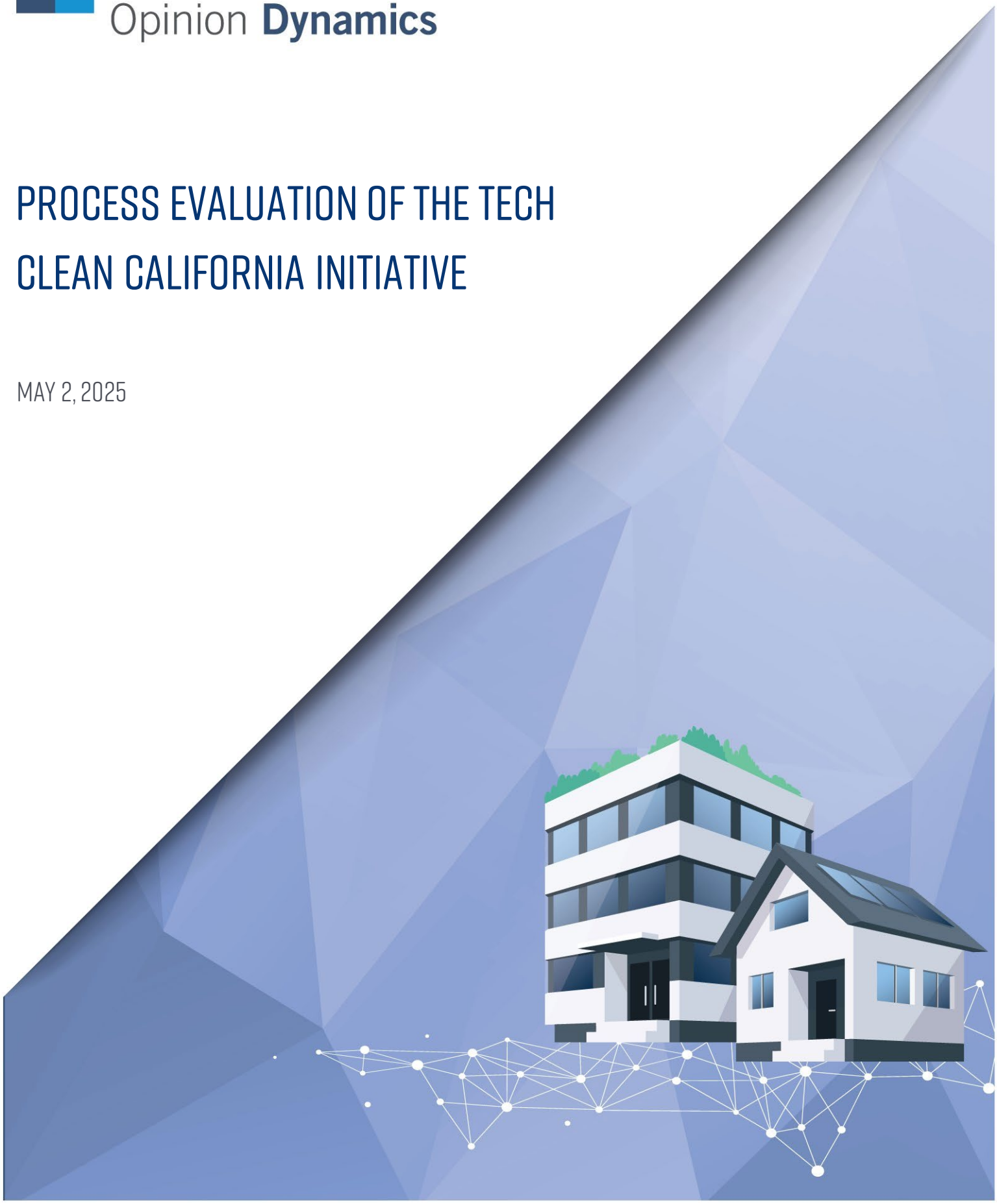
Opinion Dynamics

PROCESS EVALUATION OF THE TECH CLEAN CALIFORNIA INITIATIVE

MAY 2, 2025



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I. EXECUTIVE SUMMARY

The Technology and Equipment for Clean Heating (TECH) Initiative launched in December 2021 with $120 million in funding from the California Air Resources Board's Cap and Trade program, which generates revenue from the sale of GHG emissions allowances to gas investor-owned utilities (IOUs).[1] The TECH Initiative is designed to help advance the state's mission to achieve carbon neutrality by driving the market adoption of low-emissions space- and water-heating technologies for existing single-family and multifamily residential homes. The TECH Initiative was created as part of California Senate Bill 1477. The TECH Initiative installs low-emissions space and water heating technologies in existing California homes through a combination of market incentives, supply chain engagement, workforce development, consumer education, regional pilots, and Quick Start Grants. The TECH incentives can be paired with other heat pump program incentives, which we refer to as "layered incentives."

Opinion Dynamics serves as the developmental evaluator for the TECH Initiative, using our WISE™ approach.[2] This report is a process evaluation of the TECH Initiative, publicly known as TECH Clean California. We previously completed an interim process evaluation in 2022, approximately eight months after the TECH Initiative officially launched on December 7, 2021.

The primary objectives of this process evaluation were to investigate the TECH implementer's program processes; the contractor experience enrolling in TECH offerings, applying for incentives, fulfilling program requirements, communicating with TECH staff, and attending optional training sessions; the multifamily property owners' decision making and experience completing and paying for a TECH project; and finally, an assessment of TECH project characteristics. We also sought to identify opportunities to optimize the program and inform program scalability. Opinion Dynamics used a mix of primary data and secondary data to address these research objectives.

I.I KEY FINDINGS

TECH Contractors: A total of 856 contractors enrolled in the Statewide TECH HVAC heat pump incentive offering launched in April 2023; most of which enrolled within one month of reinstating the incentives. Comparatively, a total of 725 contractors enrolled in the Self Generation Incentive Program (SGIP) heat pump water heater (HPWH) incentive offering.[3] The large majority of enrolled contractors (1,352 of 1,610; 84%) held a C-20 Heating, Ventilation, and Air Conditioning (HVAC) Contractor license. TECH contractors most commonly served the Bay Area and Greater Los Angeles region. Notably, the proportion of TECH contractors who serve the Bay Area region has doubled since the 2022 interim evaluation.

Surveyed contractors found the HPWH incentive application to be much more difficult than the HVAC heat pump application. Nearly half of contractors (26 of 59; 44%) encountered challenges with the HPWH application; the most common challenges were collecting information around customer enrollment in a Time-Of-Use (TOU) rate, the amount of time needed to gather all required documents, and the number of pictures/attachments needed. Seven of the 100 enrolled contractors had not yet submitted an application for either HPWH or HVAC heat pump TECH incentives. A majority of contractors (60 of 100; 60%) had layered TECH incentives, and nearly all of these contractors (93 of 100; 93%) found it to be helpful in selling heat pumps to customers. To streamline the layering process, contractors indicated it would be most helpful for the TECH Initiative to align its qualifying equipment models, and application and invoice requirements with other incentive programs.

[1] https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M331/K772/331772660.PDF
[2] https://opiniondynamics.com/WISE/
[3] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/self-generation-incentive-program

The TECH Initiative has encouraged stronger promotion of heat pump equipment in California through its contractor network. Most surveyed contractors' firms (74 of 100; 74%) increased their promotion of heat pumps at least a moderate amount since they enrolled in the TECH Initiative. A majority of contractors found the customer and equipment eligibility criteria clear for both HVAC heat pump and HPWH incentive offerings. The greatest confusion related to HPWH eligibility, specifically regarding the demand response requirement.

There is still an opportunity for TECH program staff to more effectively communicate with contractors. Nearly one-fifth of surveyed contractors (18 of 100; 18%) found TECH Initiative emails, the primary method of communication between TECH staff and contractors, to be only a little clear and understandable or not at all. Of the online resources available to contractors, the TECH Clean California website was the most frequently visited by surveyed contractors and was found to be the most useful resource for information. Top suggestions provided by contractors to improve TECH communication included increasing overall accessibility to TECH staff and streamlining email communications. About half of surveyed contractors who were aware of the office hours hosted by Frontier Energy's Account Management team had attended a session (36 of 67; 54%). Nearly all who attended office hours (32 of 36; 89%) found them to be at least somewhat useful.

TECH program staff flag incentive applications when there is missing information or an error. Overall, surveyed contractors found it easier to correct flagged issues on HVAC heat pump applications compared to HPWH applications. Primary reasons contractors had difficulty resolving flagged issues included lack of clarity around why something was flagged as a discrepancy, the extended amount of time it takes to resolve the flags, and relatedly, ineffective communication protocols from the TECH team when trying to address flagged issues.

A majority of surveyed contractors (54 of 94; 57%) passed the incentive on to their customer at the point of sale; this included 25 HVAC contractors, 8 HPWH contractors, and 20 contractors who offered both HVAC and HPWH incentives. The remaining respondents waited to receive the TECH payout before doing so. About half of contractors (42 of 94; 45%) expressed dissatisfaction with the amount of time taken to receive payments from the TECH team after submitting an incentive application. HPWH contractors typically waited longer to receive payments from the TECH team compared to HVAC contractors, with 42% (25 of 59) of surveyed HPWH contractors waiting more than three months to receive their rebates.

Almost all surveyed contractors (87 of 100; 87%) were at least somewhat satisfied with the TECH Initiative overall. Contractors who had layered TECH incentives indicated slightly higher satisfaction with the TECH Initiative compared to those who did not. Overall satisfaction among contractors largely increased since the interim evaluation in 2022, particularly for those who had layered a TECH incentive (29 percentage point increase in proportion who said they were "very satisfied").

TECH Incentives: Many surveyed contractors (56 of 100; 56%) observed an increase in their heat pump sales since they began participating in the TECH Initiative. The TECH rebate was cited as a significant cause for this increase. Additionally, many contractors reported a negative impact on their heat pump sales during periods when TECH Initiative funding had been paused. Just under one-third (30 of 100; 30%) reported little to no growth in their sales, despite most of these contractors (73 of 100; 73%) promoting heat pump equipment at least somewhat to their customers.

Households in PG&E territory (17,840 of 31,064; 57%) and SoCalGas territory (10,405 of 31,064; 33%) made up the bulk of TECH projects, with the rest of households primarily residing in SDG&E territory. There are, however, differences in the distribution of heat pump types installed across these territories. Three-fifths of HPWHs were installed in households located in SoCalGas territory (688 of 1,144; 60%), while almost half of HVAC heat pumps were installed in households within the PG&E territory (11,618 of 23,658; 49%).

Multifamily Project Funding: Multifamily HPWH projects were often funded through a variety of incentive sources in addition to TECH Clean California incentives, such as BayREN incentives, federal tax credits, and California's Low-

Income Weatherization Program (LIWP), as well as other means such as HOA fees or rental income. In contrast, multifamily HVAC heat pump projects were generally funded using the property owner's own funds, such as financial reserves, capital expenditure budgets, or rental income. In both cases, the TECH Clean California incentives played a significant role, with a couple property owners indicating they would have been unlikely to purchase the equipment without these incentives.

TECH Projects: A large majority of heat pump installs were HVAC heat pumps, in single-family residences, and outside of disadvantaged communities. HVAC heat pump projects were commonly completed in two days, while HPWH installs were likely to take three days or more. Only 3% (1,004 of 30,630) of households who purchased TECH-incented heat pump equipment required an electrical panel upgrade. Panel upgrades were more commonly required for HPWH projects than for HVAC heat pump installs.

HVAC Heat Pump Projects: The majority of households that received an HVAC heat pump (17,459 of 30,630; 57%) had central air conditioning (AC) prior to installing their heat pump; although nearly all of the remaining (12,558 of 30,630; 41%) did not have AC beforehand. The layering of incentives from multiple sources allowed contractors to install more efficient heat pump systems. On average, contractors installed equipment with higher SEER ratings compared to that observed during the interim evaluation in 2022. TECH contractors were significantly more likely to have performed duct sealing at DAC households than non-DAC households. TECH contractors included smart thermostats on nearly two-thirds (18,891 of 30,630; 62%) of projects while they completed Manual J calculations on about 10% of projects (3,063 of 30,630). Duct sealing was completed at approximately one-third the rate observed in 2022 (21 percentage point decrease).

HPWH Projects: TECH-incented HPWHs were most likely to be installed in the garage. Nearly all previous water heaters (2,990 of 3,215; 93%) were under 60-gallon capacity, while more than half of the new HPWHs had a 60-gallon or greater capacity. TECH contractors installed a thermostatic mixing valve in less than half of HPWH projects; a sizeable decrease from that observed during the interim evaluation in 2022 for both DAC (32 percentage point decrease) and non-DAC (17 percentage point decrease) households. This finding came as a surprise as the TECH Initiative began requiring a thermostatic mixing valve be included for all HPWH installations in June 2022, whereas adding a thermostatic mixing valve previously incurred a bonus incentive for the contractor.

As of October 31, 2023, single-family HPWH customers were required to enroll in a demand response program to be eligible for a TECH incentive through the SGIP HPWH program. This involves TECH contractors ensuring their customers are enrolled in a demand response program when completing the installation; therefore, contractors need a certain level of understanding about how these programs work. About a quarter of surveyed HPWH contractors (14 of 59; 24%) expressed little to no confidence in their understanding of demand response programs. At the same time, we can presume that most contractors had no experience with demand response topics before their involvement in TECH Clean California, so the fact that 77% feel at least somewhat confident is a testament to the program's education efforts. When discussing enrollment, TECH customers were most frequently concerned with how their equipment will operate when enrolled in a demand response program and have trouble understanding what demand response is and/or why program enrollment is required. By and large, contractors who successfully fulfilled the demand response requirement said the most helpful strategy is to come prepared for customer questions. From surveyed contractors' perspectives, the most challenging aspects of the requirement are getting customers to agree to enroll and distinguishing the demand response requirement from the TOU rate plan requirements. Top recommendations to make the requirement easier to comply with included developing training/instructional materials for contractors, removing the requirement altogether, and providing more resources for customer questions, such as a telephone helpline.

Multifamily Property Owner Decision Making: Multifamily property owners replacing a centralized water heater tended to replace the equipment preemptively, while individual HVAC heat pump equipment was generally replaced reactively.[4]

[4] One property installed the HVAC heat pump unit in a common area, while the remaining two properties installed equipment in individual units.

Property owners noted their decision to replace their water-heating equipment was based on their desire to explore new equipment options or electrification of their property. In contrast, HVAC heat pump equipment replacement was often due to the existing equipment being old or malfunctioning. Further, likely due to the more reactive nature of HVAC heat pump equipment replacement, project timelines for HVAC heat pumps were considerably shorter, ranging from two to six months compared to 10 to 18 months for Central HPWH projects.

Workforce, Education, and Training: Nearly one-third of surveyed contractors (31 of 100; 31%) had not heard about the optional trainings offered through the TECH Initiative. Among contractors who had heard of them, just under half (31 of 69; 46%) had not attended any recent trainings in 2023 or 2024. The most common reasons contractors gave for not signing up for a training were that they had already completed a similar training (13 of 31; 42%) or that they wanted to attend but it never became a priority (10 of 31; 32%). Other reasons included inconvenience of the training, related to either time, duration, or location, unclear expectations of what would be covered, and the topics were not of interest. Top suggestions for future training topics included electrical panel upgrades, the permitting process, and a refresher on TECH Initiative guidelines and requirements (e.g., identifying qualifying equipment, demand response requirements).

I.2 CONCLUSIONS AND RECOMMENDATIONS

We offer the following conclusions and recommendations for the TECH Initiative.

- **Conclusion: While the Bay Area, San Diego, and Greater Los Angeles area have strong contractor participation, other regions—such as the Central Valley, Inland Empire, and rural Northern California—may lack adequate contractor coverage for heat pump installations.**
  - Recommendation: The TECH team should expand TECH Initiative outreach and contractor recruitment in underrepresented regions to better promote access to TECH incentives and to support statewide electrification goals.
- **Conclusion: The timeline for distributing incentive payments to contractors could be shortened to improve contractor satisfaction.** The TECH program suggests that contractors provide the incentive as an instant discount at the time of sale to customers. However, floating funds to customers while waiting for payment from the program can create cash flow issues for smaller contracting firms. Many contractors expressed dissatisfaction with the long wait times for receiving incentive payments. The approval process for incentive applications can be delayed if contractors are not aware that their application has been flagged for corrections.
  - Recommendation: The TECH team should consider ways to expedite the contractor reimbursement process, such as a mobile payment service. TECH staff should also provide the average time expectation for their reimbursement on a readily available resource, such as the Switch is On website, so contractors have a realistic time expectation for when they will receive their payment.
- **Conclusion: The TECH Initiative's equipment eligibility criteria for HVAC heat pumps could be modified to require more energy-efficient models.** Other incentive programs in the state require efficiencies that exceed the code minimum SEER 14 rating. When pairing TECH incentives with other programs, contractors have successfully installed higher-efficiency heat pumps. Further, contractors said they almost never had trouble finding HVAC heat pumps eligible for TECH incentives, likely due to the code-minimum efficiency requirement.
  - Recommendation: If the TECH Initiative wants to increase the amount of greenhouse gas savings generated by efficient heat pump equipment, then it should consider incentivizing only heat pumps that go beyond the code minimum. Such a change in the requirements should not be difficult for contractors to meet, given that they already do this for other programs.
- **Conclusion: Layering TECH incentives with other program incentives appears highly effective in boosting heat pump adoption.** Nearly all contractors who had layered TECH incentives found it to be helpful in selling heat

pumps to customers. To streamline the layering process, contractors indicated it would be most helpful for the TECH Initiative to align its qualifying equipment models and the application and invoice requirements with other incentive programs.

- **Conclusion: Water-heating contractors have found some challenges associated with the TECH Initiative's requirement for single-family customer enrollment in demand response and TOU rate plans.** Half of water-heating contractors had difficulty getting the customer to agree to enroll, and one-quarter felt little to no comfort explaining demand response benefits to customers. At the same time, contractors said TECH customers are concerned with how their equipment will operate when enrolled in a demand response program and have trouble understanding what demand response is and/or why enrollment is required. Contractors suggested that it would help to have tangible resources to share with customers, such as a fact sheet or short information video that contains "links to important instructions and information" about demand response.
  - **Recommendation:** The TECH team should increase promotion of the customer-facing handout, available to contractors on the Switch is On website, that includes answers to commonly asked questions and outlines steps customers should take to participate in a demand response program. Encouraging contractors to share this document more broadly with their customers will help ensure customers are prepared for and open to discussions about demand response when TECH contractors mention it. TECH staff should also explore crafting scripts that contractors can use in their conversations with customers to outline the benefits of demand response programs.
  - **Recommendation:** TECH staff should make the customer-facing handout easily findable and accessible for customers on the Switch is On website. The TECH team should also add information related to demand response and the associated incentive requirements to the customer FAQ page to further ensure customers have access to this information.
- **Conclusion: TECH contractors offering SGIP HPWH incentives have reported more dissatisfaction and challenges with the TECH Initiative than HVAC contractors.** Specifically, they found the TECH enrollment application more confusing and burdensome; they had more difficulty understanding the equipment and customer eligibility criteria; and had more difficulty addressing flags and completing the incentive applications.
  - **Recommendation:** TECH staff should consider targeted promotion of the recurring contractor office hours to HPWH contractors and reminders of the TECH Contractor Knowledge Base website, because 13% of contractors did not know about this website.
- **Conclusion: Clarity of communication and responsiveness among program staff could be improved.** TECH contractors reported difficulty reaching TECH staff for questions, that listed phone numbers do not work, and that calls are not returned. The most common suggestion contractors had to improve communication was to enhance accessibility to the TECH team. The article on the Contractor Knowledge Base website titled "How to Reach the TECH Team" lists only emails and no phone numbers.[5] Despite being the primary mode of communication used by TECH staff to share information, some contractors found TECH emails to be only a little clear and understandable, or not at all.
  - **Recommendation:** The TECH team, and in particular Frontier Energy, which manages the contractors, should investigate what phone numbers are listed in contractor-facing materials and check that they are current. Contractors may find a phone call a quicker and easier way to get their questions answered than multiple back-and-forth emails. Therefore, we recommend adding phone numbers to the Knowledge Base article about how to reach the appropriate TECH team member for different questions.
  - **Recommendation:** TECH staff should streamline email formats and expand live support options to improve the clarity of communication and increase staff accessibility.

[5] https://frontierenergy-tech.my.site.com/contractorsupport/s/article/How-to-Reach-Us

2. INTRODUCTION

The State of California has established ambitious climate goals. In Senate Bill (SB) 1477 (Stern, 2018), the legislature finds that the "electricity and heating fuels used in buildings are responsible for a quarter of California's greenhouse gas emissions and contribute to indoor and outdoor air pollution."[6] As part of meeting the State's climate goals, SB 1477 requires the California Public Utilities Commission (CPUC) to develop two programs, designed to test two specific approaches to building decarbonization. The two SB 1477 pilot programs are the Building Initiative for Low Emissions Development (BUILD) program and the Technology and Equipment for Clean Heating (TECH) Initiative. The BUILD Program is designed to provide incentives to eligible applicants for the deployment of near-zero-emission building technologies in new construction to significantly reduce the emissions of greenhouse gases from buildings The TECH Initiative, publicly known as TECH Clean California, is designed to advance the state's market for low-emission space and water-heating equipment for existing residential buildings. The TECH Initiative installs low-emissions space and water heating technologies in existing California homes through a combination of market incentives, supply chain engagement, workforce development, consumer education, regional pilots, and Quick Start Grants.[7] The TECH incentives can be paired with other heat pump program incentives, which we refer to as "layered incentives."

As stated in D. 20-03-027, the decision "Establishing Building Decarbonization Pilot Programs," "the BUILD Program and TECH Initiative are building decarbonization pilot programs intended to raise awareness of building decarbonization technologies and applications, test program and policy designs, and gain practical implementation experience and knowledge necessary to develop a larger scale approach in the future."[8]

In April 2020, D. 20-037-027 directed the CPUC's Energy Division to select the implementer for the TECH Initiative. Following a rigorous competitive bidding process, the CPUC, via a scoring committee, selected Energy Solutions as the prime contractor of the TECH Initiative. Energy Solutions entered into a Master Consulting Services agreement with Southern California Edison Company (SCE), the administrator of the BUILD Program and TECH Initiative, on May 20, 2021.

Similarly, in April 2020, D. 20-03-027 directed the CPUC's Energy Division to select a single evaluator for the TECH Initiative and the BUILD Program. The role of the program evaluator is to measure the impact of program activities, as well as qualitatively assess the success and scalability of the programs' strategies. This should occur in as close to real time as possible so that timely, substantive feedback can be used to change course when and if appropriate, and to ensure the success of these pilot programs. The scoring committee selected Opinion Dynamics as the embedded evaluator for the BUILD and TECH Initiatives.[9] Opinion Dynamics entered into a Master Consulting Services Agreement with SCE on June 28, 2021.

This report is a process evaluation of the TECH Initiative, an update to the interim process evaluation completed in 2022.[10] To inform the current process evaluation, we surveyed TECH-enrolled contractors about their experience participating in the TECH Initiative and conducted an analysis of the TECH incentive application database. In this report,

[6] SB 1477 was codified as Public Utilities (Pub. Util.) Code Section 748.6, Section 910.4, and Sections 921-922.

[7] Opinion Dynamics did not include an assessment of the pilots and Quick Start Grants in this process evaluation because we prepared a separate, standalone evaluation report for them. It can be found at <<Insert PDA link or public link when ready>>>

[8] https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M331/K772/331772660.PDF

[9] Embedded Evaluation is based on the principles of Developmental Evaluation as defined by Dr. Michael Quinn. It is an approach to insert evaluation within the program design, implementation, and reporting processes to support evidence-based decision-making as well as informed ongoing decision-making.

[10] The interim process evaluation took place approximately eight months after the TECH Initiative officially launched its first wave of incentives on December 7, 2021.

we also present results from the TECH Initiative Multifamily Survey, fielded with multifamily property owners who completed a project through the TECH Initiative about their overall experience.

This process evaluation assesses program design and implementation with a focus on the contractor experience, the multifamily property owner experience, and program operations. The objective of this process evaluation is to illuminate opportunities for program optimization, identify lessons learned to inform program scalability, and identify changes in contractors' experiences and project details over the past four years of implementation.

2.1 PROGRAM DESCRIPTION

The TECH Initiative launched in December 2021 with $120 million in funding from the CARB's Cap-and-Trade program for gas investor-owned utilities, which generates revenue from the sale of GHG emissions allowances to gas investor-owned utilities (IOUs).[11] spending of these funds was allowed in only the gas utility service territories from which the funds were derived. The California Energy Trailer Bill, or Assembly Bill 179 (Ting, 2022), released on August 31, 2022, allocated an additional $50 million in General Fund money for TECH Clean California to use across all of California beginning in 2023, which we refer to as Statewide TECH.[12] In October 2023, the TECH Initiative began offering HPWH incentives statewide through the SGIP program, and in 2024 offered incentives funded from the federal Home Electrification and Appliance Rebates (HEEHRA) program. The TECH Initiative enrolls contractors who apply for incentives and pass the incentive on to their customers. All incentivized heat pumps must be installed by a contractor enrolled in the TECH Initiative. To be eligible to participate in the TECH Initiative, California contractors have to meet licensure and insurance requirements. The General B, C20, and C36 licensed contractors are eligible for HPWH incentives, while General B and C20 are eligible for HVAC heat pump incentives.

The TECH Initiative's overall goal is full-scale market transformation of the heat pump market in California to ensure a thriving market for clean heating technologies in the next 10 years. In D. 20-03-027, Ordering Paragraph 32 states, "The TECH Initiative implementer shall approach the initiative with a menu of tactics… but shall implement the upstream and midstream market approach as well as provide consumer education, contractor training, and vendor training, to drive market development." The Decision also goes on to state that "market development initiatives involve phases that require development and testing of strategies and approaches to arrive at impactful market intervention efforts." The Decision gives the TECH implementer flexibility to determine and test specific tactics while also addressing the statutory mandates in SB 1477. In accordance, Energy Solutions, the TECH implementer, employed a combination of market incentives, supply chain engagement, workforce development, consumer education, regional pilots, quick start grants and public data reporting.

2.2 RESEARCH OBJECTIVES

The primary objectives of this process evaluation were to investigate program processes of the TECH Initiative as they related to the contractor and customer experience. Together, these lines of investigation illuminate how the TECH Initiative has unfolded and describe how the California markets have responded to the TECH incentive offering thus far. Specific objectives included:

- Evaluating the TECH implementer's program processes for contractor enrollment, contractor communication, incentive design, incentive processing, database management, and quality assurance procedures.

[11] https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M331/K772/331772660.PDF

[12] https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220AB179

- Investigating contractor experiences related to enrolling in the TECH Initiative, applying for incentives, fulfilling program requirements, promoting the TECH Initiative, communicating with TECH staff, and attending optional workforce development trainings.
- Understanding multifamily property owner experiences related to their decision-making when selecting a heat pump, getting the equipment installed, and paying for the equipment.
- Conducting an assessment of TECH projects to understand their locations, costs, incentive layering, and characteristics such as HVAC heat pump efficiencies, water heater capacities, or whether a panel upgrade was also completed.

3. METHODS

For this process evaluation, Opinion Dynamics used a mixed method approach that relied on a combination of surveys and a review of the TECH contractor enrollment database and TECH incentive application database of closed projects. We conducted online surveys with enrolled TECH contractors and multifamily property owner customers who purchased an incented heat pump. Descriptions of each primary and secondary data collection activity are included below.

Primary data collection

- Contractor Experience Survey: Fielded with TECH-enrolled contractors enrolled in the TECH Initiative as of July 2024. Survey fielding completed between July 31, 2024 and August 26, 2024.
- Multifamily Property Owner Survey: Fielded with property owners who had completed a TECH-incented project between the inception of the TECH Initiative (December 2021) and August 2024. Survey fielding spanned from December 2, 2024, to January 10, 2025.

Secondary data collection

- Contractor Enrollment Database: Covers contractor enrollment in the TECH Initiative from program inception in December 2021 to July 2024.
- TECH Incentive Application Database: Covers projects from program inception in December 2021 to September 2024.

In the following sections, we explain each of these methods in more detail. All data collection instruments can be found in Appendix A.

3.1 TECH-ENROLLED CONTRACTOR SURVEY

Opinion Dynamics surveyed contractors enrolled in TECH Clean California to gather information about their experience with the TECH Initiative. The objectives of the Contractor Experience Survey included the following:

- Understand how contractors first learned about the TECH Initiative and ease of the enrollment process.
- Describe contractors' understanding of various TECH Initiative eligibility criteria and availability of eligible product types.
- Characterize the ease of applying for incentives through the TECH Initiative, including completion of Multifamily Incentive Reservation forms and process of layering TECH incentives with those offered through other programs.
- Assess contractors understanding of demand response programs and their ability to fulfill the program requirement.
- Determine the influence the TECH Initiative has had on heat pump sales.
- Assess contractors' awareness and rate of enrollment in optional trainings.
- Understand TECH Initiative communication methods contractors find most useful.

Our sample frame included 899 randomly selected contractors of the 1,077 TECH-enrolled contractors from data provided by Energy Solutions on July 8, 2024. We invited these 899 contractors to take the survey via email, contacting them up to three times. The online survey was open from July 31, 2024 to August 26, 2024. We received a total of 100 survey completes which translates to a response rate of 11%. Respondents received a $30 e-gift card as a token of appreciation for taking the time to participate in this research.

Where feasible, we compared survey results with data from the 2022 Contractor Experience Survey to highlight TECH Initiative improvements over time and potential evidence supporting market transformation of heat pump technologies.

3.1.1 CONTRACTOR SAMPLE

Of the 100 TECH-enrolled contractors who completed our survey, most (82 of 100; 82%) offered the HVAC heat pump incentive to their customers in the prior year (Table 1). Half of these respondents (41 of 82; 50%) had also offered the HPWH incentive to customers in the past 12 months.

Table 1. Incentives Offered in Past Year (n=100)

Incentives Offered	Count of Respondents
HVAC heat pump incentive	82
HPWH incentive	59

Note: Some contractors offered both HVAC heat pump and HPWH incentives.

Most respondents held a leadership role in their company (67 of 100; 67%), reporting they are the owner, President, or CEO of their company (Table 2).

Table 2. Respondent Role in Company (n=100)

Professional Role	Count of Respondents
Owner	47
General Manager	25
President/CEO	20
Service Manager	12
Sales Manager	9
Office Admin	4
Project Manager	3
Rebate Specialist	3
Permit/Installer Coordinator	2
Other	2

Note: Multiple responses allowed.

Aside from English, Spanish was the most common language in which contractors offered services to customers. Very few contractors offered services in languages beyond English and Spanish (Table 3).

Table 3. Languages Services Are Offered In (n=100)

Languages Offered	Count of Respondents
English	99
Spanish	38
Russian	3
Korean	3
Vietnamese	2
Other	5

Note: Multiple responses allowed.

3.2 MULTIFAMILY SURVEY

Opinion Dynamics surveyed multifamily property owners who received TECH-incented HVAC heat pumps or HPWHs to gather information about their experience replacing space- or water-heating equipment with heat pumps. The objectives of the survey included the following:

- Customer motivations for replacing equipment
- Level of knowledge of heat pumps prior to purchase
- Importance of potential benefits of heat pumps in decision-making
- Funding used for purchasing equipment
- Satisfaction with contractors and installation process

Our sample frame included all 45 multifamily property owners who received a TECH incentive from the start of the TECH Initiative through August 2024. We used a census approach and invited all of these property owners to complete the survey via email, contacting them up to three times. The online survey was open from December 2, 2024, to January 10, 2025. We received nine completed surveys, which translates to a response rate of 20% (Table 4). Some multifamily TECH customers installed both space-heating and water-heating equipment at the same property. However, our survey respondents installed only one type of heat pump equipment. Respondents received a $25 e-gift card as a token of appreciation for taking the time to participate in this research.

Table 4. TECH Initiative Multifamily Customer Post-Install Survey Fielding Summary

Equipment Type	Sample Frame	Completed Surveys	Response Rate
HVAC HPs	18	5	28%
HPWHs	16	4	25%
Both	11	0	0%
Total	**45**	**9**	**20%**

Most of the multifamily property owner respondents operated market-rate housing (7 of 9; 78%), with the remaining properties being subsidized affordable housing (2 of 9; 22% Table 5). Their TECH-incented heat pump equipment was installed between October 2021 and June 2024, and the total incentive amount per property ranged from $1,800 to $106,800. The data in Table 5 comes from TECH Initiative tracking data, except for the “Property Type” column, which came from survey responses.

Table 5. Surveyed TECH Initiative Multifamily Participant Characteristics

Property Number	Property Type	Project Type	Installation Date	Number of Units Installed	Total Incentive Amount
1	Market Rate	Centralized HPWH	November 2023	2	$25,600
2	Market Rate	Centralized HPWH	December 2022	1	$7,200
3	Subsidized Affordable Housing	Centralized HPWH	June 2024	8	$66,000
4	Market Rate	Centralized HPWH	March 2024	6	$106,800
5	Market Rate	In-unit HVAC HP	March 2023	9	$18,000
6	Market Rate	Common Area HVAC HP	Not provided	1	$1,800
7	Subsidized Affordable Housing	Centralized HVAC HP	December 2023	6	$100,000
8	Market Rate	In-unit HVAC HP	February 2023	24	$102,000
9	Market Rate	In-unit HVAC HP	October 2021	2	$4,000

3.3 DATABASE REVIEWS

Opinion Dynamics conducted an analysis of the TECH contractor enrollment database and TECH incentive application database provided by Energy Solutions. We assessed these data to understand the following:

- How many contractors are enrolled in the TECH Initiative?
- Where were the TECH Initiative projects in California?
- To what extent were TECH Initiative projects layered with another program's incentives?
- How many projects required panel amperage upgrades?
- What were the project lengths?
- What additional tasks did the contractor perform when installing heat pumps?
- Where in the home were HPWHs installed, and did this differ by climate zone?
- What were the capacities of the installed HPWHs?
- What were the efficiencies of the installed HVAC heat pumps?

Energy Solutions provided Opinion Dynamics with a database of heat pump projects that received TECH incentives from December 2, 2021, through September 9, 2024. The database contained closed projects for which the incentive had been paid to the contractor; it did not include any open projects where the contractor was awaiting reimbursement for a heat pump installation. Our analysis focused on projects completed for single-family homes and excluded those completed through the Low-Income and Multifamily Programs, unless otherwise specified. We examined results at the equipment and household level, and assessed installations in and out of disadvantaged communities (DACs) and by climate zone. The database represented a total of 37,402 TECH-incented heat pumps installed across single-family and multifamily properties: 32,502 HVAC heat pumps, and 5,127 HPWHs. Our analysis was conducted on 33,488 heat pumps installed in 30,630 single-family households.

Energy Solutions also provided a database tracking contractor enrollment in the TECH Initiative from October 30, 2023, through July 8, 2024. This database contained data on contractor enrollment in the TECH Initiative and specific incentive offerings, as well as information regarding the licenses they hold and the regions that they serve. Please note

that throughout this report, we may refer to contractors enrolled in TECH based on distinct periods of funding – Cap-and-Trade TECH contractors,[13] SW TECH contractors,[14] and SGIP HPWH TECH contractors.[15]

Where appropriate, we assessed statistically significant differences between groups using t-test. Statistically significant differences are called out as relevant in our findings, which represents a p-value below or equal to 0.05.

[13] This refers to contractors who enrolled in the first TECH heat pump incentive offering when the program launched in December 2021.
[14] This refers to contractors who enrolled in the TECH heat pump incentive offering launched in April 2023.
[15] This refers to contractors who enrolled in the TECH heat pump incentive offering launched in October 2023.

4. PROGRAM THEORY AND DESIGN

Opinion Dynamics is serving as the developmental evaluator for the TECH Initiative. In 2021, one of our first evaluation activities was to work with the prime implementer, Energy Solutions, to create a Program Theory Logic Model (PTLM) that explicates the TECH Initiative's activities, outputs and intended market and program outcomes. We also developed key performance indicators (KPIs) that, when measured, can demonstrate whether the intended outcome was achieved.

Our evaluation approach is grounded in the PTLM of the TECH Initiative to ensure the program and market metrics are in direct alignment with the theory and logic of the TECH Initiative.

4.1 PROGRAM THEORY AND LOGIC MODEL

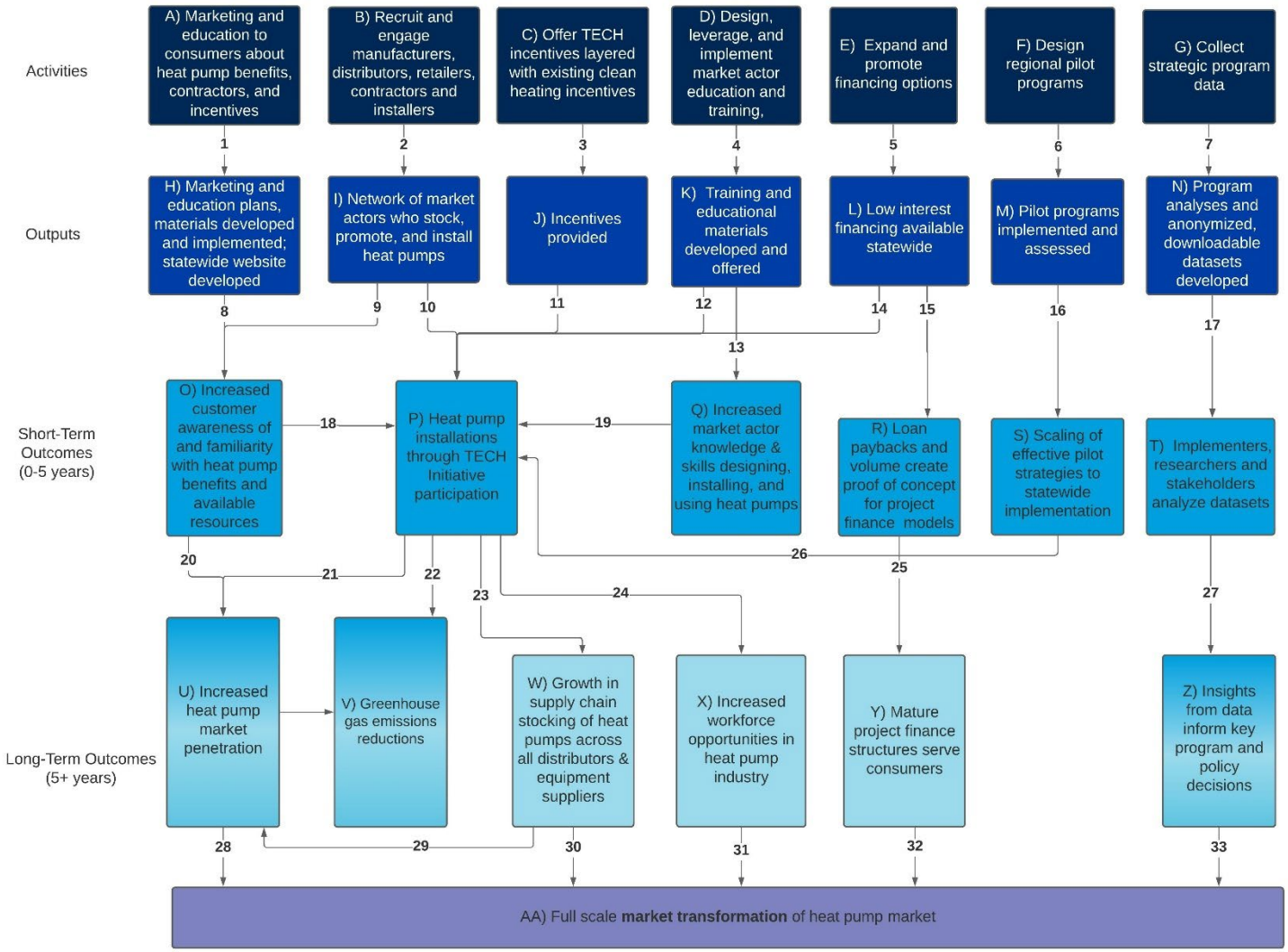
The TECH Initiative was launched in December 2021. Around this time, Opinion Dynamics developed a Program Theory Logic Model (PTLM) that documents how the TECH Clean California activities lead to outputs, and how those lead to short- and long-term outcomes (Figure 1). The PTLM activities are listed from left to right and the outcome categories are listed in chronological order from top to bottom. The PTLM features arrows labelled with numbers and these arrows represent linkages.

Opinion Dynamics also developed KPIs to measure the linkages. Examples of KPIs include measures of how contractors' heat pump promotion strategies have changed, as well as measures of improvements in customer familiarity with heat pump benefits. Opinion Dynamics reviewed and updated the linkage narrative in late 2024 to reflect updates to the TECH Initiative theory which can be found in Appendix C. The TECH Initiative implementer collects data that support many of the KPIs tied to TECH Initiative outputs. The KPIs tied to outcomes typically require additional studies to collect the necessary information. In 2024, Opinion Dynamics published a report measuring these KPIs.[16]

In 2024, we reviewed the TECH Initiative PTLM in Figure 1 given the new rounds of funding and determined no revisions were needed as TECH Initiative activities still theoretically lead to the TECH Initiative's intended outcomes. Please note that we use the term "program" to refer to the TECH Initiative in cases within the model.

[16] https://www.calmac.org/publications/TECH_Clean_California_Key_Performance_Indicator_Assessment.pdf

Figure 1. TECH Initiative PTLM



4.2 TECH TEAM AND ROLES

The TECH Initiative's prime implementer, Energy Solutions, assembled a team to help them implement TECH Initiative activities. Table 6 shows a list of organizations who support the TECH Initiative and the role they play in the TECH Initiative.

Table 6. Organizations Involved in TECH Initiative and Their Roles

Organization	Role
Administration	
California Public Utilities Commission (CPUC)	Provides oversight to the TECH Initiative
Southern California Edison (SCE)	TECH Initiative contracting agent
Implementation	
Energy Solutions	Prime TECH implementer
Energy Outlet	Supports the incentive application portal and performs QA on incentive applications

Frontier Energy	Manages contractor outreach and enrollment; leads QA on contractor enrollment
Tre' Laine	Provides support for workforce education and training, and supply chain engagement
Recurve	Supports customer targeting analyses
Ardenna Energy	Supports financing-related activities
National Comfort Institute (NCI)	TECH training implementer
Electrify My Home (EMH)	TECH training implementer
Association for Energy Affordability (AEA)	TECH training implementer, oversees multifamily project coordination, and required onboarding training
Building Decarbonization Coalition	Responsible for consumer marketing, manager of The Switch is On website
Vermont Energy Investment Corporation (VEIC)	Coordinates TECH Initiative pilots and Quick Start Grants
BayREN, Pacific Gas & Electric (PG&E), Sacramento Municipality Utility District (SMUD), Central Coast Community Energy (3CE), Future Fit, City of Alameda, Grid Savvy	Entities providing incentives that can be layered with TECH Initiative
Evaluation	
Opinion Dynamics	Prime independent evaluator
Jai J. Mitchell Analytics	Evaluator
Guidehouse	Evaluator

4.3 CONTRACTOR ELIGIBILITY

In this section, we discuss the eligibility requirements for contractors and customers in the TECH Initiative.

CONTRACTOR ELIGIBILITY: LICENSURE AND INSURANCE REQUIREMENTS

TECH eligibility for California contractors includes licensure and insurance requirements. Any contractor receiving incentives through the TECH Initiative, whether single-family or multifamily incentives, or those offered through the pilots and Quick Start Grants, must enroll in the TECH Initiative and meet the requirements. TECH Initiative licensure requirements include:

- General B, C20 HVAC, and C36 Plumbing licensed contractors are eligible for HPWH incentives.
- General B and C20 HVAC licensed contractors are also eligible for HVAC heat pump incentives.

In August 2022, TECH updated its insurance requirements for participating contractors to align with the Contractors State License Board's (CSLB's) insurance requirements. These requirements include:

- Liability insurance, with an aggregate limit of $1 million, for licenses with five or fewer persons listed as personnel; plus, an additional $100,000 for each additional personnel listed on the license; not to exceed $5 million total (LLC licenses only)
- Workers' compensation insurance as dictated by CSLB requirements
- In addition, all [insurance] policies have a financial rating of at least "A-" and a financial size category of at least "VII" on the most current edition of AM Best's Key Rating Guide or a secure rating by another generally recognized rating agency

When the TECH Initiative reinstated its HVAC heat pump incentives in April of 2023 with SW funding, participating contractors were required to re-enroll in the TECH Initiative, which involved signing a new Trade Professional Participation Agreement (TPPA). For contractors enrolling to offer SGIP HPWH incentives, at least one person at their company was required to attend an introductory, two-hour online HPWH training along with signing a TPPA and

additional trainings. Individual technicians within a contractor company must also to take a state-certified apprenticeship course, the two-hour online HPWH training, or a manufacturer's training on HPWHs.

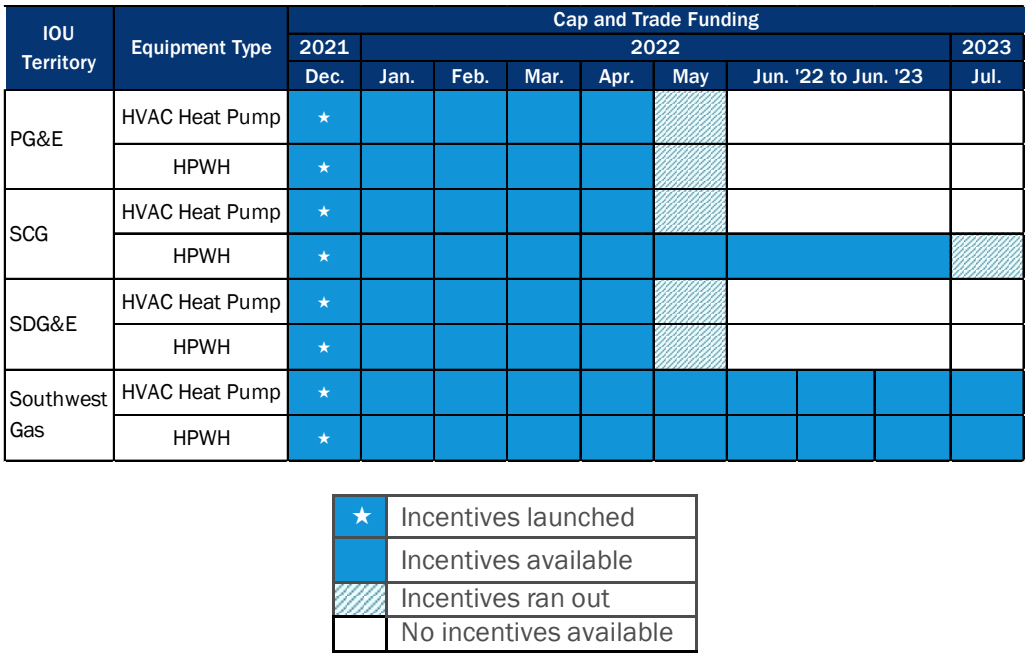
4.4 INCENTIVE DESIGN

The TECH Initiative began the incentive portion of the TECH Initiative with a soft launch in September 2021 and a full-scale launch on December 7, 2021. Initially, the TECH Initiative did not require a contractor to pass the rebate through to the customer. This requirement changed in March 2022 and was communicated to contractors via email. Contractors can choose whether they give the customer an instant rebate at the time of sale or wait to be paid by the TECH Initiative before passing it on to the customer; the TECH Initiative recommends the former approach.

The full launch of the TECH Initiative employed a complex incentive structure. The structure was designed to encourage incentive layering and manage the budget according to CARB allocations. For single-family retrofit projects, baseline incentives were available in all TECH-eligible zip codes; and enhanced incentives were available in areas where another program was already offering heat pump incentives and partnering with the TECH Initiative. We refer to projects that received enhanced incentives as those with layered incentives because more than one programs' incentives were layered together. We refer to the initial funding and program structure as "Cap-and-Trade TECH."

At the end of March 2022, the TECH Clean California implementation team noticed rapid uptake of single-family incentives. As of April 5, 2022, contractors in SDG&E territory had claimed 67% of incentives available to them. Between the end of April and mid-May, the incentives claimed more than doubled in PG&E territory and nearly doubled in SoCalGas territory. Incentive funds for SDG&E and PG&E territory were exhausted in May of 2022 as were HVAC heat pump funds in SCG territory. Only HPWH incentives in SoCalGas territory remained, as shown in Figure 3.

Figure 2. Cap and Trade Funding Incentive Availability



The California Energy Trailer Bill, or Assembly Bill 179 (Ting, 2022), released on August 31, 2022, allocated an additional $50 million in General Fund money for TECH Clean California to use beginning in 2023. With additional funding to extend program activities, the TECH Clean California team revised the incentive structure and created new Terms and Conditions for contractors to sign to offer the new incentives. The TECH Clean California incentives funded

through this second round of statewide funding became available in April of 2023 and were focused on single-family HVAC heat pumps. Multifamily incentives had not seen the same level of uptake, and both water- and space-heating incentives were consistently available throughout 2023. As Figure 3 shows, single-family HPWH incentives were still available in SCG territory until July of 2023. We refer to the second funding period that began with HVAC heat pump incentives in April 2023 as "Statewide (SW) TECH." Later, Energy Solutions became the implementer for the SGIP HPWH incentives, which were folded under TECH Clean California to avoid customer and contractor confusion. This newer offering included single-family market-rate HPWH incentives, which became available on October 31, 2023; referred to throughout this report as "SGIP HPWH TECH." Finally, when federal High-Efficiency Electric Home Rebate Act (HEEHRA) heat pump incentives were launched in 2024, they were also folded under TECH Clean California.

As of January 17, 2025, the TECH Initiative implemented a pause on all single-family market-rate HVAC heat pump incentives. During this pause, HEEHRA incentives continued to be available to low-to-moderate-income customers for installing heat pump equipment on or after November 12, 2024. However, Opinion Dynamics is not evaluating HEEHRA, so these incentives will not be discussed in this report.

Figure 3. TECH Heat Pump Incentive Availability

Equipment Type	SW Funding						SGIP Funding				
	2023									2024	2025
	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan. '24 to Dec. '24	Jan.
HVAC Heat Pump	★										
HPWH							★				

★	Incentives launched
	Incentives available
	Incentives ran out
	No incentives available

We describe each of the TECH incentive types in more detail below. Revised incentive information reflects updates made as of January 2025, prior to the statewide pause noted above.

SINGLE-FAMILY BASELINE AND ENHANCED INCENTIVES

The TECH Initiative offered residential incentives for existing single-family properties and small multifamily properties (2-4 units). Table 7 lists out single-family HVAC baseline and enhanced incentives. The TECH-incented HVAC heat pump had to replace an existing non-heat pump heating source or replace just the heating element of that system. The non-heat pump heating source could have included propane, natural gas, wood burning, electric resistance, or solar-heated appliances. Furnaces eligible for replacement included but were not limited to central furnaces, wall furnaces, forced-air furnaces, electric baseboard furnaces, and wood-burning stoves. The HVAC heat pump incentive decreased from $3,000 to $1,000 per unit in May 2022. Lowering the single-family HVAC heat pump incentive amount allowed the TECH Initiative to provide incentives to more customers within the same budget. As of November 2024, all HVAC heat

pump claims required customers to enroll in a demand response program to be eligible for the incentive. All enhanced incentives for HVAC heat pumps were discontinued in April 2023 upon the launch of SW TECH incentives.

Table 7. Single-Family HVAC Heat Pump Incentives

Equipment Type	Efficiency Rating	Total Incentive per Unit after May 2022
Unitary package/split system and mini/multi-split system	Title 20 Code minimum	$1,000

Table 8 through Table 10 describe single-family HPWH baseline and enhanced incentives.

Table 8. Single-Family HPWH Incentives (December 2021 – October 2023)

Installation Scenario	Measure Criteria	Total Incentive Available (TECH + Local Program)
Gas/propane to HPWH	HPWH < 55 gallons	$3,100
	HPWH > 55 gallons	$3,800
Electric resistance to HPWH	All HPWH sizes	$1,500
Panel Upgrade/Load Center Installations	Sizing up to 200amps	$2,000

Table 9. Single-Family HPWH Incentives (November 2023 – December 9, 2024)

Segment	Installation Scenario	Total Incentive Available (TECH + Local Program)
Market Rate	Unitary HPWH	$3,100
	55-Gallon Capacity HPWH	$700
	Low-Global Warming Potential (GWP) Kicker[b]	$1,500
	Panel Upgrade/Load Center Installations	$2,000[c]
Equity[a]	Unitary HPWH	$4,185
	55-Gallon Capacity HPWH	$700
	Low-GWP Kicker[b]	$1,500
	Panel Upgrade/Load Center Installations	$4,000[c]

Note: Total project incentive amount capped at $7,300 for market rate, and $10,385 for equity.

[a] Equity incentives launched October 31, 2023 and exhausted by July 9, 2024.

[b] Incentive for HPWH with a refrigerant with GWP of 150 or less.

[c] Electrical upgrade incentive capped at 50% of total upgrade costs for market rate, 100% for equity.

Table 10. Single-Family HPWH Market Rate Incentives (As of December 10, 2024)

Region[a]	Installation Scenario	Total Incentive Available (TECH + Local Program)
Northern California	Unitary HPWH	$1,100
	55-Gallon Capacity HPWH	$700
	Low-GWP Kicker[b]	$1,500
	Panel Upgrade/Load Center Installations	$2,000[c]
Southern California	Unitary HPWH	$3,100
	55-Gallon Capacity HPWH	$700
	Low-GWP Kicker[b]	$1,500
	Panel Upgrade/Load Center Installations	$2,000[c]

Note: The maximum incentive amount a customer can receive for a project is capped at $7,300.

[a] PG&E and SMUD electric customers receive the Northern California incentives, while SCE and SDG&E electric customers receive the Southern California incentives.
[b] Incentive for HPWH with a refrigerant with GWP of 150 or less.
[c] Electrical upgrade incentive capped at 50% of total upgrade costs or $2,000, whichever is the lesser amount.

SINGLE-FAMILY QUALITY INSTALLATION INCENTIVES

Incentives for additional tasks completed for HVAC heat pump installations, including Manual J calculations, duct testing and sealing, and field measured performance were discontinued in April 2023 upon the launch of SW TECH incentives.

For HPWH installations, the TECH Initiative removed bonus incentives for adding a thermostatic mixing valve and enrolling customers in a demand response program. Both of these actions are now requirements for baseline incentive eligibility (Table 11). Bonus incentives were available for electrical panel upgrades required to accommodate heat pump equipment, covering up to 50% of electrical costs up to $2,000.

Table 11. Bonus HPWH Incentives

Bonus Incentive	Amount	Revision
Demand Response Program Enrollment	None	On October 31, 2023, this became a requirement for all HPWH installs and was removed as a bonus incentive
Thermostatic Mixing Valve Bonus	None	On June 19, 2022, this was communicated as a requirement for all HPWH installs, was removed as a bonus incentive, and was enforced beginning October 31, 2023
Panel Upgrade Incentive[a]	$2,000	Up to $2,000, capped at 50% of electrical costs (discontinued May 2022; reinstated October 31, 2023)

[a] Panel upgrade/load center incentive is available for HPWH installations that expand the capacity of a home's electrical system - traditional panel replacement, smart load center, or subpanel. These incentives must come along with a qualifying HPWH installation. Pre-existing panel capacity must be below 200 amps.

MULTIFAMILY INCENTIVES

The TECH Initiative offered incentives for multifamily properties with five or more units. Incentives were provided for HPWH and HVAC heat pump equipment for both retrofit and new construction applications through December 31, 2021. Beginning in 2022, multifamily incentives were available for only retrofit scenarios because new construction projects could apply for incentives through the BUILD Program. Incentives were available for various equipment types that serve residential apartments and communal spaces used by residents and multifamily building staff. Projects could range from a single unit changeout for a single apartment unit, to the replacement of a large central system that served multiple units at once. Multifamily incentives could be utilized as stand-alone incentives, layered with other non–TECH Initiative multifamily incentives for which the project may be eligible, or used alongside incentives from TECH Initiative pilots targeting multifamily properties.

Given the long pre-construction and construction timelines, the TECH Initiative uses an incentive reservation system for multifamily projects. The TECH Initiative's multifamily offering limited participating contractors and property owners to a maximum of $3 million of aggregate incentives across all multifamily incentive programs. This cap was put in place to ensure the incentive budget was spread adequately across enough participants to facilitate market transformation.

Table 12 defines the multifamily HVAC heat pump incentive structure.

Table 12. Multifamily HVAC Heat Pump Incentives

Space Type Serving	System Type	TECH Incentive (per equipment/per apartment served)
Individual apartments	Split or rooftop heat pump (ducted or ductless)	$2,000
	Packaged Terminal Heat Pump (PTHP), Single Package Vertical Heat Pump (SPVHP), or unitary through the wall/ceiling heat pump	$500 (single or two stage compressor); $1,000 (variable capacity/inverter driven)
Two or more apartments at the same property	HVAC Heat Pump equipment serving multiple apartments	$1,000
	Split of rooftop heat pump (ducted or ductless)	$1,800
	PTHP, SPVHP, or unitary through the wall/ceiling heat pump	$300 (single or two stage compressor) $800 (variable capacity/inverter driven)

Table 13 describes the multifamily HPWH incentive offerings available from the program launch until October 30, 2023.

Table 13. Multifamily HPWH Incentives (December 2021 – October 2023)

Space Type Serving	Previous Water Heater Heat Source	System Type	HPWH Tank Size/Storage Volume	TECH Incentive (per equipment/per apartment served)
Individual apartments	Gas or propane	Unitary	<55 gallons	$1,400
			≥55 gallons	$2,100
Individual apartments	Electric resistance		All	$700
Two or more apartments	Non-heat pump systems	Central	<17 gallons per bedroom served	$1,200
			≥17 gallons per bedroom served	$1,800
Not applicable	Non-heat pump systems	Heat pump pool heating		$2,500/equipment

Some multifamily projects were eligible for an additional incentive for electrical panel upgrades. This incentive required that the apartment unit receive a TECH-funded HVAC heat pump or HPWH and was all-electric after upgrades were made (Table 14).

Table 14. TECH Incentives for Electrical Upgrades Between Apartment Sub Panel/Panel and Electric Utility Meter (December 2021 – October 2023)

Previous Equipment	System Type	TECH Incentive (per apartment receiving electrical upgrade)
Undersized apartment electrical infrastructure that is upgraded as part of an apartment's HPWH or HVAC heat pump installation	Apartment panel or sub-panel upgrades, feeder upgrades, or service disconnect upgrades	$1,400

Table 15 lists the unitary SGIP HPWH incentives for multifamily properties available starting October 31, 2023 through December 10, 2024.

Table 15. Multifamily Unitary HPWH Incentives (As of October 31, 2023)

Segment	Installation Scenario	Total Incentive Available (TECH + Local Program)
Market Rate	Unitary HPWH	$3,100
	55-Gallon Capacity HPWH	$700
	Low-GWP Kicker[b]	$1,500
	Panel Upgrade/Load Center Installations	$2,000[c]
Equity[a]	Unitary HPWH	$4,185
	55-Gallon Capacity HPWH	$700
	Low-GWP Kicker[b]	$1,500
	Panel Upgrade/Load Center Installations	$4,000[c]

Note: Total project incentive amount capped at $7,300 for market rate customers, and $10,385 for equity customers.

[a] Equity incentives launched October 31, 2023 and exhausted by July 9, 2024.

[b] Incentive for HPWH with a refrigerant with GWP of 150 or less.

[c] Electrical upgrade incentive capped at 50% of total upgrade costs for market rate customers, 100% for equity customers.

SINGLE-FAMILY INCENTIVE APPLICATION PROCESS AND REIMBURSEMENT

TECH-enrolled contractors complete an incentive application online, via a portal called Iris. The application form requires information about the customer, the prior equipment, the heat pump equipment, additional project work such as panel upgrades, pictures of nameplates, and the full Home Energy Rating System (HERS) report. See Appendix E for a complete list of incentive application requirements. The process for incentive application and reimbursement is as follows:

4.5 WORKFORCE, EDUCATION, AND TRAINING

One important aspect of the TECH Initiative is to provide contractor and vendor training to support the advancement of the state's market for low emission space and water-heating equipment as called for in SB 1477. Workforce development via contractor training is a TECH Initiative activity designed to improve contractor familiarity and comfort with selling, installing, and maintaining heat pump technologies. The TECH Initiative partnered with the National Comfort Institute (NCI), Electrify My Home (EMH), Association for Energy Affordability (AEA), and the ENERGYSTAR® Manufacturer Council (ESMAC) to offer a variety of optional and required trainings. A description of each training can be found in Appendix F.

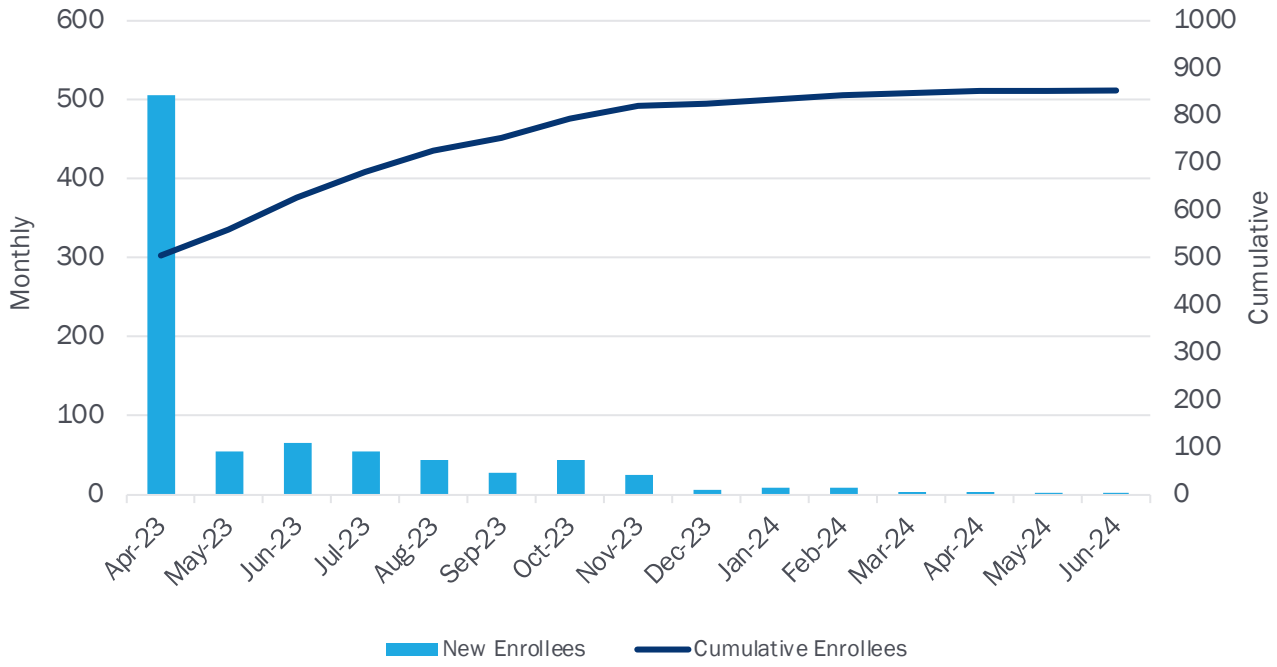
5. FINDINGS

This section presents findings related to TECH-enrolled contractors' experience with the TECH Initiative; marketing efforts to support heat pump awareness and TECH incentives; multifamily property owner decision-making and project characteristics; multifamily property owner and contractor satisfaction with the TECH Initiative; as well as findings related to contractors' experience with optional TECH-sponsored training sessions.

5.1 TECH-ENROLLED CONTRACTORS

Most contractors re-enrolled in SW TECH after participating in Cap-and-Trade TECH within one month of the HVAC heat pump incentives being reinstated (Figure 4.).[17] Of the 856 contractors who were enrolled as of July 2024, over half (506 of 856; 59%) enrolled in April 2023 upon the release of the offering. Approximately two-thirds of contractors (586 of 856; 68%) have submitted at least one claim since enrolling in the offering and before September 2024.

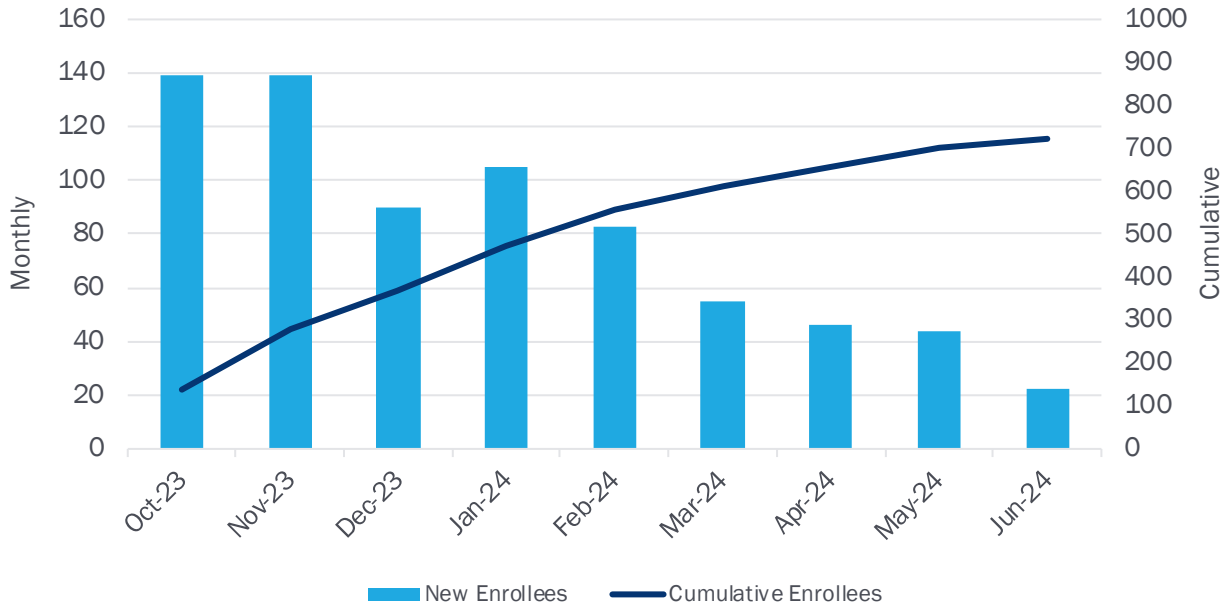
Figure 4. SW TECH Contractor Enrollment



SGIP HPWH incentives for water-heating equipment were launched statewide on October 31, 2023. SGIP HPWH enrollment peaked within the first few months of launching, whereas half of contractors (368 of 725; 51%) enrolled by December 2023 (Figure 5). Interest in the SGIP HPWH incentives continued in 2024, with enrollment nearly doubling within six months; a total of 725 contractors were enrolled in the offering by June 2024. Among those enrolled and eligible to offer SGIP HPWH incentives, about half (370 of 725; 51%) had submitted at least one claim by September 2024.

[17] The TECH Initiative required contractors to re-enroll in the TECH Initiative when incentive offerings were relaunched in April 2023.

Figure 5. SGIP TECH Contractor Enrollment



As of July 2024, the California regions serviced by the most TECH-enrolled contractors included the Bay Area (208 of 852; 24%), the Greater Los Angeles area (198 of 852; 23%), and San Diego (153 of 852; 18%) (Table 16). Notably, the proportion of contractors who served the Bay Area doubled since the interim evaluation in 2022 (12 percentage point increase). Additionally, we observed an 11-percentage point increase in the proportion of TECH contractors who served San Diego.

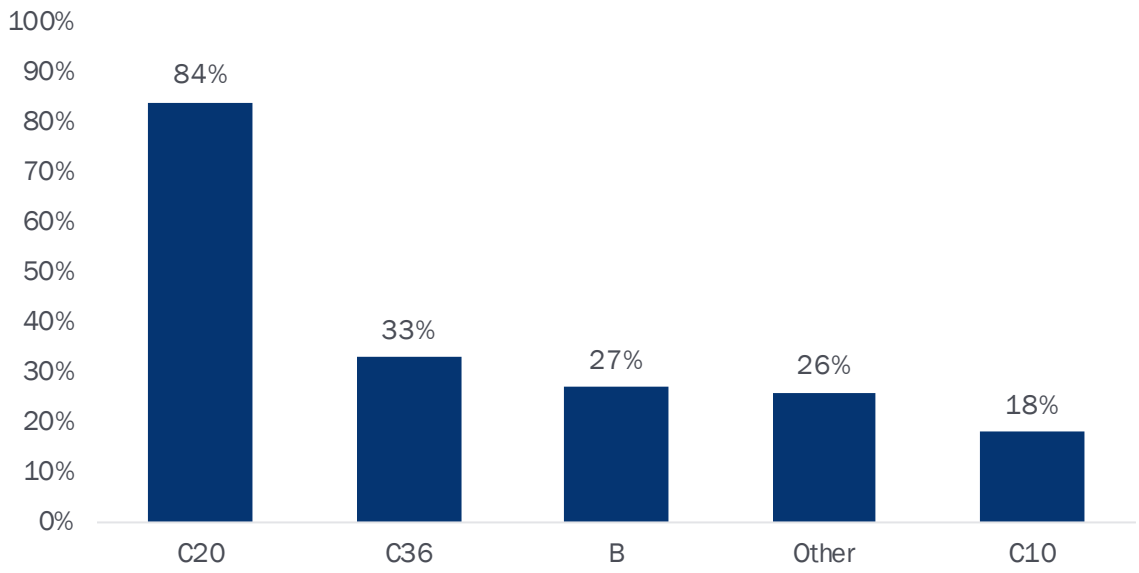
Table 16. TECH-Enrolled Contractors' Service Region(s)

Service Region	Count	Percent
Bay Area	208	24%
Greater Los Angeles	198	23%
San Diego	153	18%
Sacramento Valley	104	12%
Central Valley	65	8%
Northern CA	40	5%
Central Coast	40	5%
Orange County	31	4%
Sierra Desert	3	<1%
Statewide	1	<1%
Other	9	1
Total	**852**	**100%**

Note: Count excludes six contractors whose service region was not included in enrollment data.

Contractors with a C-20 HVAC Contractor license represented the majority of TECH-enrolled contractors as of July 2024 (720 of 1,610; 84%) (Figure 4). Notably, the proportion of contractors who held the C36 (13 percentage point increase), B (7 percentage point increase), C10 (5 percentage point increase), and some other type of license (7 percentage point increase) all increased since the 2022 interim evaluation. These findings suggest the TECH Initiative has recruited contractors with a broader range of licenses and skillsets over the last couple of years.

Figure 3. License(s) Held by TECH-Enrolled Contractors (n=1,610)



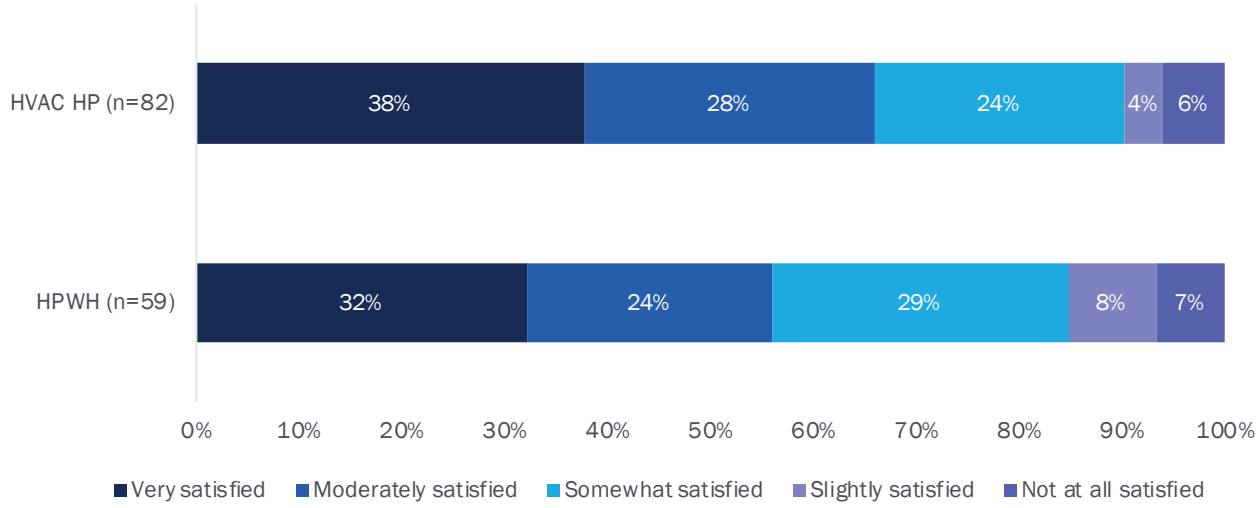
Note: This figure excludes one contractor whose license information was not available in the TECH Initiative database. License proportions amount to more than 100% due to contractors holding multiple license types.

5.2 CONTRACTOR SATISFACTION

Overall, surveyed contractors were satisfied with the TECH Initiative when asked in summer 2024. Almost all contractors were at least somewhat satisfied with their TECH Initiative experience (87 of 100; 87%), with over one-third (36 of 100; 36%) reporting they were "very satisfied" (Figure 6).[18] HPWH contractors indicated lower satisfaction with their TECH Initiative experience compared to HVAC contractors, with nearly half (26 of 59; 44%) reporting they were less than moderately satisfied with the TECH Initiative. Only 6% of all respondents (6 of 100) were "not at all satisfied" with their TECH Initiative experience.

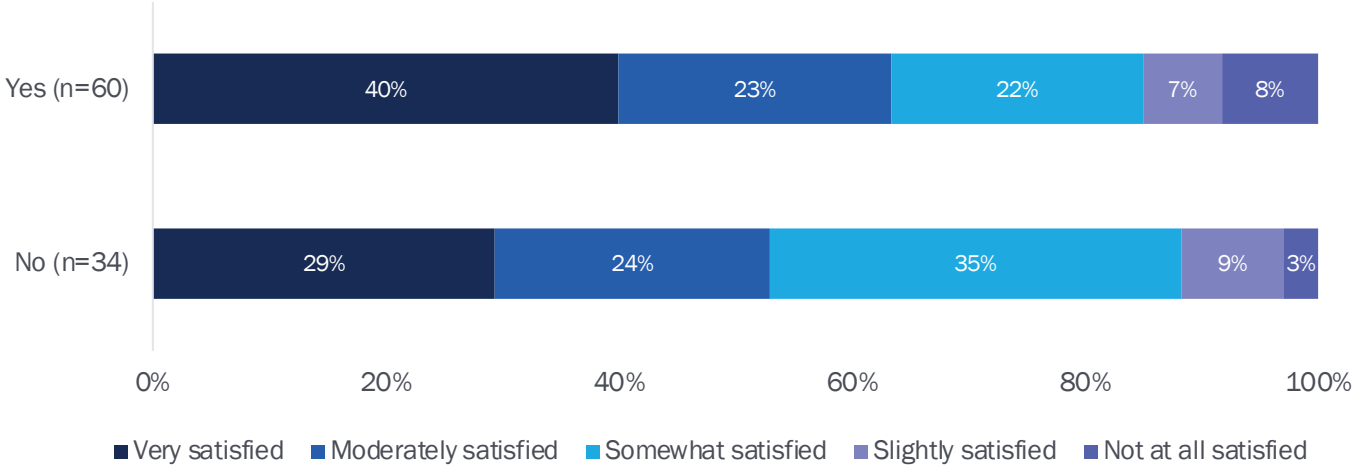
[18] This datapoint is provided to give a snapshot of satisfaction across all surveyed contractors. Many surveyed contractors offered both HVAC and HPWH incentives and thus, are represented in both groups in the figure when broken out.

Figure 6. Contractor Overall Satisfaction with TECH Clean California Experience



Satisfaction with the TECH Initiative was slightly higher among contractors who layered TECH incentives with incentives offered by other programs for the same project. Contractors who layered incentives were more likely to be at least moderately satisfied (38 of 60; 63%) with the TECH Initiative compared to those who did not (18 of 34; 53%) (Figure 7). We observed a large increase in contractor satisfaction with the TECH Initiative since the interim evaluation in 2022, particularly for those who had layered a TECH incentive (29% increase in proportion who said they were "very satisfied").

Figure 7. Contractor Satisfaction with the TECH Initiative by Experience with Layered Incentives



Note: Analysis excludes six respondents who reportedly had not filled out a TECH incentive application.

When given the opportunity to share final thoughts about their experience with the TECH Initiative in the survey, most contractors did not provide any additional input (71 of 100; 71%). The remaining respondents (29 of 100; 29%) provided suggestions to further improve the TECH Initiative; we elaborate on their feedback in the bullets below.[19]

- **Simplify the TECH Initiative overall (6 of 29).** Contractors often have limited time for additional work outside of their day-to-day projects for customers. These six contractors suggested simplifying the TECH Initiative overall to lessen the administrative burden of the program. One contractor noted how time-consuming TECH Initiative

[19] Some survey responses included multiple reasons and were coded as such, thus response counts in bullets may sum to more than the number of respondents (n=29).

administrative tasks can be and highlighted how this aspect of the TECH Initiative makes it particularly difficult for smaller companies to participate. Another contractor added that they do not have time to navigate through the intricacies of the TECH Initiative and suggested that the program streamline its guidelines.

- **Streamline incentive payments (6 of 29).** These contractors requested shorter wait times to receive their TECH incentive payments and for TECH staff to provide clearer, more solidified communication about when to expect payments after an application is submitted and approved. One of these contractors suggested hiring more claims processors to speed up the incentive payout process.[20]
- **Consistently communicate incentive changes to contractors (5 of 29).** These five contractors expressed a need for more consistent communication from TECH staff regarding the release of new TECH incentives as well as changes to incentive amounts. One contractor shared that in their experience, although customers find the incentives enticing, the uncertainty related to incentive availability and amounts at a given time prevents their company from being able to guarantee the rebate to the customer. Due to this, they shared that TECH incentives have had a minimal influence on their sales.
- **Improve usability of the TECH Initiative Iris Portal (4 of 29).** A few contractors suggested improvements to the Iris Portal. One contractor recommended 1) adding an option to allow submitted projects to be filtered on customers' last names, 2) enabling automated emails for when flags are added to incentive applications, and 3) clearer instructions for correcting application errors.[21] Another contractor said the status icons are confusing to understand and are easy to gloss over; this contractor also suggested automated emails for flags on incentive applications.
- **Increase TECH incentive amounts (4 of 29).** As described earlier in the Incentive Design section, TECH incentives have decreased since the inception of the TECH Initiative. These contractors recommended TECH Initiative stakeholders increase incentive amounts and/or return them to their original amounts. One contractor said they observed much higher single-family customer interest in HVAC heat pumps early on when the incentive was $3,000, but that they have seen a decrease in their HVAC heat pump sales since the amount dropped to $1,000.
- **Increase assistance with customer leads (2 of 29).** One of these contractors stated they have not received a single customer lead since enrolling in the TECH Initiative and asked for further assistance with getting customers. The second contractor simply asked that the TECH Initiative provide better assistance in generating leads.
- **Other (4 of 29).** Four contractors made other suggestions for improvement, including a allowing HPWH equipment that is not programmable, simpler communication between equipment of different brands (e.g., communication between heat pumps and smart thermostats), clearer information regarding the equipment serial numbers needed for the incentive application, and broader incentive offerings to account for required electrical work.

5.3 PROGRAM PROCESSES

This section presents findings about TECH Initiative processes related to contractor enrollment and the TECH Initiative's communication with contractors. It also explains how multifamily TECH Initiative projects came about from the property owner perspective, multifamily property owner satisfaction, characteristics of single-family and multifamily TECH Initiative projects, how incentives were applied to projects, and contractors' awareness of optional trainings.

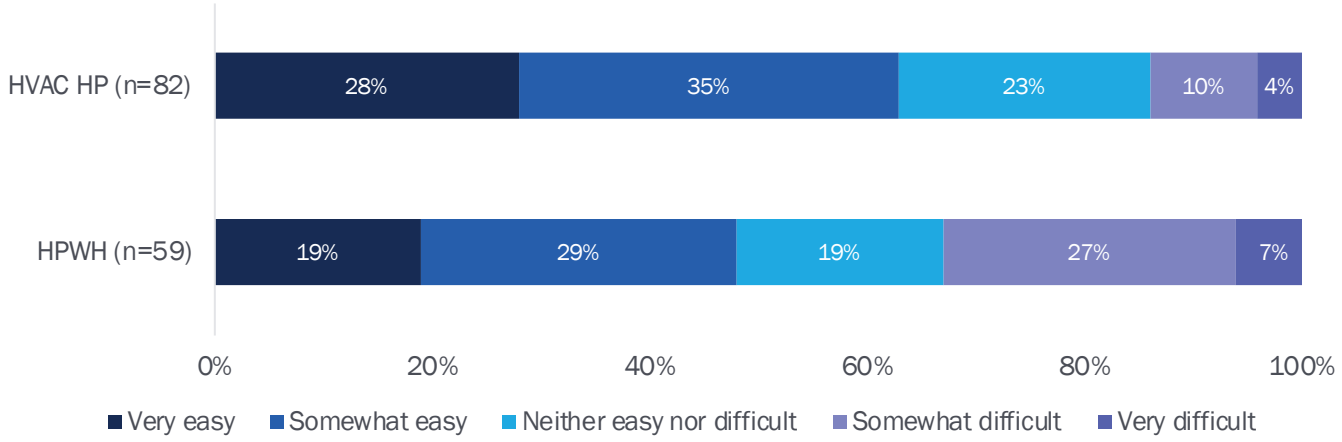
[20] It is worth noting that delays in application payments are commonly due to application quality issues rather than staffing constraints.
[21] Though this contractor suggested automated emails, TECH Initiative staff send emails weekly for all claims that need corrections.

5.3.1 TECH INITIATIVE CONTRACTOR ENROLLMENT

To enroll in the TECH Initiative, a contractor submits an application and demonstrates they meet eligibility requirements, such as proper licensure and insurance. Then, the contractor completes required trainings, including an introduction to the online incentive application portal.

TECH contractors found it easier to enroll and become eligible to offer the HVAC heat pump incentive compared to the HPWH incentive (Figure 8). Nearly two-thirds of contractors who enrolled in the HVAC heat pump incentive found the process to be at least "somewhat easy" (52 of 82; 63%), while just under half (28 of 59; 48%) found it easy to enroll in the HPWH incentive. More than one-third of contractors who enrolled to offer the HPWH incentive reported some level of difficulty with the process (20 of 59; 34%). These water-heating contractors are likely referring to the enrollment process for HPWH incentives, which relaunched in October 2023.

Figure 8. Contractor Rating of Ease or Difficulty to Enroll in the TECH Initiative by Equipment Type



Contractors' difficulty with the enrollment process was due to the amount of required information (Table 17). One HVAC contractor highlighted the fact that small business operations often do not have the time and resources to dedicate to long registration processes like that of the TECH Initiative. Many HPWH contractors also found the application requirements to be confusing and burdensome (7 of 20; 35%). Other primary reasons contractors found enrollment difficult related to the time commitment, noting that either the application itself or the required training took too long.

Table 17. Reasons Contractors Found the TECH Initiative Enrollment Process Difficult

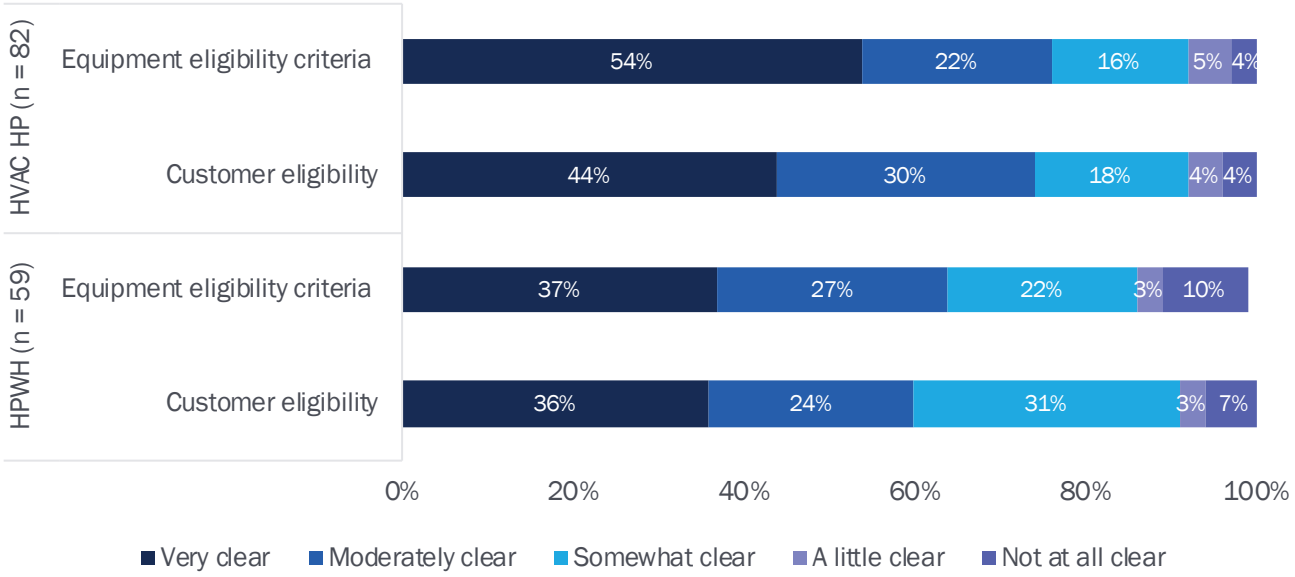
Reason	Count of HVAC Heat Pump Respondents (n=11)	Count of HPWH Respondents (n=20)
Applications ask for too much information	6	9
Applications take too long to fill out	2	5
Required training is too long	1	5
Website is not user-friendly	1	1
Confusing/burdensome requirements	2	7

Note: Responses could be grouped into multiple categories.

5.3.2 UNDERSTANDING OF CUSTOMER AND EQUIPMENT ELIGIBILITY CRITERIA

Most surveyed contractors found equipment and customer eligibility criteria to be at least "moderately clear" across both equipment types (Figure 9). Overall, HPWH contractors reported greater difficulty understanding eligibility criteria compared to HVAC contractors. Less than 10% of HVAC contractors indicated issues with the clarity of equipment (7 of 82) and customer eligibility criteria (6 of 82), rating the criteria as "a little clear" or "not at all clear."

Figure 9. Clarity of Eligibility Criteria by Equipment Type



In total, 13 respondents reported at least one of the TECH Initiative's incentive eligibility criteria to be "a little clear" or "not at all clear" (Table 18). For HVAC heat pump equipment eligibility criteria, contractors most commonly indicated issues with the lack of clarity around efficiency and model specification requirements. For HVAC heat pump customer eligibility criteria, the layering of other program incentives was least clear. Contractors who indicated a lack of clarity with HPWH eligibility criteria most commonly indicated confusion with the demand response requirement.

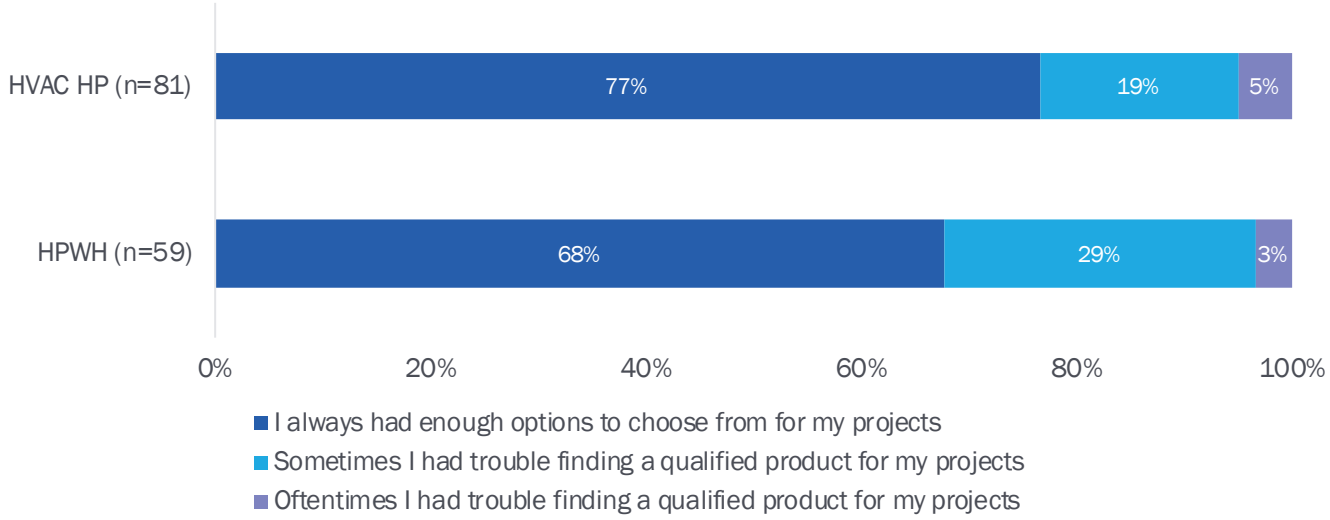
Table 18. Aspects of Eligibility Criteria Contractors Found Unclear (n=13)

Aspect	HVAC HP		HPWH	
	Equipment Eligibility Criteria (n=6)	Customer Eligibility Criteria (n=6)	Equipment Eligibility Criteria (n=8)	Customer Eligibility Criteria (n=6)
Photo requirements	1	0	1	0
Efficiency requirements	2	1	0	0
Branding requirements	2	1	1	1
Layering incentives	1	2	1	1
First Hour Rating (FHR) requirements	0	0	1	1
Demand response requirement	0	0	2	3
Distinguishing between customer utility account holder	0	0	0	1
Other	1	2	2	0

Note: Response coded as "Other" included confusion around what regions count as income qualified, the interaction between TECH Initiative requirements and building codes, and frustrations related to issues with the TECH Initiative website and lapses in program funding.

Most surveyed contractors have sufficient options to choose from within the qualified product list for both space- and water-heating heat pump equipment (Figure 10). A notable portion of contractors, however, indicated they sometimes or oftentimes have trouble finding qualified equipment for water-heating projects (19 of 59; 32%).

Figure 10. Contractor Perceptions of Product Availability



Note: Analysis excludes one "not applicable" response from the count of contractors who offered the HVAC heat pump incentive.

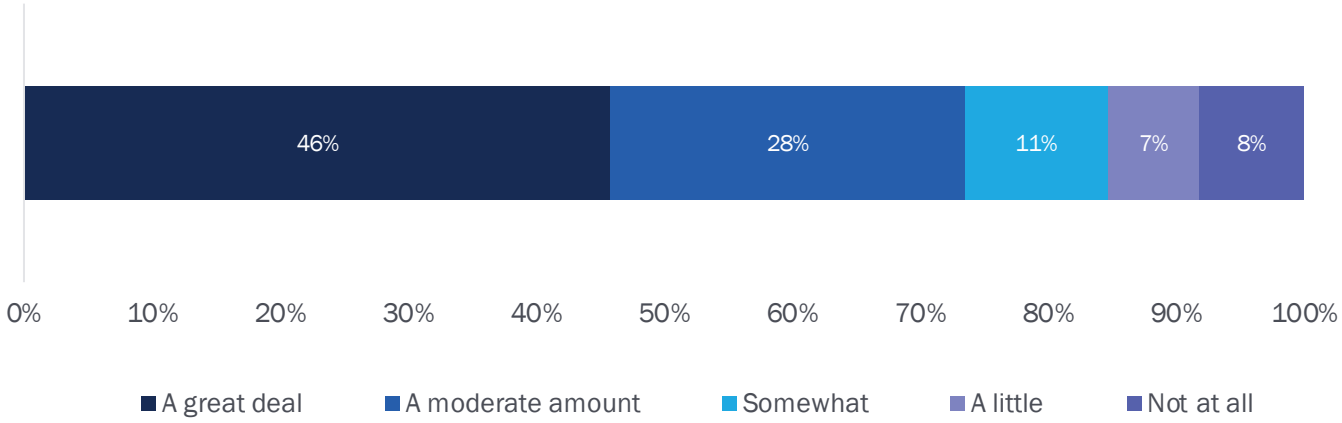
5.3.3 PROJECT GENERATION

This section presents findings related to contractor marketing to spur interest in heat pump projects and factors that influenced multifamily property owners' decision-making to purchase a heat pump.

MARKETING

Most contractors' firms increased their promotion of heat pumps after enrolling in the TECH Initiative (Figure 11). Approximately three-fourths of contractors (73 of 98; 74%) said their firm increased the promotion of heat pumps by at least a moderate amount since participating in the TECH Initiative, suggesting it has positively impacted the frequency of heat pump marketing in California. Two of the eight contractors who said they do not promote heat pumps shared that they do not do any advertising; their business and services are shared completely by word of mouth.

Figure 11. Extent Contractor Companies Increased Promotion of Heat Pumps After Enrolling in the TECH Initiative (n=98)



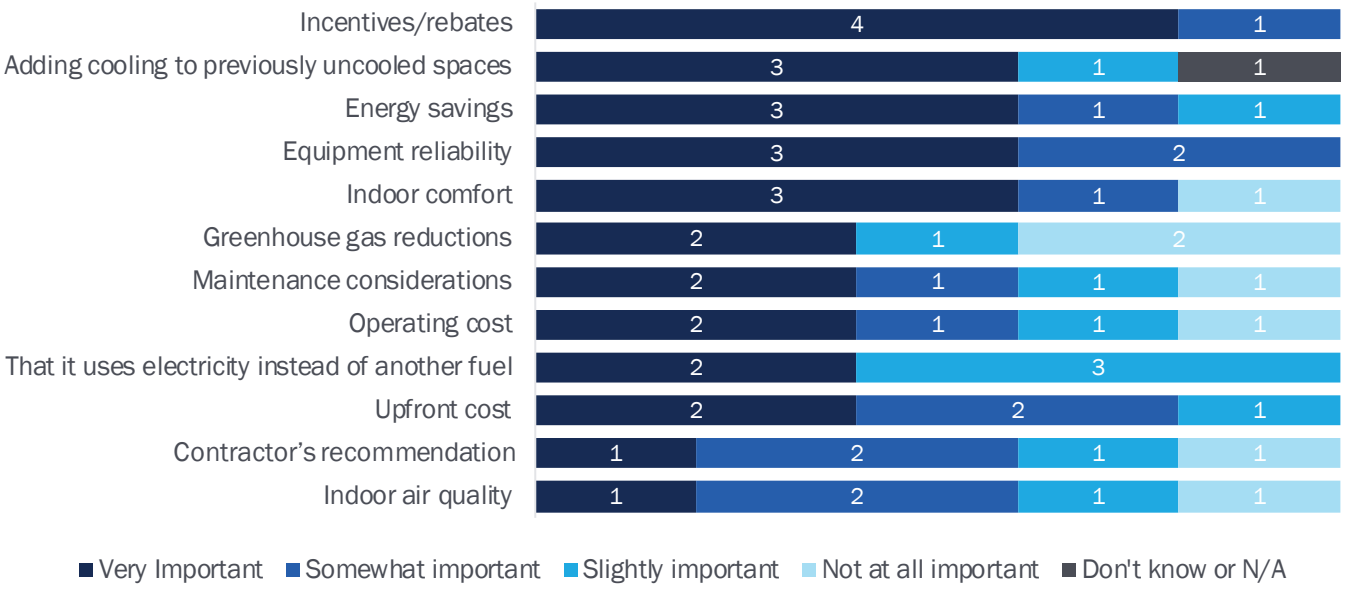
Note: Analysis excludes two respondents who provided conflicting survey responses.

MULTIFAMILY PROPERTY OWNER DECISION-MAKING

Multifamily property owners are generally replacing HVAC equipment reactively and are somewhat knowledgeable about HVAC heat pumps. About two-thirds of property owners (3 of 5) indicated that they decided to replace their existing HVAC equipment because it was old or not functioning well. Other reasons for replacing existing HVAC equipment included the fact that they could participate in TECH Clean California (2 of 5), wanting to explore options for new equipment (1 of 5), or the upgrade being planned as part of a capital improvement project (1 of 5; multiple mentions allowed). When asked about how knowledgeable they were about HVAC heat pumps, three property owners indicated they had at least some existing knowledge, while the remaining had little or no knowledge. The two property owners who were motivated to replace their equipment so they could participate in TECH Clean California reportedly had "little" and "no" prior knowledge about heat pumps. All property owners mentioned they were only considering HVAC heat pumps.

The availability of incentives and equipment reliability were the most important aspects of property owners' decisions to purchase HVAC heat pumps. All property owners found the availability of incentives and reliability of equipment at least "somewhat" important in their decision to purchase an HVAC heat pump (Figure 12). Being able to provide air conditioning, improve indoor comfort, and achieve energy savings were also highly important in property owner decision-making. For two of the three who installed in-unit heat pumps, being able to cool previously uncooled spaces was "very important."

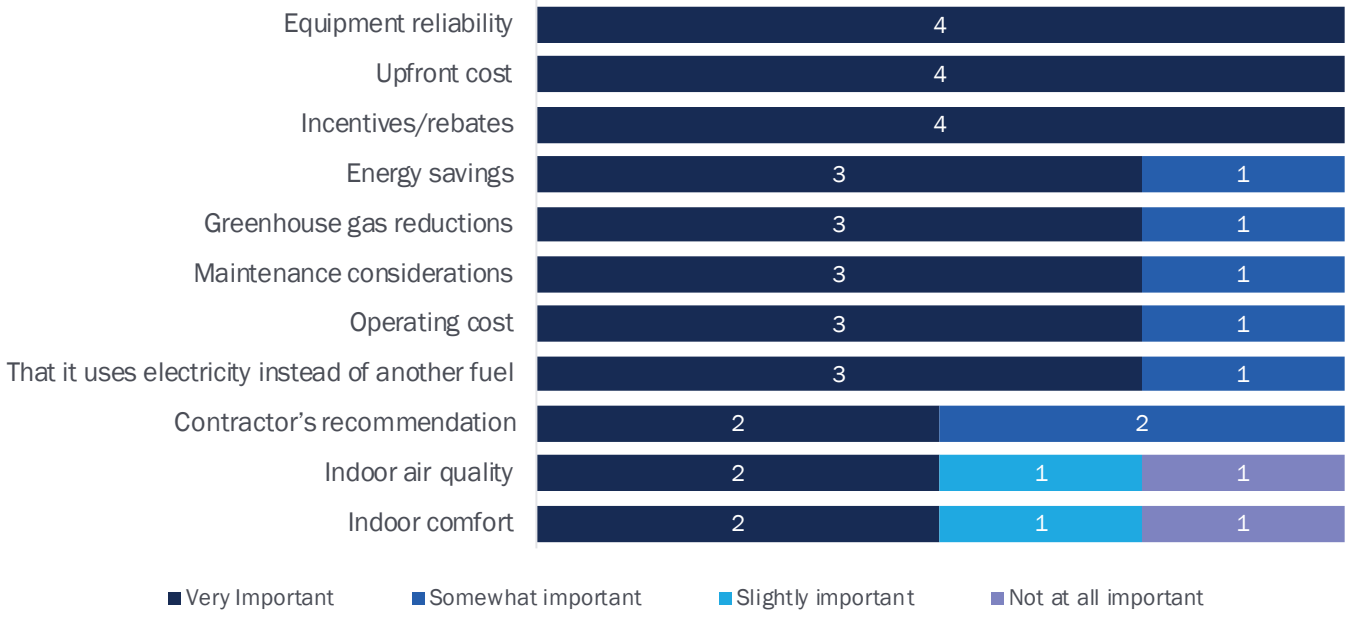
Figure 12. Importance of Reasons for Deciding to Purchase HVAC Heat Pumps (n=5)



Multifamily property owners tended to replace their centralized water-heating equipment preemptively and had some knowledge about HPWHs. Most property owners indicated they decided to replace their functioning water-heating equipment because they wanted to explore new equipment options (2 of 4), were looking to electrify the property (2 of 4), or the upgrade was planned as part of a capital improvement project (1 of 4; multiple mentions allowed). Half of the property owners (2 of 4) indicated that the TECH Clean California Initiative was also influential in their decision-making. Only one property owner (property #2 in Table 5) indicated they replaced equipment that was old or malfunctioning. This property owner also mentioned being influenced by multiple stackable incentives, including the TECH Clean California incentive, and their desire to decarbonize by replacing gas-fired equipment with low global warming potential (GWP) heat pump equipment. When asked about how knowledgeable they were about HPWHs, all but one property owner indicated they had at least "some existing knowledge," with the remaining property owner saying they had "little existing knowledge." All four mentioned they only considered HPWHs for their projects and did not look at other types of centralized water-heating equipment. However, one property owner mentioned that they were considering lower-capacity HPWHs than the one they installed.

Cost and reliability were the most important aspects of property owners' decisions to purchase HPWHs. All property owners found equipment reliability, upfront cost, and the ability to qualify for incentives or rebates to be "very important" in their decision to purchase a HPWH (Figure 13). Energy savings, greenhouse gas reductions, and operations and maintenance were also highly important in multifamily property owner decision-making for centralized HPWHs.

Figure 13. Importance of Reasons for Deciding to Purchase HPWHs (n=4)



5.3.4 PROJECT IMPLEMENTATION

This section reviews TECH-incented heat pump projects in California, including where the projects occurred, the project lengths, additional installation work the contractors performed, and how layered incentives offset project costs. While most of these analyses refer to single-family homes, a few key analyses focus on multifamily homes, which are called out as such in the report. We begin with findings comparing HVAC heat pumps and HPWH and then discuss specifics for each of those equipment types.

SINGLE-FAMILY PROJECT CHARACTERISTICS

Per the application database analysis of closed projects, TECH-enrolled contractors installed a total of 33,715 heat pumps in single-family homes between the start of the TECH Initiative, December 7, 2021, and September 9, 2024.[22] HVAC heat pumps accounted for the large majority of installed equipment, with 30,170 HVAC heat pumps installed and 3,545 HPWHs installed. These 33,488 heat pumps were installed in 30,630 households. As observed during the interim evaluation in 2022, only a small minority of households (468 of 30,630; 2%) purchased both a HPWH and HVAC heat pump (Table 19).

Table 19. Number of Heat Pumps Purchased by Household (n=30,630)

Purchase	n	Percent
Only One HPWH	3,006	10%
Only One HVAC Heat Pump	26,029	85%
More than One HPWH	19	<1%
More than One HVAC Heat Pump	1,108	4%
Both HPWH and HVAC Heat Pump	468	2%

[22] A closed project means that the contractor has been paid the incentive for that project.

Most single-family TECH Initiative projects, both HVAC heat pump and HPWH projects, were completed in non-DAC areas (27,406 of 30,621; 90%) (Table 20).

Table 20. Heat Pump Projects by DAC (n=30,621)

Community Type	All Households (n=30,621)	HVAC HPs (n=27,597)	HPWHs (n=3,492)
DAC	10%	10%	12%
Non-DAC	90%	90%	88%

Note: Analysis excludes nine households with missing data.

Overall, households in PG&E territory (17,840 of 31,064; 57%) or SoCalGas territory (10,405 of 31,064; 33%) made up the bulk of TECH Initiative projects, with the rest of households primarily residing in SDG&E territory (Table 21). There are also differences in the distribution of heat pump types installed across these territories. Three-fifths of households that installed a HPWH belonged to the SoCalGas territory (688 of 1144; 60%), while almost half of the households that installed an HVAC heat pump resided in the PG&E territory (11,618 of 23,658; 49%).

Table 21. Gas Territory by Heat Pump and Incentive Layering (n=31,064)

Gas Territory	Layered HPWHs (n=2,346)	TECH Only HPWHs (n=1,144)	Layered HVAC HPs (n=3,916)	TECH Only HVAC HPs (n=23,658)
Pacific Gas & Electric	97%	33%	91%	49%
Southern California Gas	3%	60%	8%	39%
San Diego Gas & Electric	<1%	6%	<1%	11%
Southwest Gas	0%	1%	0%	<1%

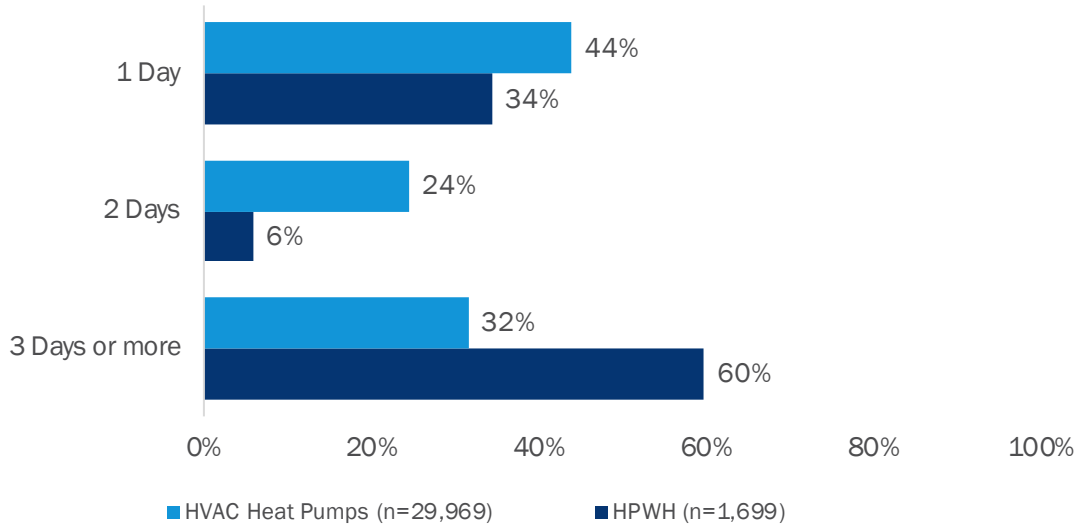
Note: Analysis conducted at the equipment unit level to account for cases where multiple units were installed as part of a single project.

According to the TECH Initiative application database, HVAC heat pump installs in single-family homes were commonly completed within two days, while HPWH installs were more likely to take three days or more (Figure 14). Nearly all HVAC heat pump (27,250 of 29,696: 91%) and HPWH (1,531 of 1,699; 90%) installs took less than one week to complete. These installation timelines are similar to those observed in the 2024 Residential Fuel Substitution Workforce Readiness Study, where 99% of both HVAC heat pump (n=72) and HPWH (n=73) installations reportedly took six days or less to complete.[23]

On average, contractors took 4.5 days to install a HPWH in single-family homes, ranging from one day to over seven months (224 days) per the incentive application database analysis of closed projects. HVAC heat pump installations took an average of 4.2 days, ranging from one day to over one year (372 days). We calculated these project timelines using information contractors provided on the incentive applications; TECH Initiative staff however, caution that there may be data quality concerns because they have reason to believe contractors did not always update the dates if they changed.

[23] Opinion Dynamics. *California Residential Fuel Substitution Workforce Readiness Study*. September 2024. https://www.calmac.org/publications/FuelSubstitutionWorkforceReadiness_Report_9_27_2024_Final.pdf#page=28&zoom=100,35,191

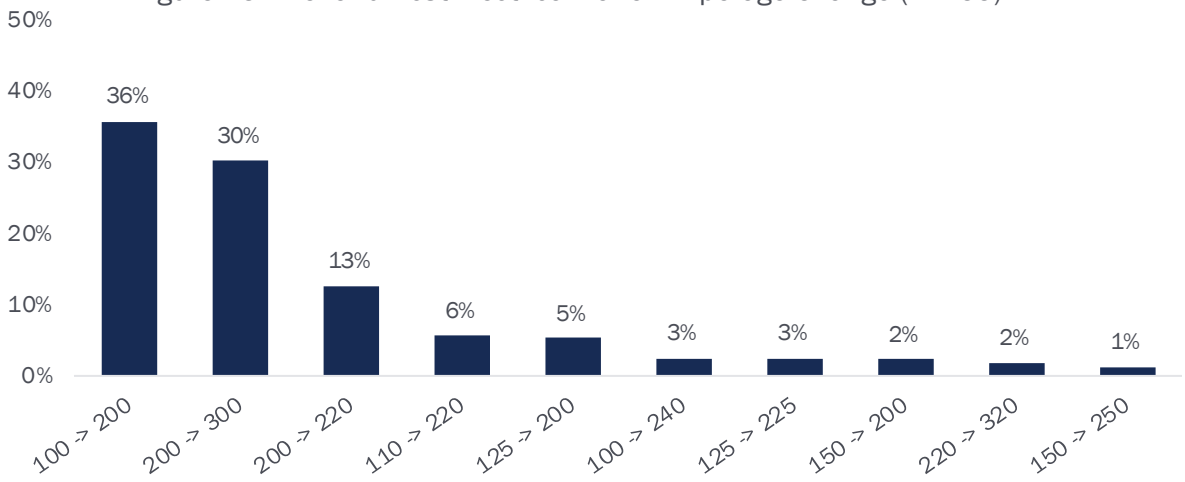
Figure 14. Single-Family Project Length by Equipment Type (n=31,668)



Note: Analysis conducted at the unit level to account for cases where multiple units were installed as part of a single project. 1,820 HPWH installs were excluded from analysis due to missing project duration.

Figure 15 displays common panel amperage changes (changes made for 10 or more households) that occurred as a result of TECH-incented projects. Overall, a minority of TECH-incented single-family projects (1,004 of 30,630; 3%) included an electrical panel upgrade to increase the home's amperage to support the heat pump equipment; this proportion aligns with estimates based on previous research on electrical panel capacity of residential homes in California.[24] Panel upgrades were more common for HPWH projects (269 of 3,493; 8%) compared to HVAC heat pump projects (735 of 27,605; 3%). Most households that received an upgrade had less than 200 amps of power prior to the project. All households had at least 200 amps post-upgrade, with a sizeable proportion resulting in 300+ amps. A list of all pre- and post-amperage values for changes that took place at two or more households is available in Appendix D.

Figure 15. Pre- and Post-Electrical Panel Amperage Change (n=799)



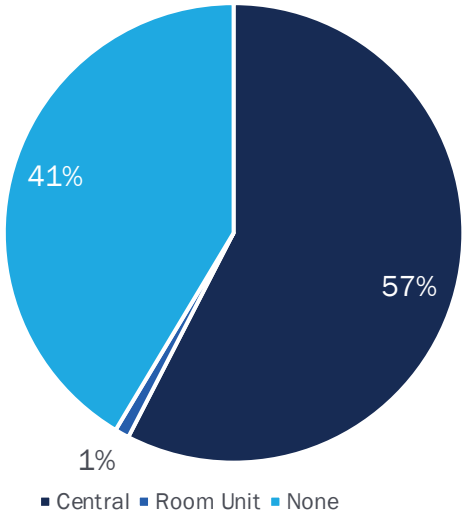
Note: Analysis conducted at project site level. Includes all changes in electrical panel amperage that occurred for at least 10 project sites. Panel upgrades with a change in amperage are shown in Table 1 in Appendix D.

[24] Eric Daniel Fournier, Robert Cudd, Samantha Smithies, Stephanie Pincetl. "Quantifying the electric service panel capacities of California's residential buildings." Energy Policy, Volume 192. (2024). https://www.sciencedirect.com/science/article/pii/S0301421524002581.

HVAC Heat Pump Projects

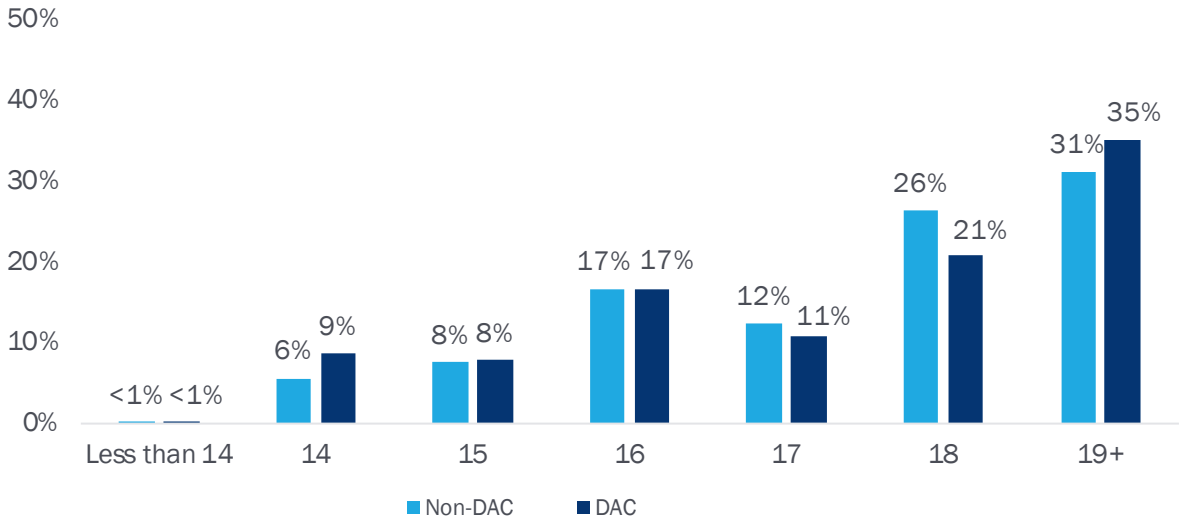
Most TECH customers had central air conditioning before installing their HVAC heat pump, although a large proportion did not have any form of air conditioning (Figure 16). The fact that HVAC heat pumps provide space heating and cooling in one piece of equipment means that customers without air conditioning before will now have it after replacing their heating system.

Figure 16. Household's Previous Air Conditioning Types (n=27,648)



On average, households in DAC and non-DAC communities received HVAC heat pumps with similar efficiency levels (Figure 17). Higher SEER ratings translate to more energy-efficient heat pumps. In the interim process evaluation in 2022, we found DAC communities had significantly higher SEER levels, but this did not hold for the current evaluation. In 2024, we found higher than average SEER ratings in non-DAC communities. However, households in DACs (6,753 of 21,624; 31%) received a larger proportion of HVAC heat pumps with a rating of 19 or higher compared to non-DACs (802 of 2,297; 35%). A sizeable proportion of units installed in DAC communities (759 of 3,038; 25%) and non-DAC communities (5,508 of 27,132; 20%) had unknown SEER ratings and were excluded from this analysis.

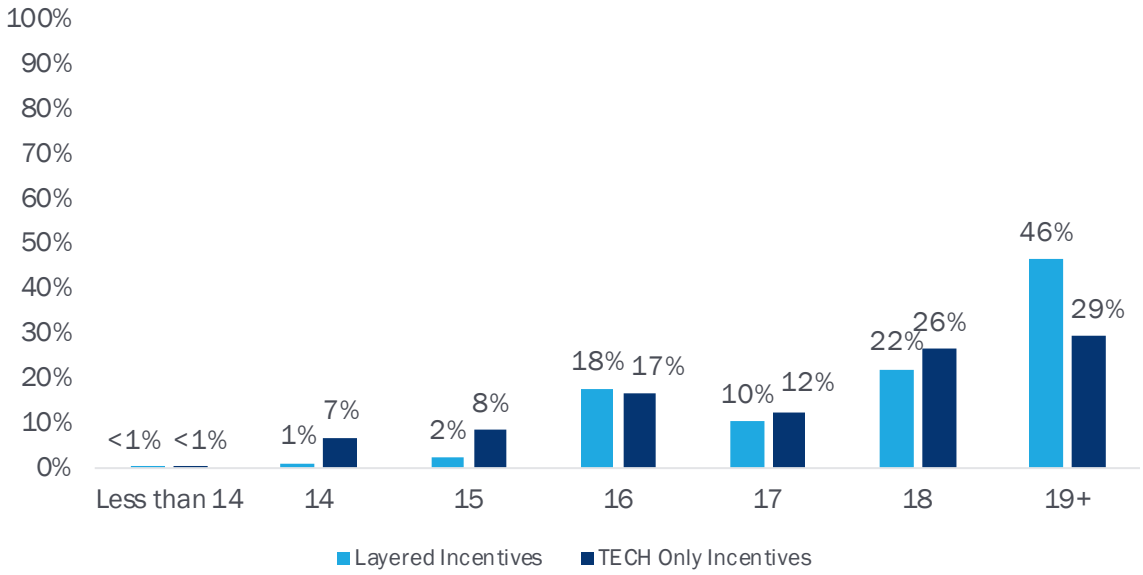
Figure 17. SEER Ratings by DAC (n=23,903)



Note: Analysis conducted at the unit level to account for cases where multiple HVAC heat pump units were installed as part of a single project. Percentages are based on the total number of HVAC heat pump units installed.

Based on TECH Initiative application data, contractors typically installed a more efficient HVAC heat pump system when pairing the TECH incentive with another incentive offering (Figure 18). Over a third of HVAC heat pumps installed with layered incentives (1,481 of 4,176; 35%) had a SEER rating of 19 or higher compared to under a quarter (6,074 of 25,994; 23%) for heat pumps installed with just the TECH incentives. While 14 SEER heat pumps qualify for TECH incentives, PG&E's Comfortable Home Rebates program required 15 SEER minimum with higher incentives for 16 and 18 SEER.

Figure 18. SEER Ratings by Layered Incentive (n=29,903)



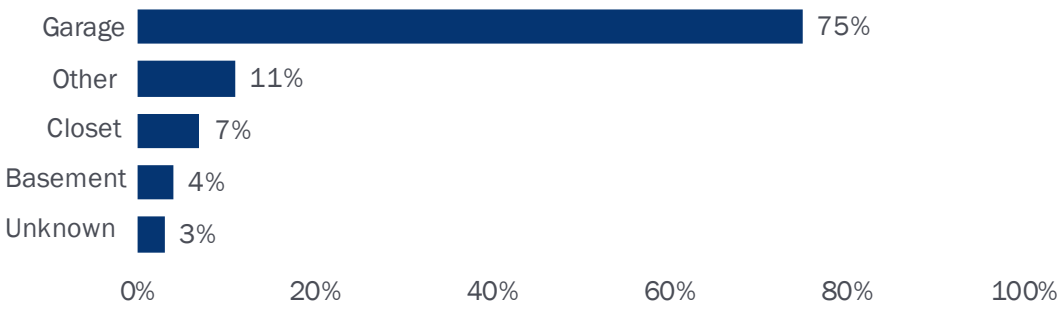
Note: Analysis conducted at the unit level to account for cases where multiple units were installed as part of a single project. Percentages are based on the total number of HVAC heat pump units installed. A percentage of projects did not indicate the SEER rating of the installed equipment, including 25% of projects in DAC communities and 20% of projects in non-DAC communities.

Heat Pump Water Heater Projects

TECH-incented HPWHs were most commonly installed in the garage (2,665 of 3,545; 75%) (Figure 19). In most California climate zones, the garage is an ideal place for a HPWH because it has sufficient space and temperature to function well.[25]

[25] The TECH Initiative database did not indicate whether the HPWH location was a conditioned space.

Figure 19. Location of HPWH Installed in Household (n=3,545)



Note: Analysis conducted at the unit level to account for cases where multiple units were installed as part of a single project. Percentages are based on the total number of HPWH units installed. The TECH Initiative labels climate zones based on the CEC's list of building climate zones by zip code.[26]

HPWHs installed in climate zone 3 were more likely to be installed in the basement when compared to other climate zones (Table 22). This is likely due to the colder winters in climate zone 3 (northern inland regions including Sacramento). In warmer climates like zones 11 and 12, HPWHs were most likely to be installed in the garage.

Table 22. Location of HPWH Units Installed by Climate Zone (n=3,545)

Location	Zone 2 (n=95)	Zone 3 (n=332)	Zone 9 (n=92)	Zone 11 (n=83)	Zone 12 (n=2,512)	Zone 13 (n=103)	Other Zones[a] (n=341)
Garage	69%	42%	63%	84%	81%	53%	73%
Basement	5%	13%	7%	5%	10%	0%	2%
Closet	3%	4%	10%	7%	7%	6%	12%
Other	2%	20%	20%	2%	2%	41%	9%
Unknown	20%	21%	1%	1%	<1%	0%	5%

[a] All other zones had samples of fewer than 80 each.

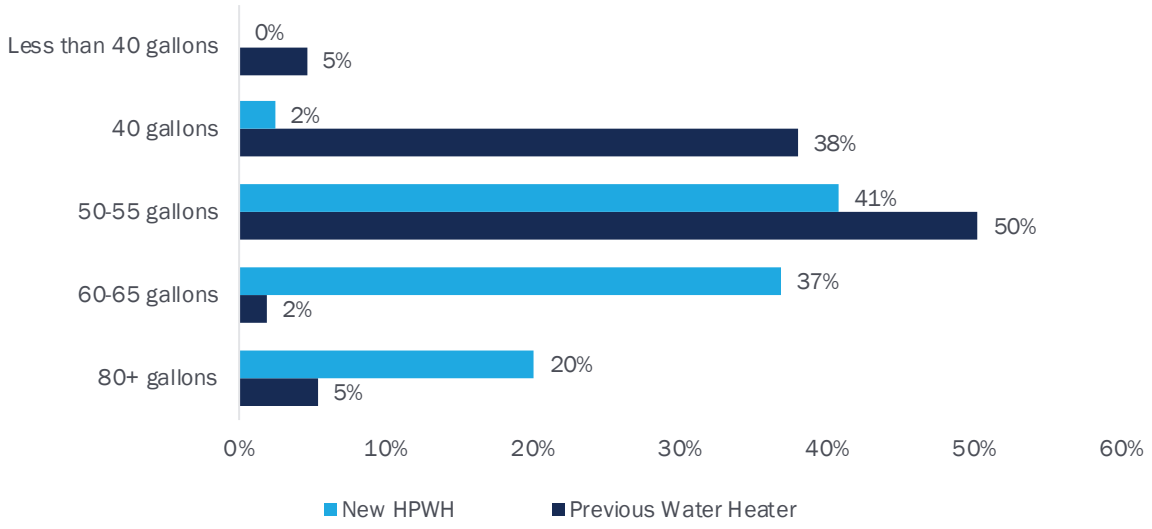
Note: Analysis conducted at the unit level to account for cases where multiple units were installed as part of a single project. Percentages are based on the total number of HPWH units installed. The TECH Initiative labels climate zones based on the CEC's list of building climate zones by zip code.

HPWHs typically had a larger capacity compared to water heaters they replaced (Figure 20). Nearly all previous water heaters (2,982 of 3,215; 93%) had a capacity under 60 gallons, while over half of HPWHs (1,833 of 3,215; 57%) were 60 gallons or larger. Most HPWHs had a larger capacity than the previous water heater (2,476 of 3,215; 77%), while one-fifth (675 of 3,215; 21%) replaced a water-heater with the same capacity. Only 2% (64 of 3,215) of HPWHs had a smaller capacity than the previous water heater. The fact that 98% (3,151 of 3,215) of TECH-incented HPWHs installed were 50-gallon capacity or larger is likely a reflection of a 2015 update to the National Appliance Energy Conservation Act.[27] The update increased the minimum water heater energy factor, such that any electric storage water heater 55 gallons or above must use heat pump technology. As such, if a household requires a water heater tank capacity of 55 gallons or more, the contractor should install an HPWH.

[26] https://www.energy.ca.gove/media/3560

[27] https://www.raysplumbinginc.com/wp-content/uploads/2015-naeca-efficiency-standards.pdf

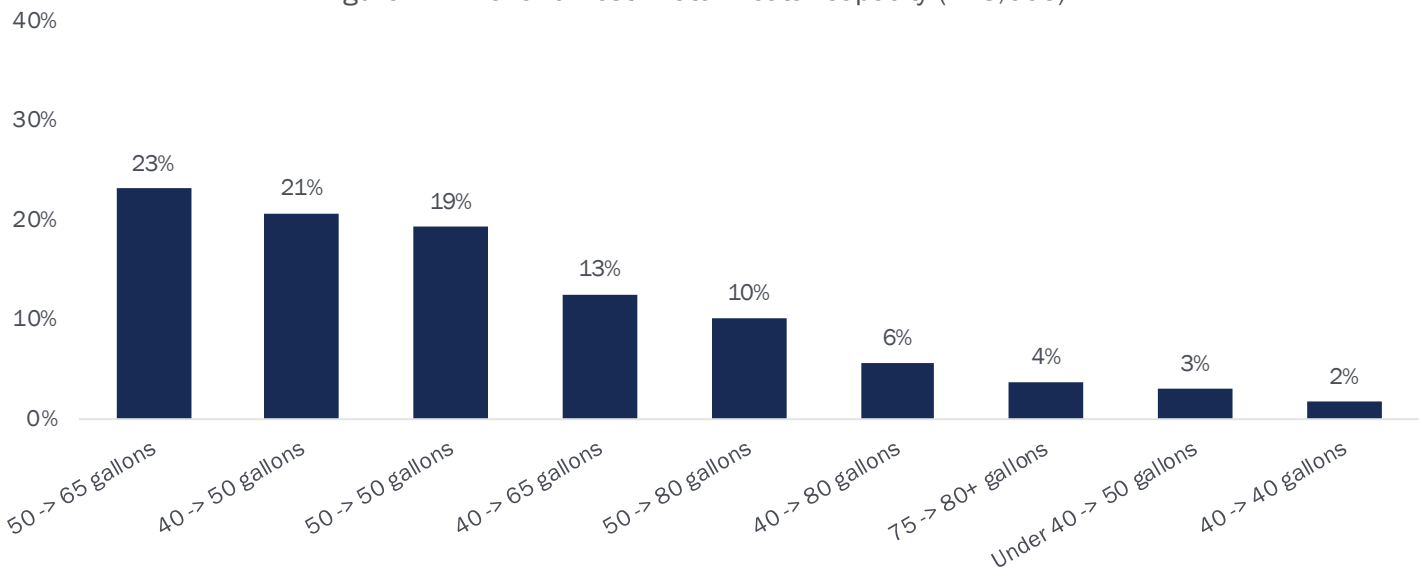
Figure 20. Heat Pump Water Heater Capacities (n=3,215)



Note: Analysis conducted at the unit level to account for cases where multiple units were installed as part of a single project. Percentages are based on the total number of HPWH units installed. Analysis includes projects where both capacities were available; 306 projects were excluded due to missing data.

Figure 21 displays the most common water-heater capacity conversions as a result of a TECH-incented HPWH installation. In most cases, the capacities of water heaters increased; however, in a sizeable number of projects where a 50-gallon system was used, the capacity did not change.

Figure 21. Pre- and Post- Water Heater Capacity (n=3,006)

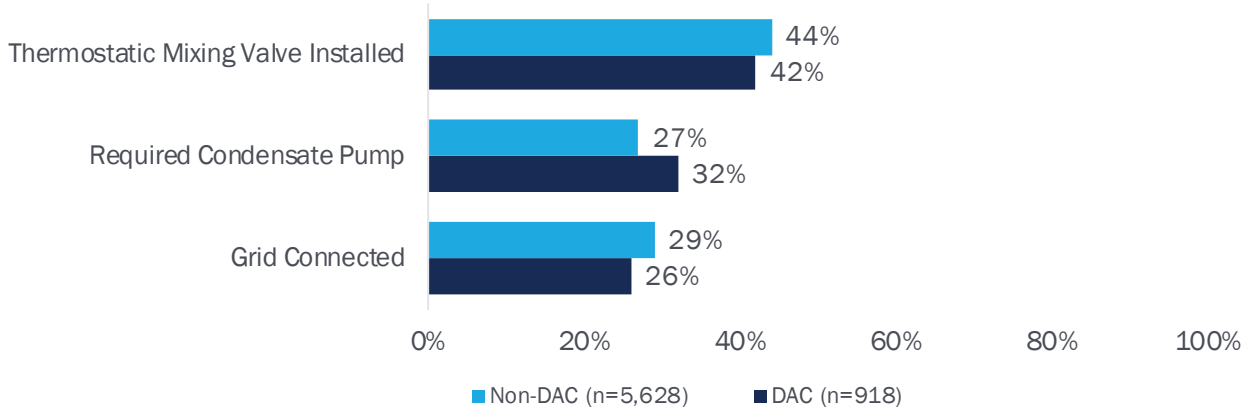


Note: Analysis conducted at the unit level to account for cases where multiple units were installed as part of a single project. Percentages are based on the total number of HPWH units installed. Analysis includes cases where both capacities were available; 306 projects were excluded due to missing data. An additional 209 projects were excluded from the figure that represented changes in water heater capacity that occurred in fewer than 40 projects; these projects represented approximately 7% of projects with both capacities available.

TECH contractors most commonly included a thermostatic mixing valve when installing HPWHs in both DAC and non-DAC households (Figure 22). In June 2022, TECH staff implemented a requirement for all HPWH installations to include a thermostatic mixing valve. Considering this change, we surprisingly observed a notable drop in the proportion of projects that completed this action since the interim evaluation; 32 percentage point decrease in DAC households and

17 percentage point decrease in non-DAC households. Contrastingly, grid connectivity, a feature required for equipment to participate in demand response programs, grid balancing, and smart grid operations, occurred in non-DAC households at twice the rate observed in 2022 (15 percentage point increase). This increase aligns with changes we would expect to see as grid connectivity is essential for demand response compatibility, and thus enrollment in a demand response program to meet the SGIP HPWH eligibility requirement implemented in October 2023. Condensate pumps were also more commonly installed in both DAC (32 percentage point increase) and non-DAC (21 percentage point increase) households compared to rates observed in 2022. Energy Solutions cautions that grid connectivity data from contractors are not entirely reliable pre-October 2023, after which point they introduced a new claim form and started receiving more reliable data.

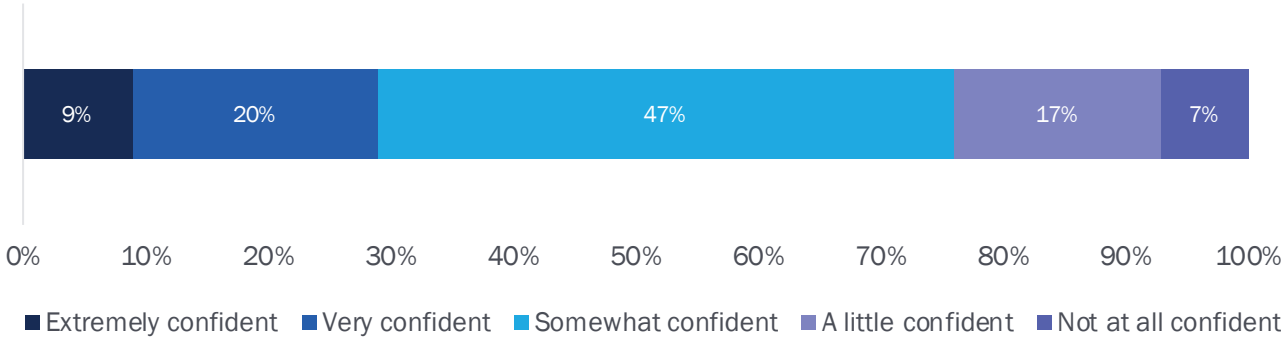
Figure 22. Actions Completed at HPWH Installs by DAC (n=6,546)



Note: Analysis conducted at the unit level to account for cases where multiple units were installed as part of a single project. Percentages are based on the total number of HPWH units installed.

As of October 31, 2023, HPWH customers were required to enroll in a demand response program to be eligible for a TECH incentive via the SGIP HPWH program.[28] This requirement involves TECH contractors ensuring their customers are enrolled in a demand response program as part of the sales process; therefore, contractors need a certain level of understanding about how these programs work and their potential impact on the operation of the equipment. Most contractors were at least somewhat confident in their understanding of demand response programs (45 of 59; 76%), although a sizeable proportion had minimal to no confidence in their understanding (14 of 59; 24%) (Figure 23). Please note that, due to the timing of the survey, contractors were asked about the demand response program enrollment requirement and not the daily load-shifting requirement for PG&E and SCE customers that was added later.

Figure 23. How Confident Contractors Are in Understanding Demand Response Programs (n=59)

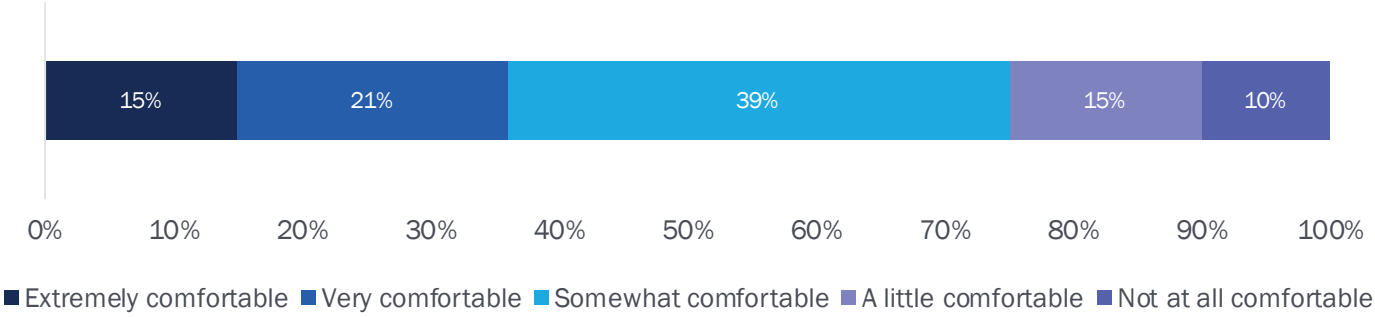


Note: Only asked of respondents enrolled in the TECH HPWH offering.

[28] https://frontierenergy-tech.my.site.com/contractorsupport/s/article/Demand-Response-Requirements.

Although most contractors were at least somewhat comfortable explaining demand response benefits to their customers, one-quarter of respondents felt little to no comfort in doing so (15 of 59; 25%). This finding highlights a need for stronger educational resources for contractors around demand response programs and how they can directly benefit customers.

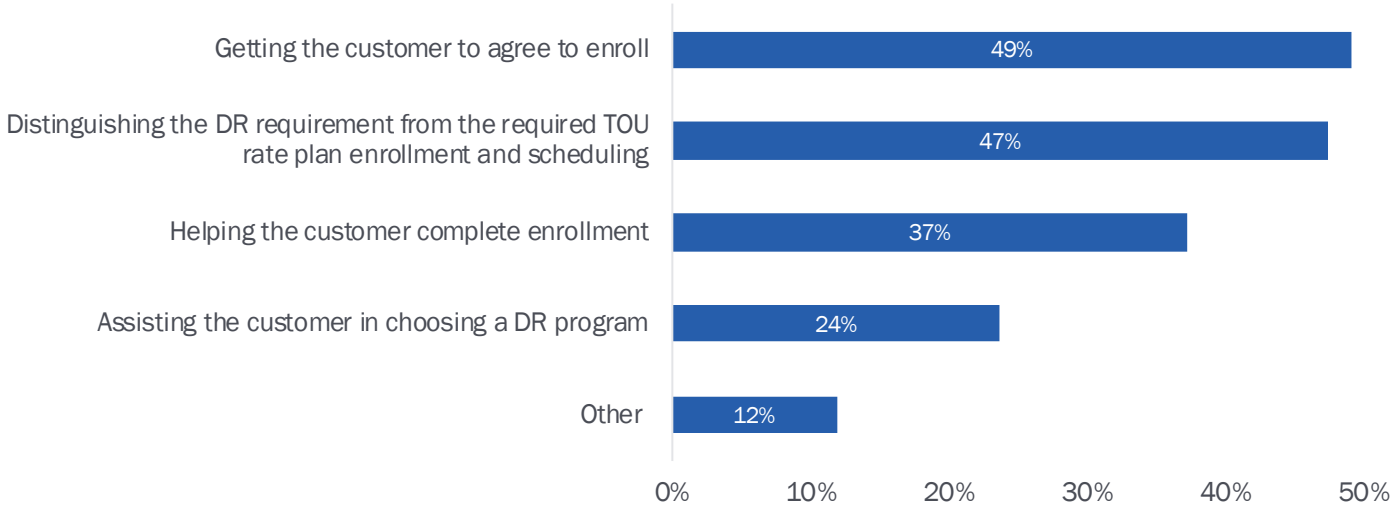
Figure 24. How Comfortable Contractors Are Explaining Demand Response Benefits to Customers (n=59)



Note: Only asked of respondents enrolled in the TECH HPWH offering.

Since instated in October 2023, contractors have found that the most challenging aspect of the demand response program requirement is getting customers to agree to enroll (Figure 25). Nearly half of contractors (28 of 59; 47%) also reported challenges distinguishing the demand response requirement from the TOU rate plan requirements.

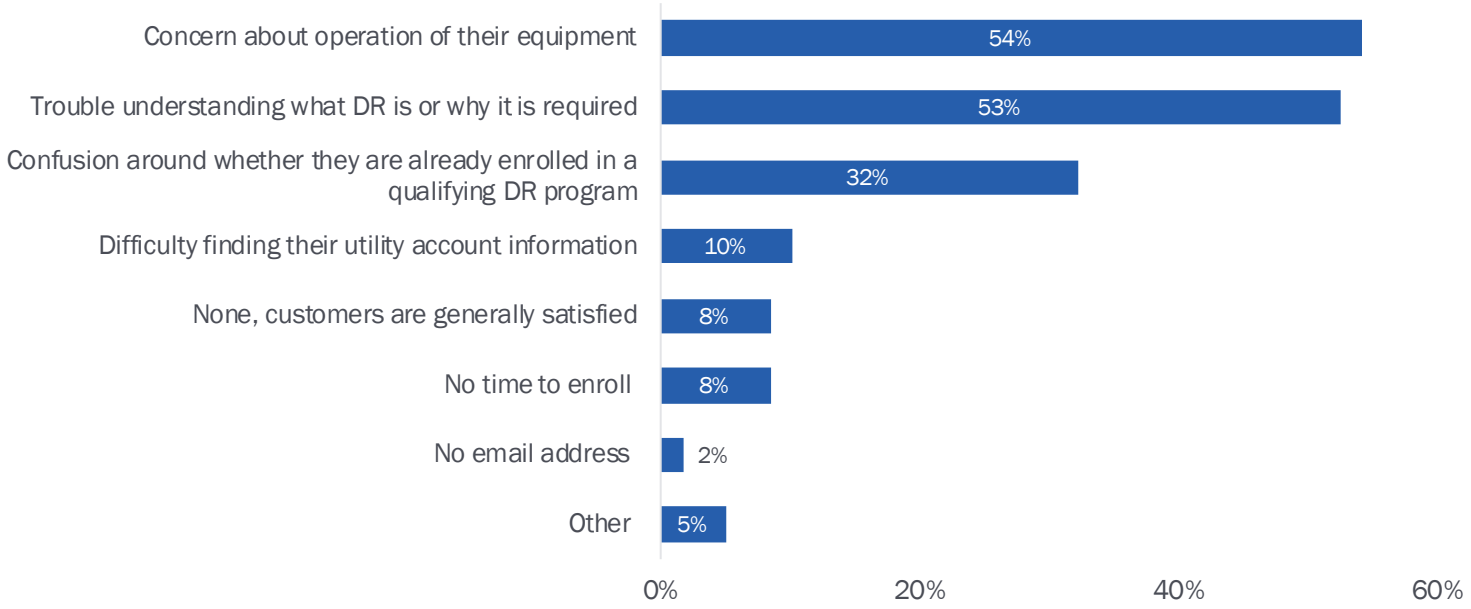
Figure 25. Contractors' Most Challenging Aspects of the Demand Response Enrollment Requirement (n=59)



Note: Multiple responses allowed. Only asked of respondents enrolled in the TECH HPWH offering. Responses coded as "Other" included the amount of time that passes between the installation and demand response program enrollment, connectivity issues with demand response on manufacturer applications, convincing customers that demand response will benefit them not just the utility, general disinterest from customers.

We also asked contractors about common challenges customers have reported to them when enrolling in a demand response program (Figure 26). According to contractors, TECH customers are most frequently concerned with how their equipment will operate when enrolled in a demand response program (32 of 59; 54%) and have trouble understanding what demand response is and/or why program enrollment is required (31 of 59; 53%). As demand response enrollment is required for customers to receive a HPWH incentive, TECH staff should consider ways they can better educate contractors and equip them to answer commonly asked customer questions, such as additional training opportunities that focus on the benefits of demand response and program enrollment.

Figure 26. Top Challenges Reported by Customers When Enrolling in a Demand Response Program (n=59)



Note: Multiple responses allowed. Only asked of respondents enrolled in the TECH HPWH offering. Responses coded as "Other" included customer concerns about electricity costs, difficulties with program enrollment portals, and customer perception that the TOU rate plan was inefficient compared to a customized demand response program.

We asked contractors who had completed a HPWH incentive application to share strategies that have helped them fulfill the demand response requirement. Of the 47 contractors who responded, 34 of them provided relevant strategies that have helped them fulfill the requirement. We elaborate on each of these in the bullets below.

The remaining 13 contractors said they could not think of any helpful strategies (6 of 13), have stopped selling HPWHs through the TECH Initiative (3 of 13), have been unsuccessful in selling TECH-incentivized HPWHs (2 of 13), and that the demand response requirement should be removed from the TECH Initiative altogether (2 of 13).

- **Being prepared to answer customer questions (19 of 34).** More than half of contractors said that coming prepared to answer customer questions about demand response and the enrollment requirement has been very helpful to them in fulfilling the program requirement. Two contractors emphasized the importance of sharing personal experience with the equipment and demand response programs; one explained they have a HPWH that is enrolled in a demand response program and that customers like hearing about their firsthand experience. Some of these contractors also found it helpful to have tangible resources to share with customers, such as a fact sheet or short informational video that contains "links to important instructions and information" about demand response.
- **Communicating upfront to customers that enrollment is a program requirement (6 of 34).** These contractors emphasized the importance of being upfront and transparent with customers about the enrollment requirement. By stating early on that enrollment is mandatory for incentive eligibility, you can ensure the customer has clear expectations.
- **Emphasizing bill and energy savings from demand response programs (5 of 34).** These contractors found it helpful to emphasize how demand response will directly benefit customers, such as highlighting the energy and bill savings they could earn by participating in a program. One contractor also found it helpful to reiterate to

customers that they do not have to remain enrolled in the program forever, but that their participation will still save them money in the meantime.[29]

- **Other (4 of 34)**. These four contractors shared suggestions for the TECH Initiative itself, rather than specific strategies they have used to fulfill the demand response requirement. Two contractors requested better training for contractors and installers to ensure they understand the demand response requirement and how it affects their customers. One respondent recommended that the TECH Initiative should partner with OhmConnect to simplify the enrollment process. Another contractor suggested making demand response enrollment optional, leaving participation up to the customer.

We also asked contractors what, if any, recommendations they have to make the demand response requirement easier to comply with. More than one-third of contractors (38 of 100; 38%) provided recommendations to simplify and improve the requirement for contractors (Table 23). We elaborate on each recommendation in the bullets below.

Table 23. Recommendations to Improve Demand Response Requirement (n=38)

Recommendations	Count of Respondents
Develop training/instructional materials for contractors	7
Remove demand response requirement	6
Provide more resources for customer questions	6
Simplify language used to explain demand response requirement	5
Improve the pathway to entry through OhmConnect	3
Communicate requirement to customers before launching associated incentive	3
Other	7

Note: Some responses were grouped into more than one category. Responses coded as "Other" included highlighting to customers this requirement is not permanent, improving ease of enrollment on demand response enrollment pages (e.g., clear location filters), improving interface on manufacturer applications for demand response, sending reminder emails to customers, giving customers only one program option, and creating an enrollment acknowledgment form for customers.

- **Develop training/instructional materials for contractors (7 of 38).** This was the top recommendation, where contractors called on the program team to develop and provide instructional materials to help not only contractors through the process, but customers as well. One contractor specifically requested "a simple guide to show what steps need to be taken and what benefits they provide for the customer." Another contractor recommended a "step-by-step video" that they can show to clients and explain the "what and why" of the demand response requirement.
- **Remove demand response requirement (6 of 38).** Six contractors expressed a desire for the TECH Initiative to remove the demand response requirement altogether. Two contractors said the demand response requirement overcomplicates TECH Initiative participation and causes unnecessary confusion for both contractors and customers.
- **Provide more resources for customer questions (6 of 38).** While contractors can be a good resource for questions, customers may benefit from additional resources. Two contractors recommended the TECH Initiative offer a helpline where customers can call directly for verbal assistance. One contractor emphasized how a helpline could be especially beneficial for elderly customers who are less tech-savvy. We want to note, however, that since TECH Clean California is a midstream program that operates through participating contractors, this recommendation mentioned in the survey does not align with the program design.

[29] To qualify for a TECH HPWH incentive, the customer must confirm that they will remain enrolled in a demand response program for a minimum of three years.

- **Simplify language used to explain the demand response requirement (5 of 38).** These contractors felt the language used to describe the TECH Initiative and its requirements was overcomplicated at times, especially when discussing with customers. One contractor stated a need for "simple verbiage that anyone can understand around how the demand response requirement works and how [customers] benefit from it."
- **Improve the pathway to entry through OhmConnect (3 of 38).** These three contractors highlighted OhmConnect as a good program for customers to sign up for to fulfill the demand response requirement. Two contractors made general suggestions for OhmConnect to simplify its enrollment process. One of these contractors suggested Ohm Connect offer a customer service number that customers can call for assistance with enrolling, adding that they think making the process easier will encourage more customers to sign up and participate.
- **Communicate with customers about the demand response requirement before launching and enforcing (3 of 38).** Three contractors recommended TECH staff communicate with customers directly about the demand response requirement ahead of time. One contractor suggested TECH staff send a direct email to customers to explain that they will not be eligible for a rebate until they enroll in a demand response program.[30] Another one of these contractors said it would be helpful if utility companies used their platforms to distribute information to customers about what demand response programs are and which programs are available to them.
- **Other (9 of 38).** These contractors shared several different recommendations, including shifting the responsibility of the requirement completely to the homeowner and none on the contractor, making the demand response requirement optional, sending contractors frequent reminder emails about the requirement, and highlighting that the demand response requirement is not permanent.

MULTIFAMILY PROJECT CHARACTERISTICS

Two-thirds of surveyed multifamily property owners had to upgrade their electrical infrastructure to get the heat pump(s) installed, including upgrades to the building's electrical panel (6 of 9), upgrades to the property's electrical service or transformer (2 of 9), or upgrades to panels in individual units (1 of 9). One property owner (property #5), had to make upgrades to their building's electrical panel, service transformer, and panels. All properties with HPWH installations had to upgrade their building's electrical panel, while only two with HVAC heat pump installations required panel upgrades. All property owners mentioned that the required electrical upgrades did not affect their decision to move forward with their projects, with three mentioning needing to upgrade their electrical panel(s) soon anyway. One property owner (property #3), however, did mention the cost of increasing their electrical capacity prevented them from upgrading space heating, saying: "We do not have enough electric capacity to electrify two systems; we electrified domestic hot water, but cannot afford electric service upgrade to run the electrification of the space heating."

At most surveyed properties, tenants paid for their electricity (6 of 9), while the landlord paid for water (7 of 9) and gas (5 of 9). No respondents reported changing who pays for which utilities after having the heat pump equipment installed. No properties had solar panels prior to their participation, although two-thirds (6 of 9) were considering installing solar in the future.

Three of the nine property owners mentioned they attended the TECH Clean California-sponsored training to learn about HVAC heat pump or heat pump water heater technologies, the benefits of electrification, and TECH Clean California. Among those who attended, all indicated they were "somewhat satisfied" with the training.[31] Two property owners found

[30] This suggestion is inconsistent with the TECH Initiative's midstream design because the TECH Initiative staff do not know who a customer is until the contractor submits a completed application, and at that point the customer has already committed to enrolling in a demand response program.

[31] The options respondents could have selected from included very satisfied, somewhat satisfied, neither satisfied nor dissatisfied, somewhat dissatisfied, or very dissatisfied.

the training covered all of their questions, but one mentioned they would have liked an update about the next steps for projects currently on the incentive reservation waitlist.

MULTIFAMILY PROPERTY OWNER CUSTOMER SATISFACTION

Property owners are satisfied with the contractors who installed their HVAC heat pumps. Property owners reported having an existing relationship with the contractor who installed their HVAC heat pumps (4 of 5) or found the contractor through general web searching (1 of 5). The property owners with a prior relationship with their contractor (4 of 5) did not investigate other contractor options, while the one property owner who used web searching spoke with four contractors before choosing one. All but the property owner who used web searching reported being at least "somewhat" satisfied with their contractor's quality of work and indicated that their contractor was able to answer their questions.[32] Additionally, all property owners mentioned that their contractors explained how to use the newly installed HVAC heat pumps to them, their maintenance staff, or tenants.

Multifamily property owners indicated their project timeline was between two and six months from when they first considered replacing the equipment to when the project was finished. Within that timeline, property owners reported that it took between one and six months to find a contractor and install the equipment, which was satisfactory to all property owners. Contrary to the water-heater findings, the longest HVAC heat pump project time was associated with a project using funds from their capital expenditure budget.

Multifamily property owners were satisfied with the contractors who installed their TECH-incented centralized HPWHs. Property owners reported finding the contractor who installed their HPHWs via recommendations (2 of 4), having an existing relationship with the contractor (1 of 4), or through general web searching (1 of 4). Half of the property owners (2 of 4) mentioned talking to only one contractor, while the other half talked to two contractors before installing the HPWHs. All property owners reported being "very satisfied" with their contractor's quality of work and indicated that their contractor was able to answer their questions and explain how to properly use the centralized HPHWs.

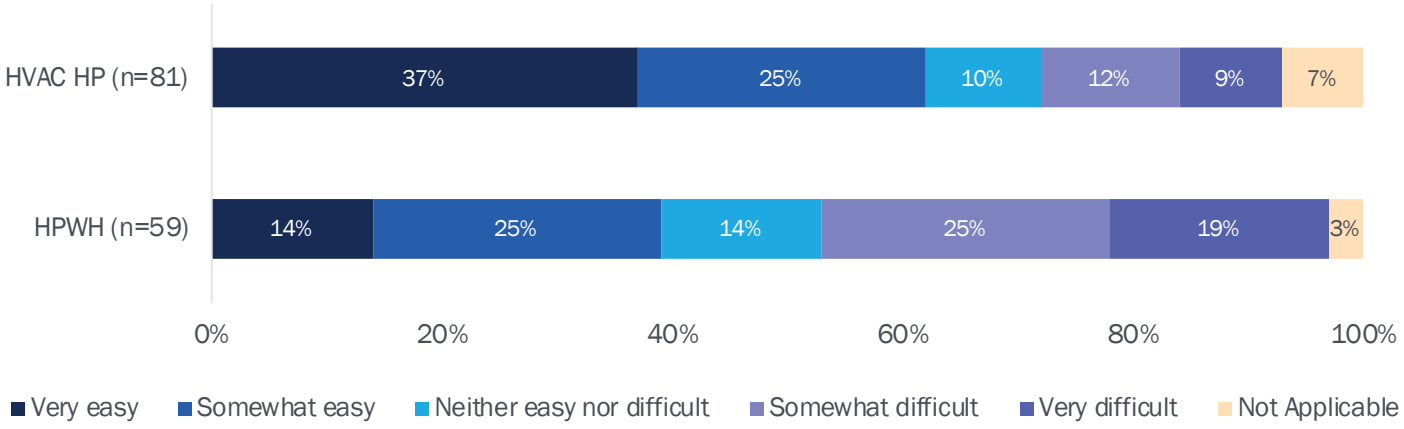
Property owners indicated their project timeline was between 10 and 18 months from when they first considered replacing the equipment to when the project was finished. Within that timeline, property owners reported that it took between four and 18 months to find a contractor and install the equipment, which was satisfactory to all property owners. The shortest timeline of four months was associated with the project using their capital expenditure budget.

5.3.5 USE OF TECH INITIATIVE INCENTIVES

Contractors found the SGIP HPWH incentive application most difficult to complete (Figure 27). Almost half of the surveyed contractors enrolled and eligible to offer the HPWH incentive (26 of 59; 44%) indicated some level of difficulty completing the application, over two times the proportion who reported difficulties with the HVAC heat pump incentive application (17 of 81; 21%). Most contractors who completed an HVAC heat pump incentive application found it easy to fill out (50 of 81; 62%), with more than one-third reporting it was very easy to complete (30 of 81; 37%)

[32] The property owner who used web searching indicated they were neither satisfied nor dissatisfied.

Figure 27. Level of Ease or Difficulty Filling Out Incentive Application



Note: One respondent was removed because they reported they had not yet filled out an HVAC heat pump incentive application.

Overall, 26 surveyed contractors found at least one of the TECH incentive applications to be difficult to complete (26 of 100; 26%). Specifically, all of these contractors found the HPWH application to be difficult, while 17 of them also reported challenges with the HVAC heat pump incentive application.

When asked to explain what made the incentive applications difficult, the most commonly reported challenges for the HPWH application related to collecting information about a customer's enrollment in a TOU rate (21 of 28; 75%) and the time it takes to gather all documents required for submission (20 of 28; 72%). For the HVAC heat pump application, contractors most frequently indicated challenges with the number of questions on the form (15 of 17; 88%) and lack of clarity on how to fill in the form (14 of 17; 82%).

Table 24. Reasons Contractors Found Incentive Application Difficult (n=26)

Reason	Count of HVAC Heat Pump Respondents (n=17)	Count of HPWH Respondents (n=26)
The number of questions on the application form	15	17
Lack of clarity on how to fill in form	14	17
The time to gather all required documents before submitting	12	20
The number of pictures or attachments to upload	11	19
Keeping track of its status during the review process	11	18
Getting your questions answered in a timely manner	10	16
Collecting information regarding customer's enrollment in a TOU rate	N/A	21
Ensuring the customer meets the demand response program requirements	N/A	18
Something else	3	6

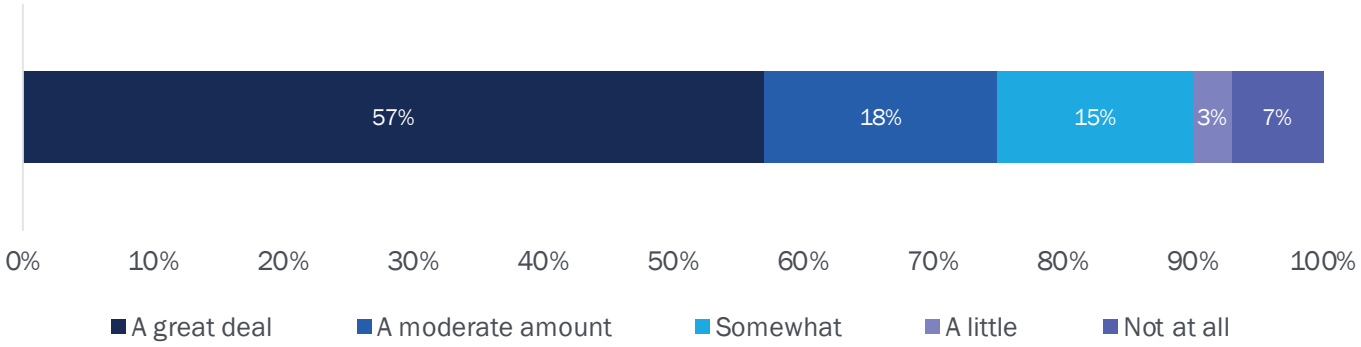
Note: Responses coded as "Something else" included technical issues with being able to submit the form, long wait times to receive TECH incentives, complicated flags for old and new claims, and delay times in getting flags addressed.

Seven contractors had not yet completed a TECH incentive application. Three of the seven contractors said they had not done so because their customers were either not interested in the incentive or ended up selecting alternate equipment for their project. Two contractors said the limited availability of eligible HVAC heat pump equipment prevented them from completing an application. The remaining two contractors said they plan to apply in the future.

LAYERED INCENTIVES

In some areas, TECH contractors can layer a TECH incentive with incentives offered by another program for the same project. More than half of surveyed contractors reported pairing a TECH incentive with another program's incentive on a project (60 of 100; 60%). Nearly all contractors who had layered incentives found it to be helpful in selling heat pumps to customers (Figure 28). Notably, most said that having two incentives to offset the upfront cost helped "a great deal."

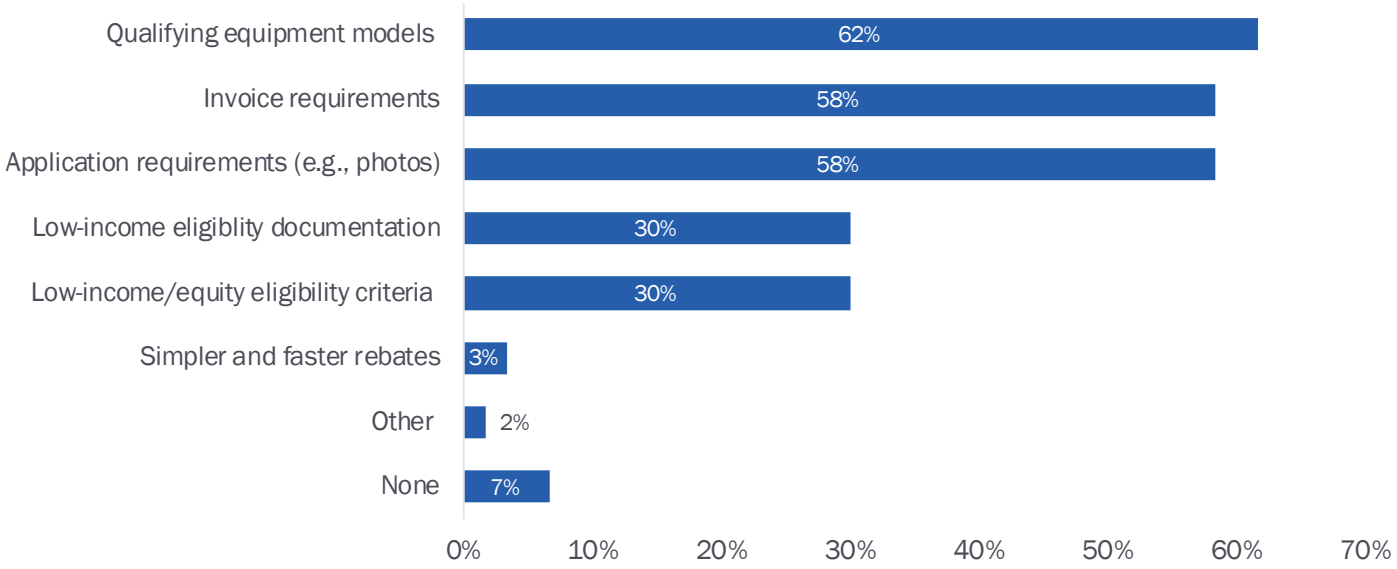
Figure 28. Extent Layering Incentives Helped Contractors Sell Heat Pumps (n=60)



Note: Only asked of contractors who layered a TECH incentive with incentives offered by another program for the same project.

To help streamline the application processes between programs, we asked contractors what program elements would be most helpful to be the same between the TECH Initiative and other programs. Contractors who had experience layering incentives said that to simplify the layering process, it would be most helpful to align the TECH Initiative's equipment qualifications (37 of 60; 62%), invoice requirements (35 of 60; 58%), and application requirements (35 of 60; 58%) with other incentive programs. Low-income eligibility criteria and documentation were among other program elements contractors felt would be most helpful to make the same between the TECH Initiative and other programs (Figure 29).

Figure 29. Program Elements That Would Be Most Helpful to Be the Same Between the TECH Initiative and Other Programs (n=60)



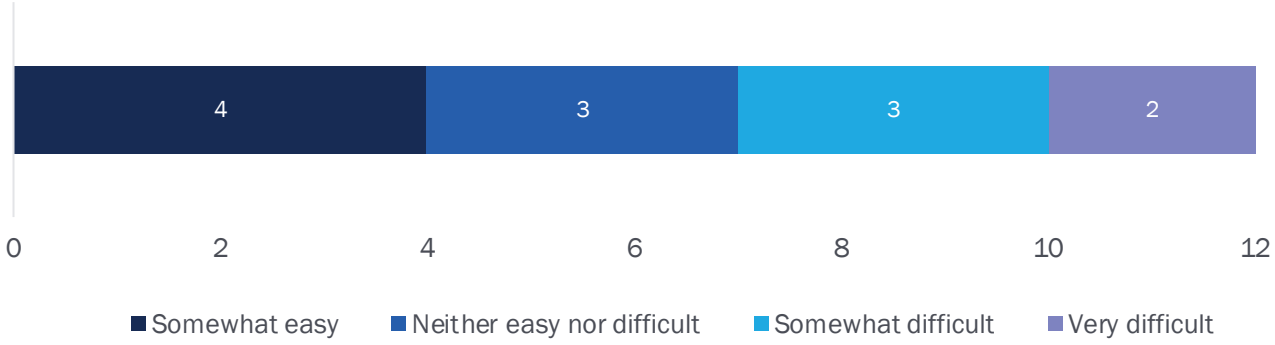
Note: Multiple responses allowed. Only asked of contractors who layered a TECH incentive with incentives offered by another program for the same project. One response coded as "Other" suggested reducing information being collected by all similar programs to reduce administrative burden.

MULTIFAMILY INCENTIVES

For multifamily projects, which are usually planned in advance, contractors fill out a form to reserve incentives to cover all the heat pumps needed for the multifamily upgrade project. The property owner also signs this reservation form.

Few surveyed contractors (12 of 100; 12%) had filled out a Multifamily Incentive Reservation form. Those who had filled out a form were mixed in terms of how easy or difficult they found the process to be; four contractors reported the form was "somewhat easy," while five contractors found it to be at least "somewhat difficult." The remaining three contractors said the form was neither easy nor difficult.

Figure 30. Contractor Level of Ease or Difficulty Filling Out Multifamily Incentive Reservation Form (n=12)



Note: Only asked of contractors who had filled out a Multifamily Incentive Reservation form.

Three of the five contractors who said the multifamily incentive reservation form was difficult to fill out said it required too much information, often requiring them to "duplicate" already entered information. The other two contractors said that after filling out the form, they were uncertain as to how long they would need to wait to be approved. Five of the 12 contractors who filled out a Multifamily Incentive Reservation form coordinated with a TECH representative to complete the form. Of those five contractors, three were "somewhat satisfied."

Multifamily property owners generally used their own funds for their HVAC heat pump projects in addition to the TECH Clean California incentives. Property owners primarily used their own financial reserves (4 of 5), capital expenditure budgets (2 of 5), or rental income (2 of 5; multiple mentions allowed) to fund their HVAC heat pump projects (Table 25). Additionally, one property owner mentioned accessing BayREN incentives, and another used financing through a bank or credit union. Two property owners mentioned they would have been "not at all likely" to purchase the HVAC heat pumps without the incentives from TECH Clean California, while the others would have been "slightly" (2 of 5) or "somewhat" (1 of 5) likely to purchase.

Table 25. Financial Resources Used by Property Owners for Purchasing and Installing HVAC Heat Pumps Beyond the TECH Clean California Incentives

ID	Funding Sources	Financing Sources	Tax Credits or Incentives
5	Capital expenditure budget	Bank or credit union financing	N/A
6	Their reserves	N/A	N/A
7	Their reserves	N/A	N/A
8	Capital expenditure budget, Their reserves, Rental revenue	N/A	BayREN
9	Their reserves, Rental revenue	N/A	N/A

Multifamily property owners accessed a variety of sources to fund their HPWH projects, in addition to the TECH Clean California incentives. These funding sources included BayREN incentives (2 of 4), federal tax credits (1 of 4), and California's Low-Income Weatherization Program (LIWP) (1 of 4) (Table 26). Property owners also reported using GoGreen Home financing, funds from a "special HOA assessment," their financial reserves, and rental income (1 mention each) to fund their projects. The three property owners who received other incentives or financing all mentioned that purchasing HPWHs helped them qualify. As one property owner wrote in the survey, "If this [centralized HPWH] wasn't eligible for BayREN and LIWP, we would not have been able to afford it." Two property owners mentioned they would have been "not at all likely" to purchase the HPWHs without the TECH Clean California incentive, while the others would have been "slightly" or "somewhat" likely to purchase without the TECH incentive.

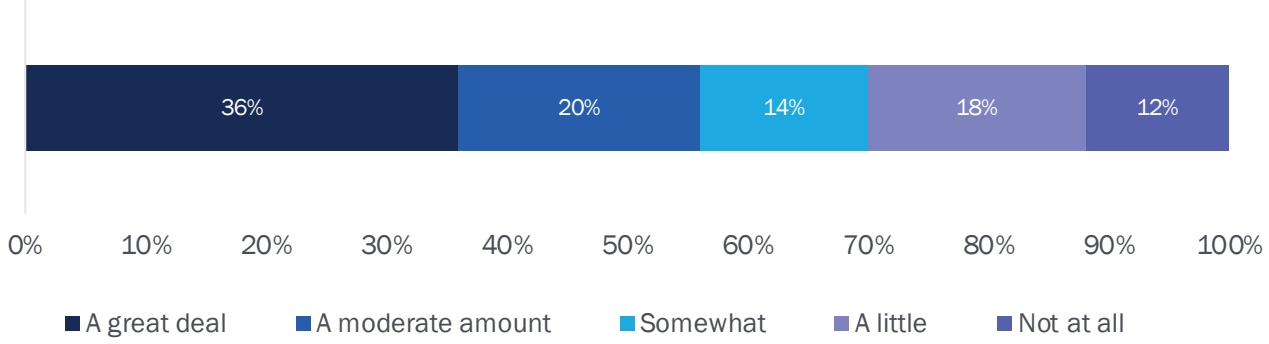
Table 26. Financial Resources Used by Property Owners for Purchasing and Installing HPWHs

ID	Funding Sources	Financing Sources	Tax Credits or Incentives
1	N/A	GoGreen Home	N/A
2	Their reserves, Special HOA assessment	N/A	Inflation Reduction Act credit, BayREN
3	N/A	N/A	LIWP, BayREN
4	Rental revenue	N/A	N/A

INCENTIVE INFLUENCE ON HEAT PUMP SALES

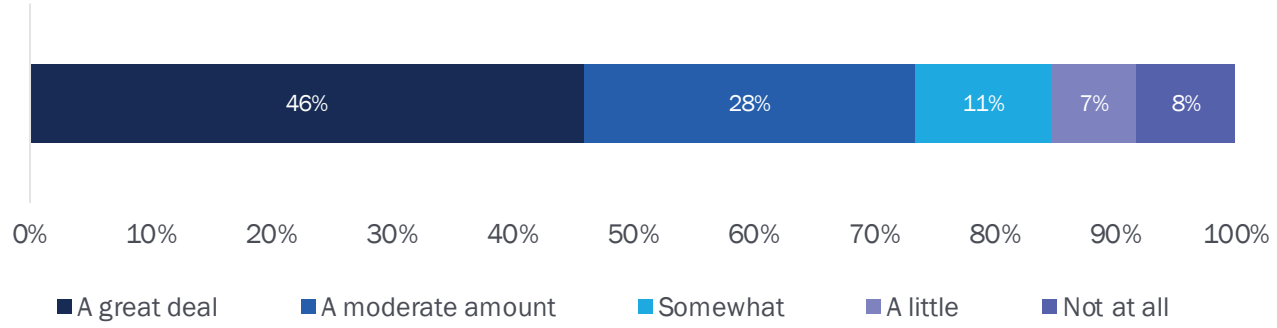
Most TECH contractors have seen an increase in their heat pump sales since they began participating in the TECH Initiative. More than half of surveyed contractors (56 of 100; 56%) saw their heat pump sales increase at least a moderate amount since participating in the TECH Initiative (Figure 31). However, nearly one-third of contractors (30 of 100; 30%) have seen little to no growth in their heat pump sales since they began participating in the TECH Initiative. Interestingly, most of these contractors' firms (22 of 30; 73%) promote heat pumps at least somewhat, suggesting a lack of customer interest due to other factors like upfront cost.

Figure 31. Extent Participating in the TECH Initiative Has Increased Contractor Heat Pump Sales and Installations (n=100)



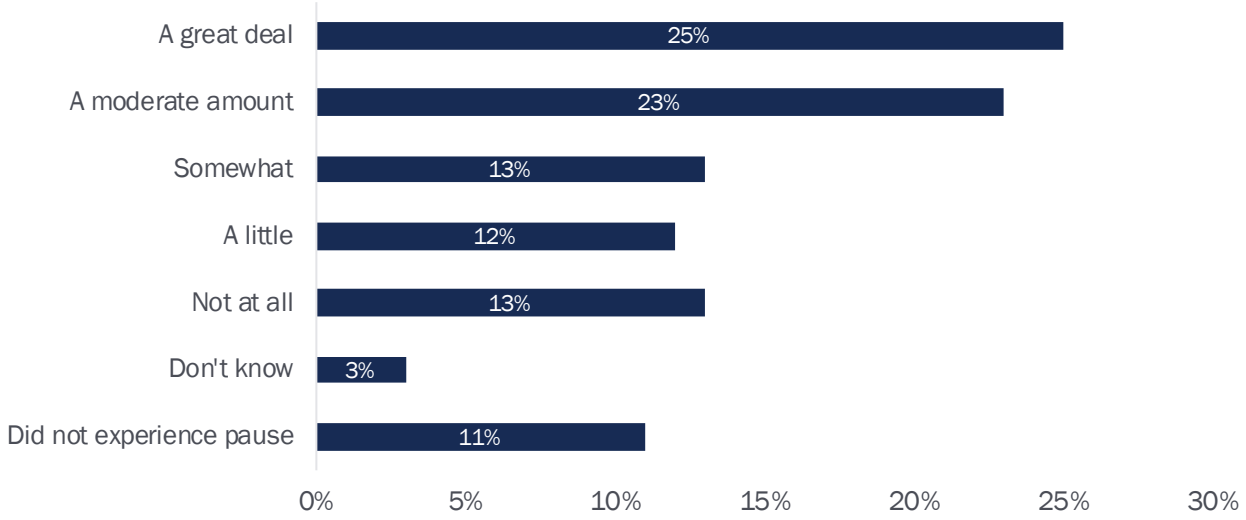
Most surveyed contractors promoted heat pumps to their customers via emails, advertisements, and recommendations over the last year (Figure 32). Nearly three-fourths of contractors (74 of 100; 74%) said they promoted heat pumps to their customers at least "a moderate amount." Overall, we observed an increase in contractors' promotion of heat pumps since the interim evaluation in 2022, with only 8% (8 of 100) reporting they did not promote heat pumps at all over the past 12 months (11 percentage point decrease since 2022).

Figure 32. Extent Contractors Promoted Heat Pumps to Customers (n=100)



Despite many experiencing an increase in their heat pump sales overall, most surveyed contractors reported that the periodic pauses of TECH incentives negatively impacted their sales (Figure 33). Nearly half of contractors (48 of 100; 48%) said the pauses in TECH's incentive funding considerably reduced their heat pump sales, reporting a moderate to great impact on their sales. One-quarter of contractors experienced little to no reduction in their sales of heat pumps as a result of the periodic pauses in TECH incentives (25 of 100; 25%), while an additional 11% (11 of 100) never experienced a pause.

Figure 33. Extent Periodic Pauses of TECH Incentives Affected Contractor Heat Pump Sales (n=100)

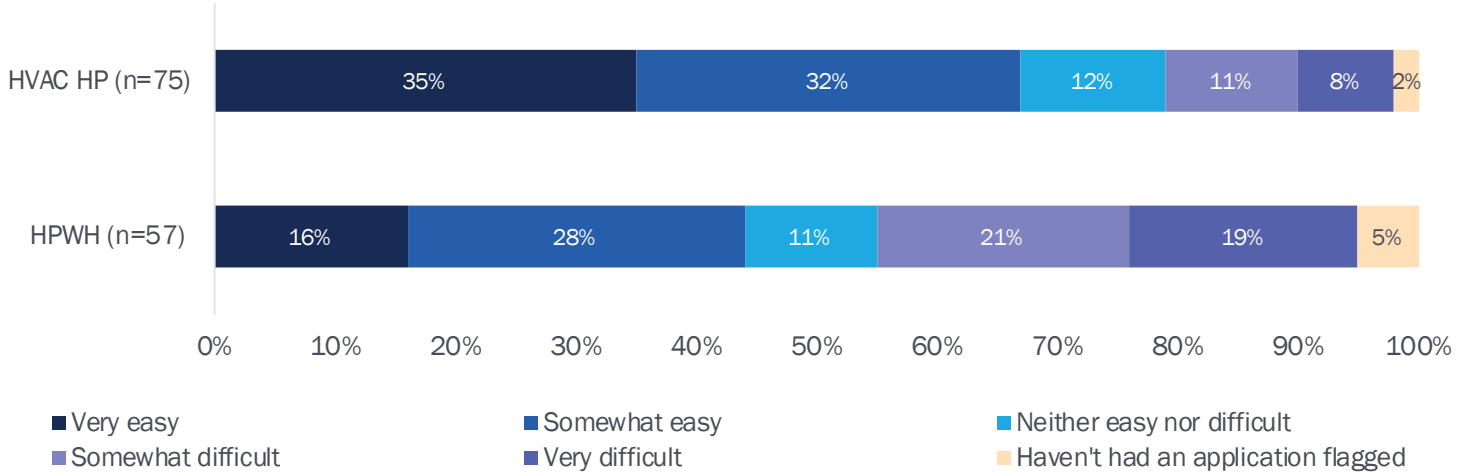


INCENTIVE APPLICATION AND PAYMENT PROCESSING

TECH program staff flag an incentive application when there is missing information or an error. Contractors will see these flags appear once they log back into the portal to check the status of their application and also receive a weekly email notifying them of claims awaiting corrections.

Overall, contractors found it easier to correct flagged issues on HVAC heat pump incentive applications compared to HPWH applications (Figure 34). Two-thirds of HVAC heat pump contractors (50 of 75; 67%) found correcting flagged issues on incentive applications to be at least somewhat easy. However, contractors were much more likely to report that the HPWH application was difficult to fill out (23 of 57; 40%) compared to an HVAC heat pump application (14 of 75; 19%).

Figure 34. Ease or Difficulty for Contractors to Correct Flagged Issues on Incentive Applications



Note: Excludes six respondents who had not filled out an HVAC heat pump incentive application (6 of 6) or HPWH incentive application (2 of 6).

Contractors provided various reasons for why resolving flagged issues on their incentive applications was difficult. We thematically coded contractor responses into the categories shown in Table 27. Most contractors said it was unclear to them why something had been flagged or labeled as incorrect (13 of 30; 43%). Contractors also highlighted the length of time it took to resolve flags after submitting their corrections (9 of 30; 30%), as well as poor communication and assistance from the TECH program team (8 of 30; 27%). One contractor noted the actual process to correct application issues is not difficult, but that the lack of more timely notification from the TECH team that an error exists tends to prolong the process for single-family applications:

> *"There is no auto-generated email to contractors notifying us that an application has been flagged. So, unless we check every day, which is time consuming and tedious, we may miss valuable processing time if we do not catch it right away. The actual correction/resolution process is not typically difficult."*

Table 27. Reasons Why Resolving Flagged Issues on Incentive Applications Was Difficult (n=30)

Reason	Count of Respondents
Unclear why something has been flagged/is incorrect	13
Extended amount of time taken to resolve flags	9
Poor communication/assistance from TECH team	8
Difficulties navigating within incentive portal	3
Experience glitches/poor functionality in incentive portal	1
Don't know	1
Other	3

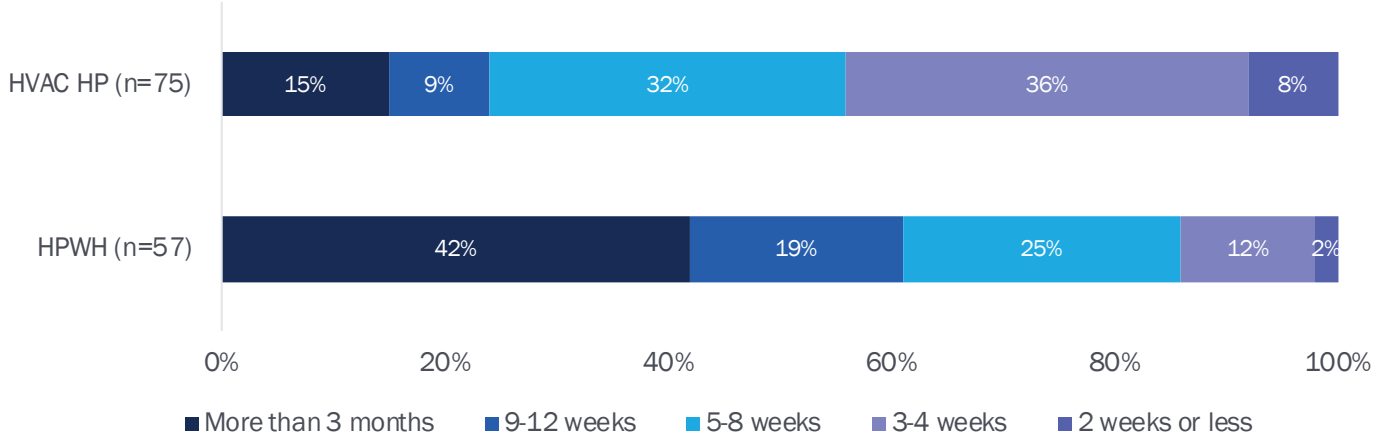
Note: Responses coded as "Other" included the following: ensuring a customer demand response information is correct, running out of funding when correcting flagged issues, and an unclear response.

Contractors can decide whether to pass on the TECH incentive to customers before or after they receive the actual payment from the TECH Initiative. Surveyed contractors were mixed with just over half incentivizing the customer

upfront via an instant discount at the point of sale (54 of 94; 57%), while the remaining respondents said they wait to receive the payout from the TECH Initiative before passing it on to the customer.

Nearly all contractors waited at least three weeks before receiving payments from the TECH Initiative, on average (Figure 35). Notably, 42% (24 of 57) of contractors who submitted an SGIP HPWH application had to wait more than three months for their associated payout from the TECH Initiative and 86% (49 of 57) waited more than a month.

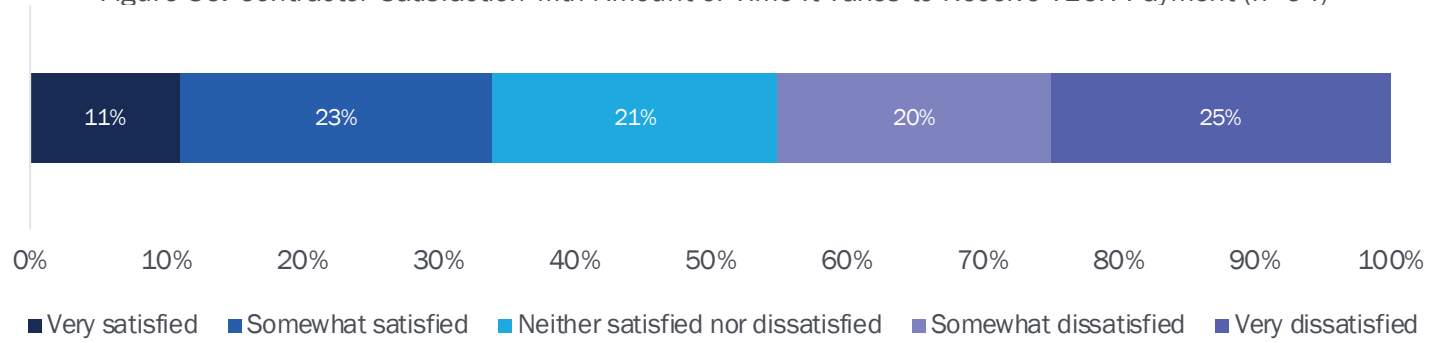
Figure 35. Average Length of Time It Takes for Contractors to Receive TECH Initiative Payments



Note: Excludes six respondents who had not filled out an HVAC heat pump incentive application (6 of 6) or HPWH incentive application (2 of 6).

Almost half of contractors (42 of 94; 45%) expressed dissatisfaction with the amount of time it takes to receive their TECH payments after submitting an incentive application (Figure 36). Only 34% of contractors were at least somewhat satisfied with the TECH payment processing timeline (32 of 94).

Figure 36. Contractor Satisfaction with Amount of Time It Takes to Receive TECH Payment (n=94)

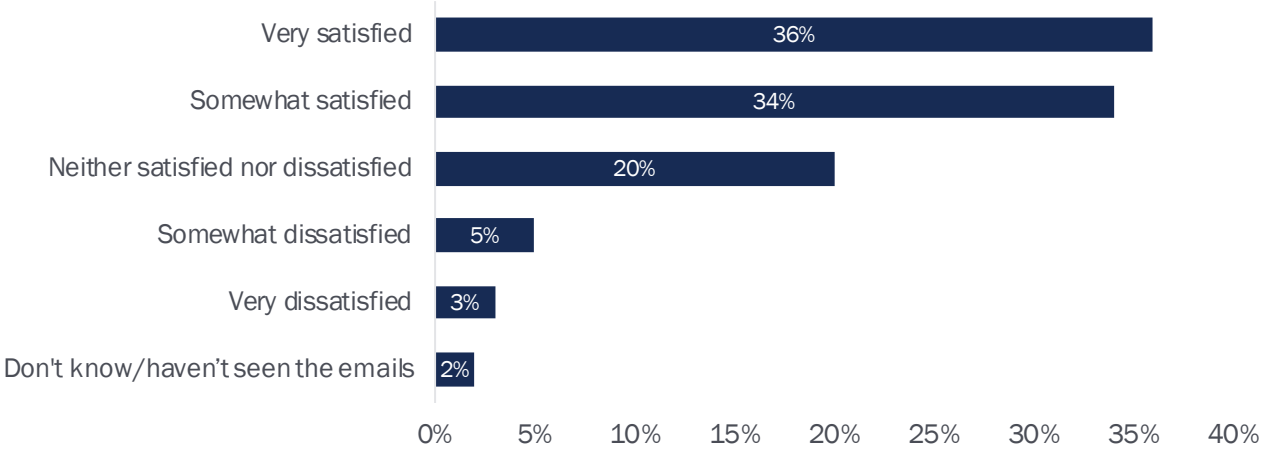


Note: Excludes six respondents who have not filled out an incentive application.

5.3.6 TECH INITIATIVE COMMUNICATION TO CONTRACTORS

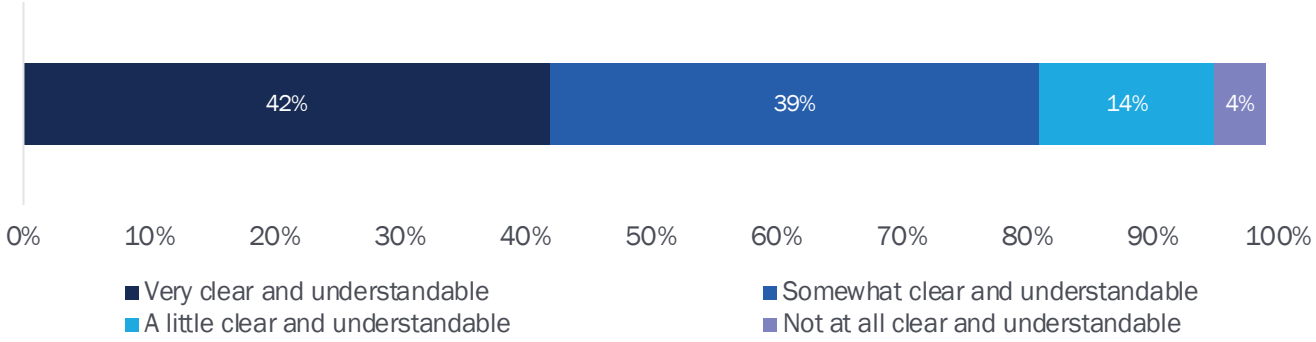
TECH staff communicate information to contractors electronically, via emailed communication or via information posted on websites. This includes periodic updates such as any changes to incentives or suspension of funds. The majority of surveyed contractors were satisfied with TECH's email communication (Figure 37).

Figure 37. Contractor Satisfaction with TECH Initiative Email Communication (n=100)



Most contractors (79 of 97; 81%) also felt the TECH Initiative emails they received were at least somewhat clear and understandable (Figure 38). However, nearly one-fifth of contractors found TECH Initiative emails to be either a little clear and understandable or not understandable at all (17 of 97; 18%). This suggests there is still room for TECH staff to improve their email communications with contractors that will help them to share updates more effectively.

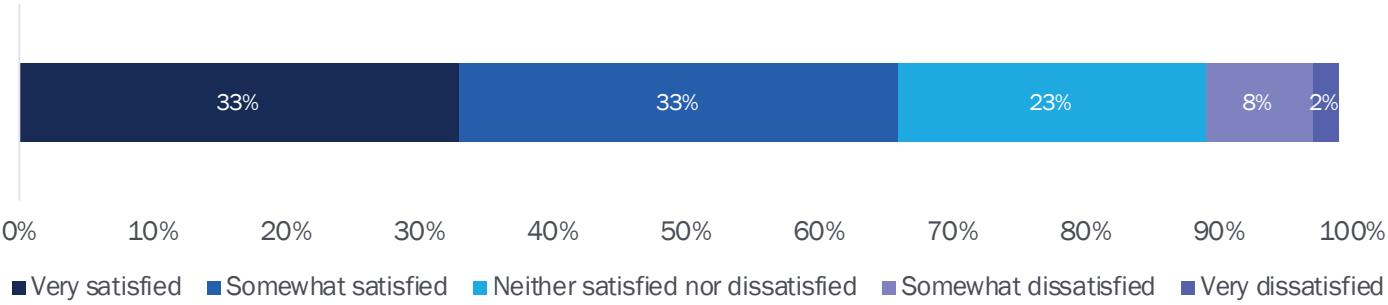
Figure 38. How Clear and Understandable Contractors Found TECH Initiative Emails (n=97)



Note: Excludes three respondents who reported they had not seen the TECH Initiative's emails.

Two-thirds of contractors who recalled receiving emails from the TECH Initiative (64 of 97; 66%) were at least somewhat satisfied with the frequency of email communication (Figure 39). Of the 10 contractors who were dissatisfied with the frequency of TECH Initiative emails, eight reported receiving too many, while the remaining two felt they received too few.

Figure 39. Contractor Satisfaction with Frequency of TECH Initiative Emails (n=97)



Note: Excludes three respondents who reported they had not seen the TECH Initiative's emails.

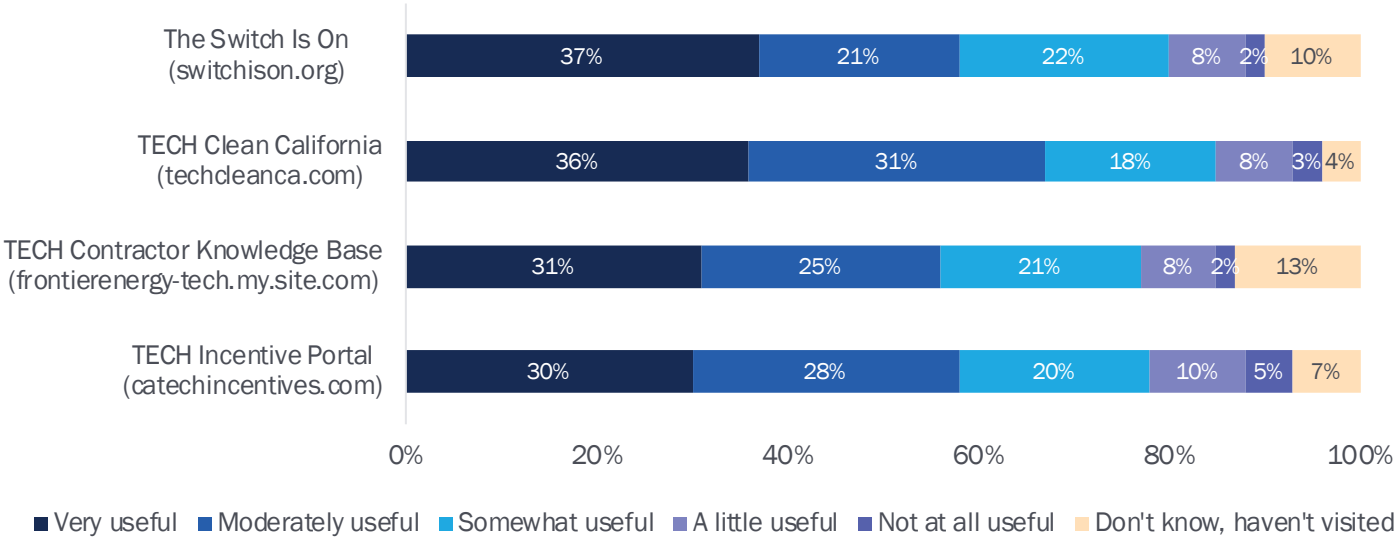
In addition to email communications, the TECH Initiative provides information to contractors on various TECH-related websites. We briefly describe each website we asked about in the survey here:

- **The Switch is On** hosted by the Building Decarbonization Coalition. According to the TECH Clean California Work Plan, the Switch is On hosted a "Contractor Hub" that was "designed as a one-stop resource that consolidates all the disparate information from different programs, supply chain actors and trade allies so that participating contractors can easily find the resources they need to both participate in the program and build their heat pump business. […] It is also a place where prospective contractors can find information about the initiative and explore and learn about how it can benefit their business and a link to an enrollment form."[33]
- **The TECH Clean California public reporting website** hosted by Energy Solutions. This public-facing website is intended to introduce the TECH Clean California Initiative, its goals, incentive budget, and partners; provide data and maps with heat pump installation data; and provide access to evaluation reports as well as events and resources.
- **TECH Contractor Knowledge Base** hosted by Frontier Energy. This searchable website is publicly accessible, though its intended audience is TECH-enrolled contractors. It contains detailed knowledge articles covering TECH Initiative rules and processes. For example, it has articles on qualifying equipment, eligible customers, step-by-step incentive application guidance, demand response program information, and frequently asked questions.
- **TECH Incentive Portal** hosted by Energy Solutions. This website requires a log-in and is accessible to TECH-enrolled contractors and TECH Clean California staff who process incentives. It is the portal where contractors reserve and apply for incentives. TECH staff review incentive applications and flag any errors for correction before they are submitted for approval.

Contractors find the TECH Clean California website to be the most useful online resource (Figure 40). Nearly all surveyed contractors visited the TECH Clean California website most frequently (96 of 100; 96%), with two-thirds of respondents (67 of 100; 67%) reporting the information to be at least moderately useful. Contractors reported a similar level of usefulness across the other TECH Initiative websites, although the TECH Incentive Portal was the site most commonly reported to be "a little" or "not at all" useful (15 of 100; 15%). The TECH Contractor Knowledge Base website was visited least often; 13% of contractors reported they had never visited the site (13 of 100).

[33] Energy Solutions. *TECH Clean California Work Plan. Page 105. (Unpublished).* November 5, 2021.

Figure 40. Usefulness of Information Provided on the TECH Initiative Websites (n=100)



Contractors provided feedback for the TECH program team on what they can do to improve communication going forward to ensure program information is more accessible. We thematically coded responses into the categories shown in Table 28. **Around half of contractors (56 of 100; 56%) found it easy to access program information and had no suggestions for improvement.** Of contractors who provided suggestions, most related to improving contractor accessibility to the TECH team when they have specific questions and streamlining the language in TECH Initiative email communications (Table *28*). One contractor mentioned confusion about who to contact when they needed help, noting that although there are many phone numbers available it is very difficult to connect with TECH staff:[34]

> *"Communication was so confusing; such as who should be contacted about what. We have at least three different phone numbers… some numbers listed on the website do not work, or no one has ever answered."*

This contractor said they have also encountered challenges with TECH Initiative email communication, noting although they have had more success with this communication method, they felt TECH Initiative responses were "weird, disconnected, and disjointed," leaving them with new, additional questions.

[34] TECH Initiative staff report that there is only one phone number available and that this contractor is mistaken.

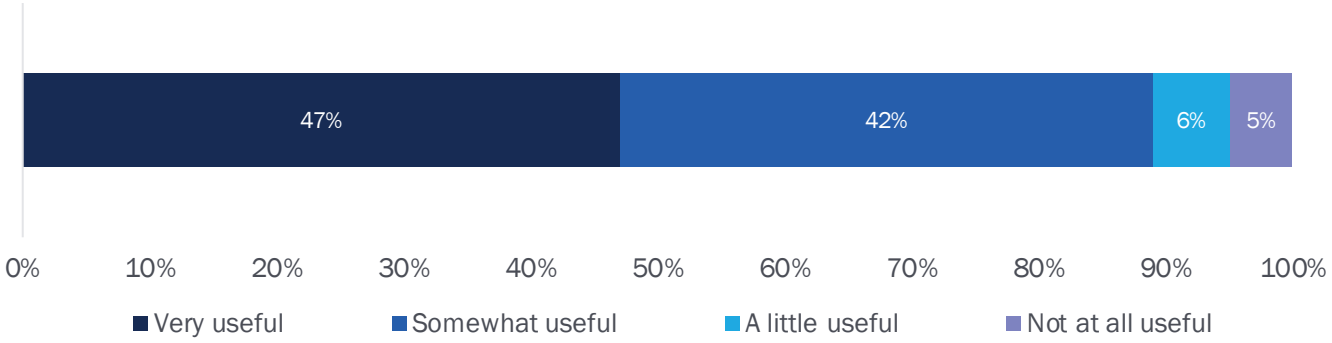
Table 28. Contractor Suggestions to Improve TECH Initiative Communication (n=100)

Suggestion	Count of Respondents
Improve/ease contractor accessibility to TECH team	12
Streamline email communications	11
Refresh contractors on TECH Initiative and guidelines	5
Add notifications for flagged claims outside of the Iris portal	3
More frequent, regular email communications	3
Offer more office hour options	2
Other	9
No suggestions - I find it easy to access program information	56

Note: Some responses were coded into multiple categories. Responses coded as "Other" included general comments about increasing TECH incentives and improving the TECH application process.

The TECH Initiative offers enrolled contractors the opportunity to attend weekly office hours hosted by Frontier Energy's Account Management team to address program-related questions and support needs. The majority of TECH contractors were aware of these office hours (67 of 100; 67%), but only about half of those aware actually attended a session (36 of 67; 54%). Nearly all contractors who attended an office hour session found it to be at least somewhat useful (32 of 36; 89%) (Figure 41).

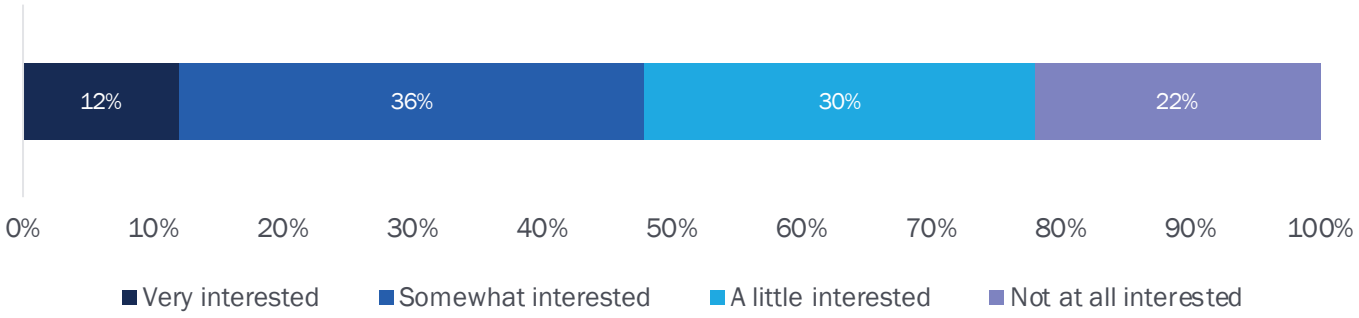
Figure 41. Usefulness of Frontier Energy's Account Management Office Hours for Contractors (n=36)



Note: Only asked of contractors who were aware of the office hours hosted by Frontier Energy's Account Management team.

Contractors who were not previously aware of the office hours, or who were aware but had not attended any of the office hour sessions showed varying levels of interest in attending a session in the future (Figure 42). Just over half of these contractors expressed little to no interest in attending an office hour session in the future (33 of 64; 52%). The remaining contractors indicated they were at least somewhat interested, but only 12% were "very interested" in attending a future session (8 of 64).

Figure 42. Contractor Interest in Attending Future Office Hours (n=64)



Note: Only asked of contractors who were not aware of the optional trainings offered through the TECH Initiative.

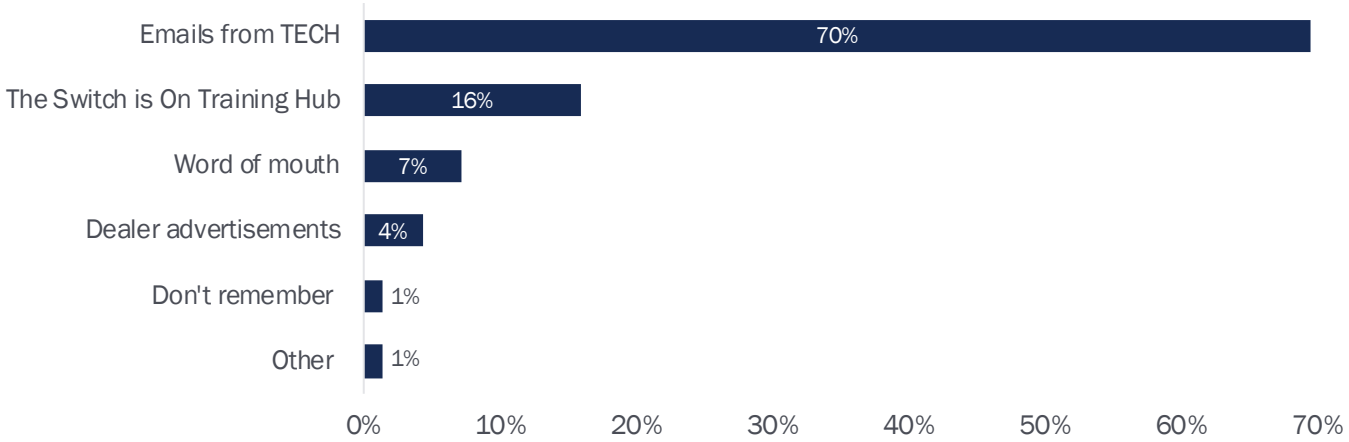
5.3.7 WORKFORCE, EDUCATION, AND TRAINING

This section reviews surveyed contractor findings related to the optional TECH Initiative workforce development trainings offered through EMH, NCI, AEA, or ESMAC. We provide a description of each optional training in Appendix F.

CONTRACTOR TRAINING EXPERIENCE

Over two-thirds of TECH-enrolled contractors (69 of 100; 69%) were aware of the optional trainings available to them. Contractors who were aware most commonly reported first hearing about the training opportunities through emails from the TECH team (48 of 69; 70%) (Figure 43).

Figure 43. How Contractors First Heard About Optional Trainings (n=69)



Note: Only asked of contractors who were aware of the optional trainings offered through the TECH Initiative. One response coded as "Other" included the National Comfort Institute.

Almost half of contractors who were aware of the optional trainings (31 of 69; 46%) did not attend any of those offered in 2023 and 2024. Most of these contractors shared that they did not attend a training because they had already attended a similar course (13 of 31), it was not a priority (10 of 31), or that the training sessions were hosted at an inconvenient time for them (5 of 31) (Table 29).[35]

[35] Note some contractors provided multiple reasons for not attending an optional training.

Table 29. Reasons Contractors Did Not Sign Up for an Optional Training (n=31)

Reasons	Count of Respondents
Already attended similar training	13
Did not become a priority	10
Inconvenient time, or duration too long	5
Unclear what would be covered in the training	4
Topics were not of interest	3
Inconvenient location, not close enough	2
Don't know	2

Note: Multiple responses allowed. Response option "Don't know" is exclusive.

We asked contractors if they have encountered any issues that have made it difficult to install an HVAC heat pump or HPWH and for which they would like to receive more training on. Contractors provided mixed suggestions. Some of the topics they suggested more training on included electrical panel upgrades (6 mentions), permitting processes (5 mentions), knowing what equipment brands qualify for incentives (4 mentions), and demand response requirements (3 mentions). In addition, three contractors shared each of the following suggestions for future trainings: JA13 programming, installing HPWHs in small closets or spaces, and resources for on-the-spot load calculations.

6. CONCLUSIONS AND RECOMMENDATIONS

We offer the following conclusions and recommendations for the TECH Initiative.

- **Conclusion: While the Bay Area, San Diego, and Greater Los Angeles area have strong contractor participation, other regions—such as the Central Valley, Inland Empire, and rural Northern California—may lack adequate contractor coverage for heat pump installations.**
  - Recommendation: The TECH team should expand TECH Initiative outreach and contractor recruitment in underrepresented regions to better promote access to TECH incentives and to support statewide electrification goals.
- **Conclusion: The timeline for distributing incentive payments to contractors could be shortened to improve contractor satisfaction.** The TECH program suggests that contractors provide the incentive as an instant discount at the time of sale to customers. However, floating funds to customers while waiting for payment from the program can create cash flow issues for smaller contracting firms. Many contractors expressed dissatisfaction with the long wait times for receiving incentive payments. The approval process for incentive applications can be delayed if contractors are not aware that their application has been flagged for corrections.
  - Recommendation: The TECH team should consider ways to expedite the contractor reimbursement process, such as a mobile payment service. TECH staff should also provide the average time expectation for their reimbursement on a readily available resource, such as the Switch is On website, so contractors have a realistic time expectation for when they will receive their payment.
- **Conclusion: The TECH Initiative's equipment eligibility criteria for HVAC heat pumps could be modified to require more energy-efficient models.** Other incentive programs in the state require efficiencies that exceed the code minimum SEER 14 rating. When pairing TECH incentives with other programs, contractors have successfully installed higher-efficiency heat pumps. Further, contractors said they almost never had trouble finding HVAC heat pumps eligible for TECH incentives, likely due to the code-minimum efficiency requirement.
  - Recommendation: If the TECH Initiative wants to increase the amount of greenhouse gas savings generated by efficient heat pump equipment, then it should consider incentivizing only heat pumps that go beyond the code minimum. Such a change in the requirements should not be difficult for contractors to meet, given that they already do this for other programs.
- **Conclusion: Layering TECH incentives with other program incentives appears highly effective in boosting heat pump adoption.** Nearly all contractors who had layered TECH incentives found it to be helpful in selling heat pumps to customers. To streamline the layering process, contractors indicated it would be most helpful for the TECH Initiative to align its qualifying equipment models and the application and invoice requirements with other incentive programs.
- **Conclusion: Water-heating contractors have found some challenges associated with the TECH Initiative's requirement for single-family customer enrollment in demand response and TOU rate plans.** Half of water-heating contractors had difficulty getting the customer to agree to enroll, and one-quarter felt little to no comfort explaining demand response benefits to customers. At the same time, contractors said TECH customers are concerned with how their equipment will operate when enrolled in a demand response program and have trouble understanding what demand response is and/or why enrollment is required. Contractors suggested that it would help to have tangible resources to share with customers, such as a fact sheet or short information video that contains "links to important instructions and information" about demand response.
  - Recommendation: The TECH team should increase promotion of the customer-facing handout, available to contractors on the Switch is On website, that includes answers to commonly asked questions and outlines steps customers should take to participate in a demand response program. Encouraging contractors to share

this document more broadly with their customers will help ensure customers are prepared for and open to discussions about demand response when TECH contractors mention it. TECH staff should also explore crafting scripts that contractors can use in their conversations with customers to outline the benefits of demand response programs.

  - **Recommendation:** TECH staff should make the customer-facing handout easily findable and accessible for customers on the Switch is On website. The TECH team should also add information related to demand response and the associated incentive requirements to the customer FAQ page to further ensure customers have access to this information.

- **Conclusion: TECH contractors offering SGIP HPWH incentives have reported more dissatisfaction and challenges with the TECH Initiative than HVAC contractors.** Specifically, they found the TECH enrollment application more confusing and burdensome; they had more difficulty understanding the equipment and customer eligibility criteria; and had more difficulty addressing flags and completing the incentive applications.
  - **Recommendation:** TECH staff should consider targeted promotion of the recurring contractor office hours to HPWH contractors and reminders of the TECH Contractor Knowledge Base website, because 13% of contractors did not know about this website.
- **Conclusion: Clarity of communication and responsiveness among program staff could be improved.** TECH contractors reported difficulty reaching TECH staff for questions, that listed phone numbers do not work, and that calls are not returned. The most common suggestion contractors had to improve communication was to enhance accessibility to the TECH team. The article on the Contractor Knowledge Base website titled "How to Reach the TECH Team" lists only emails and no phone numbers.[36] Despite being the primary mode of communication used by TECH staff to share information, some contractors found TECH emails to be only a little clear and understandable, or not at all.
  - **Recommendation:** The TECH team, and in particular Frontier Energy, which manages the contractors, should investigate what phone numbers are listed in contractor-facing materials and check that they are current. Contractors may find a phone call a quicker and easier way to get their questions answered than multiple back-and-forth emails. Therefore, we recommend adding phone numbers to the Knowledge Base article about how to reach the appropriate TECH team member for different questions.
  - **Recommendation:** TECH staff should streamline email formats and expand live support options to improve the clarity of communication and increase staff accessibility.

[36] https://frontierenergy-tech.my.site.com/contractorsupport/s/article/How-to-Reach-Us

APPENDIX A. DATA COLLECTION INSTRUMENTS

Click on the icon to open the instrument.

TECH Contractor Experience Survey instrument:

TECH Contractor Experience Survey.pdf

TECH Multifamily Property Owner Post-Install Survey instrument:

TECH Multifamily Post-Install Survey.pdf

APPENDIX B. INTERIM PROCESS EVALUATION REPORT

Click on the icon to open Opinion Dynamics' first process evaluation report from November of 2022.


TECH Interim Process Evaluation Final Repor

APPENDIX C. PROGRAM THEORY LOGIC MODEL LINKAGES

Table 30 explains the links between activities, outputs, and outcomes in more detail than can be represented in the PTLM. The table is organized by the link numbers.

Table 30. Explanation of Links in TECH Initiative Logic Model

Link	Segment Theory	Potential Key Performance Indicators for Future Consideration
1	The output of the activity ***Marketing and education to consumers about heat pump benefits, contractors, and incentives (A)*** is ***Marketing and education plans and materials developed and implemented; statewide website developed (H).*** The Implementer will launch a multi-media campaign across California and work with CBOs and existing low-income programs to develop materials targeted for low-income, non-English, and disadvantaged communities. The Implementer will also leverage the statewide consumer-facing "The Switch Is On" website. One resource on the Switch is On website will be the Find a Contractor tool.	▪ # of marketing materials developed ▪ # of marketing materials for DACs ▪ # of marketing channels used ▪ # of impressions, clicks, etc. on "The Switch is On" website and "Find a Contractor" webpage
2	The output of the activity ***Recruit and engage manufacturers, distributors, retailers, contractors and installers (B)*** is a ***Network of market actors who stock, promote, and install heat pumps (I).*** The implementer will create a network of skilled contractors who will use TECH Initiative incentives and be responsible for the installation of clean space and water heating technologies. The Implementer will recruit contractors and assign then an account manager. The Implementer will also collect sales data from them.	▪ # of manufacturers engaged ▪ # of distributors engaged ▪ # of retailers engaged ▪ # of distributors providing sales data ▪ # of enrolled contractors ▪ # of participating workforce who reside in and service low-income/DAC area
3	The output of the activity ***Offer TECH incentives layered with existing clean heating incentives (C)*** is the number of ***Incentives provided (J).*** The incentives will be processed through a centralized Incentive Clearinghouse. The Implementer will also perform QA/QC and data management. One incentive is a free HPWH for contractors to install in their homes.	▪ # of separate incentive program administrators with whom the TECH Implementer signs an MOU enabling data sharing and incentive layering ▪ # of HVAC heat pump incentives available ▪ # of HPWH incentives available ▪ # of panel upgrade incentives available
4	The output of the activity ***Design, leverage, and implement market actor education and training (D)*** is the number of ***Training and educational materials developed and offered (K).*** The TECH Initiative Implementer will enhance existing training in partnership with manufacturers, distributors, and existing WE&T efforts. The Implementer will also provide specialized business model training to high-potential and engaged contractors and will host training materials online for contractor access. Implementer will ensure that low-income residents and those living in DACs have equitable access to job trainings, by coordinating recruitment efforts with CBOs. The Implementer will work with CBOs and workforce development boards to develop clear guidance for contractors to obtain the licenses necessary to work on electrification projects. The Implementer will also build electrification knowledge and capacity among multifamily market actors through basic, intermediate, and advanced trainings.	▪ # of trainings offered ▪ # of trainings offered in high unemployment zip codes ▪ # of training attendees ▪ # of training attendees who reside in high unemployment zip codes ▪ # of disadvantaged worker[37] attendees ▪ # of CBOs assisting with disadvantaged worker recruitment ▪ # of installers receiving TECH training certificates

[37] A Disadvantaged Worker, as defined in D.18-10-008 (October 11, 2018), "Decision Addressing Workforce Requirements and Third Party Contract Terms & Conditions", defines a disadvantaged worker as "an individual that meets at least one of the following criteria: lives in a household where total income is below 50 percent of Area Median Income; is a recipient of public assistance; lacks a high school diploma or GED; has previous history of incarceration lasting one year or more following a conviction under the criminal justice system; is a custodial single parent; is chronically unemployed; has been aged out or emancipated from the foster care system; has limited English proficiency; or lives in a high unemployment ZIP code that is in the top 25 percent of only the unemployment indicator of the CalEnviroScreen Tool."

5	The output of the activity ***Expand and promote financing options (E)*** is that ***Low interest financing is available [under consistent terms] statewide (L).*** The TECH Implementer will offer financing mechanisms that offer customers pathways to electrification that significantly reduce upfront costs and increase financial leverage. Implementer will collaborate with California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) to expand the GoGreen Home (GGH) Loan program statewide.	▪ # of financing offerings available ▪ # of GGH loans issued ▪ $ amount of GGH loans issued
6	The output of the activity ***Design regional pilot programs (F)*** is the number of ***Pilot programs implemented and assessed (M).*** Regional pilots will address specific areas of the market and major adoption barriers that need to addressed to meet California's GHG reduction goals. The pilots include activities such as offering tariffed on-bill financing; technical assistance offerings for multifamily market actors; streamlined permitting processes; HPWH load-shifting best practices; customer targeting; and quick-start grants.	▪ # of pilots implemented ▪ # of pilots assessed
7	The output of the ***Collect strategic program data (G)*** activity is ***Program analyses and anonymized downloadable datasets developed (N).*** The TECH Implementers will conduct analyses of program data and provide anonymized program data on a public website. Examples of these analyses include bill savings analysis and quantification of electrification benefits.	▪ # of analyses and other public materials developed to influence policy work posted on public reporting site
8	A short-term outcome of ***Marketing and education plans, materials, developed and implemented; statewide website developed (H)*** is ***Increased customer awareness of and familiarity with heat pump benefits and available resources (O).*** The consumer-facing education and outreach will expose more people to the benefits of electrification and the resources available to help them electrify buildings, such as incentives and installers.	▪ Measures of customer program awareness attributable to program activities ▪ Measures of customer familiarity with heat pump benefits attributable to program activities ▪ Measures of customer familiarity with heat pump resources, such as project financing, attributable to program activities ▪ # of appointments made through the Find a Contractor portal to initiate electrification projects ▪ # of impressions, clicks, etc. on "The Switch is On" website and "Find a Contractor" webpage
9	A short-term outcome of there being a ***Network of market actors who stock, promote, and install heat pumps (I)*** is ***Increased customer awareness of and familiarity with heat pump benefits and available resources (O).*** The network of engaged actors will expose customers to heat pumps, increasing their customers' awareness and familiarity of electrification benefits and technologies.	▪ # of market actors promoting financing options ▪ Measures of customer awareness of and familiarity with heat pump benefits and available resources attributable to participating market actors
10	Another short-term outcome of the ***Network of market actors who stock, promote, and install heat pumps (I)*** is ***Heat pump installations through TECH Initiative participation (P).*** As the network of market actors promote and install heat pumps, they will generate participation in the TECH Initiative.	▪ Measures of changed contractor promotion strategies and/or frequency ▪ # of TECH incentive applications collected, approved, and denied ▪ # of HVAC heat pump installs in total ▪ # of HPWH installs in total ▪ # of HVAC heat pump installs in DACs ▪ # of HPWH installs in DACs ▪ # of HVAC heat pump installs in single-family homes ▪ # of HPWH installs in single-family homes ▪ # of HVAC heat pump installs in multifamily properties

		▪ # of HPWH installs in multifamily properties ▪ # of HVAC heat pump installs in single-family homes in DACs ▪ # of HPWH installs in single-family homes in DACs ▪ # of HVAC heat pump installs in multifamily properties in DACs ▪ # of HPWH installs in multifamily properties in DACs ▪ # of HVAC heat pump installs by gas utility territory ▪ # of HPWH installs by gas utility territory
11	A short-term outcome of the ***Incentives provided (J)*** is ***Heat pump installations through TECH Initiative participation (P).*** The incentives will be submitted and processed through a simplified and streamlined website with quick turnaround times. This process and the support provided to market actors will motivate them to increase their promotion and sales of heat pump equipment, resulting in TECH-incented installations. These installations will also occur in Disadvantaged Communities. Beginning in 2023 for HPWH incentives and 2024 for HVAC heat pump incentives, the TECH Initiative required contractors to ensure the customer commits to enrolling in a demand response (DR) program if they are not already in one.	▪ Proportion of HVAC heat pumps sold through the TECH Initiative ▪ Proportion of HPWH sold through the TECH Initiative ▪ Average contractor satisfaction scores with incentive processing ▪ $ amount of incentives in total ▪ $ amount of incentives for DACs ▪ $ amount of HVAC heat pump incentives ▪ $ amount of HPWH incentives ▪ $ amount of panel upgrade incentives ▪ $ amount of incentives for single-family homes ▪ $ amount of incentives for multifamily homes ▪ $ amount of incentives by gas utility territory ▪ # of incentives in total ▪ # of incentives going to low-income/DAC customers ▪ # of HVAC heat pump incentives issued ▪ # of HPWH incentives issued ▪ # of HVAC heat pump incentives in DACs issued ▪ # of HPWH incentives in DACs issued ▪ # of panel upgrade incentives issued ▪ # of panel upgrade incentives in DACs issued ▪ # of incentives for single-family homes issued ▪ # of incentives for multifamily homes issued ▪ # of incentives for single-family homes in DACs issued ▪ # of incentives for multifamily homes in DACs issued ▪ # of HVAC heat pump incentives for single-family homes in DACs issued ▪ # of HPWH incentives for multifamily homes in DACs issued ▪ Proportion of incentives going to low-income/DAC customers ▪ # of incentives by natural gas utility territory ▪
12	A short-term outcome of ***Training and educational materials developed and offered (K)*** is the ***Heat pump installations through***	▪ Measures of changed contractor promotion strategies and/or frequency

	TECH Initiative participation (P). The technical and sales training available at low to no cost to market actors will ensure they are aware of TECH Initiative participation benefits, and will sell heat pumps that are rebated through the TECH Initiative. The trainings and resulting installations will also occur in Disadvantaged Communities.	▪ # of TECH incentive applications collected, approved, and denied ▪ # of installs in total ▪ # of installs in DACs in total ▪ # of installs in single-family homes ▪ # of installs in multifamily properties ▪ # of HVAC heat pump installs in total ▪ # of HVAC heat pump installs in DACs ▪ # of HVAC heat pump installs in single-family homes ▪ # of HVAC heat pump installs in multifamily properties ▪ # of HPWH installs in total ▪ # of HPWH installs in DACs ▪ # of HPWH installs in single-family homes ▪ # of HPWH installs in multifamily properties ▪ # of HVAC heat pump installs in single-family homes in DACs ▪ # of HVAC heat pump installs in multifamily properties in DACs ▪ # of HPWH installs in single-family homes in DACs ▪ # of HPWH installs in multifamily properties in DACs
13	Another short-term outcome of ***Training and educational materials developed and offered (K)*** is ***Increased market actor knowledge and skills, designing, installing, and using heat pumps (Q).*** Once the market actors are knowledgeable and skilled about heat pumps, they will be comfortable specifying heat pumps for their projects, leading to sales through the TECH Initiative. The skilled market actors will also install heat pumps in Disadvantaged Communities.	▪ Average contractor scores on HVAC heat pump-related knowledge, skills, and confidence including value proposition ▪ Average contractor scores on HPWH-related knowledge, skills, and confidence including value proposition ▪ # of workers licensed to install, service, and maintain HVAC heat pumps ▪ # of workers licensed to install, service, and maintain HPWH ▪ Proportion of market actor jobs fulfilled by disadvantaged workers
14	A short-term outcome of the ***Low interest financing available statewide (L)*** is ***Heat pump installations through TECH Initiative participation (P)*** from reduced financial barriers.	▪ # of TECH participants using financing ▪ Proportion of TECH participants using financing ▪ Proportion of HVAC heat pump participants using financing ▪ Proportion of HPWH participants using financing ▪ Proportion of single-family participants using financing ▪ Proportion of multifamily participants using financing ▪ Proportion of DAC participants using financing ▪ Average customer scores on the influence of financing on participation
15	Another short-term outcome of the ***Low interest financing available statewide (L)*** will be ***Loan paybacks and volume [of loans issued] create proof of concept for project finance models (R).*** Once sufficient customer demand for project financing is demonstrated and the loans are paid back (instead of defaulted on), then a proof of concept will be available to financiers that this service is needed in the market.	▪ Dollar amount of loans issued ▪ # of loans issued ▪ Proportion of loans paid back vs defaulted ▪ Proportion of loans for single-family properties, multifamily properties, renters, and low-income customers

16	***Pilot programs implemented and*** **assessed, *(M)*** will lead to ***Scaling of effective pilot strategies to statewide implementation (S)*** as the TECH Initiative is also scaled. We expect this scaling to start in the third year of the program after sufficient data on the pilot strategies has been collected and assessed. These pilot activities include HPWH load-shifting, customer targeting, multifamily design team assistance, and quick-start grants, among others.	▪ # of pilots scaled
17	A short-term outcome of the ***Program analyses and anonymized downloadable datasets developed (N),*** is that ***Implementers, researchers, and stakeholders analyze datasets (T).*** A centralized database with electrification data will provide a rich source for anyone to analyze and develop insights about the TECH Initiative's impacts. It is expected that this outcome will start to occur in third year of the TECH Initiative after installations have made, and sufficient data and/or analyses has been assembled and made available. Examples of analyses may include bill savings analysis, participant motivations and satisfaction, and quantification of electrification benefits.	▪ # of visits and downloads on the TECH Working Data Set and Electrification Value Stream Analyses webpages ▪ # of unique visitors
18	Once there is ***Increased customer awareness of and familiarity with heat pump benefits and available resources (O),*** that will lead to ***Heat pump installations through TECH Initiative participation (P)***. When customers are aware of heat pump benefits and the incentives available to them, as well as the resources such as the Find a Contractor tool, they will be more likely to participate in the TECH Initiative.	▪ Measures of increased program awareness attributable to program activities ▪ Correlation between awareness and program participation ▪ # of appointments made through Find a Contractor portal ▪ # of impressions, clicks, etc. on "The Switch is On" website and "Find a Contractor" webpage ▪ # of single-family participants ▪ # of multifamily participants ▪ # of participants in DACs ▪ Proportion of participants at single-family properties ▪ Proportion of participants at multifamily properties ▪ Proportion of participants who are renters ▪ Proportion of participants who are low-income/DAC
19	***Increased market actor knowledge and skills, designing, installing, and using heat pumps (Q).*** leads to ***Heat pump installations through TECH Initiative participation (P)***. The knowledgeable and skilled market actors will be confident specifying heat pumps for their projects, leading to installations through the TECH Initiative.	▪ # of HVAC heat pump installations for contractors who did receive training ▪ # of HVAC heat pump installations for contractors who did not receive training ▪ # of HPWH installations for contractors who did receive training ▪ # of HPWH installations for contractors who did not receive training ▪ Measures of market actor confidence with HVAC heat pumps ▪ Measures of market actor confidence with HPWHs
20	The ***Increased customer awareness of and familiarity with heat pump benefits and available resources (O)*** will lead to ***Increased heat pump market penetration (U)*** in the short and long term. Once the key barrier of limited customer awareness is overcome, they will be more demanding and/or accepting of heat pumps, causing heat pumps to be more prevalent in buildings.	▪ Measures of customer awareness of heat pump benefits attributable to program activities ▪ Volume of HPWH and HVAC heat pump units sold, tracked, and reported on in California ▪ # of heat pumps installed in DACs ▪ Penetration of HVAC heat pumps in single-family and multifamily homes

		▪ Penetration of HPWHs in single-family and multifamily homes
21	***Heat pump installations through TECH Initiative participation (P)*** will lead to a long-term outcome of ***Increased heat pump market penetration (U),*** including in Disadvantaged Communities. The heat pump installations incentivized through the TECH Initiative will increase the penetration of heat pumps in single-family and multifamily residential buildings.	▪ Volume of HPWH and HVAC heat pump units sold, tracked, and reported on in California ▪ # of installs in total ▪ # of installs in DACs in total ▪ # of installs in single-family homes ▪ # of installs in multifamily properties ▪ # of HVAC heat pump installs in total ▪ # of HVAC heat pump installs in DACs ▪ # of HVAC heat pump installs in single-family homes ▪ # of HVAC heat pump installs in multifamily properties ▪ # of HPWH installs in total ▪ # of HPWH installs in DACs ▪ # of HPWH installs in single-family homes ▪ # of HPWH installs in multifamily properties ▪ # of HVAC heat pump installs in single-family homes in DACs ▪ # of HVAC heat pump installs in multifamily properties in DACs ▪ # of HPWH installs in single-family homes in DACs ▪ Market share for eligible technologies
22	***Heat pump installations through TECH Initiative participation (P)*** will lead to ***Greenhouse gas emissions reductions (V).*** Once heat pumps are installed and replace gas-based systems or less efficient electric systems, greenhouse gas emissions reductions will be achieved. TECH Initiative customers' enrollment in DR programs increases the likelihood that the heat pumps added electric load can be curtailed during peak demand events, also reducing greenhouse gas emissions.	▪ Cost per metric ton of greenhouse gas emissions reductions
23	***Heat pump installations through TECH Initiative participation (P)*** will lead to ***Growth in the supply chain stocking of heat pumps across all distributors and equipment suppliers (W)*** in the long term. Once heat pumps are selling in greater volumes, distributors and equipment suppliers should respond to the market cues and stock more heat pumps.	▪ Volume of HPWH and HVAC heat pump units sold, tracked, and reported on in California ▪ # of distributors and suppliers stocking HVAC heat pumps ▪ # of distributors and suppliers stocking HPWH ▪ # of HVAC heat pumps stocked ▪ # of models of HVAC heat pumps stocked ▪ # of HPWH stocked ▪ # of models of HPWH stocked
24	***Heat pump installations through TECH Initiative participation (P)*** will lead to a long-term outcome of ***Increased workforce opportunities in heat pump industry (X).*** As heat pumps are more frequently installed in homes, property owners will be satisfied with their performance and energy savings, leading to greater demand for heat pumps, which translates into more workforce opportunities in the heat pump industry.	▪ # of jobs created in heat pump industry ▪ Proportion of HVAC heat pump-related jobs fulfilled by disadvantaged workers ▪ Proportion of HPWH-related jobs fulfilled by disadvantaged workers ▪ # of workers licensed to install, service, and maintain heat pumps ▪ Annual # of HVAC heat pump-related positions available ▪ Annual # of HPWH-related positions available

		▪ Annual # of HVAC heat pump-related workers employed ▪ Annual # of HPWH-related workers employed
25	As the ***Loan paybacks and volume [of loans offered] create proof of concept for project finance models (R),*** that will contribute to a long-term outcome of ***Mature project finance structures that serve consumers (Y).*** Once the proof of concept is demonstrated and financiers see the opportunity of serving residential customers interested in electrification, they will develop and make available project financing, helping to mature this part of the market.	▪ # of GGH project loans issued ▪ $ amount of GGH loans issued ▪ Proportion of loans issued as part of TECH in good standing compared to those defaulted on ▪ Proportion of loans for single-family properties, multifamily properties, renters, and low-income customers ▪ # of financiers offering electrification project financing ▪ Proportion of GGH loans that received TECH incentives
26	The ***Scaling of effective pilot strategies to statewide implementation (S)*** will lead to a short-term outcome of ***Heat pump installations through TECH Initiative participation (P).*** Once the pilot strategies have been determined to be successful and are expanded, the barriers they address will be reduced and more customers will participate in the TECH Initiative. These include customers in Disadvantaged Communities and at multifamily properties.	▪ # of TECH incentives issued to customers targeted by a scaled pilot strategy
27	A long-term outcome of ***Implementers, researchers, and stakeholders analyze datasets (T)*** is that they will produce ***insights from data inform key program and policy decisions (Z)***. The data-supported insights will allow stakeholders to effectively make a case in policy proceedings and advance beneficial electrification objectives.	▪ Number of policy and regulatory decisions that advance TECH Initiative objectives
28	***Increased heat pump market penetration (U)*** will lead to a long-term outcome of ***Full-scale market transformation of the heat pump market (AA).*** Once heat pumps are more widely installed in the market and customers are comfortable with them as a water heating and space heating/cooling technology, it will support the transformation of the heat pump market. Market transformation will occur when heat pumps have 50% of market share by 2030 and gas space/water heating is phased out by 2032; plus when heat pump installed costs decline and electrification value streams make it cost competitive with gas.	▪ Proportion of water heating sales that are HPWHs ▪ Proportion of HVAC sales that are heat pumps ▪ Cost of installed HVAC heat pumps ▪ Cost of installed HPWH
29	***Growth in supply chain stocking of heat pumps across all distributors and equipment suppliers (W)*** will lead to a long-term outcome of ***Increased heat pump market penetration (U).*** With greater availability of a variety of heat pumps at distributors and suppliers, heat pumps will more accessible and become a more commonly selected choice of equipment, leading to more market penetration.	▪ Volume of HPWH and HVAC heat pump units sold, tracked, and reported on in California ▪ # of distributors and suppliers stocking heat pumps ▪ # of HVAC heat pumps stocked ▪ # of models of HVAC heat pumps stocked ▪ # of HPWHs stocked ▪ # of models of HPWHs stocked ▪ Penetration of HVAC heat pumps in single-family and multifamily homes ▪ Penetration of HPWHs in single-family and multifamily homes
30	***Growth in supply chain stocking of heat pumps across all distributors & equipment suppliers (W)*** will also lead to a long-term outcome of ***Full-scale market transformation of the heat pump market (AA).*** The greater availability and accessibility of heat pumps at suppliers will help transform the market. Market transformation will occur when heat pumps have 50% of market share by 2030 and gas space/water heating is phased out by 2032.	▪ All HVAC suppliers stock HVAC heat pumps ▪ All plumbing suppliers stock HPWH

31	*Increased workforce opportunities in heat pump industry (X)* will lead to a long-term outcome of ***Full-scale market transformation of heat pump market (AA).*** Market transformation will occur when sustained customer demand for heat pumps creates significant job growth in the electrification industry, especially in Disadvantaged Communities.	▪ Proportion of employment opportunities that require heat pump experience or training ▪ Proportion of workers selling/installing heat pumps in HVAC industry ▪ Proportion of workers selling/installing HPWH in water heating industry ▪ # of jobs created in heat pump industry ▪ Proportion of HVAC heat pump-related jobs fulfilled by disadvantaged workers ▪ Proportion of HPWH-related jobs fulfilled by disadvantaged workers ▪ # of workers licensed to install, service, and maintain HVAC heat pumps ▪ # of workers licensed to install, service, and maintain HPWH ▪ Annual # of HVAC heat pump-related positions available ▪ Annual # of HPWH-related positions available
32	*Mature project finance structures serve customers (Y)* and will lead to a long-term outcome of ***Full-scale market transformation of heat pump market (AA).*** The widespread availability of electrification project financing options will be evidence of a transformed market.	▪ Electrification project financing is easily findable
33	*Insights from data that inform key program and policy decisions (Z)* will lead to ***Full-scale market transformation of heat pump market (AA).*** The data-based policy decisions will maximize the impact of the TECH Initiative. For example, market transformation will occur when heat pumps are optimized with Time-of-Use rates controls as a standard offering.	▪ Proportion of heat pumps sold that are optimized with Time-of-Use rate controls ▪ Proportion of low-income programs that require electrification

APPENDIX D. TECH SINGLE-FAMILY PANEL AMPERAGE UPGRADES

Table 31 include all combinations of pre- and post-electrical panel amperage changes that occurred for at least two single-family project sites.

Table 31. Pre- and Post- Electrical Panel Amperage Capacity (n=901)

Pre-Install Panel Capacity	Post-Install Panel Capacity	Number of Sites
100	200	286
200	300	242
200	220	101
110	220	45
125	200	42
125	225	20
100	240	20
150	200	18
220	320	15
150	250	10
100	125	8
50	60	6
240	340	5
100	220	5
90	100	5
82	92	4
83	93	4
200	250	3
82	90	3
69	80	3
200	225	3
175	200	3
120	220	3
50	150	3
400	500	3
140	200	3
125	155	3
180	200	3
101	109	2
81	92	2
71	82	2
96	103	2

Pre-Install Panel Capacity	Post-Install Panel Capacity	Number of Sites
79	89	2
67	78	2
82	93	2
200	240	2
125	220	2
175	275	2
100	150	2
120	200	2
100	225	2
150	225	2
110	200	2
80	100	2

Note: This table includes all amperage changes that occurred for at least two project sites. Based on this, 100 projects were excluded from the table; representing 5% of projects where an amperage change occurred.

APPENDIX E. INCENTIVE APPLICATION FORM REQUIREMENTS

The step-by-step guides for single-family market-rate TECH incentive applications can be found at the links below.

- https://frontierenergy-tech.my.site.com/contractorsupport/s/article/Single-Family-HPWH-Application-Step-by-Step
- https://frontierenergy-tech.my.site.com/contractorsupport/s/article/Single-Family-HVAC-Submission-Step-by-Step

APPENDIX F. TECH OPTIONAL TRAININGS

Descriptions of each of the optional trainings offered through the TECH Initiative are provided below.

- **NCI Airflow Testing and Diagnostics**: Intended for HVAC contracting firm owners, managers, and technicians, this eight-hour class provides technical training on performing static pressure testing, how to professionally install static pressure test ports, and how to measure and interpret static pressures.
- **NCI Refrigerant-Side Performance**: This residential and commercial certification class provides students with real-world lessons and hands-on training. It is based on proven techniques on how to best approach refrigeration-side issues. Students learn to apply NCI's performance-based, systematic approach to refrigeration-side diagnostics, including strategies for mitigating non-refrigerant faults prior to attaching refrigerant gauges.
- **NCI Residential System Performance and Electrification**: This 20-hour certification course teaches students how to test, diagnose, and improve total residential HVAC performance. This course features numerous hands-on demonstrations that include how to use the test instruments, proper testing locations, and live testing and interpretation of readings. This class is offered in both in-person and live webinar formats.
- **EMH Residential Space Conditioning and Water Heating Electrification**: Designed for construction trade personnel of all levels, this three-day class informs students of near-term and far-reaching changes in the home building industry and driving forces of such, including California's regulatory and legislative framework. Students gain in-depth knowledge about heat transfer mechanisms, functionality, and benefits of heat pumps in residential electrification, as well as how to transition from traditional gas heating to modern electric heat pumps without negatively impacting their bottom line. This course is offered in live format only.
- **AEA Electrification 101 Multifamily**: This webinar reviews the benefits of electrification and policy and code considerations. It also provides an overview of what should be considered in an all-electric multifamily project (both new and retrofit), and explores electrification technologies for all end uses, as well as the role of solar PV and electric vehicles.
- **AEA Multifamily Electrician Retrofits and Assessments for Building Professionals**: This webinar explores how to approach an electrification retrofit, what the constraints and opportunities there are for multifamily buildings with different configurations, and how projects are shaped by electrical infrastructure and available technology. Attendees work through example projects in class.
- **AEA Multifamily Electrification Retrofits for Property Owners**: This course is aimed at educating multifamily property owners about what they need for a successful retrofit project. Attendees learn how to approach an electrification retrofit, what the team can look like, the constraints and opportunities for different property configurations, and how projects are shaped by electrical infrastructure and available technology. Attendees work through example projects in class.
- **AEA Individual Heat Pump Water Heater Installation:** This two-hour webinar is aimed at educating contractors, consultants, and engineers on design considerations for individual HPWHs, particularly for multifamily developments. This course provides an overview of HPWHs, code requirements, and takes a deep dive into design considerations discussing sizing, venting configurations, load shifting, and installation best practices.
- **ESMAC Introduction to Heat Pump Water Heating Education:** This two-hour webinar includes HPWH education sessions that are held by manufacturer representatives. The education sessions are focused on appropriate applications for HPWHs, energy efficiency comparison to other water heater types, and selling strategies. This course also provides an overview of ENERGY STAR® and reviews TECH Clean California program requirements, eligibility, and how to apply for incentives.

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