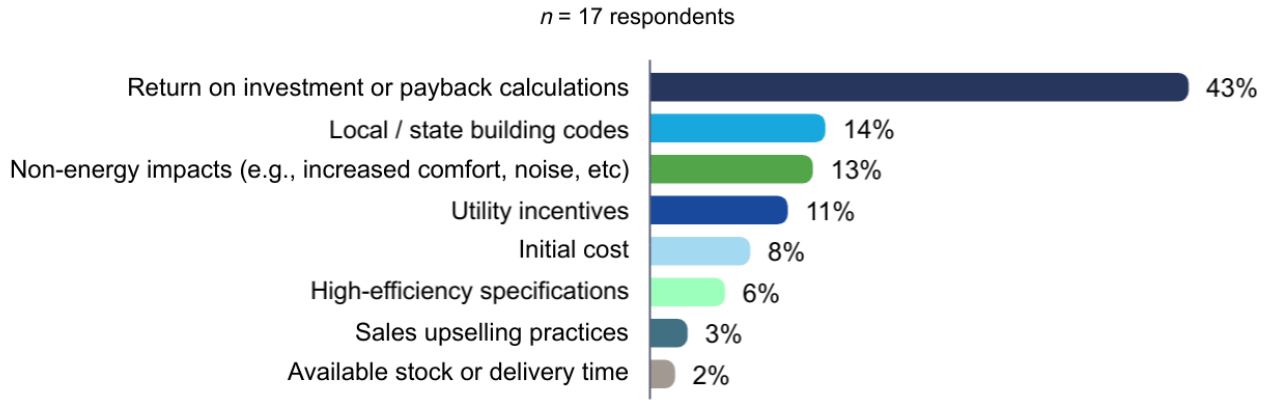
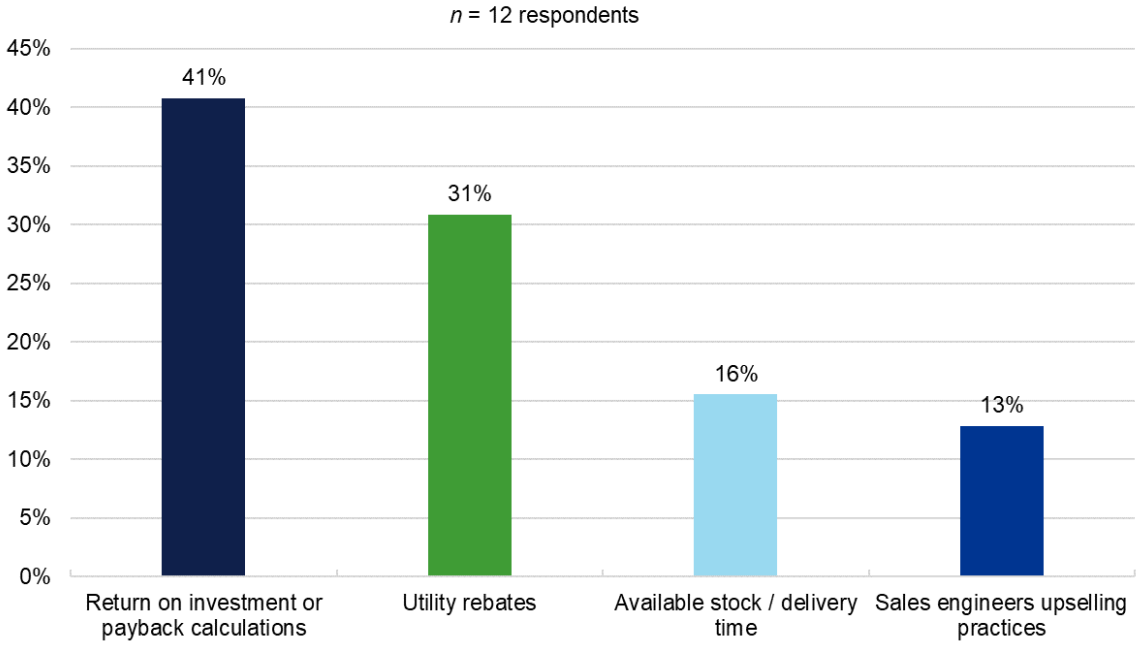


Figure 6-4. Other drivers to selling high-efficiency equipment according to distributors



Contractors were also asked the same questions, and from their perspective, 'reduced operations and maintenance (O&M) costs' was the strongest driver to selling HE HVAC equipment. Fewer respondents (14%) cited utility incentives as the primary driver, although approximately half of the contractors did mention utility incentives (56%), return on investment (43%), or manufacturer rebates / promotions (41%) when asked about any other drivers. These evaluation findings further suggest that the overall life cycle costs are the strongest motivating factors when selling high-efficiency equipment, and utility incentives are only a primary driver for a relatively small portion of market actors.

Although the program was designed to increase the stock of high-efficiency units, only 3% of contractors cited 'available stock or delivery time' as the primary motivating factor (see footnote 52). Figure 6-5 shows surveyed contractors' strongest drivers for selling high-efficiency equipment, while Figure 6-6 displays their response when subsequently asked if there were any other drivers they could think of.

Figure 6-5. Strongest drivers to selling high-efficiency equipment according to contractors[52]

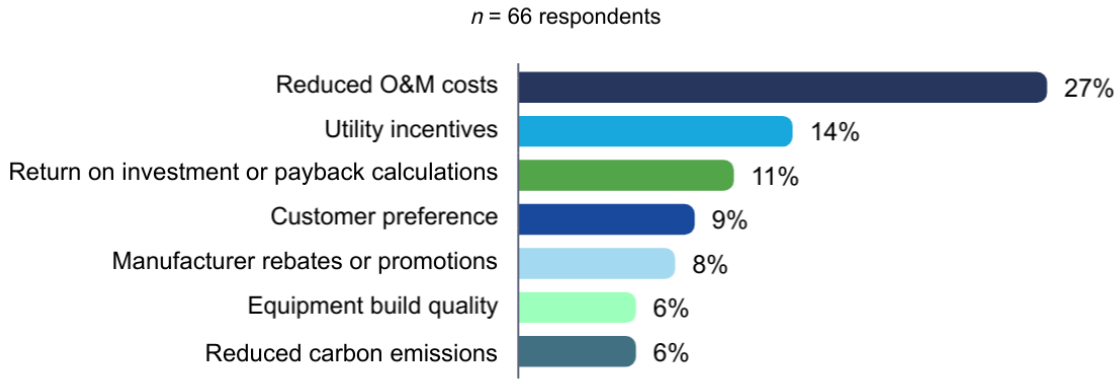
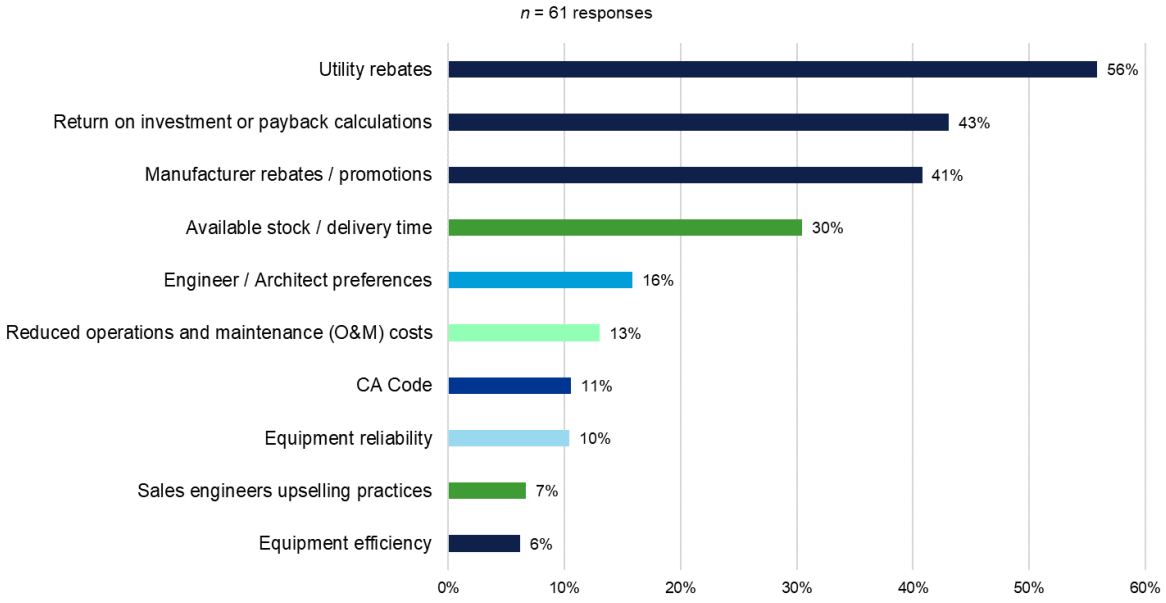


Figure 6-6. Other drivers to selling high-efficiency equipment according to contractors[53]



Participating HVAC contractors were also asked if they had purchased any additional program-qualified equipment from any distributors outside of the Comfortably California program in PY 2021. Over three quarters (76%) of respondents reported purchasing equipment from other distributors, with only 23% purchasing equipment solely through the Comfortably California program. Respondents who purchased equipment from other distributors outside the program were also asked what percent

[52] 'Other' survey responses included tax credits (4%), engineer / architect preferences (4%), initial cost (3%), available stock / delivery time (3%), non-energy impacts (i.e., increased comfort) (2%), sales engineers upselling practices (2%), and local/state building code (2%).

[53] The total percent exceeds 100% because respondents were allowed to cite multiple drivers.

of this high-efficiency HVAC equipment was purchased from participating distributors in PY 2021 and what percent were purchased from other distributors. Survey results revealed that, on average, 54% of their program-qualified equipment was purchased through the Comfortably California, with the remaining 46% being purchased from other distributors. The measure level results associated with these survey responses are included in Appendix E (Table 8-3).

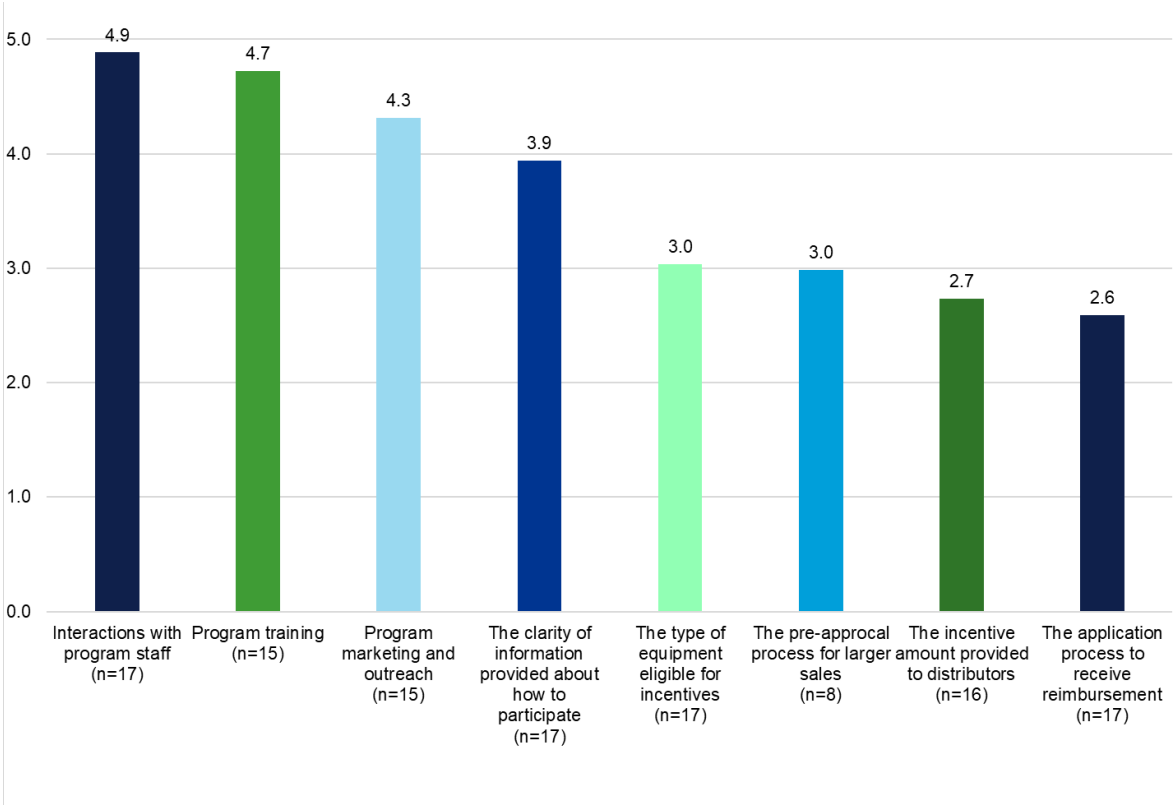
6.5 Program satisfaction

Distributors and contractors who were aware of their participation in the program were asked to rate various aspects of the program using a five-point Likert scale, where 5 means “very satisfied” and 1 means “very dissatisfied.” Eight distinct aspects were covered in the distributor interviews and six in the contractor interviews with the intention of capturing key elements of participant program engagement. The findings are detailed below.

6.5.1 Distributor satisfaction

Figure 6-7 shows distributors’ satisfaction with various aspects of the program. There was a wide range of satisfaction scores associated with different elements of the program experience, ranging from 2.6 to 4.9. Respondents were most satisfied with interactions with program staff (4.9), program training (4.7), and program marketing and outreach (4.3). Among the program elements that received moderate satisfaction scores was the clarity of information provided about how to participate, receiving a score of 3.9. The type of equipment eligible for incentives and the pre-approval process for larger sales both received moderate satisfaction scores of three. The incentive amount and the application process to receive reimbursement received the lowest satisfaction ratings of 2.7 and 2.6, respectively.

Figure 6-7. Distributor satisfaction



The ten respondents who responded with ratings of less than three for one of the eight distinct program aspects were subsequently asked why they were dissatisfied. Of the ten respondents, seven stated the incentive levels are insufficient to

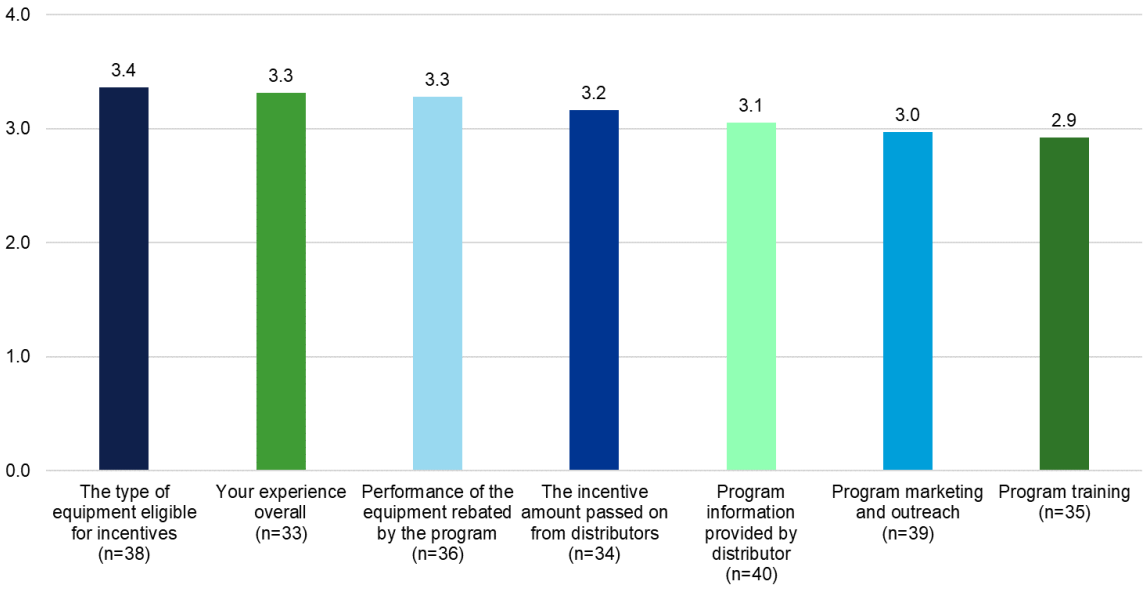
impact sales. Six of the ten respondents stated that the requirement of end user information makes the application too burdensome. A smaller portion (two of ten) of respondents commented on program requirements being hard to understand. Those dissatisfied with program elements said the following:

- *"The furnace incentive level is too low to make a difference."*
- *"The incentive too low. There is no incentive for VRF [variable refrigerant flow] which would be nice."*
- *"End user and contractor information should only be required for projects that are audited."*
- *"It's a distributor rebate which is not going to contractor, so it's hard to get information from contractors."*
- *"Additional end user information requirement is difficult to obtain because we don't talk to end users, we are selling through installation contractors."*
- *"The information provided in the overview of program showed a certain amount of money for each boiler by tier level, it was too complex and hard to understand. They should have just one level."*

6.5.2 Contractor satisfaction

Figure 6-8 presents contractor-reported satisfaction with the various aspects of the program covered in this evaluation. Only contractors who reported that they were aware of the program were asked to rate their satisfaction with the program. Compared to distributors, contractor satisfaction ratings across the seven program elements had much less variation, ranging from 2.9 to 3.4. Overall program satisfaction was moderate as well, receiving an average satisfaction rating of 3.3. Contractors were most satisfied with the type of equipment eligible for incentives and the performance of equipment, with satisfaction ratings of 3.4 and 3.3, respectively. Contractors were least satisfied with program marketing and outreach (3.0) and program training (2.9).

Figure 6-8. Contractor satisfaction



Twelve of 42 contractors responded with scores less than three for at least one element of the program which indicates dissatisfaction. These twelve respondents, as well as any respondent that provided a rating of three, were asked to provide context on their dissatisfaction or neutral rating. These respondents were largely not satisfied with four elements of the program:

- *Not being aware of the program or having to dig for the information (n=7)*

- *Training (n=3)*
- *Receiving limited information from distributors (n=3)*
- *Low incentives (n=3)*

The program satisfaction findings provide additional context for the low program net-to-gross ratio discussed above in Section 5.3, particularly the relatively low satisfaction rating (2.7) for the incentive amounts and the high frequency (n=6) of distributor respondents stating they were dissatisfied with the program due to low incentive amounts.

Three of the four aspects of the program with which contractors were not satisfied pertained to a lack of information throughout the program cycle. This shows there is an opportunity to increase engagement with contractors to further educate them on program resources. Contractors that referenced a lack of information about certain elements said the following:

- *"I feel I am getting information second hand, not directly from the source. I would prefer to get videos about the program, but instead I get pamphlets. Maybe the videos are out there but I haven't seen them.*
- *"I wasn't really aware of marketing or training or information."*
- *"There is no training, we have to do the leg work/research."*
- *"We only heard through vendors about it. They need to do a presentation and walk us through how it can save customers money. Maybe they should have the info online."*
- *"We received very little literature on the program, we had to bug them to get it."*
- *"To find out about the program, I had to dig for it. I was asking what rebates were out there from our supplier, because of the tight economy. They mentioned Comfortably California."*

6.6 Program process

This evaluation included an array of questions to HVAC distributors and contractors about various program processes. Questions surrounded barriers to sales, obstacles to participation, incentives, confusion about multiple programs, rebates from other programs, differences in programs between IOUs and statewide implementation, recommended program changes, developments, program aspects that worked well, and general program improvements. These survey findings are summarized below.

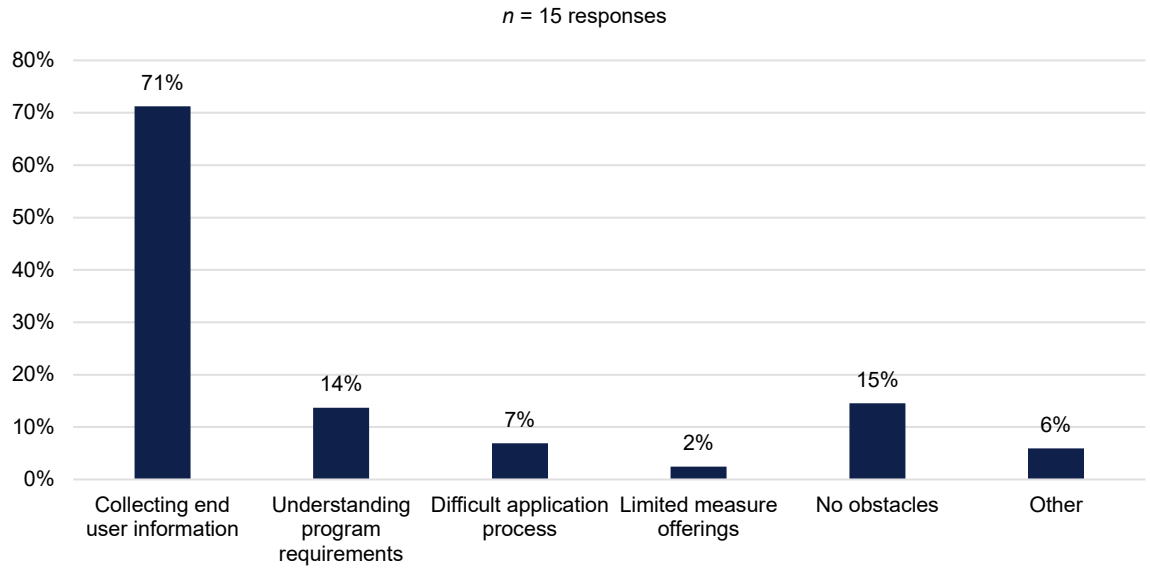
6.6.1 Sales barriers and participation obstacles

HVAC distributors and contractors were asked what the largest barriers were when it comes to selling HE equipment. The majority (94%) of distributors indicated that the increased cost of HE models was the biggest barrier to selling that equipment, while the remaining 6% of distributors indicated that limited options were the largest barrier. The majority (88%) of contractors also indicated that the increased cost of HE models was the primary barrier to selling HE equipment.[54]

Distributors and contractors were also asked about various obstacles they faced, if any, when participating in the program. Only 15% of respondents reported not experiencing any obstacles when participating in the program (Figure 6-9). Over two-thirds of distributors (71%) indicated that collecting end user data was the largest obstacle faced, with the remaining respondents citing obstacles such as understanding program requirements (14%), difficulties with the application process (7%), and overall limitations due to measure offerings (2%).

[54] The remaining contractor respondents cited increased delivery time (5%), practicality (e.g., additional weight on roof that the building isn't rated for) (5%), and limited equipment options (2%) as the largest barriers when selling HE equipment.

Figure 6-9. Distributor reported obstacles to program participation[55]



Most of the contractors indicated that there were no obstacles (52%) for program participation. However, application length and program information (30%) appeared to be obstacles to program participation. A smaller portion of responses indicated that timing of the reimbursement (8%), lack of training (4%) and customer preference (2%) were obstacles.

HVAC distributors were also asked about potential reasons why they would be hesitant to recommend HE equipment to their customers. Half (50%) of the responses indicated that they always recommend high-efficiency equipment, while the remaining responses cited hesitation due to upfront cost (43%), not meeting project requirements (17%), and/or issues with equipment availability (9%). The total percent of responses to this question exceeds 100% because respondents were allowed to cite multiple factors.

6.6.2 Incentives

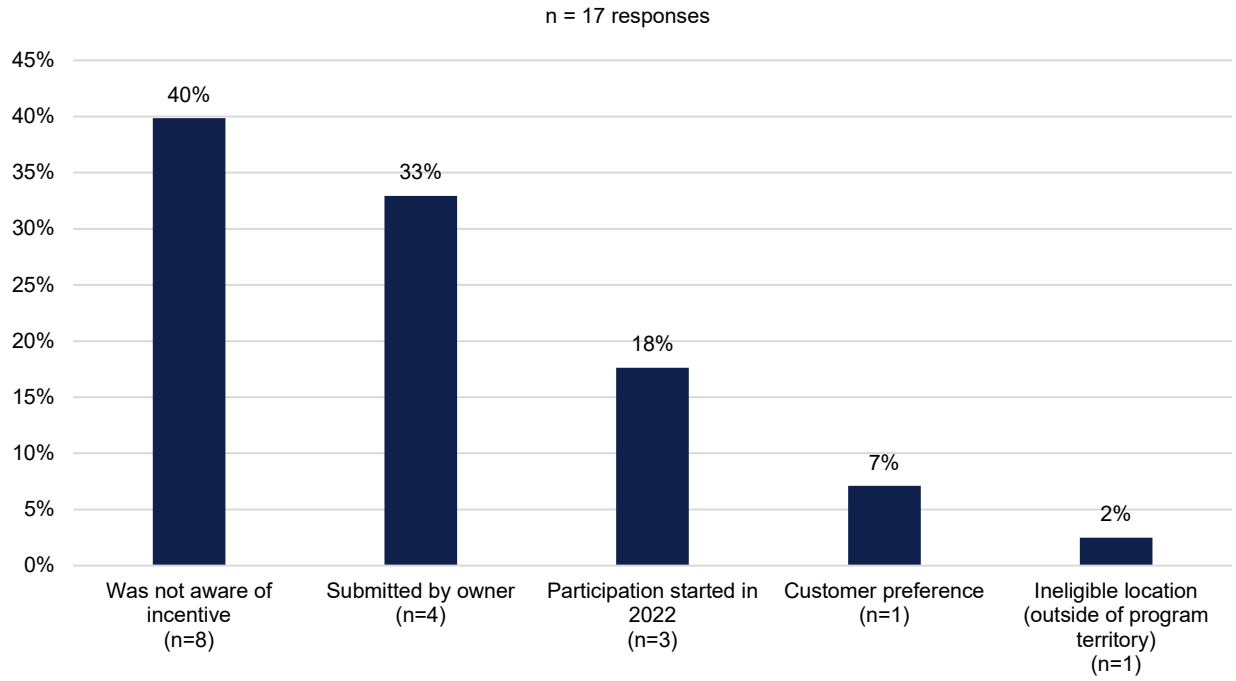
Participating distributors were asked what percentage of the program incentives are passed through to the buyer.[56] On average, distributors passed on approximately half (48%) of the incentives to the buyers of the equipment, with the remaining 52% being retained by the distributors and not passed on to the buyer.

Contractors were asked why they did not receive an incentive for all of the HE unit sales (Figure 6-10). Most contractors (40%) indicated that they were unaware of the incentives, and fewer indicated that, due to owner submission (33%) or late participation (18%), they had not received incentives. A smaller percentage of responses indicated that customer preference (7%) or location eligibility (2%) was a factor.

[55] The total percent exceeds 100% because respondents were allowed to cite multiple factors. 'Other' responses included higher sales costs and obstacles with the program being limited to specific zip codes.

[56] Most of the buyers who purchased equipment from participating distributors were HVAC contractors

Figure 6-10. Reasons why incentives were not received for all high efficiency equipment



DNV reviewed the data for incremental measure costs and incentive amounts in the CEDARS tracking dataset. In our review, we found the overall average incentive paid to PY 2021 Comfortably CA program participants (distributors) was only 15% of the overall incremental measure costs across the program (Table 6-1). Incentive levels as a percent of incremental costs were particularly low for commercial and multifamily space heating boilers, which were between 4% and 5%. DNV also reviewed the underlying measure package documentation from which the incremental measure cost values were sourced.[57] This exercise revealed many of the incremental measure costs for PY 2021 claims were sourced from reports or studies published in 2017 or prior. According to the U.S. Bureau of Labor Statistics, the Consumer Price Index (CPI) increased by 8% between January 2017 and January 2021 and increased by 23% between 2017 and 2023. [58] Given increasing equipment costs, outdated sources for incremental and measure costs, and the poor satisfaction scores for incentive amounts among participating distributors and contractors (see Section 6.5.1), DNV recommends that the program reassess the incentive amounts paid to distributors and update incremental measure costs.

Table 6-1. Average incentive paid to distributors

Measure package source description	Measure characterization	Count of claims	Incentive % of Measure Cost**	Measure cost source year
SWHC001-01	Gravity Wall Furnace, Residential	43	97%	2014
SWHC001-02	Wall Furnace, Residential	979	49%	2020
SWHC004-01	Space Heating Boiler, Commercial & Multifamily	179	5%	2012*
SWHC004-02	Space Heating Boiler, Commercial & Multifamily	137	4%	2020
SWHC013-01	Unitary Air-Cooled Air Conditioner, Over 65kBtu/hr, Commercial	2,410	13%	2017*

[57] The measure cost summaries and sources are documented in the eTRM measure catalog under the specific measure package pdf summaries. California Technical Forum. California Electronic Technical Reference Manual. Accessed February 2023 https://www.caetrm.com

[58] U.S. Bureau of Labor Statistics. Inflation Calculator. https://www.bls.gov/data/inflation_calculator.htm

Measure package source description	Measure characterization	Count of claims	Incentive % of Measure Cost**	Measure cost source year
SWHC014-01	Unitary Air-Cooled Air Conditioner or Heat Pump, Under 65kBtu/hr, Commercial	7,172	20%	2017*
SWHC031-01	Furnace, Residential	12,568	13%	2017
SWHC049-01	SEER Rated AC and HP HVAC Equipment, Residential	3,397	32%	2017*
Grand Total		**26,885**	**15%**	

**Measure package summary states values were updated or interpolated to 2020, but DNV saw no evidence of measure costs increase between older and more recent measure costs.*

***Incentive % of Measure Cost value is determined by dividing the sum of values found in the "Incentive to Others" by the sum of the values found in "Gross Measure Cost" as found in the CEDARS dataset.*

6.6.3 Program confusion

One of the key evaluation objections (presented in Section 2.2) was to investigate if there was any market confusion with distributors enrolled in multiple programs or similar equipment offered from different programs. HVAC distributors were first asked if they were able to claim incentives for the same energy-efficient equipment through other programs (e.g., BayREN's TECH Clean CA Initiative) in addition to the Comfortably California program. Approximately two thirds (65%) of the respondents indicated that they were not able to claim incentives from more than one program, while 35% indicated that they were able to claim incentives from multiple programs for the same equipment.

If HVAC distributors respondents indicated that they had claimed incentives for more than one program, they were then asked if there had been any confusion around equipment being eligible for an incentive through one program but not another. All (100%) of the respondents stated that there was no confusion. Contractors were also asked if there was confusion around equipment being eligible through one program but not another. A large majority of respondents (68%) indicated that there was no confusion. The remainder indicated that there was confusion (28%) with cross-program equipment eligibility, with a small minority (4%) of respondents that indicated there was only 'some' confusion.

6.6.4 Differences between IOU and statewide implementation

Another key research objective for this evaluation was to assess whether it is more efficient to run statewide programs through third-party implementers as opposed to running them through PAs (see Section 6.1 for the IOUs' and implementer's perspective on this topic). Distributors and contractors were asked about program differences and changes since it moved from programs run individually through IOUs to a statewide implementation design. Roughly 13% of distributors indicated that they did not notice any changes since the program moved to SW implementation. However, nearly 94% of distributors indicated that, overall, the program was more streamlined. Alternatively, roughly half (45%) of the distributors indicated that the program's application process was more intensive.[59] These findings suggest that while, overall, it does appear to be more efficient and streamlined to run statewide programs through third-party implementers instead of individually through IOUs, distributors believe that some additional effort is needed to complete the application process.

The majority (95%) of contractors stated that they did not notice any process-related differences since the Comfortably California program moved to statewide implementation, with only 5% indicating that, overall, the program was not as complicated. This can in part be explained due to the low contractor awareness discussed in Section 6.3.

6.6.5 Developments

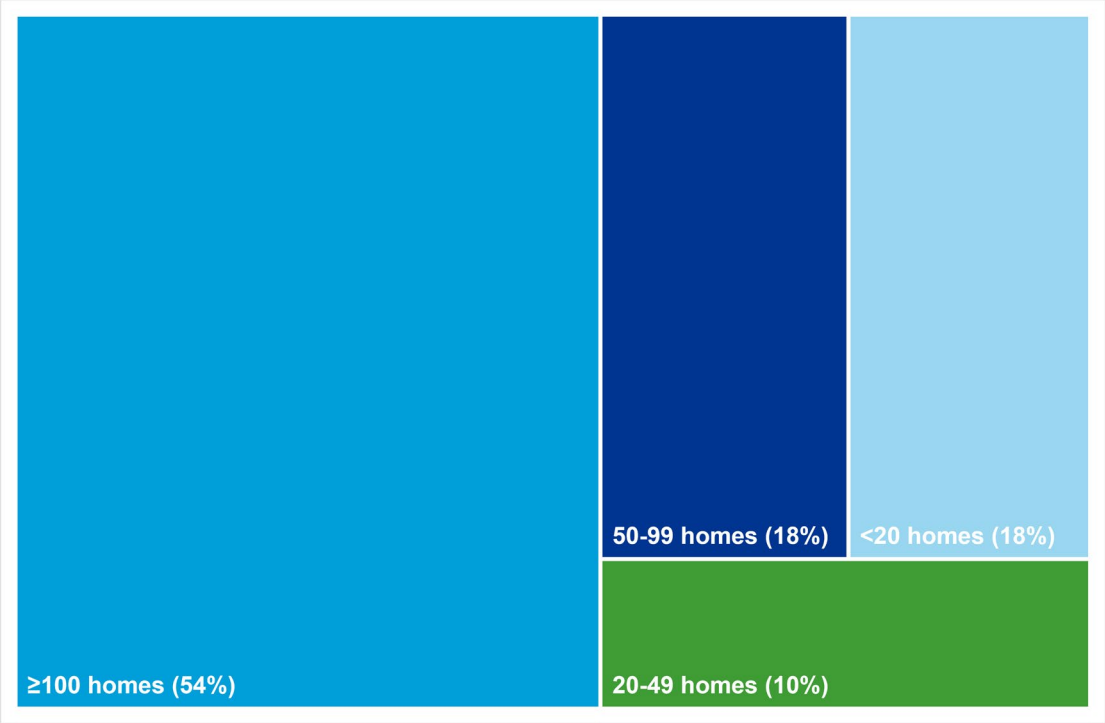
Contractors were also asked if they were subcontracted by a developer for any of the new construction or major renovation projects. Roughly half (49%) of responses indicated that the contractors were subcontracted 'most of the time.' Over a

[59] The total percent exceeds 100% because respondents were allowed to provide multiple responses to this question.

quarter of the contractors said they were subcontracted either ‘some of the time’ (20%) or ‘all the time.’ Only 13% indicated they were ‘never’ subcontracted by developers.

If the contractors did report being subcontracted by developers, they were asked about the size of the developments. More than half (54%) of the contractors indicated that the average size of the developments was more than 100 homes, while 46% indicated that the developments were fewer than 100 homes (Figure 6-11).

Figure 6-11. Average size of developments



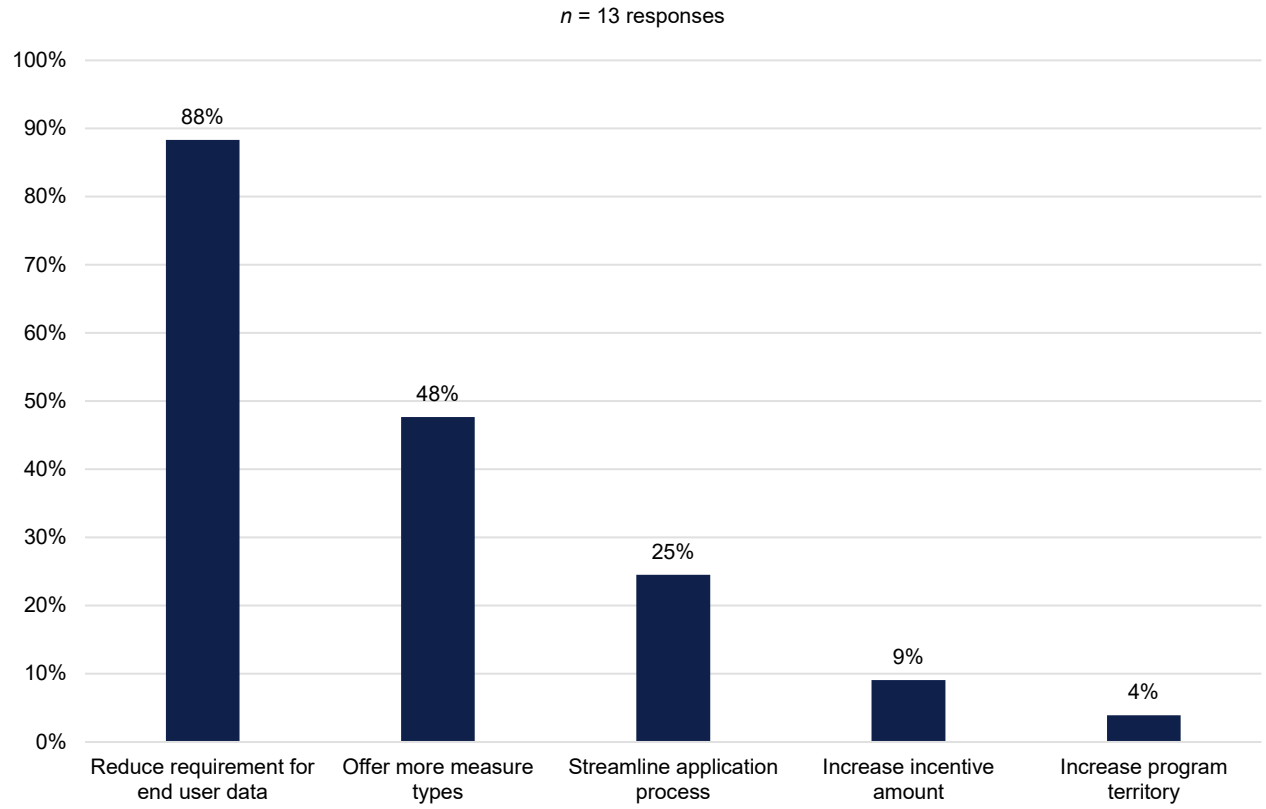
6.6.6 Recommendations for program improvement

Distributors and contractors were asked an open-ended question about various program or process-related changes that they would recommend. These questions addressed another key evaluation objective related to opportunities for program improvement (see Section 2.2 for evaluation objectives). Figure 6-12 shows how the majority (88%) of distributors indicated that a reduction in program requirements for end use data would be beneficial,[60] while other programmatic updates such as offering more measure types (48%) and streamlining the application process (25%) were also commonly reported. Fewer distributors mentioned suggestions about increasing incentive amounts[61] (9%) and expanding the program’s territory (4%).

[60] While distributors would prefer not to have to collect end user data as part of the program requirements, we note that this information is critical for internal verification purposes and for evaluation purposes.

[61] While only 9% of distributors mentioned increasing incentive amounts when responding to this open-ended question, distributors were generally dissatisfied on average with incentive amounts (see Section 6.5.1)

Figure 6-12. Program changes recommended by distributors[62]

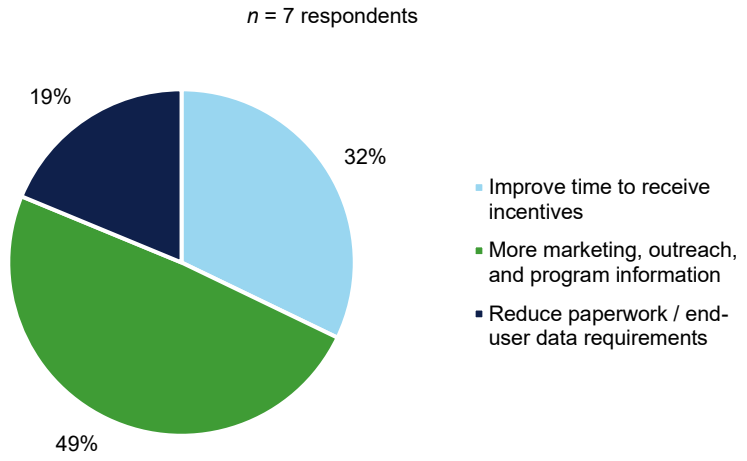


Approximately half of the contractor responses suggested that the Comfortably California program streamline the necessary paperwork (47%). The remaining contractor responses recommended program training (30%), larger incentives (23%), and improvements to marketing outreach (17%). Lastly, a small portion (6%) of respondents also recommended offering a larger variety of measures.

Distributors and contractors were asked a final open-ended question about various general improvements that the CPUC could make regarding program delivery. Most distributors (70%) said they did not have any suggestions, although almost a third (30%) indicated that streamlining the application process would be a recommended improvement. The remaining respondents (10%) suggested trying to reduce the time it takes to receive incentives. This question allowed for multiple responses from each respondent, so the total percentage exceeds 100%. When contractors were asked the same question, about half (49%) indicated more marketing, outreach, and program information would be beneficial to the program (Figure 6-13). Approximately a third (32%) of contractors indicated that improved time to receive incentives would improve the program, with the remaining 19% suggesting that a reduction in paperwork and end user requirements would improve the program.

[62] The total percent exceeds 100% because respondents were allowed to provide multiple recommendations.

Figure 6-13. Contractor's suggestions for general program improvements



6.6.7 Other findings

HVAC distributors were asked about the various components of the program that were working well. A large majority of the responses (38%) indicated that the online portal and application process were working well, in addition to communication with program staff (29%). Generally, the incentives themselves (19%) and the timeline of rebates (8%) were well-received. The total percentage exceeds 100% because respondents were allowed to cite multiple factors.

6.7 Participant characterization

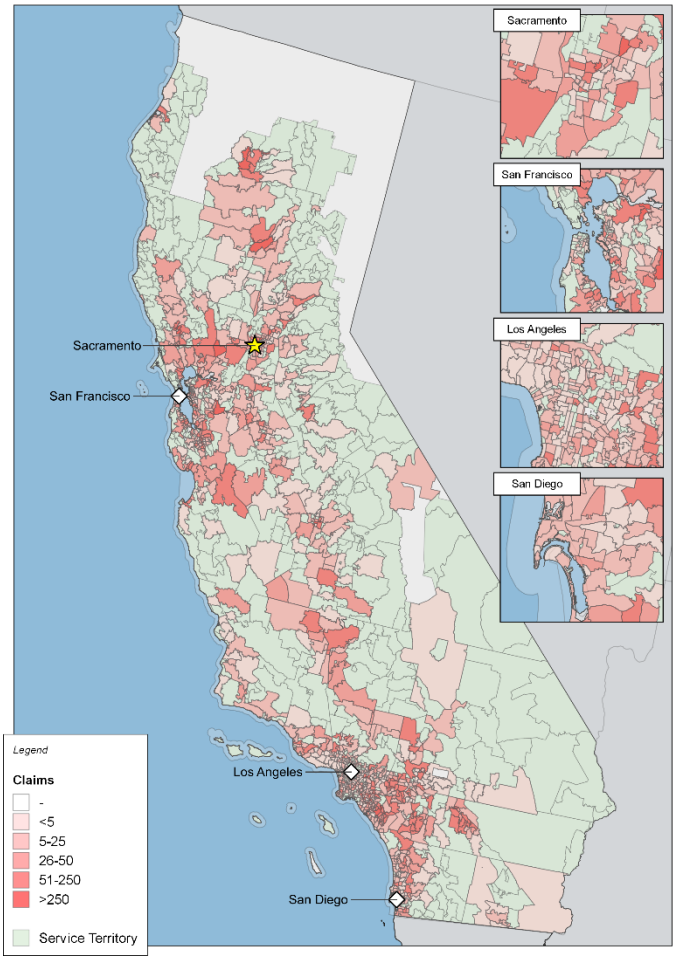
To better understand the program from a holistic perspective, DNV conducted an analysis of the geographic and demographic makeup of participants and the characteristics of participating businesses (firmographics). Given the program's lack of specific end user customer data as detailed in Section 3.6, characterization efforts were limited to the most granular geographic data available, ZIP Code Tabulation Areas (ZCTA), which we refer to here as zip codes for the sake of simplicity. As such, the evaluation team was unable to conduct a detailed participant analysis into customer characteristics such as specific geographic region, renter/owner, housing/business type, annual energy usage, and primary language spoken. Likewise, without end user addresses showing where installations occurred, DNV could not conduct a more rigorous geographic analysis of DAC and non-DAC participation.

6.7.1 Overall program participation

Figure 6-14 shows overall program participation by individual claims for PY 2021. Aligning largely with population distribution, a majority of program participation was concentrated in the urban areas of Southern California and the Bay Area while the largest number of claims occurred in zip codes 95652 (McClellan), 95688 (Vacaville), 93703 (Fresno), 92618 (Irvine), and 94520 (Concord), together comprising approximately 13% of total participation.

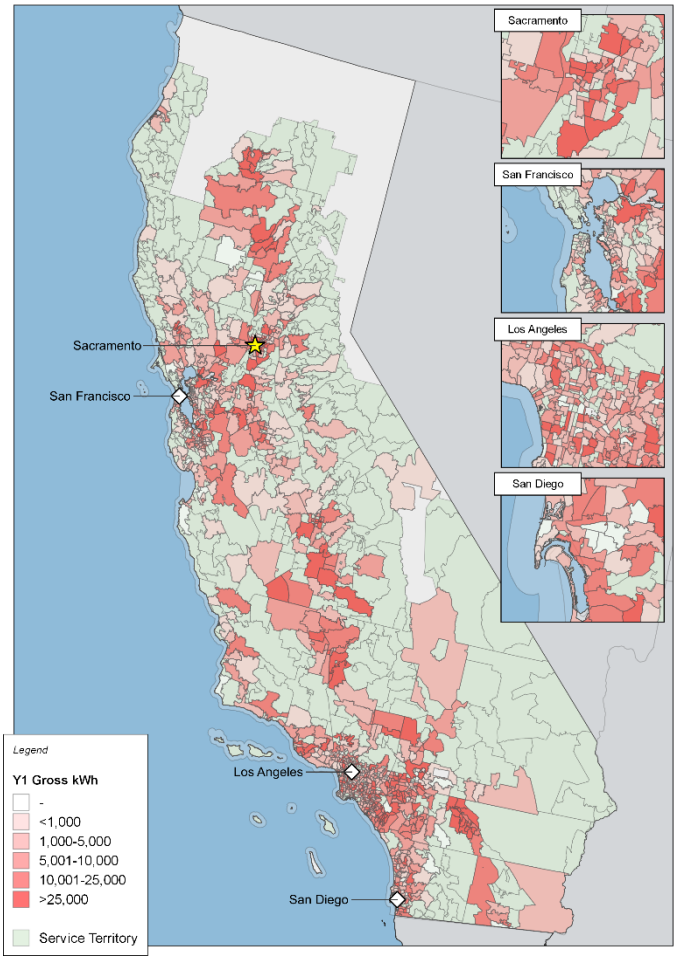
For PY 2021, overall program claims were 26,885. There were 16,987 claims associated with residential end users (63% of claims and 26% of energy savings), with 16,806 single family and 181 multifamily homes, while the remaining 9,898 (37% of claims and 74% of energy savings) were associated with commercial end users. Graduated shades of red are used to differentiate the density of claims ranging from zip codes with less than five claims to those containing greater than 250 claims, with the darker shades indicating a higher total concentration. As with all maps in this report, the combined statewide territory for the program includes the electric service territories for PG&E, SCE, and SDG&E plus the natural gas service territories for PG&E, SDG&E, and SCG (in green) while non-participating service territories are in white.

Figure 6-14. Program claims by zip code



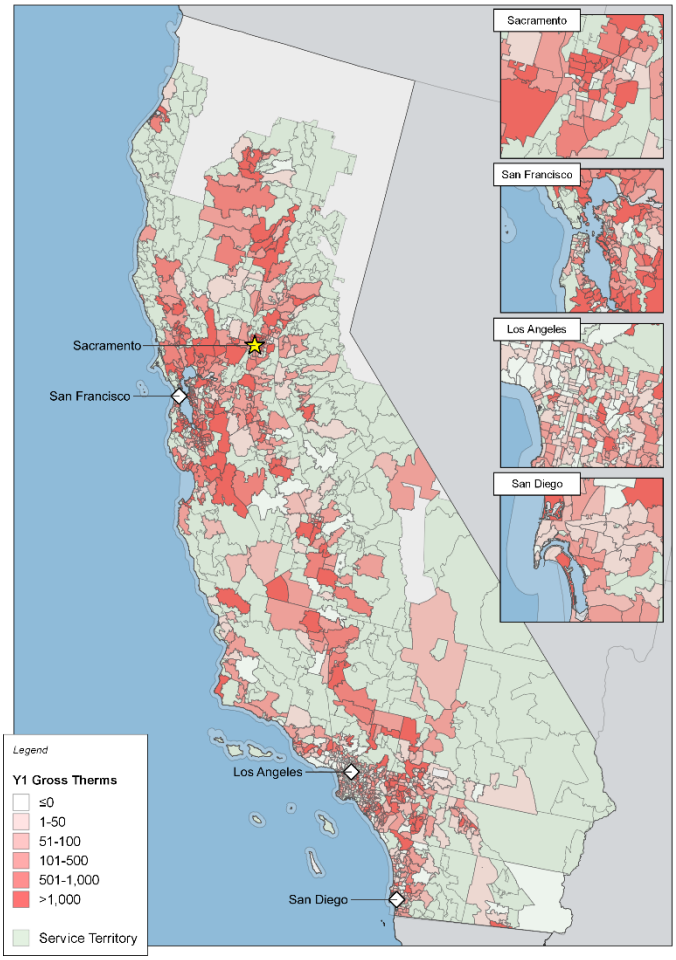
Total gross kWh savings by zip code is shown in Figure 6-15. Graduated shades of red are used to differentiate the density of program electricity savings ranging from zip codes with less than 1,000 in reported gross kWh savings to those containing greater than 25,000 reported gross kWh savings, with the darker shades indicating a higher total concentration of savings.

Figure 6-15. Program gross kWh savings by zip code



Total gross therms savings by zip code is shown in Figure 6-16. Graduated shades of red are used to differentiate the density of program gas savings ranging from zip codes with less than 50 in reported gross therm savings to those containing greater than 1,000 reported gross therms, with the darker shades indicating a higher total concentration of savings. While the category in white is used in other maps to indicate no associated savings, note that zip codes with negative therms savings are also included in the category, which represents 0 or less than 0 reported gross therm savings.

Figure 6-16. Program gross therms savings by zip code



6.7.2 Disadvantaged communities

As referenced in the CPUC's Decision 18-05-041 (Section 2.5.1),[63] the California Environmental Protection Agency (CalEPA) identifies disadvantaged communities in the state based on the following parameters:

1. Areas that are disproportionally affected by environmental pollution and other hazards that can lead to negative public health effects, exposure, or environmental degradation
2. Areas with concentrations of people that are of low income, high unemployment, low levels of homeownership, high rent burden, sensitive populations, or low levels of educational attainment

CalEPA defines DACs as census tracts scoring in the top 25 percent statewide on a set of 20 different indicators within their CalEnviroScreen tool's *Pollution Burden*, such as exposure to high levels of emissions, groundwater threats, traffic density, solid waste sites, and *Population Characteristic*, such as higher vulnerability to asthma and cardiovascular disease, low educational attainment, linguistic isolation, and unemployment/poverty.[64] In addition to tracts identified via the above methodology, census tracts scoring in the top five percent of CalEnviroScreen's Pollution Burden indicator but not having an

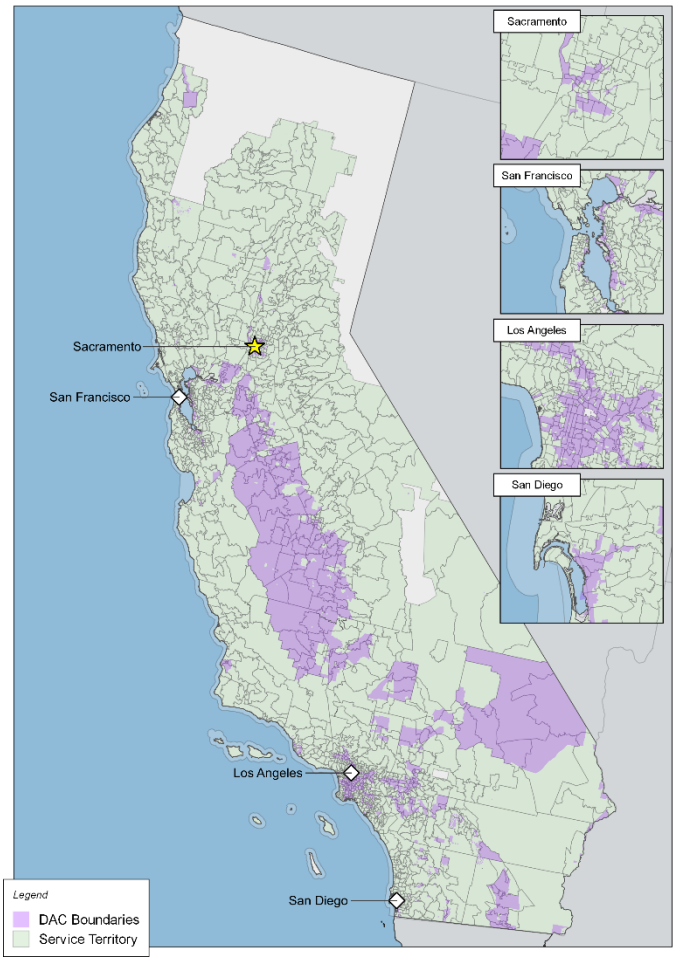
[63] California Public Utilities Commission. Decision 18-05-041. Decision Addressing Energy Efficiency Business Plans. June 5, 2018. pp. 39-40 https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M215/K706/215706139.PDF

[64] California Environmental Protection Agency (CalEPA). SB 535 Disadvantaged Communities. https://oehha.ca.gov/calenviroscreen/sb535 -

overall score in the top 25 percent statewide due to unreliable socioeconomic health data automatically fall within CalEPA's DAC definition.

In Figure 6-17 below, DAC census tract boundaries as identified by CalEnviroScreen are shown in purple overlaid on the combined statewide territory for the program in green.

Figure 6-17. DAC boundaries



Given the lack of end user street addresses, DAC participation in the program is impossible to classify with precise accuracy. With end user site data, individual participant addresses can be converted via geocoding into a latitude and longitude coordinate (or "point-level") and can be plotted accurately, falling either within or outside of designated DAC census tracts defined by CalEPA. As only accurate zip codes were included for the end user population, DNV's efforts to characterize DAC participation were significantly limited.

For demonstrative purposes, DNV utilized a U.S. Postal Service (USPS) zip code crosswalk system developed by the U.S. Department of Housing & Urban Development's Office of Policy Development & Research (HUD PD&R) to estimate potential point-level DAC participation for the program based on installation zip code. [65] DNV split participating zip codes into another geography type (census tracts as defined by the U.S. Census Bureau, which were used because this is how DAC boundaries are collated by CalEPA) and cross-referenced these against "ZIP-TRACT" crosswalk data from HUD P&R to

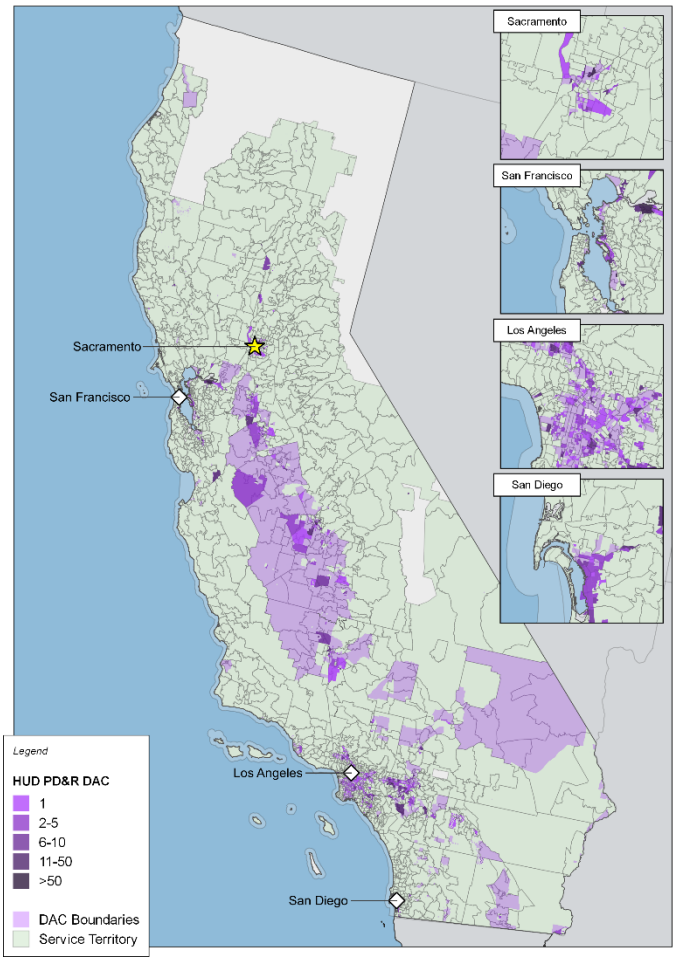
[65] HUD's Office of Policy Development and Research. HUD USPS ZIP Code Crosswalk Files. August 2022. https://www.huduser.gov/portal/datasets/usps_crosswalk.html

approximate address type ratios at the 'new' geography level.[66] Figure 6-18 shows potential DAC program participation with an estimated 13,259 (49%) of claims within DAC boundaries using this approximation methodology in shades of dark purple overlying actual DAC census tracts.

To illustrate this estimation methodology, zip code 95670 (within Rancho Cordova) is split by six different DAC-designated census tracts – 06067008907, 06067008905, 06067009008, 06067008910, 06067008912, and 06067008911. The ratio of residential addresses for these DAC "ZIP-TRACT" records within the overlying zip code is 41% while commercial addresses comprise of 22%. Cumulatively, this comes out to an estimated 63% of residential and commercial addresses contained within zip code 95670 overlapping these six DAC-designated census tracts. For PY 2021, zip code 96570 had 15 total claims. Therefore, extrapolating this using the "ZIP-TRACT" crosswalk would provide an estimated nine claims, which is the closest integer to ≤63% of 15, contained within DAC-designated census tracts.

Ultimately, without end user street addresses, precise calculations are not feasible, but HUD PD&R's crosswalk system provides an estimation tool to approximate program participation among DAC populations for visualization purposes.

Figure 6-18. HUD PD&R estimated DAC participation

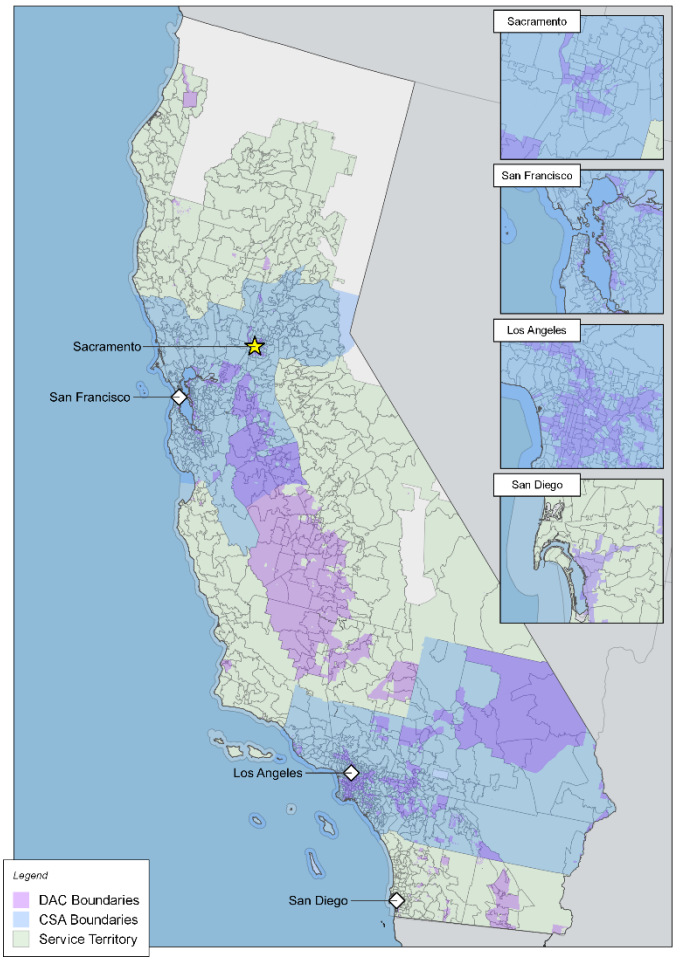


[66] Wilson, R. and Din, A. *Understanding and Enhancing the U.S. Department of Housing and Urban Development's ZIP Code Crosswalk Files.* Cityscape: A Journal of Policy Development and Research (Vol. 20, Num. 2). https://www.huduser.gov/portal/periodicals/cityscpe/vol20num2/ch16.pdf

6.7.3 Hard-to-reach customers

Commercial end users are defined as hard-to-reach (HTR) if they meet geographic prerequisites plus at least one of the following criteria: primary language, business size, or leased or rented facility. [67] Residential end users are defined as HTR if they meet the same geographic requirement plus at least one of the following criteria: primary language, income, and housing type (multifamily and mobile home tenants). If the end user does not meet the geographic requirements, then they must meet all three of the additional criteria to be considered HTR. Figure 6-19 shows the Combined Statistical Areas (CSA) for San Francisco, Los Angeles, and Sacramento in blue over CalEPA's DAC boundaries in purple. Program participants would meet the geographic definition of hard-to-reach if they fall outside of the SF/LA/SAC CSAs or inside the DAC boundaries. As described above, at least one additional demographic or firmographic requirement must be met to qualify as HTR.

Figure 6-19. Boundaries for meeting HTR geographic requirement



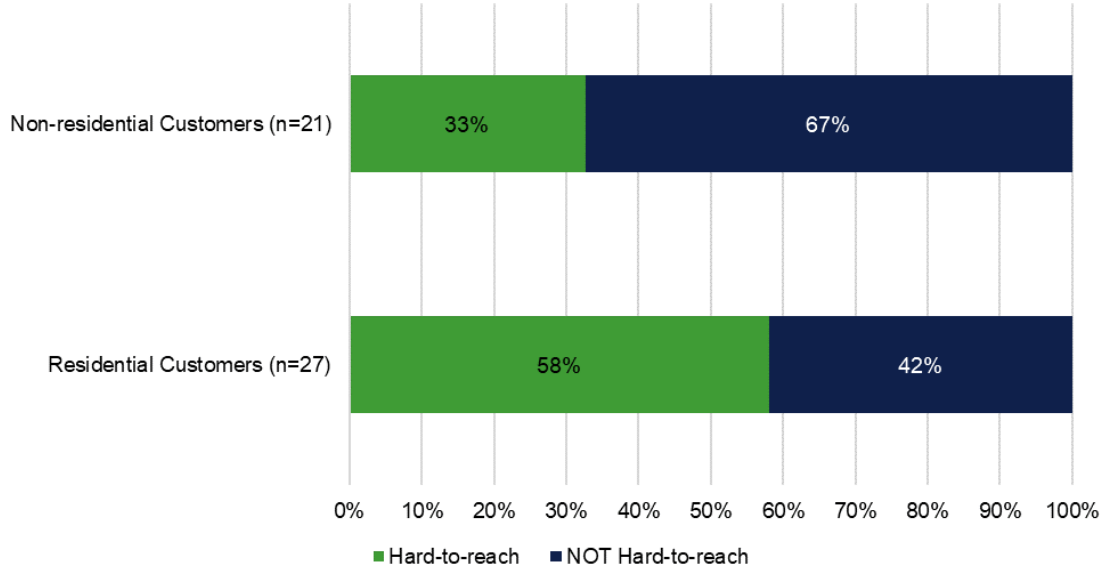
This evaluation estimated the percent of equipment sold through the program in HTR communities indirectly through contractor survey responses. We were unable to directly evaluate the percentage of HTR customers via end user surveys due to the lack of end user data as discussed in Section 3.6. Contractors were first asked if any of the HVAC equipment sold through the program was installed in residential or non-residential HTR communities. Just over half (51%) of the contractors

[67] HTR end users meet the geographic prerequisite if they a) are located outside of the Combined Statistical Areas for San Francisco, Los Angeles, and Sacramento or b) are located inside a disadvantaged community, as defined by CalEPA (https://oehha.ca.gov/calenviroscreen/sb535). Specific details can be found here: Statewide Deemed Workpaper Rulebook.

who provided valid responses (n=64) reported selling to residential HTR customers, with slightly fewer (41%) stating that they sell to non-residential HTR customers.

The contractors that reported selling program equipment to HTR customers (residential or non-residential) were also asked to estimate what percent of their customers were from HTR communities. Figure 6-20 shows that – among the contractors who sell to HTR customers – over half (58%) of residential customers and a third (33%) of non-residential would be categorized as HTR.

Figure 6-20. Percent of customers from HTR communities



7 CONCLUSIONS AND RECOMMENDATIONS

Table 7-1. Key findings and recommendations

Key findings	Implications and recommendations
1. The program achieved an NTGR of 4%, meaning the program had very little influence on the sale of high-efficiency HVAC equipment among distributors and contractors. Key drivers of the low NTGR include low incentive amounts relative to the cost of the equipment and low levels of program awareness among contractors who are key market actors in terms of being in a position to recommend program-incentivized equipment to end users.	The PAs should consider changing the current Comfortably California HVAC midstream program design. This could be done as part of the new process directed in the Bus Plan decision to assess the portfolio composition of statewide programs.
2. The program in PY 2021 was especially challenging to evaluate. While implementers did not record end user contact information, they also did not collect addresses where program installations occurred. The evaluation team could only verify equipment sales and installation of equipment indirectly through phone surveys with contractors.	Going forward, always collect installation addresses and end user contact information to facilitate internal program verification and evaluation verification efforts.
3. The program implementers failed to follow their own quality assurance plan, which stipulated that a minimum of 10% of sites - where program-incentivized equipment was installed - must be verified. The quality assurance plan also stated that end user email addresses and phone numbers needed to be collected. The distributor sales reporting sheet listed end user address and contact information as optional, which was in direct conflict with the quality assurance plan.	Inspect a minimum of 10% of sites using a combination of in-person and virtual visits across a representative sample of sites.

Key findings	Implications and recommendations
4. Distributors were most satisfied with their interactions with program staff and program training and least satisfied with the incentive amounts provided by the program and the application process for receiving reimbursement.	The program should reassess the incentive amounts paid to distributors and consider increasing incentive amounts to a minimum of 65% of the measure's incremental cost. We recommend updating the base case and measure case cost assumptions to current market costs.
5. Distributors and contractors reported that the 'higher cost of energy efficiency HVAC equipment' is the largest barrier to adoption.	
6. The average incentive paid to program distributors is only 15% of the incremental measure costs. Most of the measure cost amounts were sourced from outdated studies, most of which are at least five years old.	
7. More than half of the contractors were unaware of the program. Those contractors who were aware of the program were less than satisfied with the program training and marketing and outreach.	Program implementers should market the program, provide training, and conduct outreach efforts specifically targeted at contractors who work with participating distributors. Implementers should leave program materials with participating distributors to give to any contractor they work with who might participate in the program. Implementers should also develop a list of contractors with their contact information and conduct regular outreach with information about the program via email. The program should provide in-person or virtual trainings designed specifically for contractors to learn more about the program at least once per quarter.

Key findings	Implications and recommendations
8. CEDARS data shows building vintage conflicts between existing and new construction. For 84% of claims, the “BldgVint” (building vintage) parameter value is labeled as "EX" (existing building), but the claimed measure application type is “NC” (new construction). The claimed savings values directly correspond with the new construction savings so we assumed the “EX” value is an error for all of these claims.	Going forward, always collect and document the installation addresses for each claim. When validating claims, confirm the building at the address is an existing or newly constructed building and if it is a residential or commercial building. Ensure that the values listed in CEDARS are accurate for each claim.
9. All Comfortably CA claims in CEDARS list the “Primary Sector” values as Commercial, but the “Program Sector” values are listed as “Res,” which conflict with each other.	
10. Claims in the CEDARS tracking datasets for all statewide programs are split into four subclaims to allow for the assignment of savings across each of the four participating IOUs. For anyone unfamiliar with the datasets, this makes it appear that there are four times as many claims than the actual number of claims for the program.	The CPUC should work together with PAs to modify the design of CEDARS so that the number of claims for statewide programs can be counted accurately. Creating a separate “number of claims” variable in statewide tracking datasets could provide a solution.

8 APPENDICIES

8.1 Appendix A: Data standardized high-level saving

Comfortably California Statewide Third-Party Program, Program Year 2021. Impact and Process Evaluation.

Gross Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SW	Comfortably CA	169,463	169,463	1.00	100.0%	
SW	**Total**	**169,463**	**169,463**	**1.00**	**100.0%**	
	Statewide	***169,463***	***169,463***	***1.00***	***100.0%***	

Net Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
SW	Comfortably CA	117,929	18,716	0.16	0.0%	0.70	0.11	0.70	0.11
SW	**Total**	**117,929**	**18,716**	**0.16**	**0.0%**	**0.70**	**0.11**	**0.70**	**0.11**
	Statewide	***117,929***	***18,716***	***0.16***	***0.0%***	***0.70***	***0.11***	***0.70***	***0.11***

Gross Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SW	Comfortably CA	76.7	76.7	1.00	100.0%	
SW	**Total**	**76.7**	**76.7**	**1.00**	**100.0%**	
	Statewide	***76.7***	***76.7***	***1.00***	***100.0%***	

Net Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
SW	Comfortably CA	53.0	8.0	0.15	0.0%	0.69	0.10	0.69	0.10
SW	**Total**	**53.0**	**8.0**	**0.15**	**0.0%**	**0.69**	**0.10**	**0.69**	**0.10**
	Statewide	***53.0***	***8.0***	***0.15***	***0.0%***	***0.69***	***0.10***	***0.69***	***0.10***

Gross Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SW	Comfortably CA	13,111	13,111	1.00	100.0%	
SW	**Total**	**13,111**	**13,111**	**1.00**	**100.0%**	
	Statewide	***13,111***	***13,111***	***1.00***	***100.0%***	

Net Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
SW	Comfortably CA	8,355	809	0.10	0.0%	0.64	0.06	0.64	0.06
SW	**Total**	**8,355**	**809**	**0.10**	**0.0%**	**0.64**	**0.06**	**0.64**	**0.06**
	Statewide	***8,355***	***809***	***0.10***	***0.0%***	***0.64***	***0.06***	***0.64***	***0.06***

Gross First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SW	Comfortably CA	11,182	11,182	1.00	100.0%	
SW	**Total**	**11,182**	**11,182**	**1.00**	**100.0%**	
	Statewide	***11,182***	***11,182***	***1.00***	***100.0%***	

Net First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
SW	Comfortably CA	7,792	1,235	0.16	0.0%	0.70	0.11	0.70	0.11
SW	**Total**	**7,792**	**1,235**	**0.16**	**0.0%**	**0.70**	**0.11**	**0.70**	**0.11**
	Statewide	***7,792***	***1,235***	***0.16***	***0.0%***	***0.70***	***0.11***	***0.70***	***0.11***

Gross First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SW	Comfortably CA	5.0	5.0	1.00	100.0%	
SW	**Total**	**5.0**	**5.0**	**1.00**	**100.0%**	
	Statewide	***5.0***	***5.0***	***1.00***	***100.0%***	

Net First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
SW	Comfortably CA	3.5	0.5	0.15	0.0%	0.69	0.10	0.69	0.10
SW	**Total**	**3.5**	**0.5**	**0.15**	**0.0%**	**0.69**	**0.10**	**0.69**	**0.10**
	Statewide	***3.5***	***0.5***	***0.15***	***0.0%***	***0.69***	***0.10***	***0.69***	***0.10***

Gross First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SW	Comfortably CA	688	688	1.00	100.0%	
SW	**Total**	**688**	**688**	**1.00**	**100.0%**	
	Statewide	***688***	***688***	***1.00***	***100.0%***	

Net First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
SW	Comfortably CA	441	42	0.10	0.0%	0.64	0.06	0.64	0.06
SW	**Total**	**441**	**42**	**0.10**	**0.0%**	**0.64**	**0.06**	**0.64**	**0.06**
	Statewide	***441***	***42***	***0.10***	***0.0%***	***0.64***	***0.06***	***0.64***	***0.06***

8.2 Appendix B: Standardized per unit savings

Comfortably California Statewide Third-Party Program, Program Year 2021. Impact and Process Evaluation

Per Unit (Quantity) Gross Energy Savings (kWh)

Report Name	PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
SW3PP - Comfortably California	SW	Comfortably CA	1	0.0%		19.4	70.7	4.7	4.7

Per Unit (Quantity) Gross Energy Savings (Therms)

Report Name	PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
SW3PP - Comfortably California	SW	Comfortably CA	1	0.0%		19.4	5.5	0.3	0.3

Per Unit (Quantity) Net Energy Savings (kWh)

Report Name	PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
SW3PP - Comfortably California	SW	Comfortably CA	0	0.0%	0.0%	19.4	7.8	0.5	0.5

Per Unit (Quantity) Net Energy Savings (Therms)

Report Name	PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
SW3PP - Comfortably California	SW	Comfortably CA	0	0.0%	0.0%	19.4	0.3	0.0	0.0

8.3 Appendix C: Recommendations

Rec #	Program or database	Summary of findings	Additional supporting information	Best practice/recommendations	Recipient	Affected Workpaper or DEER
1	Comfortably California	Low program NTGR due to low incentive amounts and contractor program awareness.	The program achieved an NTGR of 4%, meaning the program had very little influence on the sale of high-efficiency HVAC equipment among distributors and contractors. Key drivers of the low NTGR include low-incentive amounts relative to the cost of the equipment and low levels of program awareness among contractors who are key market actors in terms of being in a position to recommend program incentivized equipment to end users.	The PAs should consider changing the current Comfortably California HVAC midstream program design. This could be done as part of the new process directed in the Bus Plan decision to assess the portfolio composition of statewide programs.	SDG&E	All Program Measures

Rec #	Program or database	Summary of findings	Additional supporting information	Best practice/recommendations	Recipient	Affected Workpaper or DEER
2	Comfortably California	PY 2021 was difficult to evaluate due to incomplete end user data.	The program in PY 2021 was especially challenging to evaluate. While implementers did not record end user contact information, they also did not collect addresses where program installations occurred. The evaluation team could only verify equipment sales and installation of equipment indirectly through phone surveys with contractors.	Going forward, always collect installation addresses and end user contact information to facilitate internal program verification and evaluation verification efforts.	SDG&E	All Program Measures
3	Comfortably California	Implementers failed to follow quality assurance (QA) plan which led to additional data processing outside of QA protocol.	The program implementers failed to follow their own quality assurance plan, which stipulated that a minimum of 10% of sites - where program incentivized equipment was installed - must be verified. The quality assurance plan also stated that end user email addresses and phone numbers needed to be collected. The distributor sales reporting sheet listed end user address and contact information as optional, which was in direct conflict with the quality assurance plan.	Inspect a minimum of 10% of sites using a combination of in-person and virtual visits across a representative sample of sites.	SDG&E	All Program Measures

Rec #	Program or database	Summary of findings	Additional supporting information	Best practice/recommendations	Recipient	Affected Workpaper or DEER
4	Comfortably California	Distributors were most satisfied with program outreach but least satisfied with incentives and application processes.	Distributors were most satisfied with their interactions with program staff and program training and least satisfied with the incentive amounts provided by the program and the application process for receiving reimbursement.	The program should reassess the incentive amounts paid to distributors and consider increasing incentive amounts to a minimum of 65% of the measure's incremental cost. We recommend updating the base case and measure case cost assumptions to current market costs.	SDG&E	All Program Measures
5	Comfortably California	HE equipment cost was largest barrier to adoption.	Distributors and contractors reported that the 'higher cost of energy efficiency HVAC equipment' is the largest barrier to adoption.		SDG&E	All Program Measures
6	Comfortably California	Average program incentives were 15% of incremental measure costs.	The average incentive paid to program distributors is only 15% of the incremental measure costs. Most of the measure cost amounts were sourced from outdated studies, most of which are at least five years old.		SDG&E	All Program Measures

Rec #	Program or database	Summary of findings	Additional supporting information	Best practice/recommendations	Recipient	Affected Workpaper or DEER
7	Comfortably California	Contractor program awareness and satisfaction were very low.	More than half of the contractors were unaware of the program. Those contractors who were aware of the program were less than satisfied with the program training and marketing and outreach.	Program implementers should market the program, provide training, and conduct outreach efforts specifically targeted at contractors who work with participating distributors. Implementers should leave program materials with participating distributors to give to any contractor they work with who might participate in the program. Implementers should also develop a list of contractors with their contact information and conduct regular outreach with information about the program via email. The program should provide in-person or virtual trainings designed specifically for contractors to learn more about the program at least once per quarter.	SDG&E	All Commercial and Residential Measures

Rec #	Program or database	Summary of findings	Additional supporting information	Best practice/recommendations	Recipient	Affected Workpaper or DEER
8	Comfortably California	CEDARS data was inconsistent with reported claims for building vintage.	CEDARS data shows building vintage conflicts between existing and new construction. For 84% of claims the “BldgVint” (building vintage) parameter value is labeled as "EX" (existing building), but the claimed measure application type is “NC” (new construction). The claimed savings values directly correspond with the new construction savings, so we assumed the “EX” value is an error for all of these claims.	Going forward, always collect and document the installation addresses for each claim. When validating claims, confirm the building at the address is an existing or newly constructed building and if it is a residential or commercial building. Ensure that the values listed in CEDARS are accurate for each claim.	SDG&E	All Commercial and Residential Measures
9	Comfortably California	CEDARS data inconsistent with reported “Primary Sector” claims.	All Comfortably CA claims in CEDARS list the “Primary Sector” values as Commercial, but the “Program Sector” values are listed as “Res,” which conflict with each other.		SDG&E	All Commercial and Residential Measures
10	Comfortably California	CEDARS tracking datasets caused issues/confusion around duplicate savings for IOUs.	Claims in the CEDARS tracking datasets for all statewide programs are split into four subclaims to allow for the assignment of savings across each of the four participating IOUs. For anyone unfamiliar with the datasets, this makes it appear that there are four times as many claims than the actual number of claims for the program.	The CPUC should work together with PAs to modify the design of CEDARS so that the number of claims for statewide programs can be counted accurately. Creating a separate “number of claims” variable in statewide tracking datasets could provide a solution.	SDG&E	All Commercial and Residential Measures

8.4 Appendix D: Sample design: contractor surveys

For the HVAC contractor surveys, we used a stratified sampling approach to collect primary data using telephone surveys. The approach placed contractor participants into segments of interest by residential and commercial segments. The segments are then placed into strata by savings, measured in a common unit of MBtu to reflect both kWh and therms savings. The methodology then estimates appropriate sample sizes to achieve the desired relative precision at 90% confidence by sector type. [68] The desired precision for the contractors targets the overall program. Table 8-1 below presents a summary of the contractor sample design which targets ±10% relative precision across the program and ±20% precision or better for each sector.

Table 8-1. HVAC contractor sample design results summary[69]

Sector	Contractors	First year savings (MBtu)	Error ratio	Sample	Expected relative precision
Residential	1,093	33,338	0.4	15	20%
Commercial	1,513	134,916	0.4	40	12%
Total	**2,606**	**168,254**	**0.4**	**55**	**10%**

Table 8-2 presents additional details on the stratification used for the contractor survey sample design. Each measure was divided into three strata based on the first year MBtu savings. The table presents the maximum MBtu, number of contractors, total savings (MBtu), number of sample points, and the inclusion probability for each stratum.

Table 8-2. HVAC contractor sample design stratification

Sector	Stratum	Maximum (MBtu)	Contractors	First year savings (MBtu)	Sample	Inclusion probability
Residential	1	35	943	6,690	5	0.005
	2	223	126	10,366	5	0.040
	3	2,327	24	16,283	5	0.208
Residential Total	-	**2,585**	**1,093**	**33,339**	**15**	-
Commercial	1	93	1202	30,549	14	0.012
	2	360	236	43,473	13	0.055
	3	5,000	75	60,894	13	0.173
Commercial Total	-	**5,453**	**1,513**	**134,916**	**40**	-
Overall	-	**8,038**	**2,606**	**168,255**	**55**	-

[68] Relative precision is defined as error bound divided by estimated ratio, giving an idea of the range of possible values relative to the size of the ratio.

[69] The total number of contractors (n=2,606) referenced in Table 8-1 and Table 8-2 is two less than what was cited in Section 5.2.1 (n=2,608), because two contractors without email addresses were removed from the sample frame.

8.5 Appendix E: Additional survey results

Figure 8-1. Measure-level equipment installations verified by contractors

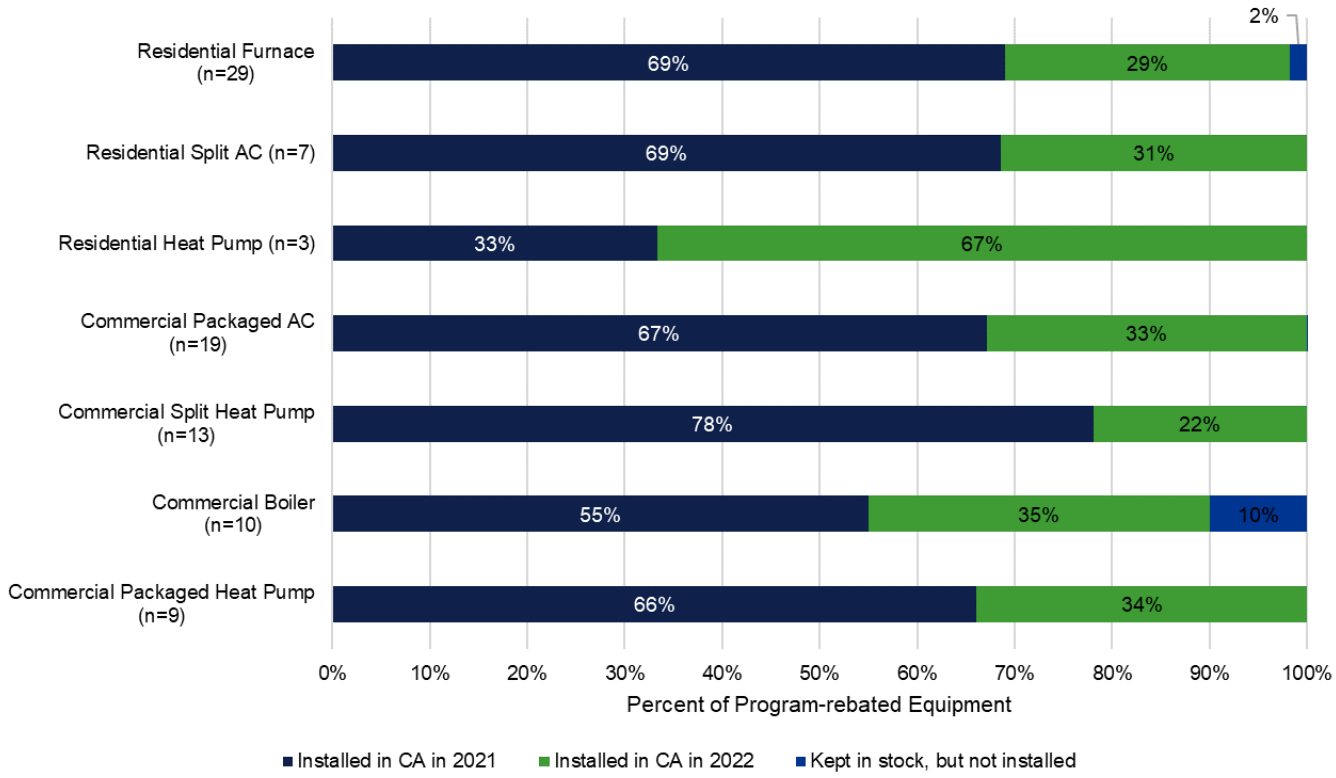


Figure 8-2. Percent of contractor program sales installed in retrofit vs new construction buildings

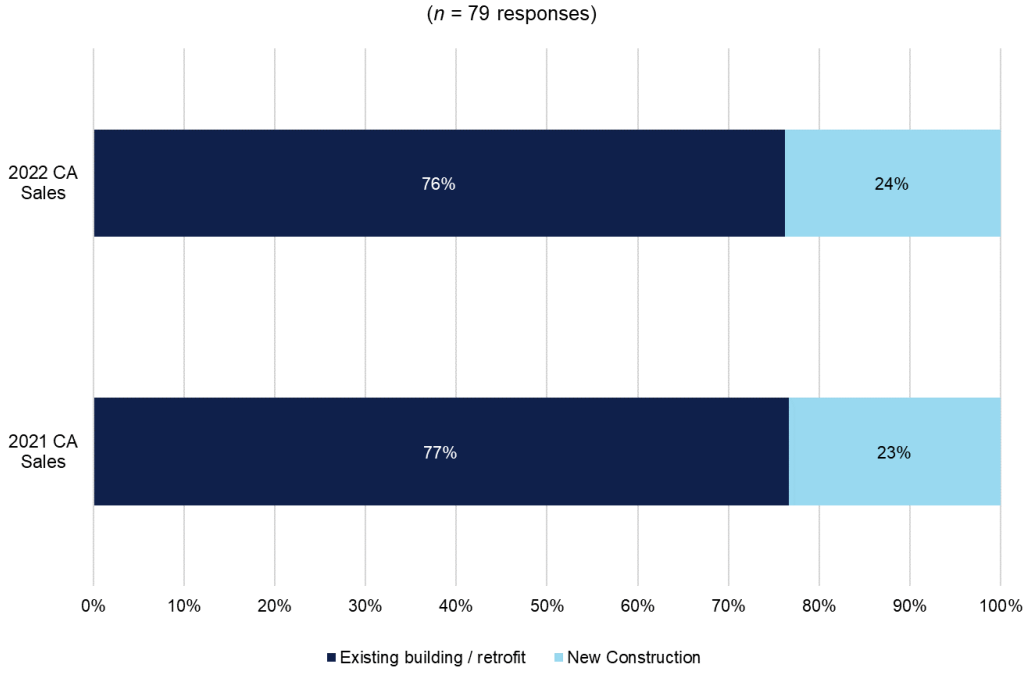


Table 8-3. Equipment purchased from program distributors and other distributors

Measure type	Percent of sales from:	
	Program distributors	Other distributors
Commercial Boiler	60%	40%
Commercial Packaged AC	64%	36%
Commercial Packaged Heat Pump	45%	55%
Commercial Split Heat Pump	53%	47%
Residential Furnace	33%	67%
Residential Heat Pump	60%	40%
Residential Split AC	47%	53%
Overall	**54%**	**46%**

8.6 Appendix F: Data collection instruments

In this section, we include the data collection instruments used to support this evaluation:

8.6.1 Contractor interview guide

Statewide Upstream and Midstream Commercial HVAC Program (Comfortably California)

Research Questions Addressed:

- What are the net savings for evaluated measures in the program (influence of program on sales and types of equipment sold)?
- To what extent are contractors installing incentivized equipment in California homes and businesses?
- What percent of contractor installations are retrofit and what percent are new construction?
- To what extent do they serve hard-to-reach (HTR) customers and disadvantaged communities (DACs)?
- To what extent are participating customers and distributors satisfied with the programs?
- Is there any market confusion among contractors participating in multiple programs?

Equipment included in Comfortably California Program:

Commercial unitary air conditioners
Commercial heat pumps
Commercial chillers
Commercial space heating boilers
Residential air conditioners
Residential heat pumps
Residential gas furnaces
Residential gravity wall furnaces

[NOTE: We will only ask about equipment installed by the contractor being interviewed]

Introduction

Hello. I'm [INTERVIEWER NAME] calling on behalf of the California Public Utilities Commission. We've been hired by the CPUC to get a better understanding of the Statewide Third-Party Upstream and Midstream HVAC Program known as "Comfortably California," which was rolled out statewide in 2021.

As a thank you for your participation, we would like to provide you with a $30 Amazon e-gift card. The information gathered will be used solely for research purposes and your individual responses will be kept confidential.

SCREENING

1. California's investor-owned utilities deliver incentives through an HVAC Program referred to as "Comfortably California" that buys down the cost of high efficiency equipment and offers training and marketing support to participating distributors. Are you familiar with your company's participation in this program?
2. [IF Q1 = NO] Is there anyone else from your company who is familiar with your participation in the Comfortably California HVAC program?
    a. [IF Q2 = YES] Please provide their contact information:

i. Name

ii. Phone Number

iii. Email

b. [IF Q2 = NO] Continue with interview, but skip questions that are dependent on program awareness

EQUIPMENT VERIFICATION

[LOOP Q3 – Q8 FOR EACH MEASURE; SET LIMIT TO 3 MEASURES MAX]

3. According to our records, your company purchased [Measure1 Unit Count] [Measure 1 Description](s) from [Distributor(s) X/Y/Z]. What percent of your this equipment was… [TOTAL SHOULD EQUAL 100%]

Scenario	% of units
4a. Installed in CA in 2021	
4b. Installed in CA in 2022	
4c. Kept in stock, but not installed	
Don't know	98
Refused	99

4. [IF Q3c GREATER THAN 0%] Why did you not end up installing some of this [Measure 1 Description] equipment?

5. Approximately what percentage of these [Measure 1 Description] units were installed in California in existing buildings (i.e., retrofit) compared to new construction buildings? [TOTAL FOR EACH YEAR SHOULD EQUAL 100%]

Building Type	% of 2021 CA Sales	% of 2022 CA Sales
a. Existing building / retrofit		
b. New construction		
c. Other (specify)		
Don't know	98	98
Refused	99	99

6. Thinking about the [Measure1 Unit Count] [Measure 1 Description](s) you purchased from [Distributor(s) X/Y/Z] in 2021, did you purchase any additional [Measure 1 Description](s) from any other distributors that we haven't talked about?

1	Yes
2	No
98	Don't know
99	Refused

7. [IF Q6=YES] What were the names of those distributors?

   [Record Names]

8. [IF Q6=YES] What percent of your total purchases of [Measure 1 Description](s) were from [Distributor(s) X/Y/Z] and what percent of your purchases of [Measure 1 Description](s) were from [Other Distributor Names from Q7] in 2021?

Measure	Distributor(s) X/Y/Z	Other Distributors	Total=100%
Measure 1			
Measure 2			
Measure 3			
Don't know	98	98	
Refused	99	99	

[End Measure Loop]

9. [IF Q5B > 0% AND HIGH-VOLUME CONTRACTOR] Were you subcontracted by a developer for any of the new construction or major renovation projects?

1	Never
2	Some of the time
3	About half the time
4	Most of the time
5	Always
98	Don't Know
99	Refused

10. [IF Q9 = 2, 3, 4, or 5] In general, how large were these developments?

1	Few than 10 homes
2	10 – 19 homes
3	20 – 49 homes
4	50 – 99 homes
5	More than 100 homes
98	Don't Know
99	Refused

11. [IF Q9 = 2, 3, 4, or 5 AND IF AWARE OF PROGRAM] Did your company or the developer receive the incentive for the program-qualified equipment?

1	Our company (contractor) received the incentive
2	The developer received the incentive
3	Other (specify)
98	Don't Know
99	Refused

EQUIPMENT CHOICES

12. What is the strongest driver when it comes to selling high efficiency equipment?

1	Sales engineers upselling practices
2	Available stock / delivery time
3	ROI or payback calculations
4	Engineer / Architect preferences
5	Manufacturer rebates / promotions
6	Utility rebates

7	Non-rebate activities (e.g., quarterly sales meeting, letter of commitment, market reports)
8	Reduced operations and maintenance (O&M) costs
50	Other (Record)
98	Don't know
99	Refused

13. Are there any other drivers you can think of when it comes to selling high efficiency equipment? Please select all that apply.

1	Sales engineers upselling practices
2	Available stock / delivery time
3	ROI or payback calculations
4	Engineer / Architect preferences
5	Manufacturer rebates / promotions
6	Utility rebates
7	Non-rebate activities (e.g., quarterly sales meeting, letter of commitment, market reports)
8	Reduced operations and maintenance (O&M) costs
50	Other (Record)
98	Don't know
99	Refused

14. Prior to this survey, were you aware that Comfortably California discounted the cost of eligible high efficiency HVAC equipment?

1	Yes
2	No

15. [IF Q14 = YES] How did you first learn about these discounts?

1	Distributor
2	Utility staff or marketing materials
3	CLEAResult
4	Comfortably California marketing
5	Other [specify]
98	Don't know

16. How often is your company the most influential decision maker (rather than the customer or another party) on the type of equipment that is eventually installed?

1	Rarely
2	Some of the time
3	About half the time
4	Most of the time
5	Almost Always
98	Don't Know

17. What percentage of your sales of HVAC are fulfilled out of your own inventory, and what percent are fulfilled by a distributor? [TOTAL SHOULD EQUAL 100%]

Fulfillment Source	**% of Sales**
Out of own inventory	
Purchased from distributor	
Other (specify):	
Total	**100%**

18. Have you noticed any changes in the availability of high efficiency HVAC equipment since 2021?

Yes	1
No	2
Don't Know	98
Refused	99

19. [IF Q18 =YES] Has the availability of high efficiency equipment increased or decreased?

Increased	1
Decreased	2
Don't Know	98
Refused	99

20. [IF Q18 =YES] What do you think is the primary reason for this change in availability of high efficiency equipment? [Select one]

Supply chain issues	1
Greater diversification of suppliers	2
Influence of energy efficiency programs	3
Other (specify):	4
Don't Know	98
Refused	99

21. [IF Q18 =YES] Are there any other reasons for this change in availability of high efficiency equipment? Please select all that apply.

Supply chain issues	1
Greater diversification of suppliers	2
Influence of energy efficiency programs	3
Other (specify):	4
Don't Know [Exclusive]	98
Refused [Exclusive]	99

INFLUENCE OF UPSELLING

22. On a scale of 1 to 5 where 1 is "not at all influential" and 5 is "extremely influential," how influential are distributors' equipment recommendations on the decision of what ultimately gets installed?

23. [ASK IF Q21 < 4] Why do you say that?

24. What is the largest barrier when it comes to selling high efficiency equipment?

Higher cost of high efficiency models	1
Increased size / weight of high efficiency models	2
Increased delivery time of high efficiency models	3
Market demand or turnover rate	4
Sales marketing / educating buyers	5
Unwillingness to get rid of existing equipment	6
Other (Record)	50
Don't know	98
Refused	99

INFLUENCE OF PRICE

25. If your distributor charged you less for the following high efficiency equipment, how much of those savings would you pass on to your customer? Please respond with what dollar ($) amount of the following average system incentives you would pass on to your customer.

[HIDE ROWS THAT ARE NOT APPLICABLE; SET LIMIT TO 3 MEASURES MAX]

Measure	Average System Incentive
Residential Furnace	$10
Residential Heat Pump	$65
Residential Split AC	$75
Commercial Packaged Heat Pump	$60
Commercial Split Heat Pump	$55
Commercial Package AC	$100
Commercial Split AC	$60
Commercial Boiler	$255

26. Without these rebates we just discussed, how likely are your customers to purchase the high efficiency equipment? Please answer on a 1 to 5 scale where 1 means “Very unlikely” and 5 means “Very likely”.

MARKET / NTG

[ASK QUESTIONS Q27 - Q28 IF AWARE OF PROGRAM]

27. [IF AWARE] What percentage of your company’s total unit sales of high efficiency in California in 2021 would you estimate received a rebate through the Comfortably California program?

28. [IF AWARE AND IF Q26 LESS THAN 100%] Why did you not receive an incentive for all of the high efficiency unit sales?

[RECORD RESPONSE]	

29. [LOOP FOR EACH MEASURE; SET LIMIT TO 3 MEASURES MAX] If [Distributor X/Y/Z] charged [Measure1_incentive] more for each [Measure1_type] you sold in 2021, do you think your sales of [Measure1_type] would have been about the same, lower, or higher?

    a. [IF Q28 = LOWER] Approximately what percent lower do you estimate sales would be of [Measure_type(s)] if the program did not exist?

    b. [IF Q28 = HIGHER] Approximately what percent higher do you estimate sales would be of [Measure_type(s)] if the program did not exist?

    c. [IF Q28 = HIGHER OR SAME] Why?

Technology	Lower or Higher	% lower or higher	Why?
Measure_type 1			
Measure_type 2			
Measure_type 3			

Don't know	98	98	98
Refused	99	99	99

PROCESS

30. [ASK IF AWARE OF PROGRAM] How often did the distributor list the dollar amount of the discount on your invoice?

Never	1
Rarely	2
About half of the time	3
Often	4
Always	5
Don't know	98

31. When you sell high efficiency equipment, are you able to claim incentives for the same equipment through other programs (e.g., BayREN's TECH Clean CA Initiative) offered in California in addition to this program?

Yes	1
No	2
Don't Know	98
Refused	99

32. [IF Q30 = YES] What other programs also provide incentives for the same equipment?

BayREN's TECH Clean CA Initiative	1
Statewide Third Party New Construction Program(s)	2
Other (specify)	3
Don't know	98
Refused	99

33. [IF Q30 = YES] Has there been any confusion around equipment being eligible an incentive through one program but not another?

34. [ASK IF AWARE OF PROGRAM] What do your staff typically tell buyers about the Comfortably California incentives?

35. [ASK IF AWARE OF PROGRAM] Prior to 2021, HVAC programs were run separately by each investor-owned utility (PG&E, SCE, SoCal Gas, and SDG&E). Since it has moved to a statewide program, have you noticed any differences in processes?

36. To your knowledge, is any of the equipment you sell through the program being installed in residential or non-residential hard-to-reach (HTR) communities?

    - Residential HTR customers are defined as those who do not have easy access to program information due to language barriers, living in rural areas, and/or reside in multifamily buildings or mobile homes.
    - Non-residential HTR customers are defined as business with less than 10 employees or those who lease and/or rent their facilities.

Customer Sector	**Yes / No / Don't know**
Residential Customers	
Non-residential customers	

37. [IF Q35 = YES FOR RES OR NON-RES; HIDE COLUMNS THAT ARE NOT APPLICABLE] Roughly what percent of your customers are from HTR communities?

Percent (%) of Customers that are defined as:	Residential Customers	Non-residential Customers
Hard-to-reach		
NOT Hard-to-reach		
Total [SHOULD EQUAL 100%]		

38. [ASK IF AWARE OF PROGRAM] Please rate your level of satisfaction with each of the following items related to the program using a scale of 1 to 5, where 1 is 'very dissatisfied' and 5 is 'very satisfied.

Topic	Level of Satisfaction
Your experience overall	
The type of equipment eligible for incentives	
The incentive amount passed on from distributor	
Program marketing and outreach	
Program training	
Program information provided by distributor	
Performance of the equipment rebated by the program.	

39. [IF Q37 < 4] You indicated you were not satisfied with at least one aspect of the program. Why do you say that?

[SKIP TO Q45 IF Q1 = NO]

40. [IF AWARE] Are there any additional technologies you would like the program to offer incentives for?

41. [IF AWARE] What obstacles do you face, if any, when participating in the program?

42. [IF AWARE] What aspects of the program are working well, in your opinion?

43. [IF AWARE] Based on your experience, which aspects of the program, if any, would you change?

44. [IF AWARE] What general improvements, if any, you would like to see related to program delivery?

45. [IF AWARE] Is there anything else you think the California Public Utilities Commission (CPUC) should know about the Comfortably California program?

46. Would it be ok if we follow up and reach out to you if we have any additional questions?

Yes	1
No	2

47. As a thank you for your participation, we would like to provide you with a $30 Amazon e-gift card. Would you be interested in receiving this e-gift card?

Yes	1
No	2

41. [IF Q40 = YES] What is the best email to send this e-gift card to?

[RECORD RESPONSE]	

Thank you for taking the time to complete this survey.

8.6.2 Distributor interview guide

Statewide Upstream and Midstream Commercial HVAC Program (Comfortably California)

Research Questions Addressed:

- What are the net savings for evaluated measures in the program (influence of program on sales and types of equipment sold)?
- To what extent are participating distributors satisfied with the programs?
- Is there any market confusion among distributors participating in multiple programs?
- What, if any, general process improvements for statewide administration could be recommended?

Question or Section	Instrument Goal
Screener questions	To identify the contact who is most familiar with the sales of high efficiency equipment through the Statewide HVAC program
General distributor information	Get the contact to think about their business before diving into causal pathway questions
Market effects	Obtain a high-level understanding of efficient products and sales
Sales	Questions to understand what technologies the distributor keeps in sell and why
Upselling	Questions to determine the impact of the program on the distributors' upselling tactics
Pricing	Does the program incentive impact the final price paid by the customer, how much of the incentive is passed on to the contractor or end-user
Market/NTG	These questions are intended to obtain NTG values in the traditional manner by asking the distributor about their sales of high efficiency equipment with and without the program. These are included in the survey to ensure NTG data is collected even if the causal pathway approach is not feasible
Process	Obtain feedback on program awareness, satisfaction, obstacles, and suggestions

Equipment included in Comfortably California Program:

Commercial unitary air conditioners
Commercial heat pumps
Commercial chillers
Commercial space heating boilers
Residential air conditioners
Residential heat pumps
Residential gas furnaces
Residential gravity wall furnaces

Introduction

We've been hired by the California Public Utilities Commission (CPUC) to get a better understanding of the Statewide Third-Party Upstream and Midstream HVAC Program known as "Comfortably California," which was rolled out statewide in 2021.

SCREENING

1. The CPUC Program Administrators deliver incentives through an HVAC Program referred to as "Comfortably California" that buys down the cost of high efficiency equipment and offers training and marketing support to participating distributors. CLEAResult runs the program on behalf of the utilities. Are you familiar with your company's participation in this program?

2. [IF Q1 = NO] Can you provide me with the contact information for the correct person to speak with?

GENERAL DISTRIBUTOR INFO

3. Today I'd like to ask you about [Measure type 1, Measure type 2, etc]. What percentage of [Measure_type] do you sell to installation contractors, and what percentage do you sell directly to end-users? End-users are defined as the final customer who owns the equipment. Your best guess is fine.

[NOTE: We will be asking only about the equipment sold by the interviewee]

Technology	Percent sold to Contractors	Percent sold to end-users
Commercial unitary air conditioners	%	%
Commercial heat pumps	%	%
Commercial chillers	%	%
Commercial space heating boilers	%	%
Residential air conditioners	%	%
Residential heat pumps	%	%
Residential gas furnaces	%	%
Residential gravity wall furnaces	%	%
Don't know	98	98
Refused	99	99

MARKET EFFECTS

4. What is the strongest driver when it comes to selling high efficiency equipment?

Sales engineers upselling practices	1
Available stock / delivery time	2
ROI or payback calculations	3
Engineer / Architect preferences	4
Manufacturer rebates / promotions	5
Utility rebates	6
Non-rebate activities (e.g., quarterly sales meeting, letter of commitment, market reports)	7
Reduced operations and maintenance (O&M) costs	8
Other (Record)	50
Don't know	98
Refused	99

5. Are there any other drivers you can think of when it comes to selling high efficiency equipment? Please select all that apply.

Sales engineers upselling practices	1
Available stock / delivery time	2
ROI or payback calculations	3
Engineer / Architect preferences	4
Manufacturer rebates / promotions	5
Utility rebates	6
Non-rebate activities (e.g., quarterly sales meeting, letter of commitment, market reports)	7

Reduced operations and maintenance (O&M) costs	8
Other (Record)	50
Don't know	98
Refused	99

6. What is the largest barrier when it comes to selling high efficiency equipment?

Higher cost of HE models	1
Increased size/weight of HE models	2
Increased delivery time of HE models	3
Market demand or turnover rate	4
Sales marketing / educating buyers	5
Unwillingness to get rid of existing equipment	6
Other (Record)	50
Don't know	98
Refused	99

INFLUENCE OF PROGRAM ON SALES

7. On a scale of 1 to 5 with 1 being the lowest influence and 5 being the highest influence, what numerical rating would you give for the influence of the Comfortably California program (e.g., incentives, marketing, outreach, and training) on the selection of high efficiency equipment your company typically sells?

INFLUENCE OF UPSELLING

8. In situations where your company's sales staff are selling equipment, does the program (e.g., incentives, marketing, outreach, and training) influence the efficiency of the equipment that your company recommends to buyers?

9. What percent of the time does your company's sales staff recommend high efficiency equipment to buyers?

INFLUENCE OF PRICE

10. Does the incentive impact the final price paid by the buyer?

11. On average, what percentage of the incentive is passed through to the buyer?

MARKET/NTG

12. Approximately what percentage of your company's total unit sales of high efficiency equipment in California in 2021 received incentives through the program?

13. [IF Q12 < 100%] Why did you not receive an incentive for all of the high efficiency unit sales?

14. [LOOP FOR EACH MEASURE; SET LIMIT TO 3 MEASURES MAX] In 2021 the Comfortably California program offered your company incentives, marketing, outreach, and training for each [Measure_type] unit sold. If the program did not exist, do you think your sales of high efficiency [Measure_type] units sold in 2021 would have been about the same, lower, or higher?

a. [IF Q14 = LOWER] Approximately what percent lower do you estimate sales would be of [Measure_type]s if the program did not exist?

b. [IF Q14 = HIGHER] Approximately what percent higher do you estimate sales would be of [Measure_type]s if the program did not exist?

c. [IF Q14 = HIGHER OR SAME] Why?

Technology	Lower or Higher	% lower or higher	Why?
Measure_type 1			
Measure_type 2			
Measure_type 3			
Don't know	98	98	98
Refused	99	99	99

PROCESS

15. When you sell high efficiency equipment, are you able to claim incentives for the same equipment through other programs (e.g., BayREN's TECH Clean CA Initiative) offered in California in addition to this program?

16. [IF Q15 = Yes] Has there been any confusion around equipment being eligible an incentive through one program but not another?

17. What do your staff typically tell buyers about the Comfortably California program?

18. Prior to 2021, HVAC programs were run separately by each investor-owned utility (PG&E, SCE, SoCal Gas, and SDG&E). Since it has moved to a statewide program, have you noticed any differences in processes?

19. Please rate your level of satisfaction with each of the following items related to the program using a scale of 1 to 5, where 1 is 'very dissatisfied' and 5 is 'very satisfied.'

Topic	Level of Satisfaction
Your experience overall	
The type of equipment eligible for incentives	
The incentive amount provided to distributors	
Program marketing and outreach	
Program training	
The clarity of information provided about how to participate	
The application process to receive reimbursement	
The pre-approval process for larger sales	
Interactions with program staff	

20. [IF Q19 < 3] You indicated some dissatisfaction with at least one aspect of the program. Why do you say that?

21. Are there any additional technologies you would like the program to offer incentives for?

22. From your perspective, what are the reasons you might be hesitant to recommend high efficiency equipment to your customers? [PROBE BY EQUIPMENT TYPE; ALSO PROBE FOR FIRST COST, RETURN ON INVESTMENT, RELIABILITY, PERFORMANCE, or MAINTENANCE CONCERNS]
23. What obstacles do you face, if any, when participating in the program?
24. What aspects of the program are working well, in your opinion?
25. Based on your experience, which aspects of the program, if any, would you change?
26. Are there any general improvements you would like to see related to program delivery?
27. Thank you for taking the time to complete this survey. Is there anything else you think the California Public Utilities Commission (CPUC) should know about the Statewide Foodservice Instant Rebate Program?

About DNV

DNV is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.