Heat Pump Water Heater Conversion Readiness Focused Pilot

Final Report

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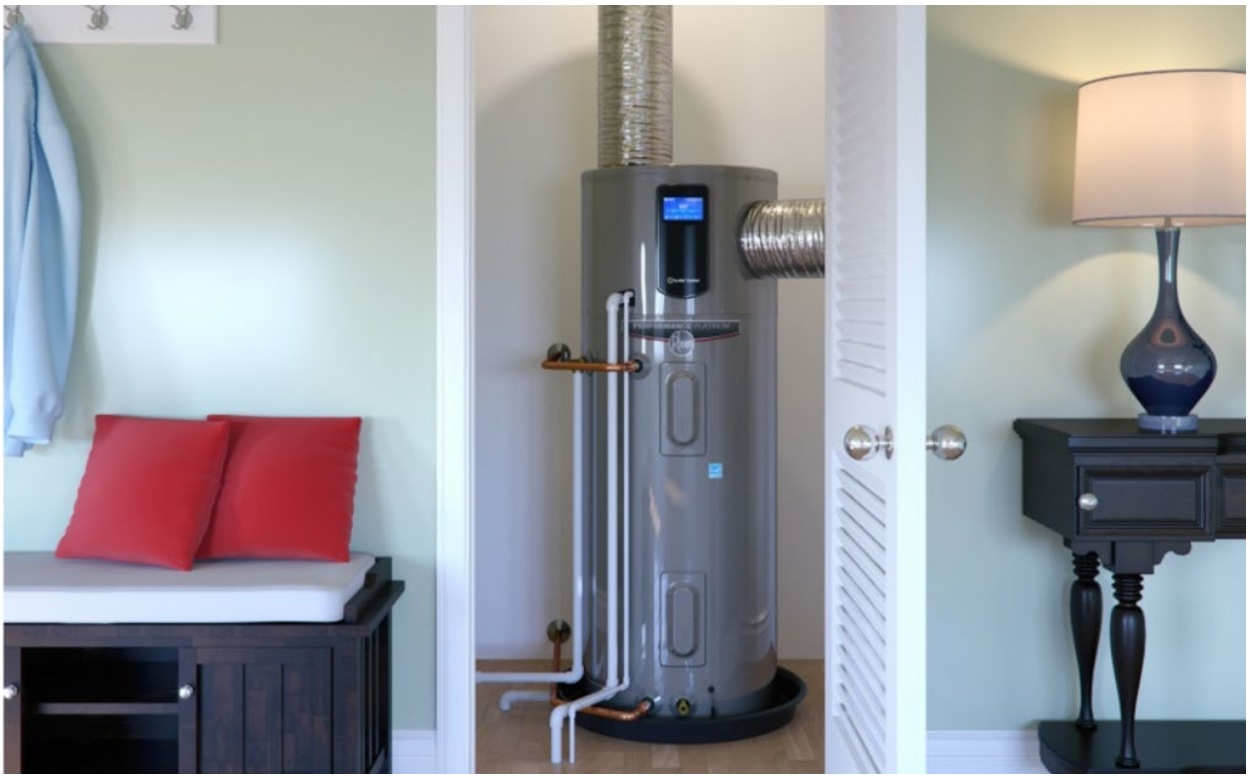

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Finally, we thank all involved for their dedication and partnership in advancing sustainable heating and cooling solutions in the state of California.

Disclaimer

Executive Summary

The Heat Pump Water Heater Conversion Readiness Focused Pilot was designed to target solutions to four barriers and to assess whether the proposed solutions to those barriers will result in scaled adoption of heat pump water heaters in single-family homes. Those barriers are: 1) gaps in homeowner awareness of opportunities for prioritizing electrification improvements; 2) evaluating primary constraints to heat pump water heater installations including, but not limited to, space, noise and ventilation; 3) assessing the need for and cost of required electrical upgrades for heat pump water heaters and other electrification opportunities; and 4) potential negative customer experiences associated with heat pump water heater installations, such as hot water supply or utility bill impacts. The Focused Pilot tested interventions at the stages of customer engagement, participation in home assessments, and installation of heat pump water heaters, and evaluated the scalability of the heat pump water heater conversion readiness program.

The scope of the Focused Pilot included:

- Identifying Southern California Edison customers for electrification opportunities
- Offering electrical readiness assessments to targeted Southern California Edison customers
- Coordinating with the existing and parallel TECH Clean California programs
- Designing and developing the process for providing customer assessment reports
- Developing a customer portal and process for reserving and paying incentives for heat pump water heater electrical readiness upgrades associated with heat pump water heater installs
- Identifying local and experienced contractors to support pilot participants
- Conducting electrical readiness assessments and customer walk-through of assessment report findings, recommendations, and next steps to pursue electrical upgrades and a heat pump water heater installation
- Designing surveys for participants to collect feedback on program design
- Tracking pilot observations

No-cost electrification readiness assessments were marketed by email to Southern California Edison customers in Orange County, who met the pilot's objective of single-family homes converting to a heat pump water heater. All targeted Southern California Edison accounts were listed as single-family, owner-occupied homes built after 1968. Through the Focused Pilot, 23,672 customers received Southern-California-Edison-branded and distributed email promotions of the Heat Pump Water Heater Conversion Readiness Focused Pilot and electrification readiness incentives. Of these, 276 customers applied for a home assessment, 74 customers completed enrollment and received a home assessment, 35 customers reserved electrification incentives, and 6 customers completed the installation of a heat pump water heater and necessary electrical upgrades.

Key findings from the Focused Pilot are summarized into three broad categories, which are further detailed in the Key Findings section.

1. **Homeowner Engagement in Electrification Opportunities:** While homeowner engagement in the program was initially strong, the delivery model broke down in later stages of the pilot, which led to customer confusion and reticence. Specifically, the pilot found that transparency at each stage of a program, as well as a streamlined program process flow, are paramount in maintaining customer engagement. Likewise, ensuring that all stakeholders are aligned, informed, and up to date on all relevant aspects of the program is key in providing participants with a positive program experience.
2. **Installation Space and Ventilation Constraints:** Without the data collected from an on-site assessment, space- and ventilation-related constraints can complicate heat pump water heater installations, even for homes that appear to be well-situated for a water heater replacement.
3. **Evaluation for Required Electrical Upgrades for Heat Pump Water Heaters and Other Electrification Measures:** The need for electrical panel upgrades, electrical panel replacements, and additional electrification opportunities varied across pilot participants, however there were clear trends regarding the electrical infrastructure of homeowners. Notably, a limited percentage of the homes assessed had sufficient electric panel space and capacity to accommodate a heat pump water heater installation, and most of the homes that did have capacity also had solar panels. Additionally, incentivizing homeowners to pursue electrification readiness that is not contingent upon the adoption or replacement of existing equipment would remove a major barrier to large-scale home electrification readiness.

Recommendations from the Focused Pilot are summarized below and further elaborated on in the Recommendations section.

Assessments and Customer Education:

- Create independent assessment, electrification readiness, and electrification upgrade program pathways.
- Create alternative options for customers to properly assess their specific home needs for electrification upgrades.
- Leverage independent electrification readiness assessments to avoid duplication of efforts in coordination with building; electrical; plumbing; and heating, ventilation, and air conditioning contractors.
- Maintain a reputable, qualified contractor list to increase customer confidence and accelerate upgrade work.
- Ensure continuity of incentives and program offerings critical for homeowner and market engagement.
- Focus on reducing the upfront cost of heat pump water heater installations to increase customer willingness to switch away from existing gas water heaters.

Targeted Outreach and Programming:

- Target non-solar homes with low-capacity electrical panels for panel and service upgrades, limiting cost barriers that may emerge at future electrification steps.

Incentives:

- Offer pre-electrification incentives independent of equipment upgrades.
- Retain pre-electrification incentives paired with equipment upgrades where appropriate.
- Establish tiered incentives for pre-electrification work.
- Support “pre-wiring” incentives.

Contractor Education and Participation:

- Engage contractors early to increase program success.
- Drive contractor engagement through stable and consistent incentives.

Abbreviations and Acronyms

Acronym	Meaning
AR	Accelerated Replacement
CARE	California Alternate Rates for Energy
CIA	Customer Implementation Agreement
DAC	Disadvantaged community
eTRM	Electronic Technical Reference Manual
HES	Home Energy Savings
HPWH	Heat pump water heater
HVAC	Heating, ventilation, and air conditioning
IOU	Investor-owned utility
kBTU	One thousand (1,000) British thermal units
kWh	Kilowatt-hours
MCE	Marin Clean Energy
QSG	Quick Start Grant
RHA	Richard Health & Associates
SCE	Southern California Edison
SGIP	Self-Generation Incentive Program
TECH	Technology and Equipment for Clean Heating
TRC	Total Resource Cost
TSB	Total System Benefit
UEF	Uniform Energy Factor
WH	Water heater

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Introduction

The Focused Pilot was designed to test whether engaging homeowners to remove known barriers to heat pump water heater (HPWH) conversions increased their willingness to undertake electrification projects. The pilot offered targeted customers a no-cost "electrification readiness assessment" that informed each customer of electrification opportunities, with a focus on HPWHs and likelihood that electrical wiring and panel upgrades will be required to electrify end uses. This assessment included guidance on all eligible incentives and a list of expected "readiness" tasks necessary to complete an HPWH installation. The assessment also showcased the offer of no-cost electrical upgrades to prepare for home electrification if customers chose to move forward with an HPWH installation and provided data on common HPWH conversion readiness steps to inform a scalable model for statewide delivery. Finally, this project aimed to provide program implementers with important findings and recommendations to inform new and existing HPWH programs on novel approaches to cost-effectively increase program participation and reduce barriers for homeowners.

Background

HPWHs provide an energy-efficient and reliable source of hot water while offering additional benefits, such as reduced carbon emissions and demand response functionality. Even as HPWH adoption is encouraged through available incentive programs such as Technology and Equipment for Clean Heating (TECH) Clean California and the Inflation Reduction Act (IRA), HPWH adoption must scale significantly to support decarbonization of the existing residential building stock and achieve California's statutory carbon neutrality targets, as described in Senate Bill 1477.

Many existing programs do not address the full scope of work required for HPWH installations. The widespread use of natural gas water heaters in California homes means that HPWH retrofits often require electrical upgrades and home remediation. Because of the absence of existing and dedicated 240-volt and/or 120-volt wiring at the water heater location, it is often necessary to relocate the unit within the home. Another challenge is limited electrical panel capacity for an additional 240-volt and/or 120-volt breaker.

Further, construction, plumbing, or heating, ventilation, and air conditioning (HVAC) modifications may be needed to accommodate HPWH installation requirements related to space, ventilation, or condensate drainage. These pre-electrification upgrades can significantly increase project costs, presenting a substantial barrier to adoption for many homeowners.

Primary Barriers to HPWH Installations

A recent water heater market assessment for TECH Clean California (Loomis and Steiner 2024) confirms that the primary driver of water heater replacements is equipment failure or diminished functionality. In these cases, homeowner priorities center on reliability, performance, and cost. Recommendations from contractors or awareness of incentives were rarely cited as influential factors; when evaluating equipment options, homeowners reported relying most heavily on manufacturer reputation and customer reviews, with professional contractor and utility recommendations ranking as secondary information sources.

The same assessment identified several consistent barriers to HPWH adoption:

- The need for electrical repairs, remediation, or panel upgrades.
- Concerns about increased utility bills and high upfront installation costs.
- Doubts about equipment reliability.
- Limited awareness of available rebates and tax credits.
- Even lower levels of understanding regarding HPWH performance characteristics.

These barriers are especially pronounced in emergency replacement scenarios, where homeowners are less likely to explore alternatives or make non-standard installation decisions. A CalNEXT market study on emergency replacements underscores how the urgent need to restore hot water service severely constrains homeowner choice (VEIC 2024). Under pressure to act quickly, consumers typically opt for the lowest-cost, like-for-like replacements, resulting in a continued reliance on natural gas systems. The report's analysis of cost drivers identified electric panel upgrades as the highest incremental cost, which was $803. Other notable cost drivers identified in the CalNEXT report included replacing a $471 tankless gas water heater—often located in constrained spaces, installations that took two days or more, and installations completed by one of the top three TECH Clean California contractors by volume.

As the report concludes, even with available incentives, the complexity and cost of switching to HPWHs in an emergency replacement scenario render conversion impractical without preparing the home to be "electrification ready" prior to equipment failure. With at least 75 percent of water heater replacements occurring during emergency replacement scenarios, shifting customer behavior toward proactive equipment replacement is necessary to overcome these structural market barriers.

Findings from the TECH Clean California Quick Start Grants (QSGs) further indicate that homeowners are open to early replacement when provided with a clear, actionable pathway.[1] Successful initiatives used electrification readiness assessments and home energy evaluations to inform and guide decision-making. For example, the Marin Clean Energy (MCE) Home Energy Savings program faced barriers due to the inability to fund electrical readiness work, which prevented many customers from moving forward with heat pump installations. With QSG funding, Franklin Energy addressed this gap by layering grant funds to cover necessary repairs, such as running dedicated electrical circuits for HPWHs. These upgrades were required in 27 percent of installations and averaged $1,250 per home.

By presenting specific procedural steps to customers and available funding to offset upfront costs, these programs reduced perceived risk and eliminated informational barriers. In many cases, combining required home remediation with HPWH installation made the retrofit more attractive and financially viable for homeowners. Readiness assessments also enable contractors to optimize installation efficiency by tailoring approaches to household appliance replacement planning. These

[1] See Appendix A: Background on TECH HPWH Initiatives for more detailed findings from related TECH Clean California QSG projects.

assessments may uncover minor, low-cost upgrades that eliminate the need for major retrofits, such as panel replacements, which improves the feasibility and cost-effectiveness of the project.

Evaluation of the California and SCE Single-Family Water Heater Market

A 2024 CalNEXT study estimated 364,000 gas water heaters are replaced annually in California single-family homes by contractors in cases of emergency or imminent failures (VEIC 2024). Although emergency replacements offer a significant opportunity for capturing lost opportunities for HPWHs, additional opportunity remains with proactive water heater replacements. Table 1 provides an estimate of the proactive replacement HPWH market opportunity in Southern California Edison (SCE) territory and statewide for single-family, owner-occupied detached homes targeted in this pilot initiative. In this context, "proactive" is defined as homeowners who replace their water heater before failure and is referenced as Accelerated Replacement (AR) in the measures list in the California electronic Technical Reference Manual (eTRM).

Table 1: Technical proactive replacement market potential estimate for SCE territory and California.

Technical HPWH Remediation Market Potential		California	SCE Territory
Number of water heaters (million)	Estimated number of market rate, single-family, owner-occupied homes built after 1960 (NREL n.d.)	**3.8 M**	**1.1 M**
Percentage of remediation work for HPWH	Pilot program through the MCE Home Energy Savings Program found 27% of residential homes in the program required remediation work for HPWH installations.	**27%**	
HPWH Readiness Opportunity (million)	HPWH readiness support opportunities for market rate, single-family residences requiring remediation or electrical upgrade work for HPWH installations.	**1 M**	**290,000**

Sources: NREL n.d., TECH QSG

In single-family residences in California, 69 percent of water heaters are in the garage; 16 percent are in the main living area, such as a closet, and 13 percent are on the exterior of the. Reduced space and noise constraints, as well as the proximity to electrical panels, mean that HPWH installations in garages or on the exterior of the home typically offer easier and lower cost installations for contractors and homeowners.

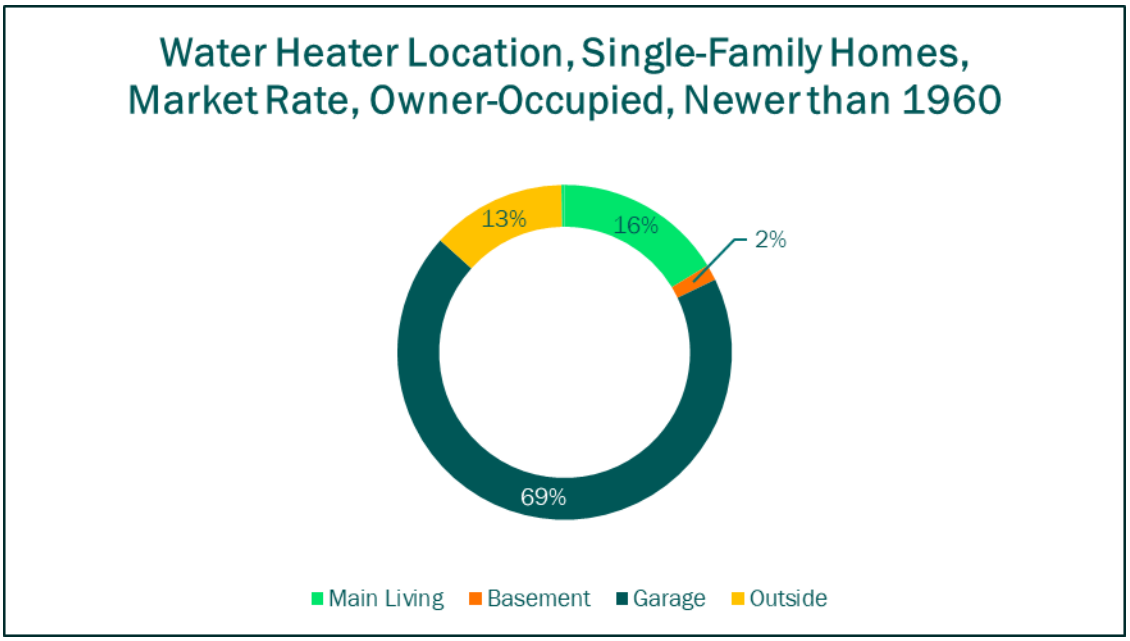


Figure 1: Water heater location in California single-family homes.

Source: EIA RECS 2020

Eighty-eight percent of single-family residences in California and 84 percent of single-family residences in SCE territory use natural gas or propane as the primary fuel source for water heating, and a growing share—10 percent—are tankless models. Although not exclusively focused on gas-to-HPWH and tankless conversions, the percentage of residences with natural gas or propane systems increases the likelihood of required electrical, plumbing, and building upgrades relevant to HPWH readiness support in targeted single-family homes.

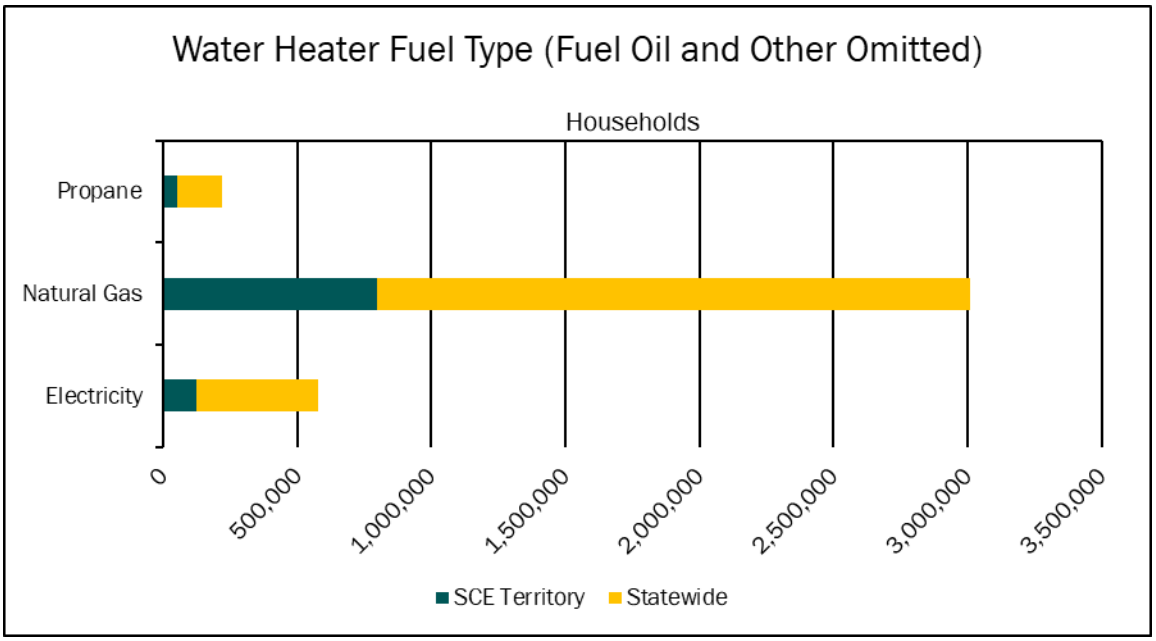


Figure 2: Water heater fuel type in California single-family homes.

Source: NREL ResStock

Proposed Solution

Multiple pathways exist for homeowners to consider replacing their existing water heater. Homeowners can access existing information through national, state, and utility programs, as well as guidance documents and best-practice design guides, to evaluate HPWHs as a replacement solution. Alternatively, they can work with a contractor to navigate the water heater replacement process, but that will typically require some financial commitment by the homeowner to the contractor.

The HPWH readiness assessment model offers a distinct alternative by lowering the decision-making burden for customers. The model provides specific, actionable information with minimal homeowner effort, enabling informed adoption without full reliance on contractor-led proposals. This project builds upon prior TECH Clean California and CalNEXT work by testing scalable solutions to the key adoption barriers described in Table 2 below. The Focused Pilot approach was to assess the effectiveness of targeted interventions in overcoming these barriers and accelerating time-to-market for HPWH installations across California's existing residential building stock.

Table 2: Barriers and solutions for HPWH adoption addressed through the Focused Pilot.

Barrier	Barrier Description	Solution
High first costs due to electrical upgrades	HPWH installations often require wiring remediation and upgraded panel capacity, as well as possible relocation, adding significant cost compared to like-for-like gas replacements. These pre-electrification measures are not typically covered in existing efficiency programs.	Provide electrification readiness incentives that complement and layer with existing efficiency programs to significantly reduce or eliminate out-of-pocket costs associated with HPWH conversions.
Low awareness and uncertainties of electrification opportunities	Many homeowners lack awareness of the benefits, incentives, and feasibility of electrification improvements such as HPWHs. A lack of accessible, personalized information limits engagement and delays action.	Provide a no-cost "heat pump readiness assessment" summarizing site-specific electrification opportunities, identifying potential upgrade needs, and delivering recommendations and available incentives to inform homeowner decision-making prior to installation.
Timing complications from required electrical upgrades	Water heater failures often require immediate replacement. If an HPWH installation requires panel upgrades, the added time can delay installation of an essential appliance, pushing customers to default to gas replacements.	Offer preemptive electrification readiness assessments and complete electrical upgrade work in advance, allowing customers to opt into HPWHs without delay during emergency replacement scenarios.
Negative customer experience and bill impacts from poor system sizing or use	Risks of poor equipment siting or sizing, unexpected noise, insufficient hot water delivery, or higher electric bills undermine customer confidence in HPWHs.	Partner with qualified TECH Clean California contractors and provide guidance through assessments to align installation expectations with customer needs.

Accessing Incentives to Address Higher HPWH Equipment Costs

Contractor and customer awareness of the availability of incentives, eligibility criteria, and ability to layer incentives are frequently identified as sources of confusion and a barrier to increased rates of

HPWH installations. This Focused Pilot expands what is covered by existing incentive programs in California to include other pre-electrification work that adds meaningful expense to projects. Although there are additional HPWH incentives offered in California, the incentives available to homeowners that fall in line with the Focused Pilot's targeted area are outlined in Table 3.

The Self-Generation Incentive Program (SGIP) and TECH Clean Californian HPWH Programs are the primary statewide heat pump incentive programs, providing market customers with up to $3,100 in incentives to replace a gas water heater unit, and up to 50 percent of the cost of electrical upgrades, capped at $2,000. A detailed listed of incentive-eligible measures is available in Appendix A: Background on TECH HPWH Initiatives.

Table 3: Incentives available for HPWH installations and pre-electrification work in SoCalGas territory.

Source	HPWH	Low-GWP Kicker	≥ 55 Gallon Kicker	Panel Upgrade	Electrical / Other Upgrades	Max Incentive
SGIP/TECH Market Rate	$3,100	$1,500	$700	$2,000*		$7,300
SGIP/TECH Equity	$4,185	$1,500	$700	$4,000**		$10,385
IOU Statewide Midstream	$700***					
CalNEXT Focused Pilot				$4,000	$1,500	$5,500
Fed ITC (30%)****	$2000			$600		$2,600

* For General Market incentives, the Electrical Upgrade incentive is capped at 50 percent of eligible electrical costs.

** For Equity incentives, the Electrical Upgrade incentive is capped at 100 percent of eligible electrical costs. The $4,000 incentive may cover a variety of other "pre-electrification" costs associated with an HPWH installation.

*** Statewide Midstream and Golden State IOU rebates are offered through point-of-sale discounts at participating distributors and retailers. The minimum HPWH rebate for replacing a natural gas water heater is $700 to $900, based on water heater capacity and specific retailer and distributor offerings.

**** Federal Investment Tax Credits allow for a tax credit of 30 percent of the total installed cost of an HPWH up to $2,000, and associated electrification upgrades of up to $600. The tax credit has eligibility requirements that are likely to apply only for homeowners that have sufficient tax basis, (i.e., market rate).

Source: CA TECH, Golden State Rebate program, Switch Is On (May 2024)

The CalNEXT HPWH Conversion Readiness Focused Pilot was designed to layer with existing incentives by providing participants with up to $4,000 in additional funds for electric panel upgrades, and up to $1,500 for other electrical and remediation work necessary to enable HPWH conversion, such as relocating a water heater, replacement of flooring damaged by water heater leaks, additional

venting, or adding a condensate pump. As such, the Focused Pilot will leverage these other incentive programs to reduce the upfront costs of equipment.

Pilot Scope and Objectives

The Focused Pilot's primary objective was to evaluate the effectiveness and scalability of directly engaging with homeowners to guide them through the necessary site assessment, home remediation work, and electrical wiring and panel upgrades required for HPWH installations. A secondary goal of the pilot was to evaluate the factors that contribute to electrification readiness, such as availability of incentives for HPWHs. Lastly, the assessment and remediation work aimed to evaluate the need and role for gas water heaters or plug-in 120-volt HPWH loaners as temporary replacement water heaters during homeowners' HPWH conversion journey.

The pilot sought to conduct electrification readiness assessments on up to 107 single-family homes, identifying opportunities for electrification, as well as the feasibility and site-specific needs that support HPWH installs. To overcome HPWH installation cost barriers, the program offered incentives for necessary panel upgrades, electrical remediation, and rewiring work to facilitate an HPWH installation in up to 40 single-family homes. The pilot team developed specific targeting criteria to guide the selection of participating homes, and to ensure we captured and analyzed a diverse sample of homeowners with a wide range of remediation and electrical upgrade steps. Furthermore, the pilot gathered direct homeowner experiences and feedback to inform further scaling of the HPWH deployment program model.

The team developed additional process and program components necessary for a scaled program, including targeted email marketing to homeowners, program websites and FAQs, contractor enrollment processes, templates for a home assessment report, and surveys to inform homeowners of electrification opportunities and next steps, as well as surveys to gather customer feedback on program delivery.

The HPWH readiness assessment implementation framework—highlighted in Figure 3 through Figure 6 below—outlines the steps necessary to deploy a program and assess the level of success in achieving desired outcomes. This pilot's desired outcomes included increased homeowner engagement, better understanding of home remediation needs, and ultimately, increased rates of HPWH installations. Although this framework is designed for a utility-level implementation, it can be applied to an individual business or contractor providing these "concierge" services to a homeowner.

The implementation framework involves three primary stages of homeowner support: recruitment, HPWH readiness assessment, and remediation and electrical upgrades.

Recruitment

SCE's marketing team sent four batches of emails offering no-cost electrification readiness to nearly 25,000[2] SCE customers in Orange County, all of whom met the pilot's objective of single-family homes converting to an HPWH. All targeted SCE accounts were listed as single-family, owner-

[2] Promotional emails were sent to 23,672 SCE customers located in Orange County, California.

occupied homes built after 1968.[3] These eligibility criteria were chosen to minimize travel time between customer sites and ensure the participants had the authority to install equipment in their home.

The marketing emails guided homeowners to visit a website and learn more about the program offering, where they could also complete an application to indicate their interest in participating. The application process included site and participation questions to ensure that the pilot could meet its objectives to 1) capture a representative sample of typical homes and homeowners most likely to benefit from targeted remediation and electrical upgrade financial support, and 2) install HPWHs.

The pilot also permitted and accepted applications from homeowners in the Orange County area who learned about the program through word of mouth as a number of customers had opted out of receiving marketing emails from SCE. Additionally, all applicants—who were matched to their SCE account to identify additional metrics for customer targeting—were required to verify that none of their household members were affiliated with or employed by SCE. These pilot marketing materials are available for review in Appendix B: Pilot Marketing Materials.

All applicants were provided with feedback surveys at the end of their pilot engagement, and applicants who chose not to move forward with an assessment received a survey during the pilot's recruitment phase. The survey measured motivations for participation, experience with the assessment, and factors that drove their decision to install the HPWH. The team analyzed this data for relevant insights, such as the profile of homes and homeowners reached through the pilot and the types of customers who experienced the greatest barriers to electrification. The findings from these surveys should be used to inform the design of future electrification readiness programs.

[3] Buildings built before 1968 or undisclosed in the customer targeting dataset were removed to minimize likelihood of more significant electrical or remediation costs.

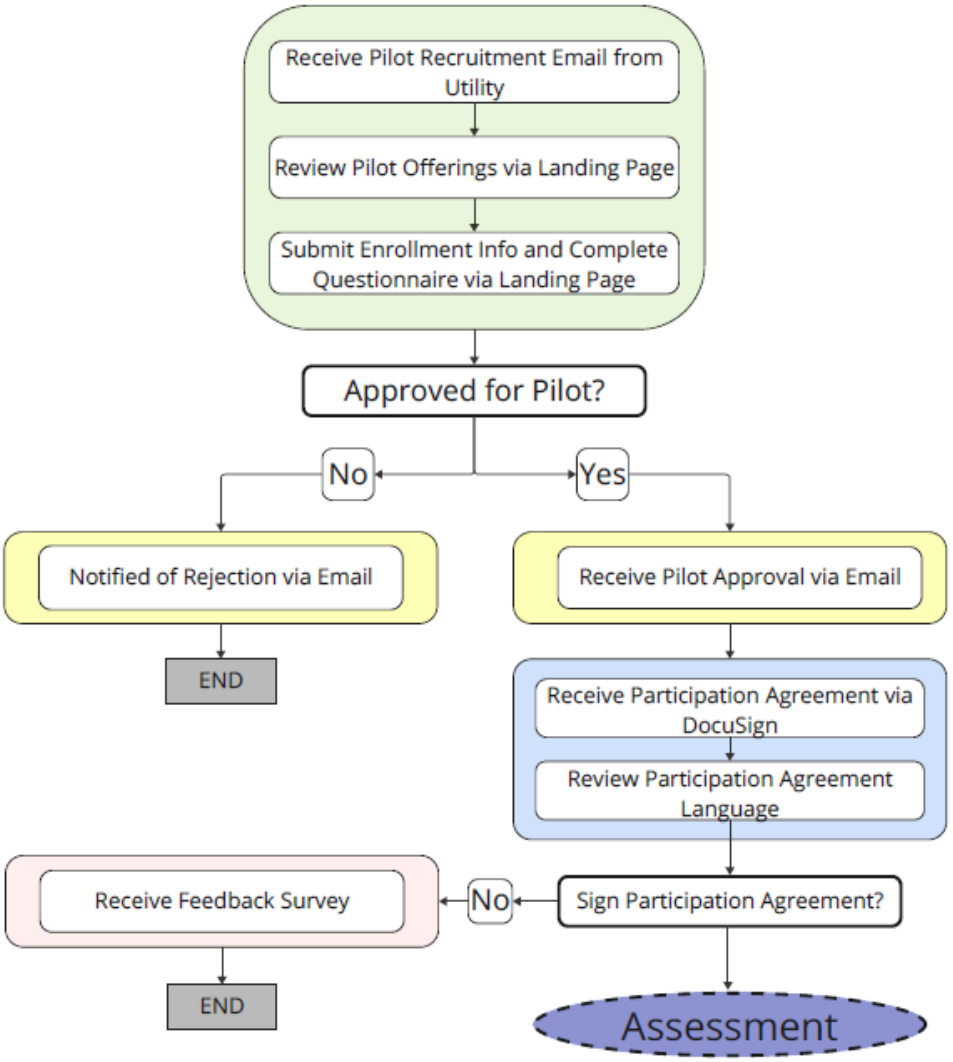


Figure 3: Customer recruitment framework.

Source: Project Team

HPWH Readiness Assessment

The pilot offered no-cost electrification readiness assessments—which included a review of the existing electrical panels, HVAC and water heating systems, and appliances—to SCE customers with signed participation agreements. The information from each assessment allowed the pilot team to track common improvements required for HPWH installations; additionally, the data was used to generate individual reports informing customers of their opportunities for electric replacements, expected readiness tasks needed to install an HPWH, available incentives, and contractors who were approved to pass incentives to the homeowner.

Whenever possible, the assessor reviewed the report and recommended next steps with the homeowner immediately following the completion of the assessment. The report included a list of readiness tasks, which helped customers navigate conversations with pilot-eligible contractors on

their required electrical wiring or panel upgrades and HPWH installation. Furthermore, the report's readiness tasks provided customers with a reference to help them plan for future electrification. A list of data collected during the assessment, as well as a sample of the assessment report, is available in Appendix E: Electrification Readiness Assessment Fields and Report.

The team surveyed homeowners who completed an HPWH readiness assessment on its impact on simplifying the HPWH conversion process, as well as on the benefits of providing homeowners with the necessary technical guidance and financial support to complete necessary remediation and electrical upgrade work. The survey also looked at specific next steps to engage a contractor, access the rebates, and complete the installation work.

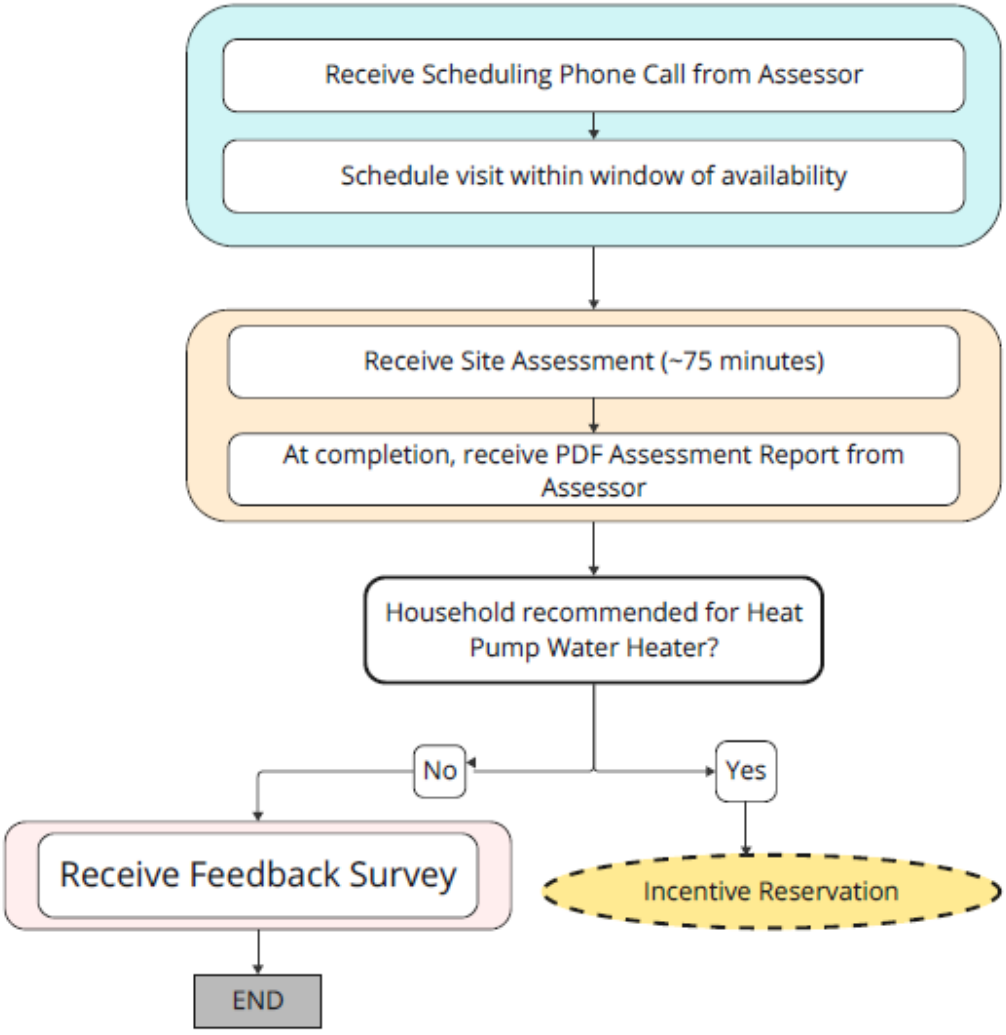


Figure 4: Assessment framework.

Source: Project Team

Incentive Reservation, Remediation, and Electrical Upgrades

Homeowners who completed an HPWH readiness assessment and subsequently committed to replacing their existing equipment with an HPWH were eligible for pilot incentives toward electrification readiness upgrades. Incentives were available for a limited time for up to 40 homeowners who completed HPWH installations with one of the seven participating contractors. The available incentives included up to $4,000 for panel-related upgrades or replacements and up to $1,500 for additional electrical remediation work, such as wiring and circuit additions, for a combined maximum of $5,500 per customer.

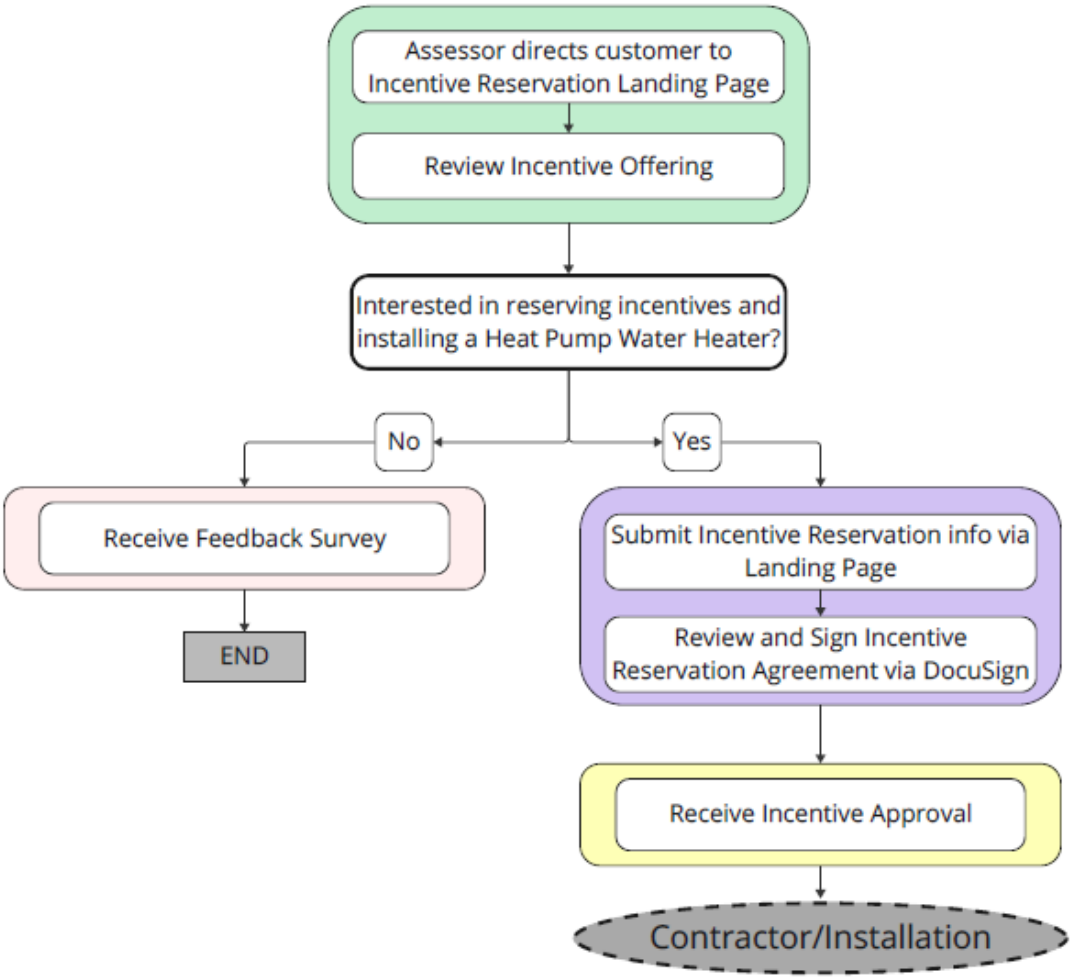


Figure 5: Incentive reservation framework.

Source: Project Team

The incentive reservation stage of the pilot tested whether additional incentives and early intervention assistance could help customers overcome the financial and logistical barriers to home electrification. These measures were intended to help the customer proactively install an HPWH.

Participants who opted to move forward with electrical upgrades and HPWH installation were required to select a pilot-qualified contractor. The pilot required all upgrades to be performed by a licensed electrician and be properly documented, permitted, and up to code. To simplify contractor coordination, the project team shared a list of seven pre-qualified contractors who had previously submitted claims to the TECH Clean California program via the incentive reservation landing page. The project team then processed incentives for electrical remediation for a comprehensive view into the work completed at each household and associated costs.

The itemization of electrical upgrades and other remediation work on contractor invoices documented the frequency, cost, and level of impact of potential preparatory work to expect in a scaled remediation readiness program. Data from these upgrades helped inform HPWH incentive programs on the range of potential upgrades customers must complete to enable HPWH installations, whether electrification readiness incentives can help motivate customers, and the costs customers encounter as part of HPWH upgrade projects, such as:

- Observed pre-electrification wiring issues
- Home envelope remediation measures for health, safety, and code compliance
- Customer feedback survey results
- Total number of panel upgrades, replacements, and electrical infrastructure remediation
- Total number of installed HPWHs
- Total project costs and incentive funding

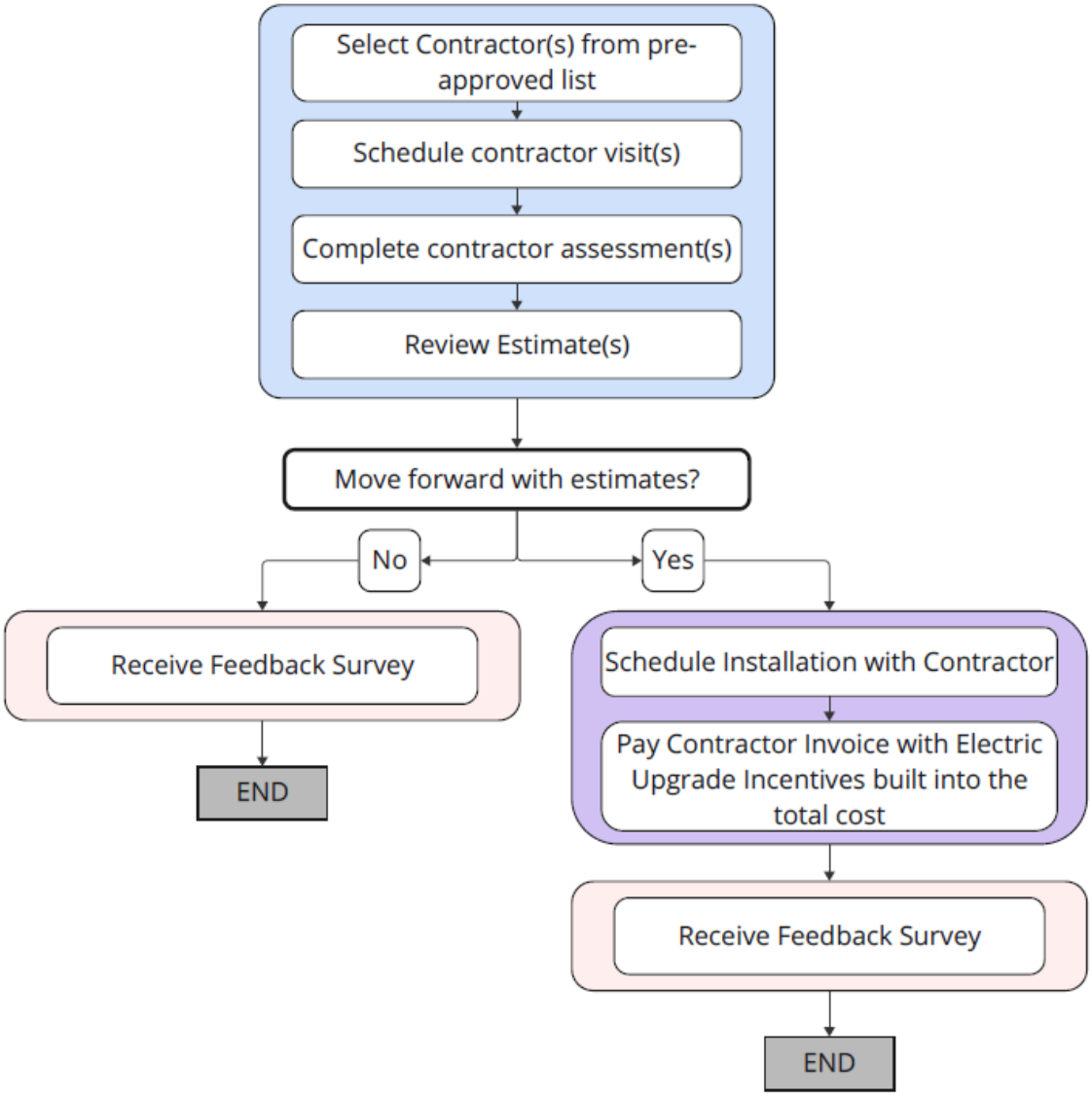


Figure 6: Remediation and upgrades framework.

Source: Project Team

Temporary Gas and 120-Volt Water Heater Loaners and Contractor Incentives

Water heater replacements most frequently occur after a customer's existing water heater fails. In these situations, a customer's top priority tends to be restoring hot water as soon as possible, which often does not allow contractors the opportunity to prepare the site for necessary upgrades associated with switching to an HPWH. As such, the pilot included a water heater loaner option to allow customers to participate in the pilot without experiencing a gap in hot water service. The loaner portion of the pilot was designed so that once the final HPWH was installed, the contractor would either remove the loaner and return it to the pilot program or keep it for future customer loaners. Ultimately, in large part due to limited customer participation in the plot, the team did not encounter any customers who experienced a water heater failure and thus, no loaner water heaters were required for this pilot. The loaner design framework, developed during the conception of the program, is outlined in Appendix G: Pilot Loaner Water Heater Design Framework.

Results

The pilot implementation, from initial recruitment to the final completed installation, lasted eight months.

- **Recruitment:** Commenced on November 11, 2024, with an email blast to targeted SCE customers.
- **Assessments:** Conducted 74 in-person home assessments between March and May 2025.
- **HPWH Installations and Electrical Upgrades:** Completed six HPWH installations and electrical upgrades between April and June 2025.

Recruitment

The analysis of building stock data for California provided an initial framework for the targeting criteria for HPWH Readiness Assessment participating customers (NREL n.d.). Homes in the SCE service area generally reflect statewide averages, although the area has a slightly lower percentage—61 percent—of single-family, owner-occupied homes that were built after 1968, when building energy codes required increased quality and consistency of construction. Otherwise, it represents key characteristics that allowed the team to extrapolate pilot results to the statewide population, as shown in Table 4 below.

Table 4: Customer percentage of potential targeting criteria.

Electrification Readiness Assessment Targeting Criteria		California	SCE Territory
Owner-occupied, single-family homes	Percentage of owner-occupied single-family homes in California and in SCE territory.	69%	67%
Market rate	Percentage of owner-occupied, single-family homes in California and in SCE territory with income at or above 200 percent of AMI. [4]	86%	84%
Building age	Buildings built before 1968 or undisclosed in the customer targeting dataset will be removed to minimize the likelihood of more significant electrical or remediation costs.	68%	61%

Source: Project Team

[4] Customers enrolled in California Alternate Rates for Energy (CARE) or Family Electric Rate Assistance Program (FERA) rates and eligible for the Energy Savings Assistance (ESA) Direct Install program will not be included in this program.

Originally, the pilot limited its geographic scope to the cities of Irvine, Huntington Beach, and Orange, with the intent of reaching approximately 25,000 customers. This figure was determined using an assumed 3 percent click-through rate[5], which would allow for a manageable number of applications. However, SCE informed the pilot team that less than 20 percent of the identified customer accounts had opted to receive marketing emails. To ensure the pilot received enough applications, the team expanded the geographic scope to include more cities in Orange County.

The pilot team identified 127,707 pilot-eligible accounts, of which 28,180 were eligible to be contacted by SCE; remaining accounts were determined as ineligible for marketing emails or participation in the pilot due to various reason, including: presence of a valid account email address, CARE or FERA account status, inactive accounts, accounts of SCE employees or SCE affiliates, or other eligibility and targeting factors identified by SCE and the pilot team. The pilot targeted SCE customers in the following cities: Anaheim, Buena Park, Costa Mesa, Cypress, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Irvine, La Palma, Los Alamitos, Midway City, Orange, Rossmoor, Santa Ana, Seal Beach, Stanton, Tustin, Villa Park, and Westminster. Portions of Costa Mesa and Turtle Rock were excluded due to commercial zoning and university housing, respectively. Areas of Anaheim were excluded because most homes were built prior to 1968, and Yorba Linda was excluded to maintain the total number of targeted accounts below 130,000, as shown in Figure 7.

Through four campaigns, SCE distributed approximately 86,000 emails advertising a free electrification readiness assessment in an effort to recruit participants for the Focused Pilot, shown in Table 5. About 1,505—or 2.8 percent—of the SCE customers who opened the email continued to the landing page, where the pilot received 272 applications.[6] The team conducted another quality assurance screening to confirm applicant eligibility based on geographic restrictions; complete customer information, e.g., no missing addresses or unmatched SCE account numbers; homeownership status; existing HPWH status; and duplicate submissions, resulting in a pool of 225 eligible applicants.

Table 5: Email engagement data from SCE marketing campaigns.

Date	Total Sent	Open Rate	Unsubscribe Rate	Click-Through Rate of Total Sent	Click-Through Count (approx.)
11/20/2024	23,672	60.96%	0.09%	2.23%	528
12/4/2024	21,870	62.78%	0.15%	1.63%	356
3/27/2025	20,771	61.15%	0.12%	2.16%	449
5/8/2025	20,287	62.80%	0.08%	0.85%	172

[5] The percentage of people visiting a web page who access a hypertext link to a particular advertisement.

[6] Click-through rates reflect aggregate clicks, not unique users. A single user may have clicked multiple times, so the actual number of distinct SCE customers interested in the pilot may be lower than 1,505. Consequently, the conversion rate from landing page visits to sign-ups may be proportionally higher.

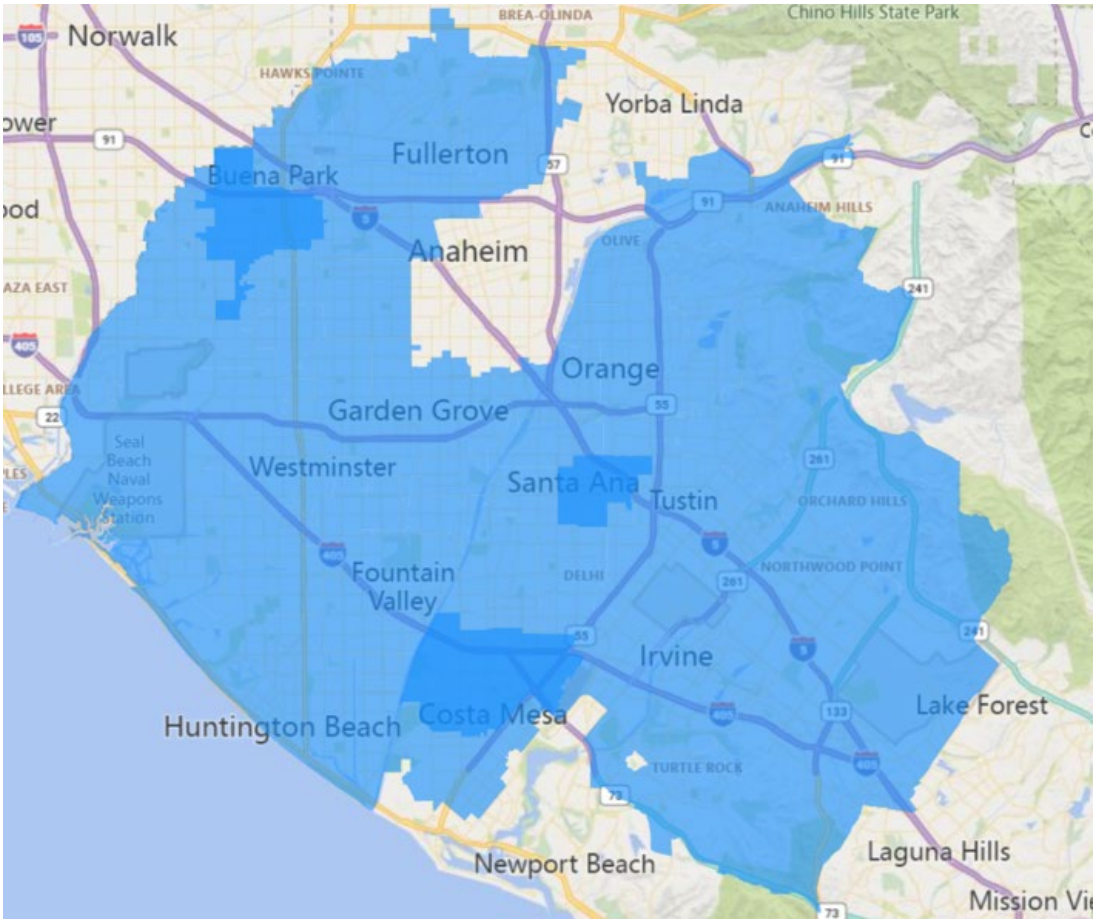


Figure 7: Geographic scope of Focused Pilot

Targeted Recruitment Strategy

Targeted recruitment is a strategy designed to improve program participation and facilitate proactive water heater replacements. By selecting applicants based on predefined criteria, pilot programs can achieve higher conversion rates following electrification readiness assessments. This model can be adapted to meet the specific needs of programs or utilities, such as targeting low-income households or high-energy users.

TECH Clean California's Innovative Customer Targeting Pilot illustrates this approach, intending to identify California residents most likely to benefit from home electrification and to evaluate the effectiveness of various outreach strategies for encouraging heat pump adoption (TECH Clean California n.d.). To address the high incremental costs associated with heat pump technologies, the TECH Clean California Innovative Customer Targeting Pilot uses metered energy consumption data to identify customers with high energy savings potential. In parallel, it tests the efficacy of direct, personalized outreach in influencing customer decision-making.

Preliminary results of this meter-based approach through the TECH Clean California Innovative Customer Targeting Pilot were promising: The initial marketing campaign to SCE customers saw higher engagement from customers who received personalized messages indicating they were strong candidates for energy savings through heat pump adoption based on their energy consumption patterns. Although increased engagement did not immediately lead to heat pump

conversions, SCE and the TECH Clean California Innovative Customer Targeting Pilot team created customer segmentation profiles to refine and target outreach more effectively. By incorporating innovative customer targeting into a strategy that addresses several key adoption barriers, the pilot can quickly build a pipeline of customers who are both highly interested in electrification and most likely to benefit from it, while also reducing potential grid impacts.

This Focused Pilot leveraged the TECH Clean California Innovative Customer Targeting framework, preventing strain on the electric grid by prioritizing applicants expected to benefit most from HPWH conversion while avoiding recruiting customers with high mid-day peak. In addition, data from intake forms allowed the pilot team to analyze participant behavior and outcomes across each stage of the customer journey. The pilot was able to confirm the SCE meter account for 242 of the 272 total applicants. Segmentation and prioritization were based on the customer attributes listed in Table 6.

Table 6: Focused Pilot customer targeting variables.

Category	Variable
Equipment Characteristics	• Existing water heater fuel and tank type
Customer Awareness	• Prior awareness of HPWH technology • Previously considered HPWH replacement
Site Attributes	• Presence of rooftop solar • Year of home construction
Sociodemographic Factors	• Participation in CARE or FERA • Residence in disadvantaged community (DAC) • Household income
Behavioral Segmentation	• Customer classification by Energy Consumer Dynamics Segmentation Data[7]
Load Profile	• Maximum evening ramp kWh observed

To prevent oversubscription of the available assessments, the pilot team assigned each applicant a prioritization score, calculated as a weighted evaluation of applicant data, to identify candidates who were most likely to need electrical upgrades to facilitate an HPWH conversion, as shown in Table 7. This focus on supporting electrification readiness led to prioritizing homes with natural gas water heaters with storage tanks, as well as customers with an awareness of HPWHs and interest in early replacement and other high-efficiency electric equipment and appliances.

[7] Acxiom's Energy Consumer Dynamics Segmentation (ECDS) categorizes US households into 13 clusters based on their energy consumption behaviors, financial capacities, and green orientations, providing actionable insights for targeted marketing. This segmentation model leverages demographic, economic, and psychographic data to enhance understanding of consumer engagement in the energy market.

Table 7. Applicant prioritization scoring criteria.

Application Questions for Prioritization	Weighted Score	Evaluation Criteria	Reasoning
What type of fuel does your current water heater use?	25%	Natural Gas, Gas or Propane (5 pt) Unsure (3 pt) Electric Resistance (1 pt)	Prioritize conversions requiring electrical panel upgrades.
What type of tank does your current water heater have?	20%	Tank (5 pt) Unsure (3 pt) Tankless (1 pt)	Prioritize tank replacements to reduce cost and complexity.
Have you replaced your water heater in the last five years?	25%	No (5 pt) Unsure (3 pt) Yes (0 pt)	Lower likelihood of conversions for replace on burn out.
Have you heard of an HPWH?	10%	Yes (5 pt) No/Blank (3 pt)	Slight preference for awareness to support conversions.
Have you considered replacing your existing water heater with an HPWH in your home?	5%	Yes (5 pt) No/Blank (3 pt)	Slight preference for action to support conversions.
What has prevented you from scheduling an installation?	5%	Cost, time, or needed electrical work (5 pt) Waiting for equipment (3 pt) Other (1 pt) Blank (0 pt)	Lower likelihood of conversions for replace on burn out.
Are you interested in any other new high efficiency electric equipment or appliances in your home?	10%	Yes (5 pt) No (1 pt)	Slight preference for awareness/interest to support conversions/panel upgrades.

Pilot applications were approved on a rolling basis using the prioritization score. Once approved, applicants received a confirmation email from the team, along with a Customer Implementation Agreement (CIA) sent through DocuSign. The CIA was necessary to authorize the release of customer contact information to the assessor for scheduling and to permit the assessor to conduct the electrification assessment at the customer's home. To discourage unresponsive customers from limiting participation, applicants were informed they had 10 days to sign the CIA before forfeiting their spot to the next eligible applicant.

If the pilot was not nearing capacity or completion, applicants who signed their CIA after the 10-day window were still permitted to move forward. To encourage CIA signatures and completed enrollment, the team contacted approved applicants up to three times by email and phone during

this period prior to moving on to the next eligible applicant. Individual customer CIA signature requests were also routinely resent through DocuSign to encourage CIA review, signature, questions, or to decline the CIA signature request and formally opt out of further assessment consideration.

Demand for the pilot stalled at this stage. In addition to the applicant concerns noted below, the initial recruitment occurred during the end-of-year holiday period and was followed by severe wildfires in Southern California in January 2025. As a result, the team delayed notifying applicants of their acceptance until February 2025, creating a gap of several months between application and approval for some participants. Additionally, TECH Clean California single family HPWH incentives—anticipated to be available to pilot customers at the program's conception--were fully reserved as of February 24, 2025, prior to scheduling of the electrification readiness assessments. This subsequently increased the final cost barrier for potential pilot participants.

Table 8: Percentage of participants by recruitment period and final pilot stage.

	Marketing Email 1 (40% of pilot applications)		Marketing Email 2 (25% of pilot applications)		Marketing Email 3 (22% of pilot applications)		Marketing Email 4 (13% of pilot applications)	
Participant final pilot stage (pilot average)	Within-round percent	Pilot-wide percent	Within-round percent	Pilot-wide percent	Within-round percent	Pilot-wide percent	Within-round percent	Pilot-wide percent
Did not receive assessment (67%)	69%	28%	70%	17%	58%	13%	72%	9%
Completed assessment, did not reserve incentive (12%)	12%	5%	13%	3%	18%	4%	0%	0%
Completed assessment, reserved incentive, did not install HPWH (18%)	14%	6%	16%	4%	22%	5%	28%	4%
Completed assessment, reserved incentive, installed HPWH (3%)	4%	2%	2%	0%	2%	0%	0%	0%

The prioritization scores therefore became irrelevant as a participation screener; the team approved all eligible applicants—those with a confirmed SCE account, in a single-family home within Orange County, and with a non-HPWH—to reach the targeted number of electrification readiness assessments completed through this Focused Pilot. Selection notifications and CIAs were sent to

225 applicants in total: of these, 74 applicants signed CIAs and proceeded with scheduling and completing assessments, 47 went on to request Focused Pilot incentive reservations, 35 signed CIA Exhibit B and officially reserved incentives, and just 6 customers ultimately completed an installation, as shown in Figure 8. Of the approved applicants, 151 were unresponsive, declined, or withdrew from participation prior to completing an assessment.

The pilot team fielded numerous questions from potential applicants during recruitment, revealing consistent patterns of uncertainty and confusion that indicate structural barriers to participation.

- **Cost:** Many homeowners sought clear information on total out-of-pocket costs in the absence of parallel HPWH incentives, expressing concern over the affordability of participation. Questions such as, "Are you offering no-cost HPWHs, and/or a rebate if I replace my gas water heater with electric?" and, "Can you give me a ballpark number?" reflected a widespread misunderstanding of the pilot's scope and cost structure. Others cited financial risk as a deterrent, with one applicant stating, "I am ready to sign but don't want to agree to if it will financially bankrupt me."

- **Complexity and Transparency:** Two other factors that contributed to customer hesitancy included administrative complexity when accessing and signing CIAs sent through DocuSign, as well as misinterpretations of contractual language further. Several participants found the application materials difficult to interpret, lengthy, and generally inaccessible, highlighting the friction created by the enrollment process. The team clarified that assessments were no cost—or that subsequent incentive reservations were never an obligation to incur future costs, upgrades, or installation—at multiple phases of enrollment or attempted enrollment. Still, multiple applicants expressed confusion over their obligations upon signing the DocuSign-delivered CIA, misinterpreting the language as binding them to proceed with installation.

  While the pilot team had addressed most of the concerns raised through FAQs on the application landing page, confusion persisted. The formality and legal tone of the DocuSign agreement, though consistent with typical program enrollment procedures and intended to hold the pilot contractually accountable to deliver agreed benefits without sending personally identifiable information through unsecured methods like email, appeared to elevate customer perception of risk. The detailed scrutiny from participants suggests that its presentation as a standalone, signable document led some to view it as a binding legal contract rather than a standard participation agreement embedded within an application workflow.

- **Enrollment Workflow:** Another recurring issue was that CIA documentation was perceived as missing or delayed, particularly referenced in the assessment CIA, which is referred to and labeled as "Exhibit A." This misperception also included a secondary CIA, referred to and labeled as "Exhibit B," which was to be provided at a later stage of the pilot after 1) a participating customer successfully scheduled and completed an electrification readiness assessment, 2) the customer's assessment report confirmed the presence of a non-HPWH in the assessed home, and 3) the customer informed the team they would like to reserve one of the maximum of 40 incentive spots the pilot plan established as eligible for electrical incentives. The absence of Exhibit B in assessment CIAs only containing Exhibit A generated concern and mistrust, with customers asking: "Please add to document or at the minimum

provide a copy to me as soon as possible." Several applicants also asked whether equipment incentives were available outside of the pilot. Though Golden State Rebates remained available, customers hesitated to commit to assessment or installations in the absence of the larger and previously anticipated TECH Clean California single family HPWH incentives, which were not guaranteed to return, may not have funding replenished, nor be retroactively available to pilot participants if HPWH installations had already occurred.

Of the 151 approved applicants who chose not to complete an assessment, 121 never signed the CIA or responded to the pilot team's follow-up attempts. Of the remaining 30 selected applicants who did not receive an assessment but completed the assessment CIA, 15 were unresponsive to the team's attempts at scheduling an assessment. Others noted challenges with finding a time that worked for them. In two instances, the customer denied the assessment contractor entry to a home based on a misunderstanding of the pilot, though it was not clear what the customer's expectations were in these cases. One customer withdrew participation due to replacing their water heater between the time of their application on February 25, 2025, and the scheduled assessment on March 11, 2025.

As discussed below, there were no significant differences in targeting metrics noted between participants and non-participants.

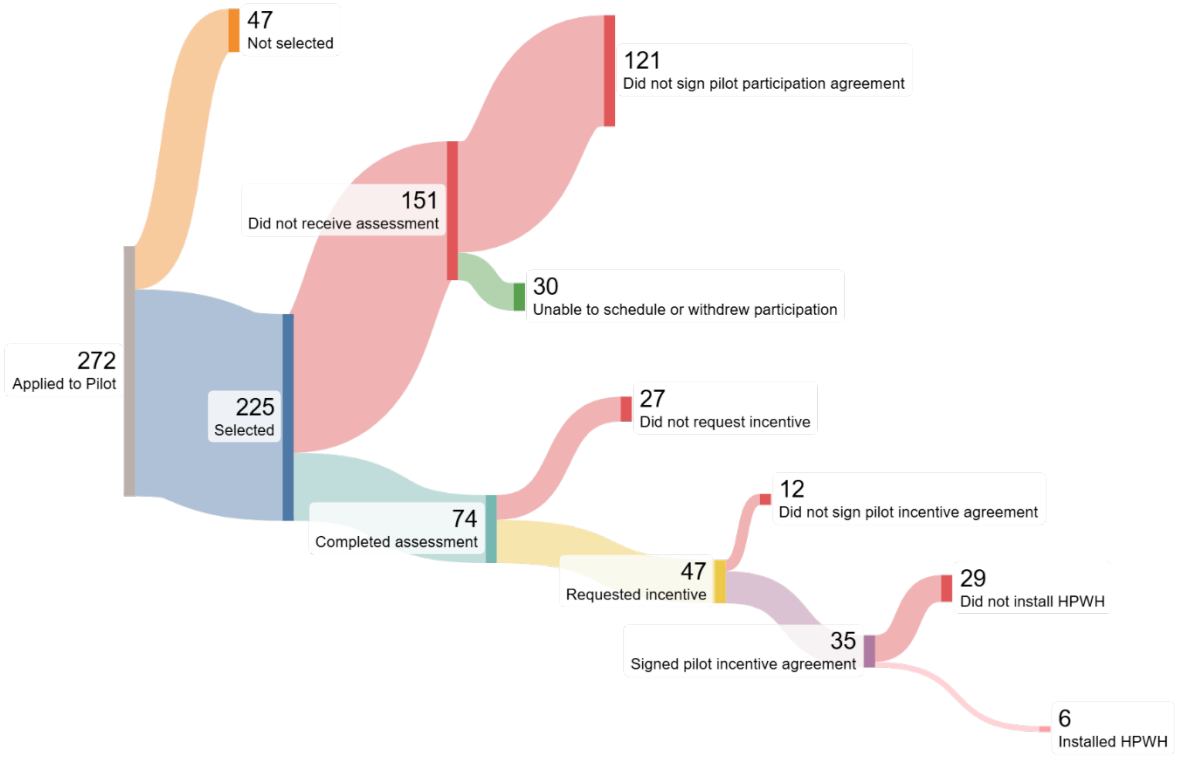


Figure 8: Flow of applicants through each stage of the pilot.

Analysis of Applicant Characteristics

Applicant responses regarding characteristics of their existing water heater system were generally representative of the broader SCE customers and statewide population. As participants progressed through each stage of the Focused Pilot, the concentration of existing natural gas systems grew from 81 percent of all applicants to 91 percent of all assessed homes, and eventually, 100 percent of all homes that installed an HPWH, as shown in Figure 9. Similarly, the ratio of homes with conventional storage tank water heaters grew from 84 percent of all applicants to 91 percent of all assessed homes, and finally, 100 percent of all homes that installed an HPWH, as shown in Figure 10.

While the overall population of applicants is similar to statewide and SCE territory averages, as illustrated in Figure 2, their growth is likely a product of the sample size becoming more concentrated as participants progressed through each stage of the pilot. This caused less conventional water heater configurations to appear at a lower frequently than they might in a larger population. Further, as presented in the results of the assessment data, the actual proportion of these system configurations exceeded what homeowners reported. As such, it is not expected that the existing water heater fuel and tank type independently influenced pilot participation. The average daily electricity consumption during the peak demand, evening ramp-up period of 4:00 p.m. to 9:00 p.m. was 0.3 kWh across all applicants.

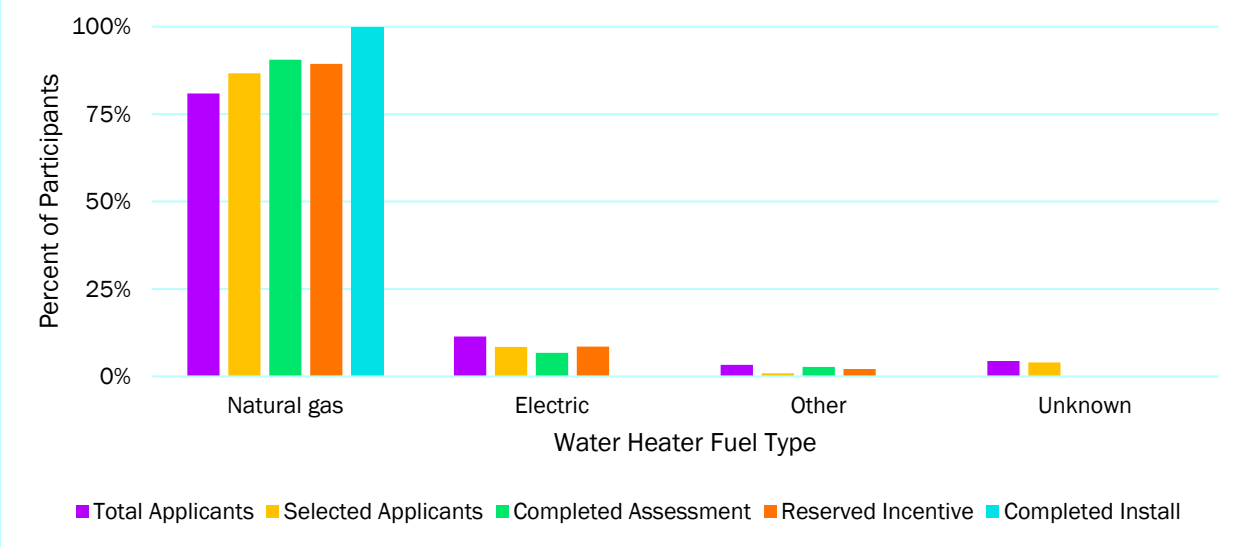


Figure 9: Existing water heater fuel type by pilot stage.

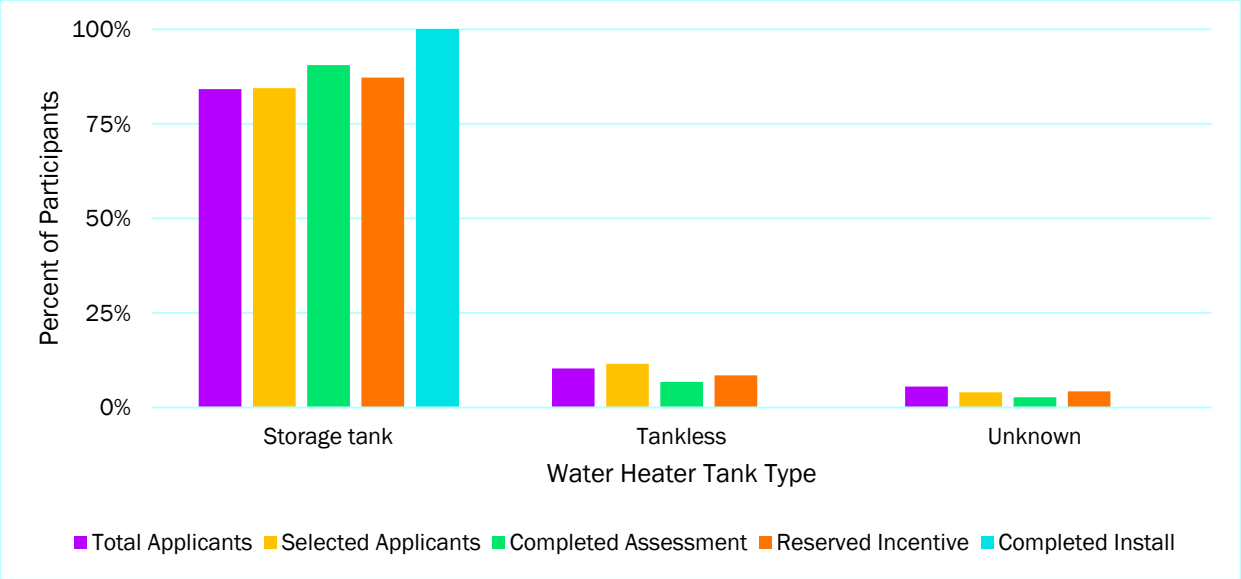


Figure 10: Existing water heater tank type by pilot stage.

Applicants for the pilot tended to have higher incomes, with over one-third reporting their household annual income to be greater than $125,000. However, the income distribution remained consistent throughout each stage of the pilot—as shown in Figure 11 below—and did not appear to influence outcomes of participation. About 25 percent of applicants were enrolled in CARE or FERA rates, and only 5 percent were in a DAC.

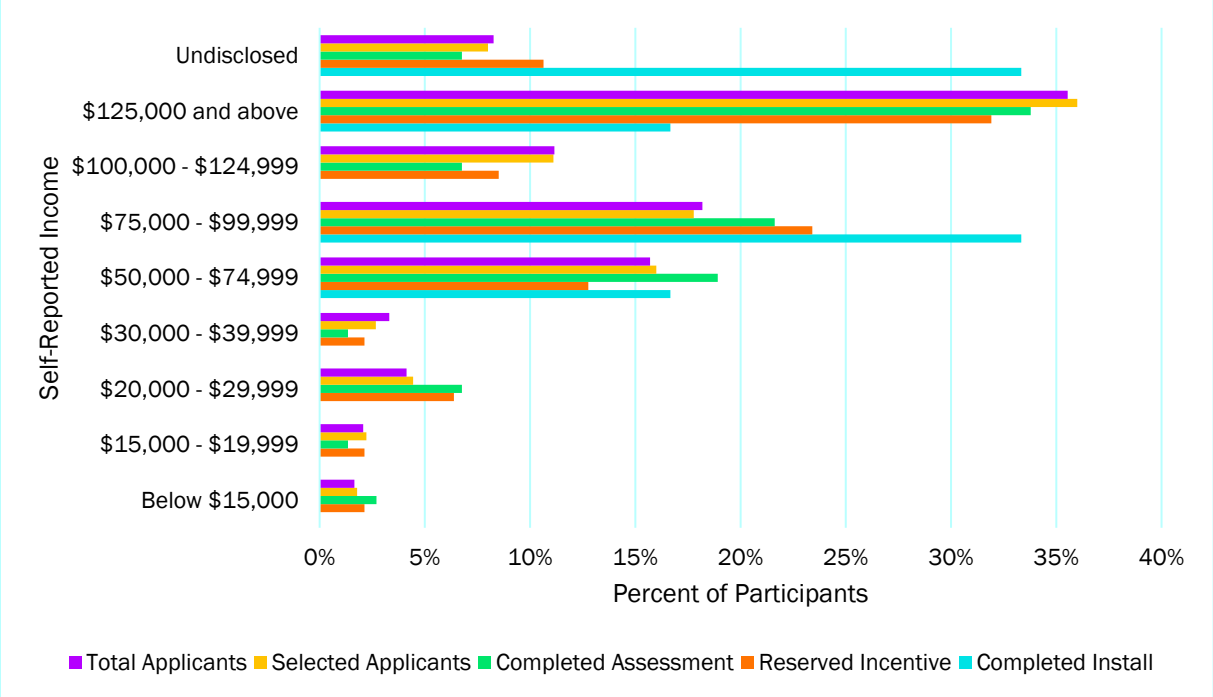


Figure 11: Reported household income by pilot stage.

Over 40 percent of participants reported the year of construction between 1968 and 1975. Like income, the year of construction remained steady throughout each stage of participation, as illustrated in Figure 12. The large representation of older homes reflects the more general decline in housing construction in California following the 1970s.

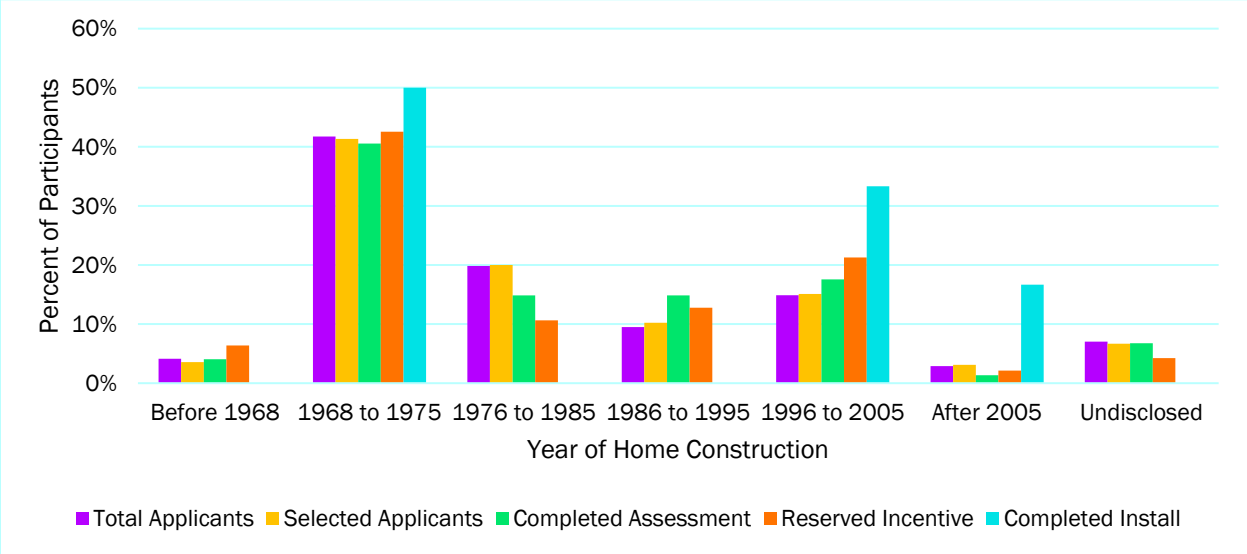


Figure 12: Reported year of home construction by pilot stage.

Motivations to Participate

In addition to assessing the characteristic profile of applicants, the team sought to better understand motivations to receive an electrification readiness assessment and whether these metrics might increase the likelihood of a homeowner converting to an HPWH. During the intake process, the team asked applicants about their familiarity with heat pump technologies and prior consideration for energy efficiency upgrades, along with perceived barriers to complete these upgrades in their home.

Nearly half—45 percent—of applicants reported they were familiar with HPWHs. By comparison, a recent evaluation of customer awareness through TECH Clean California reported 39 percent of California homeowners were aware of HPWHs in 2023, an increase of 7 percent from the baseline study a year prior (Loomis and Steiner 2024). Even more of the pilot applicants—81 percent—who were familiar with the technology reported that they have considered replacing their existing system with an HPWH. Table 9 below provides more detail.

Table 9: Percentage of applicants who are familiar with HPWHs and considered installing one in the past (n = 272)

Applicant Response	All Applicants	Selected Applicants	Scheduled Assessment
	"Have you heard of an HPWH?"		
Yes	45%	44%	51%

Applicant Response	All Applicants	Selected Applicants	Scheduled Assessment
No	55%	56%	49%
"Have you considered replacing your existing water heater with an HPWH in your home?"*			
Yes	81%	81%	76%
No	19%	19%	24%

*Only asked to those who reported being familiar with HPWHs (n = 100)

The pilot team also asked what barriers had prevented those that have considered an upgrade from scheduling an installation in the past. As Figure 13 illustrates, while cost was the leading driver, 44 percent reported uncertainties about needed electrical repairs and 40 percent planned to wait for equipment failure prior to replacement.

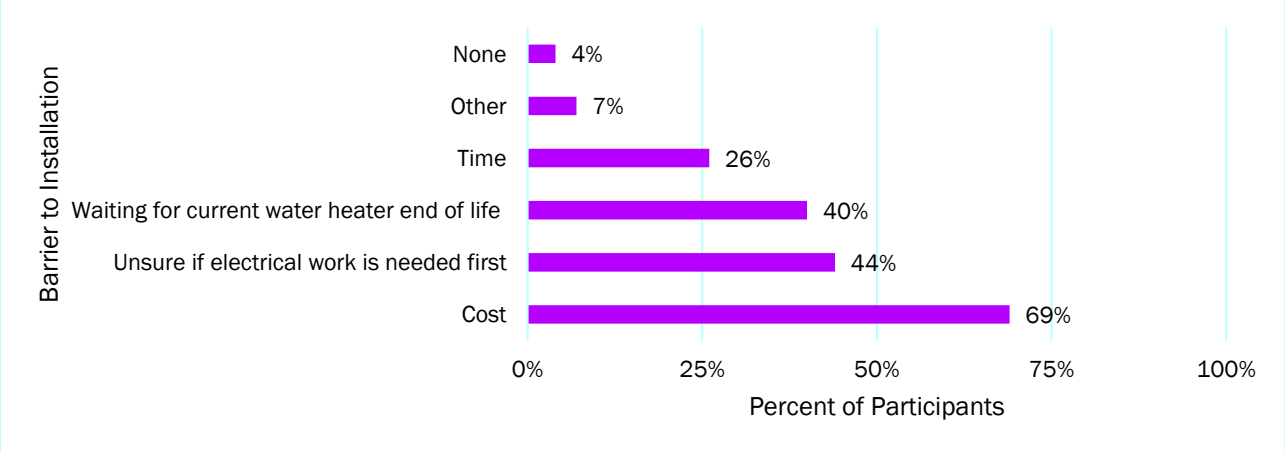


Figure 13: Applicant responses to the question: "What has prevented you from scheduling an installation?"

In addition to barriers, the team also surveyed applicants on interest in other home efficiency upgrades to understand whether installing other measures might help facilitate HPWH conversions. As reported by Loomis and Steiner, customers who have a desire to switch to all electric appliances were most likely to recommend an HPWH to others (Loomis and Steiner 2024). Consistent with these results, 84 percent of pilot applicants reported interest in switching to more efficient electric alternatives, including heat pump HVAC systems—54 percent—and induction cooktops—35 percent. Relatively high interest in conversion to heat pump HVAC systems was consistent with the interest in HPWHs, as 77 percent of the assessed homes had central air for cooling, with just 16 percent having no existing cooling system, and nearly all heating systems—89 percent—were fueled by natural gas.

Table 10: Applicant responses to the question: "Are you interested in any other new high efficiency electric

equipment or appliances in your home?"

Response	Count	Percentage
Heat pump HVAC system	147	54%
Electric vehicle	107	39%
Solar and battery storage	104	38%
Induction cooktops	96	35%
None	44	16%
Other	4	1%
Washer and dryer	3	1%
Electric panel	2	1%

Additional electrification measures identified included purchasing electric vehicles—39 percent— and installing solar battery storage—38 percent. Notably, two applicants specifically mentioned interest in receiving a new electric panel, though neither applicant upgraded their panel through the Focused Pilot. Most surveyed applicants, across all stages of pilot participation, reported evenly distributed interest in additional electrification measures. One exception to the even distribution was interest in induction cooktops, with 83 percent of those who completed installations reporting interest in the cooking electrification measure. Figure 14 below provides further details.

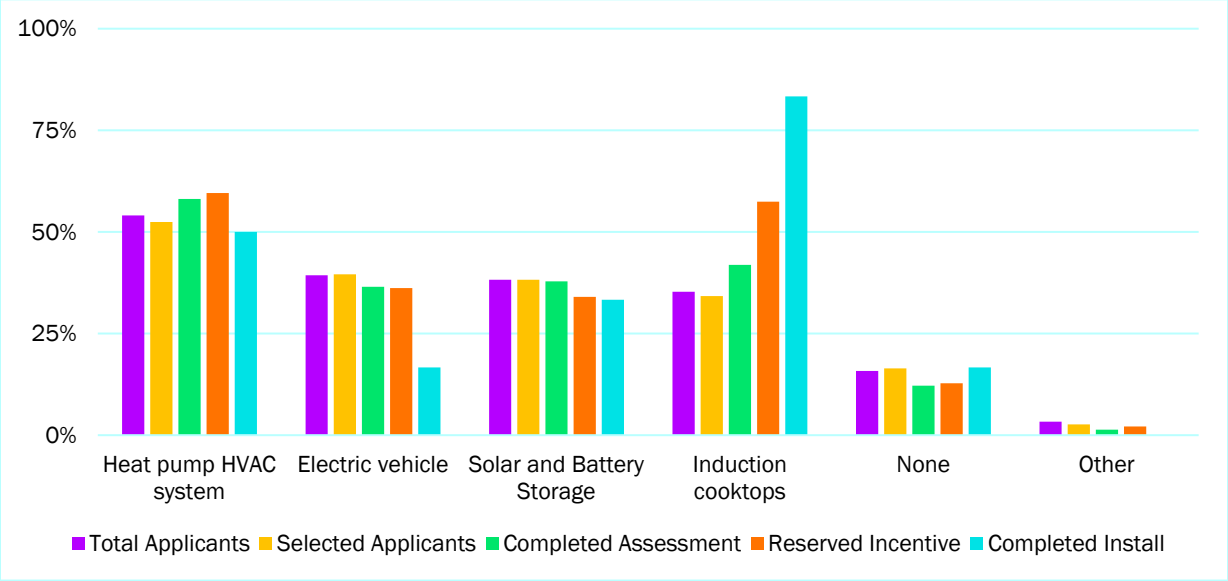


Figure 14: Interest in various electrification measures across pilot stages.

HPWH Readiness Assessment

As discussed above, readiness assessments may be a critical step in moving customers into a model of proactive water heating system replacement. The goal of the assessment is to break down major barriers to HPWH adoption by alleviating customer doubts about bill impacts and upfront costs.

After signing the CIA, as shown in Exhibit A, the assessment contractor contacted participants to schedule their electrification readiness assessment. The assessment was designed to collect information about the home's existing electrical panel, HVAC system, and water heating system configuration. At the time of assessment completion, the assessment contractor debriefed the results with the homeowner, providing clear guidance on "readiness" tasks to electrify their home and what incentives are available to them through this Focused Pilot and other layered programs. The customer also received this in an emailed report along with potential bill impacts and the expected "readiness" tasks needed prior to installing an HPWH.

The project team analyzed data on customer information and assessment results to understand which customers moved forward with installations and common pre-electrification needs. The survey also asked customers how the readiness assessment impacted their decision to move forward with the electrification projects.

Household Characteristics

As shown in Table 11, participating homes most often had one to five occupants, three or four bedrooms, and two or three bathrooms. Eighty-six percent of homes were site-built, detached single-family residences, and 10—or 14 percent—were townhomes or condos. The average home was about 2,000 square feet and built prior to 1980. More than half (54 percent) have electric vehicles that are charged at home, while a smaller fraction (38 percent) already have solar or plan to install it in the next five years (12 percent). A recent report published by TECH Clean California found that solar had a pronounced impact on the motivations of customers to pursue electric alternatives for their home appliances (Opinion Dynamics 2025).

Table 11: Household characteristics of assessment participants.

Number of Bedrooms	Percent
2	7%
3	31%
4	43%
5	14%
6+	5%
Number of Bathrooms	**Percent**
1	4%
2	58%
3	32%
4	4%
6+	1%
Year Home Constructed	**Percent**
N/A	1%
1950s	1%
1960s	18%
1970s	43%
1980s	11%
1990s	14%
2000s	12%

Participants were also asked what they were most interested in learning from the assessment. The vast majority—76 percent—reported general education or information about available incentives to be their top priority, while 11 percent reported interest in a heat pump installation specifically. Ten percent wanted to reduce energy consumption and utility bills, 3 percent were planning for home improvement, and 1 percent were seeking ways to help the environment. All participants reported the assessment improved their understanding of costs and impacts on utility bills.

Table 12: Factors reported by participants on their interest in receiving an electrification readiness assessment.

Leading Interest in Assessment	Percentage
Education	36%
Interested in heat pump installation	11%
Learn more about rebates and incentives	39%
Lower my utility bill	7%
Reduce energy	3%
Home improvement planning	3%
Help the environment	1%

Water Heater Characteristics

Almost all homes assessed had an existing natural gas system with a conventional tank, located in the garage. Though these figures are notably higher than statewide averages, they are representative of candidate homes that are likely to benefit from the electrification readiness incentives offered through the pilot. Most water heaters were 40 to 50 gallons in size.

Interestingly, the distribution of system age was rather flat, though the greatest number of water heaters—27 percent—were more than 20 years old. Fifty-nine percent of the water heaters assessed in the pilot exceeded the 10-year expected useful life of the equipment, increasing the risk of failure.[8] The flat distribution indicates the opportunity to influence replace-on-burnout installations and HPWH conversion rates on an ongoing basis over at least the next 20 years.

Table 13: Water heater metrics collected during assessment.

Water Heater Metric	Metric Subcategory	Percentage
Water Heater Fuel	Electric	5%
	Natural Gas	95%

[8] Ten years is the effective useful life determined by the prescriptive water heating savings characterization in the California eTRM. (CA eTRM 2023)

Water Heater Metric	Metric Subcategory	Percentage
Water Heater Tank Type	Conventional tank	93%
	On-Demand Tankless system	7%
Size (gallons)	30	7%
	40	27%
	50	62%
	80	4%
Age of System	0-4 years	16%
	5-9 years	24%
	10-14 years	16%
	15-19 years	16%
	20 years or greater	27%

Although most existing water heaters were in garages, many without obstructions, there were also several instances with access, height, ventilation, and other installation and service limitations. Figure 15 below shows two examples of participant home water heaters located in garages.

Figure 15: Example installation constraints for HPWHs in space or height limited garage locations

Water heater closets can often be modified to allow for the additional ventilation requirements of HPWHs to operate at rated performance. Height limitations can often require either relocation or other mechanical modifications to the space to accommodate the increased height of unitary HPWH models or conventional gas and electric water heaters.

Water heaters were commonly collocated with laundry in the garage or interior. In the assessed homes, nearly one in six of the water heater locations were already adjacent to an available 240V outlet. This is commonly due to the replacement of an older electric clothes dryer with a gas model, providing a low-cost opportunity for an HPWH installation and avoiding panel upgrade or wiring needs.

Electrical Infrastructure and Observed Remediation Needs

As shown in Table 14 below, 46 percent of the participating homes had 100-amp-rated electrical panels. These results highlight one of the most significant barriers to electrification in California: adequate electrical capacity for electrification of existing gas appliances and home electric vehicle chargers. An additional one-fifth of homes, or 19 percent, had 125-amp panels, and over one-third, or 32 percent, had 200-amp panels.[9] Just under one-quarter of homes had an existing sub-panel, and 47 percent of the panels assessed were evaluated to be in "good" condition—60 percent of which were 200-amp panels. Comparatively, two-thirds of the 39 panels described as being in "fair" or "poor" condition were 100-amp panels.

[9] A relatively small percentage (3%) of homes had 150-amp electrical panels.

Table 14: Panel capacity of participating homes by status of solar installation.

Panel Capacity	Overall Percent of Participating Homes	Only participants without solar	Only participants with solar
100-amp	46%	63%	18%
125-amp	19%	20%	18%
150-amp	3%	2%	4%
200-amp	32%	15%	61%

Table 15: Sub-panel capacity of participating homes.

Existing Sub-Panel Capacity	Percentage of Participating Homes	Age of Existing Water Heater				
		0-4 years	5-9 years	10-14 years	15-19 years	20 years or greater
None	77%	14%	25%	16%	12%	33%
< 100-amp	14%	10%	20%	20%	40%	10%
100-amp	8%	33%	33%	17%	17%	0%
200-amp	1%	100%	0%	0%	0%	0%

Notably, 71 percent of homes with 200-amp electrical panels had solar energy systems. The program assessor identified solar adoption as a common correlation for panel upgrades in California homes. In contrast, 63 percent of non-solar homes had 100-amp panels. Put differently, non-solar homes with 100-amp panels accounted for 85 percent of all 100-amp panel homes in the pilot. Targeting this segment may address most of the homes that need panel upgrades before electrification. Within the broader residential building stock, 2.6 million single-family homes without and that were built before 2000 are in the SCE service area; statewide, this number exceeds 7.4 million. This indicates that approximately 1.7 million SCE customers and 4.7 million homes across California may benefit from pre-electrification interventions, assuming the proportion of 100-amp panels seen in the pilot is similar to the proportion seen in SCE territory and statewide.

Figure 16 below highlights the trend of increasing panel ampacity in participating homes based on year of construction. However, the persistence of the large share of 100-amp panels continued for all homes until those constructed since 2000. While newer homes prior to 2000 tended to have higher amperage rating panels, this trend did not happen independently of having solar installed.

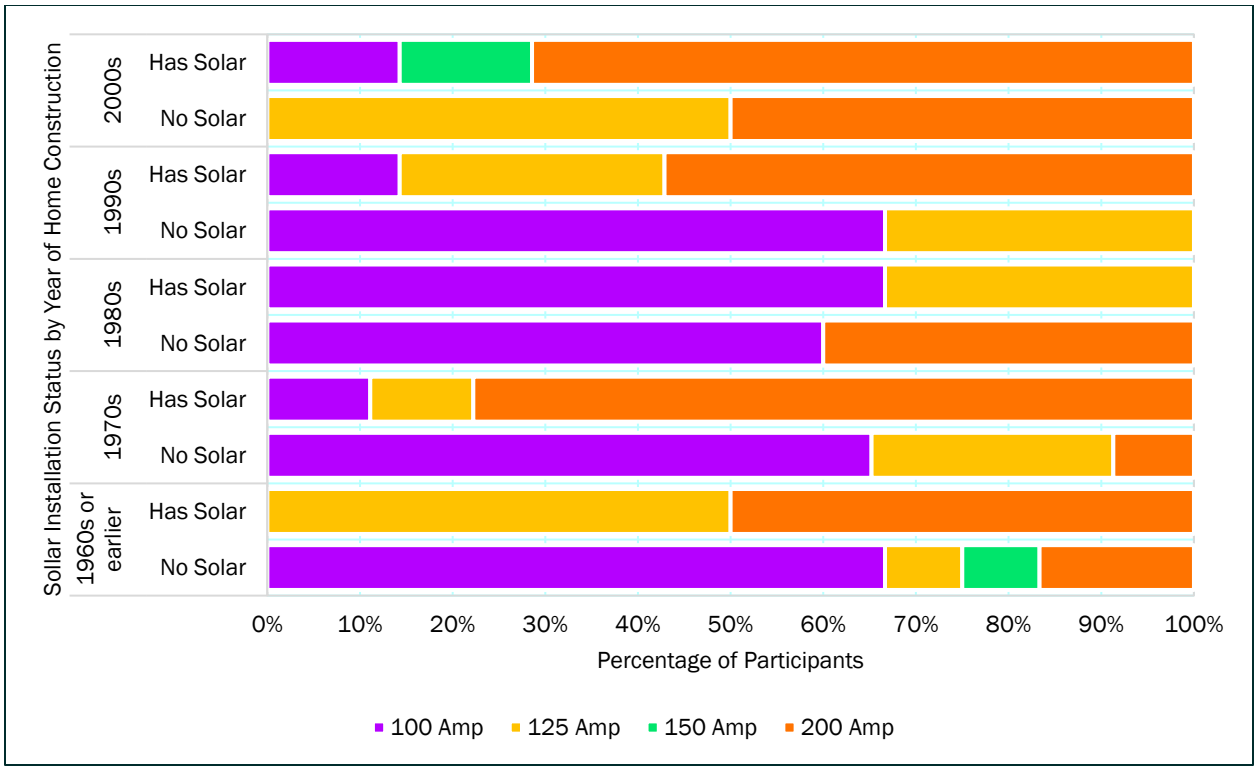


Figure 16: Panel capacity by age of home construction and status of solar installation.

In addition to panel capacity, the lack of sufficient space in electrical panels to add another two-pole 240V breaker posed another substantial barrier to electrification in participant homes. The assessed homes' electrical panels had a limited number of unutilized breaker slots, with 62 percent of 100-amp panels having between zero and two open slots. This was also common for 65 percent of 125-amp panels and universal in 150-amp panels. While 32 percent of 200-amp panels had more flexibility, 42 percent still only had up to two open slots. This illustrates that even higher-capacity homes may require upgrades depending on future load profiles, as shown further in Figure 17.

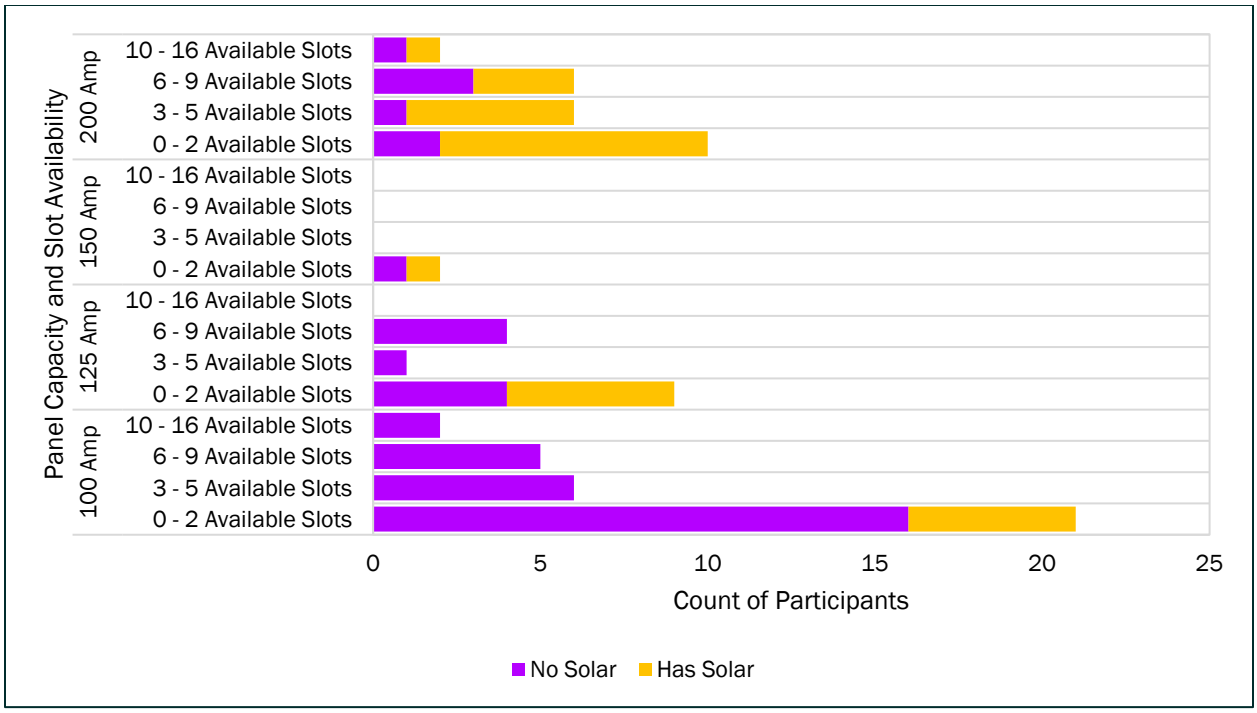


Figure 17: Available slots by panel capacity and presence of solar.

This lack of panel space affects the ability to add new electric appliances, especially high-powered ones like HPWH, electric vehicle chargers, heat pump HVAC systems, electric dryers, and induction cooktops and stoves, as well as the potential addition of home solar and energy storage systems. If a panel still has some flexibility, which can often be achieved with slim or tandem breakers, it may be possible to add one new 240V load with minimal work and cost. However, once a panel is fully optimized and still doesn't have enough room, or if it's close to reaching its overall capacity, a full panel replacement is likely. This is especially true for homes with lower service sizes like 100 amps, which can be quickly maxed out as more electric loads are added. The field assessor noted that most panels with slim breakers had already been optimized, leaving little room for expansion. The most common technical barrier was the inability to install a new 240V circuit without triggering a panel upgrade.

Figure 20 below shows two examples of electrical panels from participant homes. The 125-amp panel on the left has been enhanced with tandem breakers, suggesting it was previously optimized to accommodate the additional solar energy system and electric vehicle charger loads. The absence of additional panel space or opportunity for optimization to support electrification loads, as well as the relatively low existing panel ampacity, indicates the panel will need to be upgraded. In comparison, the 200-amp panel on the right has a higher electrical load capacity and additional breaker slots open, suggesting it is less necessary to upgrade the panel and can support a 240V HPWH installation and further panel optimization for electrification.

Figure 18: Examples of electrical panel upgrade (left) and optimization (right) opportunities.

Other factors that may lead to a panel upgrade or replacement include outdated panels known to be fire risks or for homes adding solar, which were common in assessed homes; participants said contractors had refused work in their homes given the high-risk and liability of a fire from these panels. While solar adoption was relatively common, the field assessor noted most still relied on gas appliances and expected that the systems were sized to cover existing loads, rather than planned with future electric conversions in mind. Notably, homes with newer panels typically already had solar, underscoring that panel upgrades often follow other energy investments rather than preceding them.

Forty-six percent of all water heaters were classified as “fair,” or in “poor” condition, which the field assessor determined through appearance, leak evidence, service history, and age. Many units had not been serviced and lacked basic code-compliant features like expansion tanks. Physical access issues were also common, with only 45 percent offering unobstructed electrical and condensate access. Many were located directly on the ground, in finished areas, or in detached garages with limited access to drainage or circuits, which may necessitate additional plumbing or piping for HPWH installations. A similar proportion of assessed electrical panels—52 percent—were in “fair” or “poor” condition, with most being located on an exterior wall. More details are available in Table 16 through Table 18 below.

Table 16: Distribution of water heater location and condition.

Water Heater Location	Percentage of Participating Homes
Garage	86%
Interior closet	12%
Crawlspace	1%
Water Heater Condition	**Percentage of Participating Homes**
Fair	41%
Good	54%
Poor	5%

Table 17: Electric panel metrics collected during assessment.

Panel Location	Percentage of Participating Homes
Attached garage interior	4%
Detached garage Exterior	8%
Exterior wall	85%
Interior space	3%
Panel Condition	**Percentage of Participating Homes**
Good	47%
Fair	47%
Poor	5%

While most homes have no spatial limitations for airflow, as the panels were typically located in garages, 20 percent were reported to have some constraints—such as small closets—that required ducting, venting, or unconventional mounting solutions. The assessment contractor noted that 22

percent of installations would require electrical work in finished spaces. This introduces other labor, cost, and complexity to facilitate an HPWH installation.

Table 18: Observed electrical, pre-wiring, and remediation metrics collected during assessment.

Water Heater in Finished Room	Percentage of Participating Homes
Obstructed electrical	27%
Obstructed electrical and condensate	20%
Unobstructed electrical/condensate	45%
Obstructed condensate	8%
Wiring Will Require Access in Finished Space	**Percentage of Participating Homes**
Yes	22%
No	78%
Potential Condensate Drain Options	**Percentage of Participating Homes**
No	43%
Yes	57%
Cubic Airflow Space	**Percentage of Participating Homes**
Limited airflow space, requires ducting/venting (e.g., closet)	12%
Limited space for HPWH (likely a height limitation for small closet water heater)	8%
No limitations (e.g., garage)	80%
Electrical Outlet Nearby	**Percentage of Participating Homes**
120V and 240V	18%
120V	47%
None	35%

HPWH Remediation and Upgrades

The Focused Pilot was designed to layer with the TECH Clean California and SGIP statewide heat pump incentive programs, as previously discussed in Table 3, to reduce upfront HPWH installation costs for participants. However, funding for these programs was unavailable during the pilot implementation phase. Single-family HPWH incentives were only available from December 2024 through February 24, 2025, and the team was unable to schedule assessments and qualify customers for incentives within this limited timeframe (TECH Clean California 2025).

In the absence of TECH Clean California and SGIP HPWH incentives, this Focused Pilot relied on offsetting the electrical repair costs and leveraging other programs, including the federal investment tax credit, to encourage participant conversion. Customer assessment reports included references to other programs. Additional incentives were available through the statewide Golden State Rebate and Statewide Midstream Water Heating Programs, which offered a maximum point-of-sale rebate of $900 to customers or contractors purchasing an HPWH from participating retailers or distributors.

TECH Clean California and SGIP rebates of up to $3,100 for HPWH, $1,500 for Low-GWP HPWH Kicker, and $700 for a ≥ 55 Gallon HPWH Kicker for market rate customers--$4,185; $1,500; and $700 for equity rate customers, respectively—may have provided customers with $5,300 to $6,385 in additional incentives. TECH Clean California, SGIP, and pilot incentives would have combined to nearly double the pilot incentives on their own, totaling between $10,800 and $11,885. Without the $5,300 to $6,385 TECH Clean California and SGIP HPWH rebates, the pilot's success depended more heavily on homeowners' willingness to electrify despite increased out-of-pocket costs. Participants were eligible for up to $900 in statewide rebates and $5,500 in incentives through the Focused Pilot, for a combined total of $6,400 during the program period.

Assessment Outcomes

The field assessor noted that many customers did not understand the purpose of the visit. For example, confusion between HPWHs and gas on-demand systems was common, as both are newer technologies with a growing market presence. In at least one case, the field assessor reported that a participant lost interest in proceeding after being reminded that installing an HPWH was required to qualify for the electrification readiness incentives. The participant claimed they had recently installed a gas "HPWH" and were unwilling to replace it. In reality, the participant had a natural gas on-demand tankless water heater, since gas HPWHs do not exist, but refused to accept this explanation from the field assessor.

Language barriers were a recurring issue. In many cases, communication between the field assessor and homeowner relied on translation apps, with mixed effectiveness. Customers with limited English proficiency, or who were initially focused on a single technology, often disengaged once panel upgrades or additional requirements were introduced. This misunderstanding appeared in several of the post-assessment customer survey responses. Participants reported expecting incentives for the HPWH itself, despite the pilot team's explicit communication that the incentives were for electrical upgrades, and that installing an HPWH was a prerequisite for eligibility on the incentive reservation landing page, as shown in Appendix B: Pilot Marketing Materials.

The field assessor observed that customers frequently asked about out-of-pocket costs but were largely unaware of available incentives. He emphasized the incentive reservation process during each visit, even walking through the form in real-time, yet only a fraction followed up. Interestingly,

the field assessor noted that many customers were more interested in receiving a new electric panel than an HPWH.

Customer follow-through was limited. Many asked the field assessor for contractor recommendations, but the assessor was not familiar with the local market and could not provide referrals beyond the seven incentive-eligible contractors enrolled in the pilot and the resources listed on the assessment reports, which included switchison.org and rewiringamerica.com. This was a missed opportunity to leverage the trust built between the assessor and homeowner during the field visit, and aligning future assessments with contractor networks would likely improve outcomes. Additionally, bundling HPWH with heat pump HVAC upgrades may generate stronger engagement, as there was higher customer interest in space conditioning changes, even with the understanding that a panel upgrade would still be required.

The team distributed surveys to all selected applicants to better understand the variables that influenced their engagement.

1. **Applicants that did not move forward with an assessment**

Only 7 of the 151 applicants that did not receive an assessment responded to the survey, and of those, just 2 indicated they recall having ever signed up through the landing page. Those responses further stated they did not recall receiving confirmation of their approved application or the CIA document.

Both responses indicated that they sought to participate in the pilot to learn more about installing a heat pump and available incentives. They also identified receiving a list of recommended products, assistance in applying for rebates, and help with finding a qualified contractor as the kind of support needed to transition their home to more efficient electric equipment. They cited information on upfront costs and utility bill impacts as having the greatest influence on their decision to make the switch in the future.

2. **Participants who received an assessment but did not install an HPWH**

The team distributed a survey to the 69 participants who received an assessment but did not complete an installation by June 9, 2025. This included the group of participants who reserved, but did not ultimately claim, the electrification readiness incentives. The pilot team received a 20 percent response rate of 14 participants.

Most participants in this group—57 percent—indicated that the assessment provided clear, actionable steps they could take to install an HPWH and electrify their home, which is further shown in Figure 20. The remaining 29 percent of participants still needed more guidance, while 14 percent found the assessment unhelpful in improving their understanding of what steps to take.

Seventy-nine percent reported the assessment had at least some influence on their confidence to install an HPWH in the future. Like the non-participant responses, receiving a list of recommended products, assistance in applying for rebates, and help with finding a qualified contractor had the most influence on a customer's decision to proactively replace equipment. Only one response stated they would not replace equipment until it fails. Forty-three percent of participants said they were at least somewhat likely to replace their water heater with a heat pump in the next 12 months because of the electrification readiness assessment.

Participants pointed to uncertainty about costs as a prominent barrier. This was conflated with challenges many noted in getting in contact with participating contractors; since the assessment did not estimate project costs, participants needed to obtain a quote from a contractor to understand the cost of moving forward with an electrification project. This was a missed opportunity to have a closer connection between the pilot and contractors to provide more clarity on project costs.

As one respondent shared: “The exercise was really good. I just wish that I [could] have a ballpark estimate if there are any upfront cost[s] from an Eligible Contractor that is outside of the incentives. This way, this could be budgeted within the next couple of months. At this time, there is just fear of wasting everyone's time if we could not afford any expenses outside of the incentives being provided.”

This stage appeared to be fraught with challenges for participants. The survey segmented financial, logistical, and informational barriers, all of which included at least one response about the contractor engagement process. Issues with contractors were especially pronounced in long-form answers, with many noting they did not hear back from several contractors they had reached out to before the pilot incentives expired. Participants stated concerns about the timeliness: “It is almost three weeks and no one contacted me,” and extent of outreach needed: “I contacted at least five companies, only had one respond…but did not reply with a quote upon request.”

There were also miscommunications and continued misunderstandings about the pilot incentive structure. Some responses indicated that contractors told them pilot incentives were no longer available, despite this not being communicated by the team. Others appeared to have misunderstood the incentives the pilot was providing even after completing the assessment, claiming they were “under the impression the program provides an HPWH.” No participants were denied a spot to reserve or claim incentives available through the pilot.

3. Participants who installed an HPWH

The pilot team sent a post-installation survey only to those who submitted an incentive claim after installing an HPWH by June 9, 2025, and received a response rate of 80 percent from four participants. Overall, they reported a positive experience from the assessment, suggesting their participation in the pilot had swayed their decision to install an HPWH.

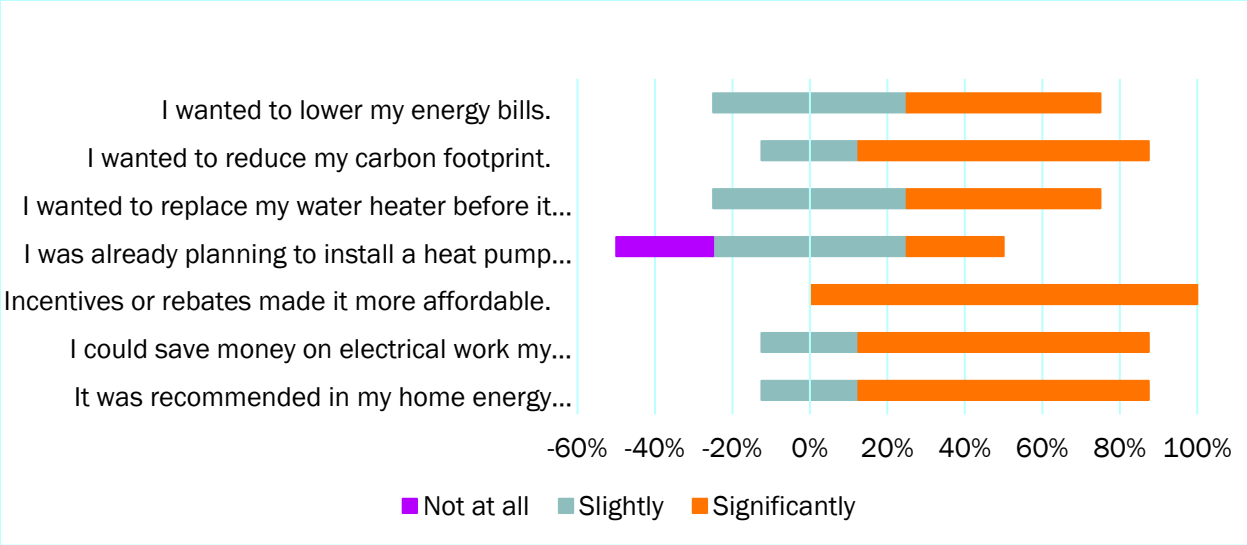


Figure 19: Participant responses to the question: "How much did each reason affect your choice to get an HPWH?"

Despite ultimately installing an HPWH, this group similarly struggled to engage with contractors. Every respondent believed it was at least somewhat difficult to find an available contractor, with three of the four stating it posed the greatest challenge to their participation throughout the pilot. One participant noted that many of the participating contractors listed on the focused landing page "didn't even know much or anything about the program or how it worked when I called."

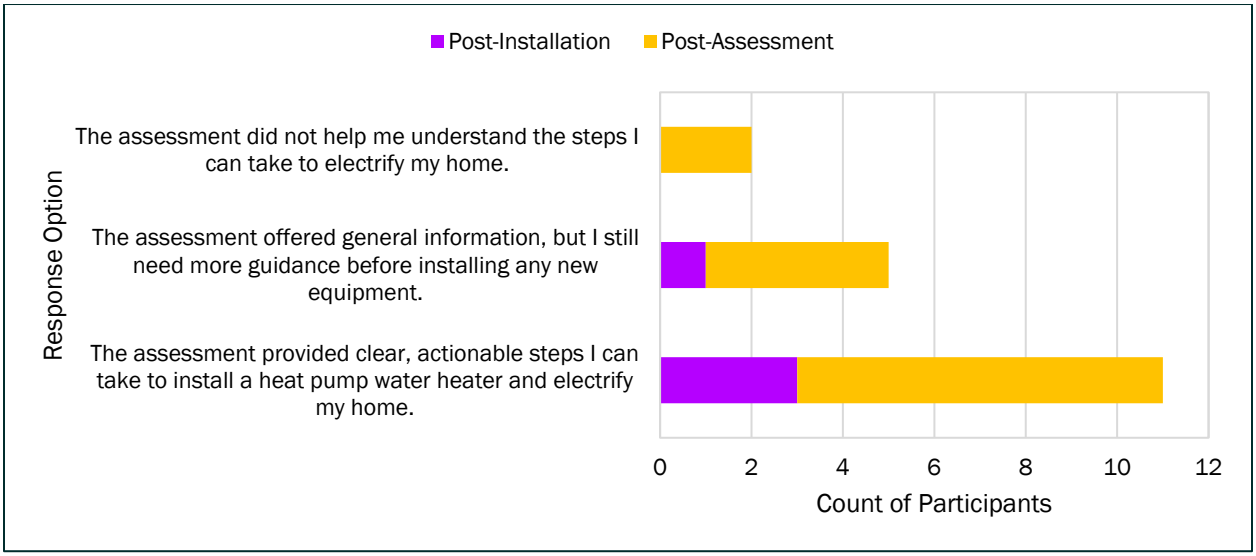


Figure 20: Participant responses to the question: "Choose the statement that best matches your experience with the residential electrification readiness assessment."

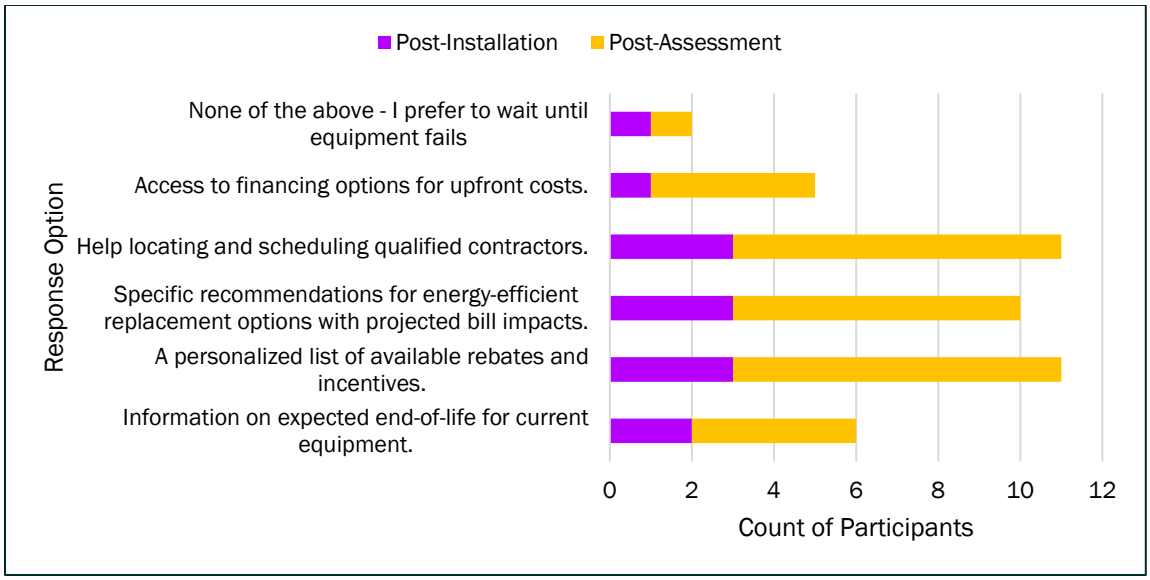


Figure 21: Participant responses to the question: "Which of the following would be most important in your decision to replace an appliance in your home before it fails? (Select all that apply)."

Case Study of Homes Completing HPWH Installations

For the six homes completing an HPWH installation and electrical upgrades, an analysis of utility, assessment and contractor installation reporting provided an opportunity to assess common traits about the homes and the homeowners. Below are some additional details about the homes, water heaters, and electrical panels. All six of the homeowners were interested in switching from gas to electricity for water heating.

As shown in Table 19 below, three of the six homes were built around 2005 around three were built around 1970, and all had four to five bedrooms and two to three bathrooms. All except one homeowner had completed college or graduate school, and the participants were equally split on awareness of HPWHs and interest in installing one in their homes.

Table 19: Home characteristics for participants who installed an HPWH.

Field	Home #1	Home #2	Home #3	Home #4	Home #5	Home #6
# of bedrooms	4	4	4	4	5	4
# of bathrooms	3	2	3	3	3	2
Year home constructed	2007	2004	1970	1971	2004	1968
Leading interest in assessment	Reduce energy	Education	Education	Learn more about rebates and incentives	Lower my utility bill	Education

Electrification and Panel Upgrade Assessment

- Three of the six homes had 200-amp electrical panels, one had a 175-amp rating, one had a 125-amp rating, and one had 100-amp rating.
- Panels had a range of zero to eight available breaker slots to accommodate an additional 240-volt load for an HPWH installation or additional loads for future electrification measures.
- Two of the panels were completely filled, even with the use of tandem breakers to double up the use of available slots.
- Three of the six homes had additional electrification loads with solar, and four had electric vehicle chargers installed.

Table 20: Electrical infrastructure and panel characteristics for participants before installing an HPWH.

Field	Home #1	Home #2	Home #3	Home #4	Home #5	Home #6
Panel capacity	200-amp	200-amp	200-amp	125-amp	150-amp	100-amp
Sub-panel capacity	0	0	0	0	0	0
Has solar?	Yes	Yes	No	No	Yes	No
Has EV charger?	Yes	No	Yes	Yes	Yes	No
Total # available slots	1	5	8	0	0	1

Water Heater Assessment

- All the water heaters in the participant homes were natural gas models.
    - There were 5 50-gallon storage tank water heaters, 4 of which were reported as at least 15 years old. Of the 4 water heaters that were 15 years old, there were no reported instances of water heater failures although the assessment did recommend replacement of the water heater due to age.
    - There was one new, on-demand tankless model.
- Five of the six water heaters were in garages but in generally obstructed areas, notably closets requiring potential mechanical work to accommodate larger HPWH sizes and required ventilation. However, one water heater was in an interior closet.
- Three of the homes had 120V outlets accessible to the water heater location to support the potential option of a plug-in 120V HPWH model.

Table 21: Water heater characteristics for participants before installing an HPWH.

Field	Home #1	Home #2	Home #3	Home #4	Home #5	Home #6
Water heating fuel	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas	Natural gas
Water heater tank type	On-demand tankless system	Conventional tank	Conventional tank	Conventional tank	Conventional tank	Conventional tank
Size (gallons)	30	50	50	50	50	50
Age of system	0–4 years	15–19 years	15–19 years	20 years or greater	20 years or greater	5-9 years
Water heating electrical outlets available for replacement install	120V	None	None	120V	120V	None

HPWH Installation and Panel Upgrades

- Installed HPWHs ranged in sizes from 50-, 65-, 66- and 80-gallon models for the replacement of existing 50-gallon conventional tank gas water heaters despite similar bathroom and bedroom configurations in homes.
- Three of the six HPWH installations involved panel optimization, which included the installation of a new subpanel for $4,900 as an alternative to full replacement of the electrical panel.
- In the case for one of the three full-panel replacements, the costs reported on the invoice included additional home repair of the exterior stucco for the panel upgrade. The panel upgrade was $6,000, plus an additional $1,100 for the stucco repair.
- Four of the seven contractors enrolled in the pilot completed all the installations. Participating contractors had significant communication with the pilot team after enrollment regarding customer eligibility, program requirements, and timeline. Contractors who did not complete installation during the pilot were slightly less communicative or responsive.

Table 22: Observed electrical, pre-wiring, and remediation metrics for participants before installing an HPWH.

Field	Home #1	Home #2	Home #3	Home #4	Home #5	Home #6
Water heater location	Garage	Garage	Interior closet	Garage	Garage	Garage
Water heater condition	Good	Fair	Fair	Fair	Poor	Good
Panel location	Exterior wall	Exterior wall	Exterior wall	Exterior wall	Exterior wall	Exterior wall
Panel condition	Good	Fair	Good	Good	Good	Fair
Water heater in finished room	Unobstructed electrical/condensate	Obstructed electrical	Obstructed electrical and condensate	Unobstructed electrical/condensate	Obstructed electrical	Unobstructed electrical/condensate
Wiring will require access in finished space	No	Yes	Yes	No	Yes	No
Potential condensate drain options	Yes	Yes	Yes	Yes	Yes	No
Cubic Air-Flow Space	Limited space for HPWH (likely a height limitation for small closet water heater)	Limited space for HPWH (likely a height limitation for small closet water heater)	Limited airflow space, requires ducting/ venting (e.g., closet)	No limitations (e.g., garage)	Limited space for HPWH (likely a height limitation for small closet water heater)	No limitations (e.g., garage)

Table 23: Electrical repairs, remediation, and water heater information post-installation.

Field	Home #1	Home #2	Home #3	Home #4	Home #5	Home #6
Readiness upgrade	Panel optimization	Panel optimization	Panel optimization	Panel replacement	Panel replacement	Panel replacement
Panel capacity post-install	200-amps	200-amps	200-amps	200-amps	225-amps	200-amps
Sub-panel capacity post-install	30-amps	30-amps	30-amps	0-amps	0-amps	0-amps
HPWH size (gallons)	65	65	50	80	66	65
HPWH voltage	240V	240V	240V	240V	240V	240V
Total electrical panel cost	$4,900	$4,900	$4,900	$6,000	$4,000	$5,200
Total electrical auxiliary work cost	$2,850	$2,850	$2,850	$1,500	$1,500	$1,813
Heat pump installation cost	$5,500	$5,500	$5,500	$6,500	$4,000	$4,244
Total project cost	**$13,250**	**$13,250**	**$13,250**	**$16,885**	**$9,500**	**$11,297**

Savings, TRC, and TSB from Installed HPWHs

- Energy savings from the six pilot HPWH installs—kWh, therm, and BTU savings—as well as Total Resource Cost (TRC) and Total System Benefit (TSB) are shown in Table 24 below. Please refer to for supporting calculations.

Table 24: Energy savings, TRC, and TSB from installed HPWHs.

Customer Reference Number	Water Heating Fuel (Main)	Primary Water Heating Type	Total Resource Cost (TRC)	Total System Benefit (TSB)	Electric Savings (kWh)	Gas Savings (Therms)	Electric & Gas Savings Combined (kBTU)
Home #1	Natural gas	On-demand tankless system	$3,521	$937	-1,240	106	6,366
Home #2	Natural gas	Conventional tank	$4,245	$2,886	-1,200	177	13,601
Home #3	Natural gas	Conventional tank	$4,245	$2,886	-1,200	177	13,601
Home #4	Natural gas	Conventional tank	$4,873	$3,406	-1,190	196	15,535
Home #5	Natural gas	Conventional tank	$4,160	$2,727	-1,320	177	13,192
Home #6	Natural gas	Conventional tank	$4,299	$2,966	-1,240	182	13,965
Total			**$25,342**	**$15,809**	**-7,390**	**1,015**	**76,260**

Savings Potential from Electrification Readiness Assessment Participants

The potential energy savings, TRC, and TSB from the 68 pilot customers who completed assessments but did not install an HPWH are available below in Table 25. Savings potential is based on using the lowest potential Uniform Energy Factor (UEF = 3.30) from existing measures in the California ETRM: SWWH025-09: Heat Pump Water Heater, Residential, Fuel Substitution and SWWH014-07: Heat Pump Water Heater, Residential. Savings could be greater if customers were to install eligible equipment rated at the higher measure-aligned UEFs of 3.50 or 3.75, supporting calculations for which are also available in Appendix H: Participant Savings, TRC, and TSB Calculations.

Table 25: Potential energy savings, TRC, and TSB for customers completing pilot assessments and not installing an HPWH.

Water Heating Fuel (Main)	Primary Water Heating Type	Customer Qty.	Total Resource Cost (TRC)	Total System Benefit (TSB)	Electric Savings (kWh)	Gas Savings (Therms)	Electric & Gas Savings Combined (kBTU)
Electric	Conventional tank	4	$2,788	$3,994	6,200	0	21,155
Natural gas	Conventional tank	60	$244,155	$162,399	-83,310	10780	793,477
	On-demand tankless system	4	$14,548	$3,031	-5,560	427	23,718
Total		**68**	**$261,491**	**$169,425**	**-82,670**	**11207**	**838,351**

Pilot Intervention Impacts on Existing Measures' Infrastructure Costs, TRC, and TSB

- Interventions explored in the pilot should not impact existing eTRM measures' Total System Benefit (TSB) for single-family HPWHs installed as an accelerated replacement.
- The TSB cost test used in California's energy efficiency framework is a benefit-only metric, meaning it quantifies the value of avoided costs—such as energy, capacity, and greenhouse gas emissions—without factoring in any program or measure costs. Unlike traditional cost-effectiveness tests that compare benefits to costs, TSB is designed solely to express the lifecycle value of energy savings in dollar terms. As a result, the cost of implementing a measure—e.g., equipment, installation, or program administration—does not influence the TSB result. This allows TSB to serve as a consistent and fuel-agnostic benchmark for evaluating the grid and environmental benefits of energy efficiency interventions, regardless of their upfront or ongoing costs.
- The TSB values estimated across California's climate zones underscore the broader value of HPWH conversion readiness efforts to the state's energy system. Extrapolating from existing eTRM measures, the statewide average TSB per HPWH unit installed in single-family homes is estimated at $971.57. With values ranging from $885.77 to $1,165.13, the pilot's interventions demonstrate meaningful contributions to grid efficiency, decarbonization, and long-term cost savings. Notably, all six HPWH installations occurred in Climate Zone 6, which corresponds where the estimated TSB is $1,024.64, indicating that installations in this region yielded above-average system benefits.
- For Total Resource Cost (TRC), HPWH installation auxiliary costs like piping and electrical infrastructure costs are accounted for in existing measures and are similar across different heat pump sizes. However, these "infrastructure costs" are limited to the material and labor

costs of capping existing gas lines, outlets, and wiring, and currently do not include electrical panel upgrade material costs, as it is assumed that the existing panel could support the added electrical load. The Focused Pilot assessment and installation results challenge this conclusion, as referenced in Figure 17, which showed there were 42 assessed panels with zero to two available breaker slots.

  - Further consideration should be given to panels that only have slot capacity for an HPWH breaker but would be incapable of pursuing other electrification measures without panel upgrades.

  - As noted in California Energy Efficiency Measure Data for ETRM SWWH025-09 – Heat Pump Water Heater, Residential, Fuel Substitution:

    - **Infrastructure Costs.** For a natural gas water heater to HPWH infrastructure, upgrades would include capping off the natural gas line, closing exhaust vents, and running 240V power to the heater, including adding a new 30-amp breaker. The infrastructure costs do not include electrical panel upgrade costs, as it is assumed that the existing panel could support the added electrical load. Existing gas water heaters will typically only be using 120V power. These infrastructure costs were estimated using 2022 RSMeans Online data and online retailer costs.

- Future program administrators sponsoring downstream fuel substitution measures in the energy efficiency portfolio should continue to record and track instances where existing infrastructure and panel upgrade costs are required to facilitate the fuel substitution measure. Current measures require this data collection and reporting—as noted in California Energy Efficiency Measure Data for ETRM SWWH025-09 – Heat Pump Water Heater, Residential, Fuel Substitution:

  > "Per CPUC Decision 19-08-009 and *Fuel Substitution Technical Guidance*, building infrastructure costs shall be collected for fuel substitution measures with downstream and direct install delivery types.
  >
  > Only costs for work done within the building are required to be reported. Per CPUC guidance, costs associated with upgrades or replacements of the electrical panel that were required for measure installation shall be reported as infrastructure costs for the project.
  >
  > Other electrical connection costs associated with a fuel substitution measure, such as new electric outlets, new wiring, conduit from the electrical panel to the new equipment, or capping and/or demolishing natural gas supply lines are considered requirements for installation and are considered part of the measure cost.

The pilot incurred a range of costs that meaningfully impact TRC calculations but would not fully carry over into a scaled implementation. These costs can be broadly categorized as non-recurring, or fixed, versus potentially scalable or avoidable under a mature program model. With streamlined systems, integrated contractor coordination, and optimized incentive design, it is possible to achieve substantial reductions in per-project costs, improving TRC performance at scale.

FIXED OR NON-RECURRING COSTS

- **Landing page development:** One-time design and deployment costs for participant application, unlikely to recur in a statewide program using existing program infrastructure.
- **Original marketing materials:** Four separate campaigns required tailored content creation and multi-organization approvals. These startup costs would not persist once materials are established and reused at scale.
- **Pilot-specific research and reporting:** Labor dedicated to documenting pilot design and findings is unique to this pilot phase and would not be required under ongoing operations.

SCALABLE PROGRAM ELEMENTS WITH POTENTIAL COST EFFICIENCIES

- **Redundant customer intake processes:** The need for participants to sign multiple agreements, and the administrative oversight to coordinate this, were specific to the pilot structure. Intake, eligibility, tracking, and incentive processing systems can be automated or centralized in a scaled program, significantly reducing per-participant administrative costs.
- **Assessment contractor coordination:** The third-party assessment contractor operated on a separate customer intake platform and data collection system that was not integrated with the pilot team's analytical process. This misalignment added labor hours and complexity that would be resolved in a fully integrated program design.
- **Customized assessment reporting:** Tailoring home energy assessment reports specifically for pilot needs added time and cost. Standardized reporting protocols in a scaled setting would reduce this burden.

COST DRIVERS LIKELY TO PERSIST OR REQUIRE PROGRAM DESIGN CHANGES

All six completed installations in the pilot claimed the maximum available incentive of $5,500 for electrical repairs and panel upgrades. This pushed the average total project cost to $12,900, well above comparable projects in the TECH Clean California dataset. Statewide, the median cost of HPWH installations with storage volumes over 55 gallons in single-family homes was $7,822. Projects with electrical service upgrades had a median cost of $8,422, while those without had a median of $7,100. This suggests that electrical work to facilitate HPWH costs approximately $1,300, in line with findings from other pilots exploring home repairs as a mechanism to encourage HPWH installations.

However, project costs were notably higher in Orange County, where the pilot took place. Of 280 HPWH installations in the region, 98 included electrical service upgrades, with a median cost of $12,400. The remaining 182 projects, which did not include upgrades, had a median cost of $5,025. This cost gap is significantly larger than the statewide difference between upgraded and non-upgraded projects.

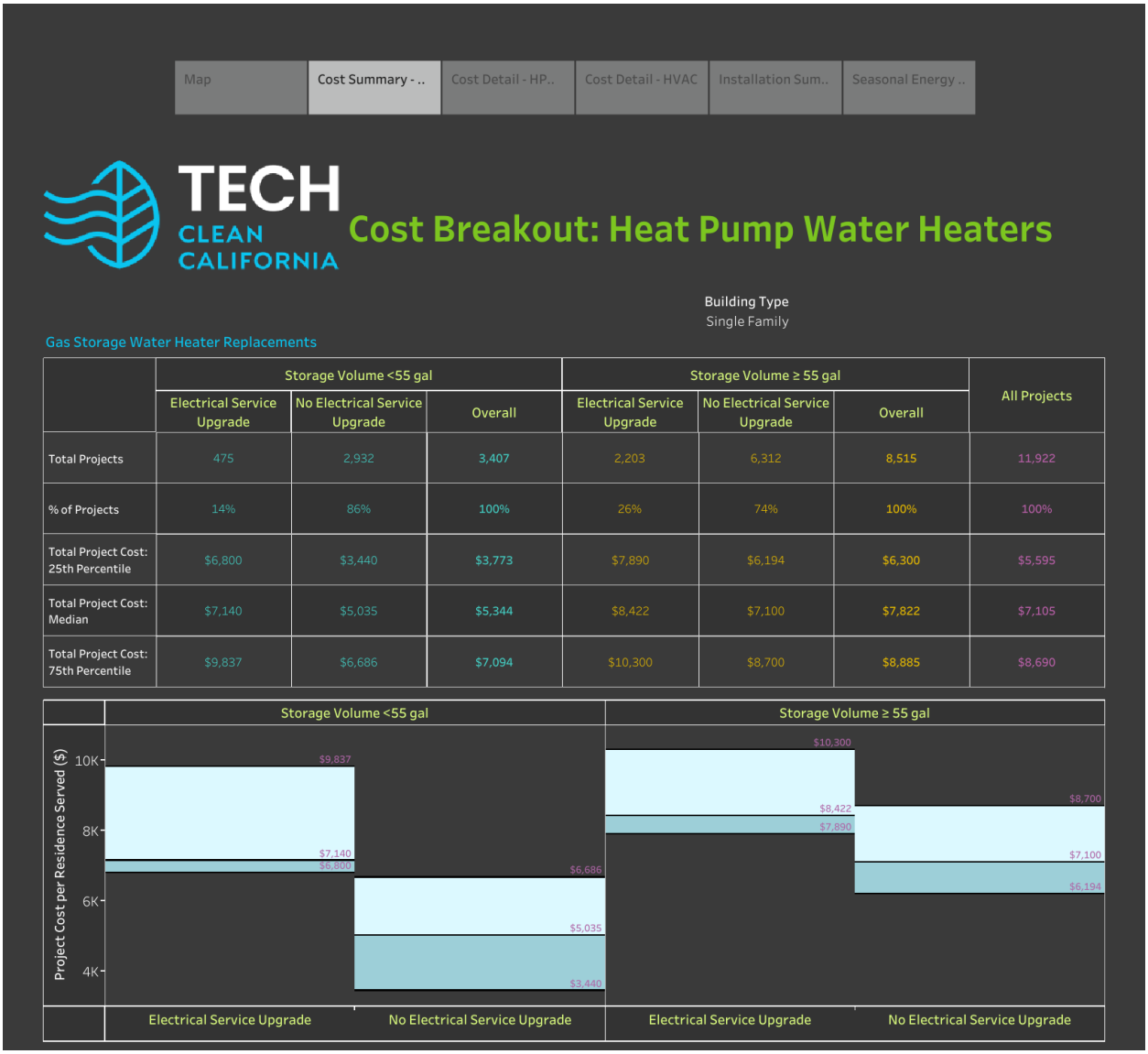


Figure 22: TECH Clean California cost breakout: heat pump water heaters.

Source: TECH Clean California Public Reporting Heat Pump Data Visuals. Data include projects that have been completed up to July 31, 2025.

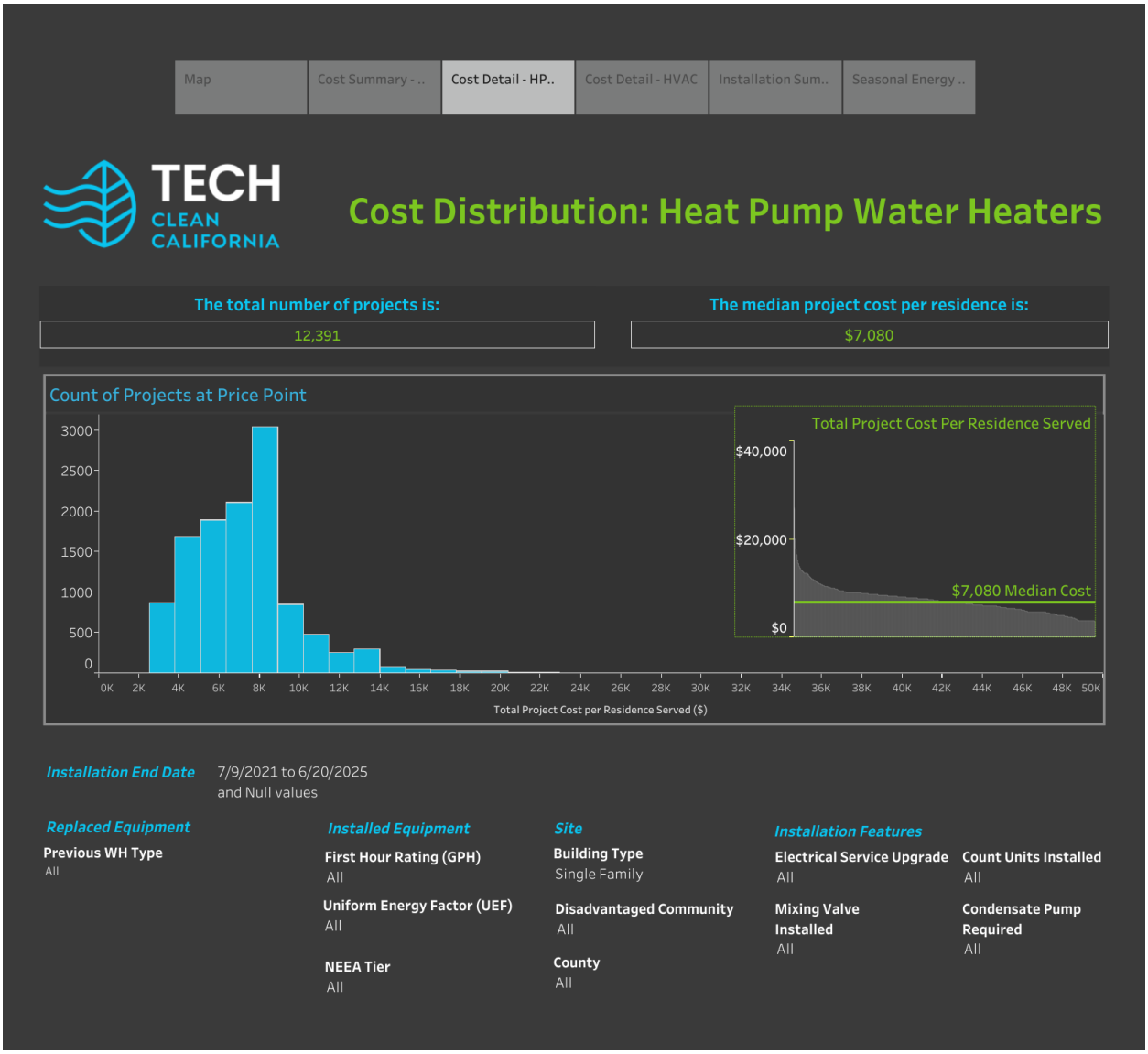


Figure 23: TECH Clean California cost distribution: heat pump water heaters (all counties).

Source: TECH Clean California Public Reporting Heat Pump Data Visuals

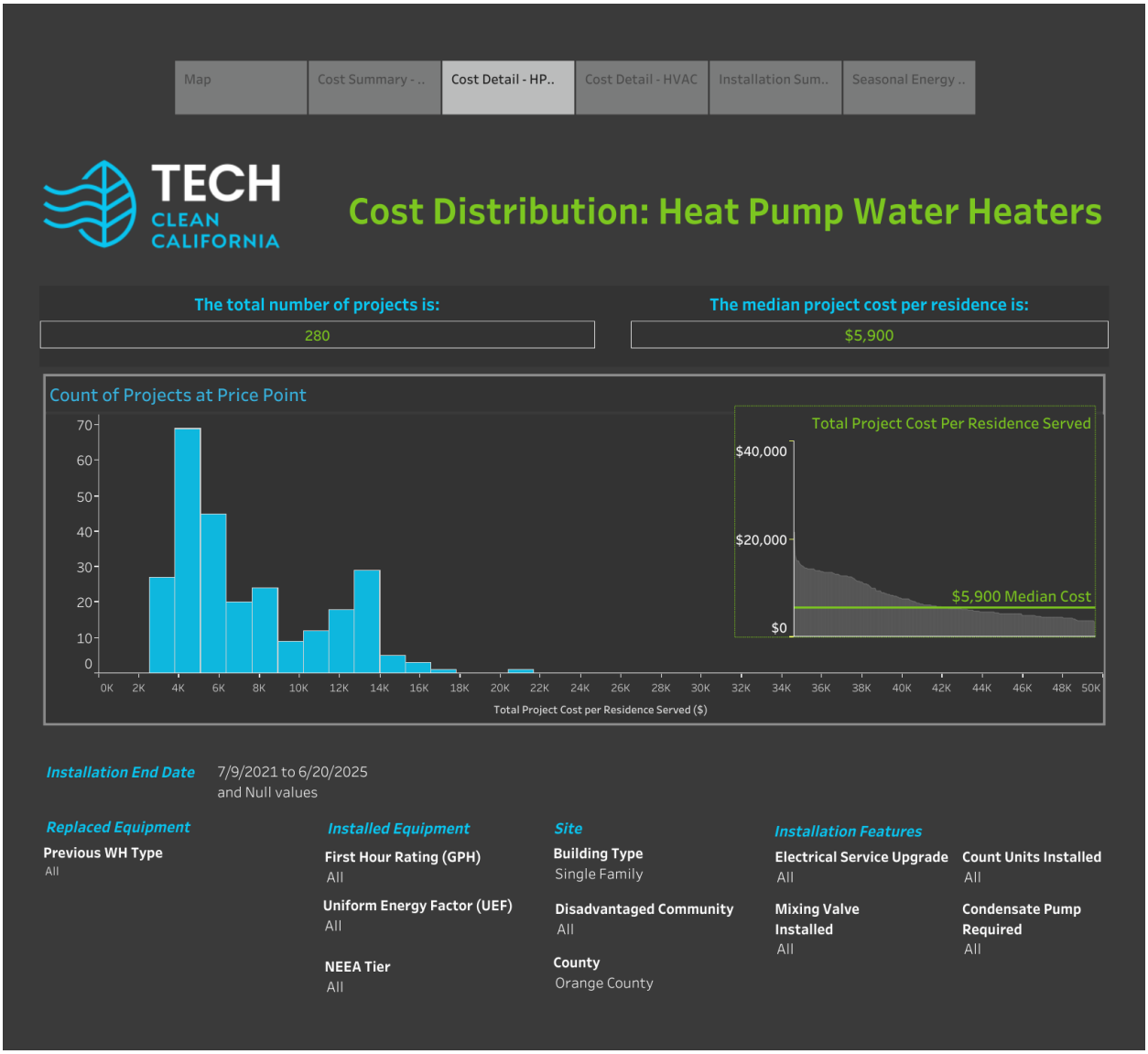


Figure 24: TECH Clean California cost distribution: heat pump water heaters (Orange County).

Source: TECH Clean California Public Reporting Heat Pump Data Visuals

Key Findings

Over the course of the pilot, key findings emerged in three areas: homeowner awareness and messaging, additional constraints impacting electrical upgrades, and incentive design. The success of homeowner engagement was closely tied to the program's transparency and the ease with which homeowners could move through pilot handoff points. Addressing space constraints and mechanical barriers to electrical upgrades was also a necessary pilot component. Finally, several future opportunities to address customer needs through adjusted incentive design and customer targeting approaches emerged based on assessed panel attributes and the presence or absence of solar.

Homeowner Engagement in Electrification Opportunities

Early stages of homeowner engagement during the pilot garnered initial interest and engagement, but this dropped off in later stages as additional barriers prevented homeowners from taking full advantage of available incentives. This highlights how important it is to clearly outline a that makes all opportunities and necessary steps clear at the outset rather than one that includes several contingencies in a multi-stage approach. Areas of particular importance are described below.

- **End-to-end transparency in electrification readiness programs:** Successful residential electrification efforts depend not only on technical feasibility but also on clear, coordinated program design that enables homeowners to act. The pilot revealed that while interest in electrification exists, difficult handoffs at two transition points—from outreach to assessments, and from assessments to contractor involvement—created confusion and disengaged participants. Effective readiness programs must ensure that information is articulated accurately and fully, processes are simple, timelines from launch to customer action are condensed, and support is continuous from initial interest through installation. Prolonged timelines, complexities in enrollment, unclear incentive structures, volatility of incentive funding, and lack of contractor alignment and responsiveness significantly weakened the Focused Pilot's outcomes.
- **Coordinated program delivery model:** Of the 74 participants who received assessments, 47 requested incentives, indicating strong initial interest because of the assessment. However, only 6 of those 47 completed an HPWH installation. The significant drop off between assessment and installation highlights the importance of an integrated delivery model in which assessments directly trigger coordinated engagement from pre-vetted, enrolled contractors. Some motivated participants struggled to obtain timely quotes or installation timelines, which in turn stifled the interest the assessment process built.

  As there were no formal obligations to use reserved incentives, other participants reserved incentives "just in case" the incentive funding was fully reserved, including some participants with plans to leverage TECH Clean Californian HPWH incentives if they returned during the pilot term. The lack of consistent and continuous customer incentives, such as the TECH Clean California single-family market rate HPWH incentives, impedes customer and contractor confidence in anticipated final costs and hinders market adoption. While the team cannot quantify potential increases in pilot installations if TECH Clean Californian HPWH incentives remained available during the pilot as anticipated, the team believes the quantity of assessments and subsequent incentivized installations would have increased significantly. Coordinating a direct handoff from assessment to installation contractors into the program model could have reduced attrition, given the otherwise demonstrable interest in the pilot incentive offering—both by increasing ease of participation for motivated homeowners and by creating clearer decision points for those who might otherwise drop off after incentive reservation.

Installation Space and Ventilation Constraints

Space constraints, access limitations, and structural complexities are largely unknown until an assessment is performed. The pilot's outcomes show that even homes appearing well-suited for HPWH installations face installation barriers that extend beyond simple equipment replacement.

These constraints introduce friction at every phase of the project, from contractor engagement to homeowner decision-making, and must be systematically accounted for in readiness planning. Trends in pilot assessment results demonstrated that:

- **Favorable panel capacity does not guarantee install readiness.** Among the six homes completing HPWH installations, three had 200-amp panels, yet two still lacked sufficient breaker space, even with tandem breakers. Three of the six case study homes had solar systems and four had electric vehicle chargers, further limiting available panel space and indicating that homes on the path to electrification may run into constraints after the process has started but before all upgrades are complete. As more homes adopt distributed energy technologies, retrofitting for electrification must consider the cumulative impact of concurrent 240V loads on breaker space and energy management. Readiness programs should develop integrated load planning tools that account for these trends.
- **Mechanical space limitations are common, even in garages.** Though five of the six installed HPWHs were in garages, three of these projects still involved mechanical access constraints, such as closet locations, limited clearance, or poor ventilation. Three homes had nearby 120V outlets, suggesting that 120V HPWH models could serve as targeted solutions in constrained retrofit environments. However, broader deployment will depend on carefully matching product capacity with household demand and structural conditions.

Evaluation for Required Electrical Upgrades for HPWHs and Other Electrification Measures

The cost of and need for electrical upgrades for HPWHs and related electrification measures varied across pilot participants. Even so, several trends became clear after assessing the sample of homeowners engaged in the pilot, detailed below.

- **Defined need for panel upgrades:** A limited percentage of participating homes had sufficient space and electrical capacity in their panel to accommodate a new electrical load from an HPWH installation. Some assessed homes would likely require panel optimization work to consolidate existing electrical loads with new tandem breakers to create space for new electrification loads. However, many homes, especially those with lower electrical capacity—e.g., 100-amp panels—and those without additional optimization opportunities, would require full panel replacements, utility meter relocation approval, and potentially service upgrades by the utility. Panel status especially varied based on the presence of solar.
    - **Solar drove pre-pilot panel upgrades:** Sixty-one percent of participating homes with solar had 200-amp panels, while 18 percent still had 100-amp panels. The inverse is true for non-solar homes: 15 percent had 200-amp panels, while 63 percent had 100-amp panels. However, higher ampacity panels still frequently had less than two available slots for new electrical load, particularly in homes with solar, suggesting an opportunity for further optimization, as well as for targeting homes with solar for additional, concurrent appliance electrification.
    - **Significant targeting opportunity exists in non-solar segments:** Non-solar homes with 100-amp panels accounted for 85 percent of all 100-amp panel homes in the pilot, indicating a key demographic for intervention. Statewide, approximately 4.7 million single-

family homes built before 2000 without solar—1.7 million in SCE territory—could benefit from panel upgrades prior to electrification.

- **Observed opportunities to incentivize electrification readiness without requiring concurrent, full electrification:** Electrification readiness incentivization without a mandated electrification installation would allow for the 75 percent of customers who replace equipment at the time of failure to convert to heat pump water heating, heat pump HVAC, and other electrification opportunities at the time of failure without additional time and costs associated with panel upgrades and 240-volt electrical supply at the installation location.
- **Potential for tiered incentive structure to influence approach to electrical panel upgrades required for electrification:** While the pilot aimed to maximize incentives in support of customer choice, a tiered panel incentive structure may help convey contractor options for electrification readiness, thereby optimizing the customer experience. Material, labor, permitting, utility meter relocation approval, and service upgrades all impact installation timelines and final costs. A tiered incentive structure for sub-panel installations in comparison to full panel replacements may influence the rate of HPWH and other electrification measures, as well as increase the volume of installs individual contractors can complete over a set period.
- **Additional opportunity for incentives to address pre-electrification power supply at point of installation:** Completing necessary electrical wiring to new electrification loads is in general simpler and lower cost in comparison to meter, panel, or subpanel work. Support for home pre-wiring could have played a greater role in this pilot and may have increased the likelihood of customers opting for future electrification replacements, especially during emergency replacements, e.g., converting a gas water heater to an HPWH at the time of failure.

Recommendations

The Focused Pilot findings indicate several opportunities to improve the design and flow of future electrification programs and pilots. Recommended next steps include creating pathways for electrification awareness and assessments distinct from incentive programs, increasing targeted outreach to customer segments with high potential for full-home electrification, and adjusting pre-electrification incentive design and contractor engagement approaches. These recommendations can be pursued simultaneously and independently of each other, and prioritization can be adjusted based on the scope, budgets, and goals of future program administrators and program implementers.

Assessments and Customer Education

- **Create independent assessment, electrification readiness, and electrification upgrade program pathways.** By defining multiple pathways to access electrification offerings and incentives, utilities can recognize the different motivations of customers at different stages of electrification. This differentiation will likely result in increased customer and contractor engagement, thereby accelerating adoption of HPWH in targeted service areas. During the pilot, electrification assessments and marketing efforts helped to inform customers of HPWH

opportunities, but the on-site tasks completed during the assessment were high-effort, administratively and logistically complex, and required homeowners to schedule contractor follow-up visits. Tying incentives and assessments together added "red tape" that decreased customer awareness and motivation due to perceived and actual barriers to project progress.

- **Create alternative options for customers to properly assess their specific home needs for electrification upgrades.** Support for assessment should evaluate equipment, as well as the potential need for relocation, site modifications, electrical panel replacement, optimization and/or wiring. Homeowners may be best supported through two independent pathways:
    - **Professional evaluation**: In-home assessments by an experienced assessor able to provide in-person, real-time guidance are appreciated and desired by some customer segments. Further clarifications on available incentives, from individual incentive programs or incentives capable of being stacked from multiple programs, can help customers fully understand the electrification and energy efficiency landscape without being overwhelmed by existing online information.
    - **Guided self-evaluation:** Self-assessments, informational guides, online tutorials, photo-submitted assessments, or virtual video assessments serve as alternative or parallel approaches to increase customer education without deploying field staff. In addition to reducing administrative and scheduling barriers for homeowners, this approach may significantly reduce implementation costs and increase the cost-effectiveness of future scaled programs.
- **Leverage independent electrification readiness assessments to avoid duplication of efforts in coordination with building, electrical, plumbing, and HVAC contractors.** Contractors—including HVAC technicians, water heater technicians, electricians, etc.—can reinforce and leverage information from the assessment reports to maximize the value of such reports, and can reduce the burden of explaining electrification benefits and upgrade needs to homeowners. The independence of the data captured in the assessments can also benefit customers, as customers without access to independent assessment data may question the completeness of a contractor's estimate—ecially when multiple, competitive bids are encouraged. A combination of independent assessments and separated work scopes, like electrical upgrades completed in advance of and decoupled from equipment installation, can increase customer confidence in receiving competitive quotes and quality installations.
- **Maintain a reputable, qualified contractor list to increase customer confidence and accelerated upgrade work.** Finding a contractor with experience installing HPWHs and completing electrical panel upgrades and optimization can be an overwhelming task for homeowners. To reduce this burden, customers may benefit from a resource that includes how long an incentive-eligible contractor has been enrolled in a program and their level of experience in completing specific electrification equipment and panel upgrades. Furthermore, ensuring these contractors are educated in advance on program terms and requirements is key to establishing the contractor as a trusted resource for customers. The list must allow for the addition of new contractors and the ongoing incorporation of homeowner feedback on the quality and cost of completed work.

- **Ensure continuity of incentives and program offerings critical for homeowner and market engagement.** The pilot confirmed that assessments and incentives addressed adoption barriers associated with first costs, as well as any barriers associated with a lack of education on HPWH or uncertainty on the electrification readiness of their homes. However, the effectiveness of assessments as an intervention to increase HPWH installations cannot be decoupled from the high, non-scalable electrification upgrade incentives utilized in this pilot. Assessments and homeowner education provided additional standalone value, even considering that TECH Clean Californian HPWH incentive funding was exhausted prior to launching. To increase homeowner and contractor engagement, and to facilitate widespread adoption of HPWHs, electrification readiness incentives must be paired with stable and accessible equipment incentives.

- **Focus on reducing the upfront cost of HPWH installations to increase customer willingness to switch away from existing gas water heaters.** Homeowners were almost universally most concerned with the out-of-pocket cost of HPWH installation, more so than other factors, such as long-term energy costs. The importance of state and utility programs focusing on driving down these installed costs cannot be overstated. Long-term customer satisfaction and energy benefits can be best achieved or accessed by providing structures in which contractors must utilize best practices to properly size and install HPWHs, and in which alternative paths to panel upgrades are clear and accessible.

  These alternatives include panel optimization, targeted application of plug-in 120V HPWH models, and repurposing of existing well-placed 240V outlets, e.g., unused electric dryer outlet in garages or laundry/mechanical rooms. Short-term, it is important to ensure that customers are educated on the use of the HPWH settings, servicing, and ways to optimize energy costs and hot water delivery, which helps achieve better customer satisfaction and benefits from the high efficiency of HPWHs. This education can be delivered at the point of sale, during installations, and ideally routinely after installation or when moving into a new home with an HPWH. Future programs should also consider long-term, systemic reduction of eventual HPWH conversion costs through adjustments to gas water heater placement in new construction settings.

Targeted Outreach and Programming

- **Target non-solar homes with low-capacity electrical panels for panel and service upgrades to limit cost barriers that may emerge at future electrification steps.** Future program administrators should target non-solar homes with low capacity—e.g., 100-amp—electrical panels for pre-electrification upgrades. Based on the demographics of customers who applied for the pilot and completed assessments, and of those converting to HPWH when upgrading their electrical panels, focusing on these customers will maximize the impact and success of future programs. Every homeowner participating in pilot assessments was at a different stage of electrification. Some homeowners already had solar, electric vehicle chargers, or heat pump HVAC systems that had driven previous upgrades to a higher ampacity electrical panel or the optimization of an existing panel to create space for those new loads. However, even higher ampacity panels lacked space for additional breakers, due to a lack of planning for additional electrified appliances. Utilities deliberately targeting homes with older, low ampacity panels

could future-proof electrification planning for the homeowner, as well as significantly reduce the cost of converting individual existing gas appliances and water and space heating systems—either proactively or more commonly at the time of failure.

Incentives

- **Offer pre-electrification incentives independent of equipment upgrades.** Future incentive measure packages and program administrators should consider pre-electrification incentives without a mandated electrification installation. This will reduce future cost barriers by allowing customers to plan ahead, reduce logistical barriers when equipment fails and like-for-like options may otherwise appear to be the only realistic choice, and increase the likelihood that 75 percent of customers who replace their appliances at the time of failure can convert to a high-efficiency electrification option. While the goal of facilitating HPWH, HP-HVAC, induction cooktop, electric clothes dryer, and electric vehicle charger installations remains critical, some homeowners beginning to engage with electrification options may be better engaged through independent pre-electrification and equipment upgrade pathways as opposed to paired ones.

- **Retain pre-electrification incentives paired with equipment upgrades where appropriate.** Future incentive measure packages and program administrators should also allow pre-electrification incentives to be used at the time of electrification appliance replacement as well as at the time of failure. Pilot results show that the barrier to use of pre-electrification and equipment incentives was the requirement for pairing; some customers would still have benefited from optional pairing of these incentives, especially with an informed contractor.

- **Establish tiered incentives for pre-electrification work.** Future incentive measure packages and program administrators should consider tiered pricing for multiple panel scenarios, including panel replacement and sub-panel upgrades, panel optimization, and increased incentives for 120V plug-in low load alternative equipment options. Homes completing panel upgrades or optimization as part of HPWH installations in this pilot had higher invoices than anticipated, suggesting that increased participation from a broader list of TECH Clean California contractors, as well as more nuanced and differentiated incentives for upgrades, would help promote more cost-effective HPWH installations and electrical panel upgrades.

- **Support "pre-wiring" incentives.** Future incentive measure packages and program administrators should consider pre-electrification incentives to support "pre-wiring" for replacing future equipment, reducing total electrification costs, and supporting homeowner electrification planning.

- **Continue analysis of market sizing and incentive impact on naturally occurring market adoption (NOMAD) curve supported by Delphi Panel.** Future incentive recommendations require additional data for sizing the market and projecting NOMAD. Quantifying historical market uptake and modeling NOMAD-estimated baseline data will require populating key parameters of start year, maximum penetration, a coefficient of growth, and a coefficient of imitation. An Initiative Review Committee should reference the following to establish an initial baseline projection over the life of the initiative: research and survey results from the pilot; research and review of published studies from industry associations, universities, and government publications; interviews with industry SMEs, distributors, or manufacturers;

historical sales data from willing distributors and retailers; historical sales data from manufacturers; distributor/dealer surveys about the percentage of high efficiency equipment sales dealer stocking and sales change over time; and a formal Integrated System Planning Study. This could be measured over time through market actor surveys to document changes in stocking and sales of high efficiency equipment.

See Appendix I: NOMAD, Bass Diffusion Curve, and Delphi Panel Considerations for detailed recommendations on estimating NOMAD curve for HPWH, the formula and parameters to create a NOMAD baseline estimate, and recommendations for identify industry experts for establishing a Delphi Panel.

Contractor Education and Participation

- **Engage contractors early to increase program success.** Whether through the maintenance of a list of qualified contractors, or through early targeted outreach to a select subset of contractors with specific capabilities—e.g., whole-home pre-electrification work plus HPWH installations—it is critical to guide customers to qualified contractors who are aware of program offerings. This handoff point substantially influenced the pilot results and should be a focus of future pre-electrification program designs in cases where electrical and equipment upgrade incentives are coupled.
- **Drive contractor engagement through stable and consistent incentives.** Future program administrators should anticipate slow adoption but accelerated participation by qualified contractors as programs gain longevity and customers and contractors can rely on the stability of incentives over multiple years. Significant gaps in incentive funding are detrimental to program success, as highlighted by the impact of the absence of TECH Clean Californian HPWH incentives during the pilot program period. Because the team had anticipated the return of TECH Clean Californian HPWH incentive funding but it ultimately could not be accessed, homeowners had lower motivation to move forward with electrification upgrades and HPWH installations.

References

Barnett Plumbing. 2023. *Bridging the Gap to Heat Pump Adoption: Water Heater Loaner Program .* July 27. https://apppack-app-tech-reporting-prod-privates3bucket-z0onruvirqb2.s3.amazonaws.com/documents/Barnett_Plumbing_-_Final_Report_230810.pdf?AWSAccessKeyId=ASIASLLU4AX2GOL56ZEX&Signature=JrzysD0u66OrQ7XvTS.

California Legislature. 2018. *SB 1477: Low-emissions buildings and sources of heat energy.* September 14. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1477.

EIA. n.d. *Residential Energy Consumption Survey.* https://www.eia.gov/consumption/residential/.

Franklin Energy. 2024. *Addressing Home Repair Barriers in Marin Clean Energy's Home Energy Savings Program.* August 14. https://techcleanca.com/quick-start-grants/2021-quick-start-grant-recipients/franklin-energy/.

Loomis, Jen, and Ellen Steiner. 2024. *TECH Clean California: Time I Market Assessment Findings.* Opinion Dynamics. https://techcleanca.com/documents/4687/TECH_Time_1_Market_Assessment_Final_Report_4.22.24.pdf.

NEAA. 2018. "Water Heater Market Characterization Report." April 3.

NEEA. 2018. "Water Heater Characterization Report."

NREL. n.d. *ResStock Building Stock Analysis.* Accessed April 6, 2023. https://resstock.nrel.gov/.

Opinion Dynamics. 2022. "California Heat Pump Residential Market Characterization and Baseline Study."

Opinion Dynamics. 2025. *TECH Clean California: Insights into Customer Experience and Satisfactions.* TECH Clean California. https://techcleanca.com/documents/5601/TECH_Updated_Customer_Experience_and_Satisfaction_Report_3.31.2025_Clean_UPDATED.pdf.

Opinion Dynamics. 2022. "Technology and Equipment for Clean Heating (TECH) Initiative Baseline Market Assessment."

RHA. 2024. *Heat Pump Water Heater Retrofit Installation Field Guide and Job Aids .* https://techcleanca.com/quick-start-grants/2022-qsg-recipients/rha-heat-pump-water-heater-best-practices-and-field-guide/.

TECH Clean California. n.d. *Innovative Customer Targeting Pilot.* https://techcleanca.com/pilots/strategic-customer-targeting/.

—. n.d. *Public Data.* https://techcleanca.com/public-data/data-visualizations/.

—. 2025. *Single Family Incentives.* June 17. https://techcleanca.com/incentives/single-family-incentives/.

The Switch is On. n.d. Accessed May 15, 2024. https://switchison.org/.

VEIC. 2024. *Emergency Replacement Heat Pump Water Heater Market Study.*

Appendix A: Background on TECH HPWH Initiatives

TECH Clean California

TECH Clean California is a statewide market transformation initiative launched in 2021 with the objective of accelerating the adoption of heat pump technologies to support California's carbon neutrality goals. Prior to the program, HPWHs were present in about 2 percent of multifamily homes and less than 1 percent of single-family homes in California (Opinion Dynamics 2022). Homeowners were largely unaware of HPWHs, and many of those who were familiar were concerned about increasing their utility costs. Additionally, more than half reported the need for an electric panel upgrade as a barrier to installing an HPWH in their home.

Contractors reported less than one HPWH per month in 2021, and more than one-third of those surveyed did not sell any in the past year. As of May 2023, TECH Clean California reports 4,763 single-family HPWH installations since the launch in September 2021, a median project installation cost of $6,599, and a total incentive received by the contractor of $3,800 (TECH Clean California n.d.).

The TECH Clean California program is designed to ensure a thriving market for clean heating technologies within the next ten years. Within the initiative, regional pilots, and Quick Start Grants (QSGs) are intended to test strategies overcoming market barriers to adoption of heat pump technologies. Several of these pilot projects have generated lessons relevant to this Focused Pilot.

TECH Quick Start Grant: Addressing Home Repair Barriers in Marin Clean Energy's Home Energy Savings Program

The Marin Clean Energy (MCE) Home Energy Savings (HES) program is a direct install energy efficiency program that provides residential customers with no-cost home energy assessments and upgrades to more efficient home appliances, including heat pumps (Franklin Energy 2024). However, as program funds must be tied to energy saving measures, the upfront costs to address the needed electrical repairs had to be covered by the customer. This gap in coverage, along with a lack of awareness of what maintenance is required, prevented many from moving forward with installations and limited the program's ability to electrify many homes. Seeing this opportunity, Franklin Energy received funding through a TECH Clean California QSG to provide dedicated funding specifically for these repairs. This grant funding was combined or "layered" with the HES program funding, allowing the program to pay for the home repairs necessary before heat pumps could be installed and remove the financial burden of electrification readiness work from the homeowner.

During the QSG project implementation period, 9 of the 33 HPWHs (27 percent) installed through the HES program required grant funding to run a dedicated electrical circuit. Unlike gas units, which typically require minimal electrical input, HPWHs often necessitate wiring and panel upgrades to accommodate their electrical demands. The dedicated circuit ensures safe, uninterrupted power supply, prevents overload on shared circuits, and complies with electrical code requirements.

This was the only repair needed for water heaters replaced during the QSG project, averaging $1,250 per home in electrification readiness costs. However, there were several efficiencies the project was able to leverage to drive costs down below typical market rates.

Instead of requiring homeowners to find separate contractors for the repairs, the existing program contractors, who were already performing the efficiency measures and heat pump installations, also performed the home repairs. Using a single, experienced contractor who had a guaranteed portfolio of work from the closed program model allowed them to offer competitive pricing, resulting in lower-than-market rates for repairs. The contractor could often perform all necessary work, including repairs and installation, in one trip to the residence. Experienced staff could efficiently scope, itemize, and execute the work quickly, often completing those repairs and installation in a single day. To further minimize costs and increase efficiency, repairs were categorized into minor, moderate, or major tiers, each with a set price, rather than requiring individualized quotes for every home. This system reduced administrative time for program administrators and benefited the customer by allowing work to begin more quickly. It also provided a clear overview of the severity of repairs needed for future budgeting.

TECH Clean California Quick Start Grant: Heat Pump Water Heater Best Practices and Field Guide

Through a TECH Clean California QSG, Richard Health & Associates (RHA) aimed to address key barriers to the widespread adoption of HPWHs by developing an industry best practices document and visual job aids for HPWH retrofit installations (RHA 2024). The project team assembled a diverse group of stakeholders—including subject matter experts, educators, contractors, and industry partners—to collaboratively create these field guide resources. Rather than creating educational materials themselves, RHA developed this guide for others to align their training programs with. By doing so, the content can be readily integrated by training providers, leveraging the existing network of resources instead of introducing something entirely new.

Additionally, RHA utilized the panel of experts and content from the best practices document to create job aids for the retrofit installation of HPWH to be used by installers in the field. These job aids provide simple, high-level information paired with visuals that guides technicians through the installation process, cross-references their work, and reinforces their learning. This method offers a rapidly scalable pathway to ensure that contractors consistently apply uniform methods resulting in safe, quality, and compliant retrofit installations.

The materials received high approval the group of contractors who piloted them, commending their ease of adoption and usefulness in addressing a known barrier to workforce development. Consequently, the contractors have since incorporated the documents into their regular operations following this project. Training providers have also expressed excitement about leveraging the information from this project in their own materials. RHA plans to collaborate with California investor-owned utilities (IOUs) to further integrate this content into workforce education and training efforts.

TECH Clean California Quick Start Grant: Gas Loaner Program

Approximately 90 percent of water heater replacements performed by Barnett Plumbing are emergency replacements. In these situations, customers often proceed with whichever solution restores their hot water the quickest and cannot wait for the retrofit requirements that would allow them to convert from a gas water heater to an HPWH. With so few customers looking to proactively electrify their equipment, the ability to provide an emergency replacement HPWH that does not inconvenience the customer is essential to decarbonizing California's residential building stock.

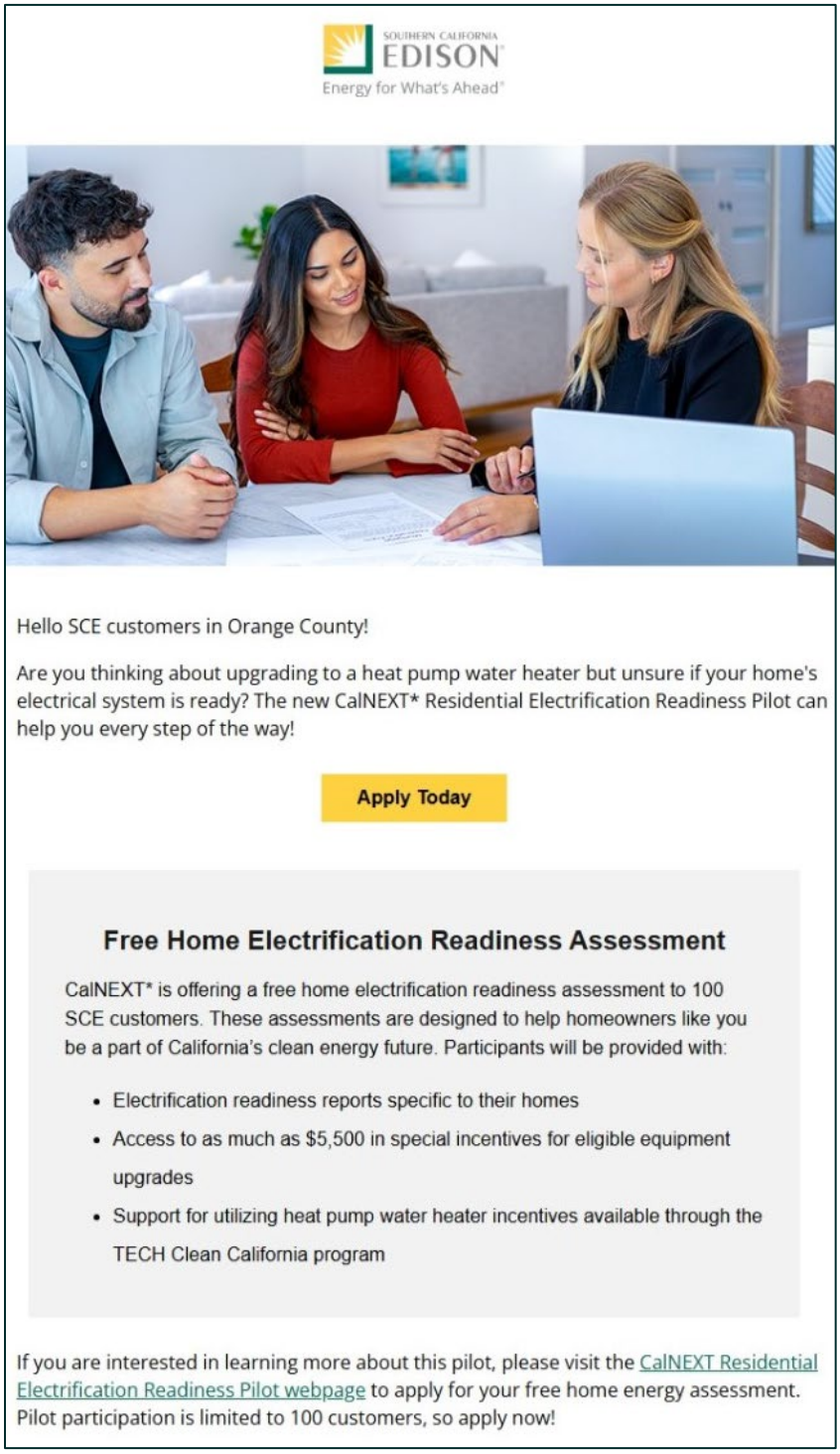
Barnett Plumbing was awarded a QSG through TECH Clean California to test whether providing a temporary gas water heater while retrofits were completed would enable more households to switch to HPWHs (Barnett Plumbing 2023). The QSG project provided same-day hot water restoration through a gas loaner water heater at no cost to homeowners, creating sufficient time to complete necessary electrical upgrades and HPWH installation. The gas loaner was removed after the retrofit was complete, leaving a home previously facing an emergency replacement with an efficient all-electric source of hot water.

This method resulted in Barnett Plumbing completing 149 HPWH installations in 2022, increasing customer conversion to HPWHs from less than 1 percent to 17 percent. In addition, Barnett Plumbing developed an effective targeted marketing campaign and technician training program to support the project's success and reported extremely high customer satisfaction with the process. As the loaners were repurposed for multiple installations, the QSG only provided funds to cover the added cost of labor from the gas loaner installation and removal.

Following the end of this project, Barnett Plumbing has continued to provide customers with loaners to bridge the gap in TECH Clean California funding for residential HPWH incentives. In addition, Barnett has added new 120-volt (120V) plug-in HPWHs as an alternative to the loaner option for customers in their service area. During the post-program period, Barnett reported an increased conversion rate of 52 percent with these combined strategies. This strategy demonstrated an effective structure for contractors to convert customers to HPWHs in most replacement scenarios.

Appendix B: Pilot Marketing Materials

SCE Customer Outreach Email



SOUTHERN CALIFORNIA EDISON
Energy for What's Ahead

Hello SCE customers in Orange County!

Are you thinking about upgrading to a heat pump water heater but unsure if your home's electrical system is ready? The new CalNEXT* Residential Electrification Readiness Pilot can help you every step of the way!

Apply Today

Free Home Electrification Readiness Assessment

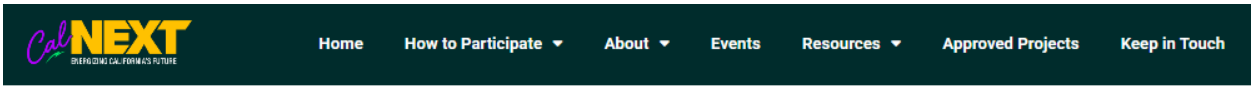
CalNEXT* is offering a free home electrification readiness assessment to 100 SCE customers. These assessments are designed to help homeowners like you be a part of California's clean energy future. Participants will be provided with:

- Electrification readiness reports specific to their homes
- Access to as much as $5,500 in special incentives for eligible equipment upgrades
- Support for utilizing heat pump water heater incentives available through the TECH Clean California program

If you are interested in learning more about this pilot, please visit the CalNEXT Residential Electrification Readiness Pilot webpage to apply for your free home energy assessment. Pilot participation is limited to 100 customers, so apply now!

Assessment Application Landing Page

https://calnext.com/hpwh-pilot/



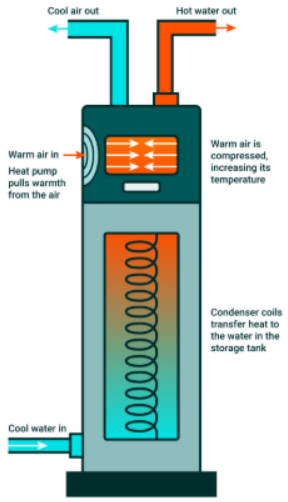
Residential Electrification Readiness Pilot

About the Pilot

The CalNEXT Residential Electrification Readiness Pilot is designed to help homeowners served by Southern California Edison (SCE) be a part of California's clean energy future. Installing new and efficient electric equipment can benefit your wallet. However, replacing appliances with new, more efficient models can require additional preparation. That's where this pilot can help!

Through this pilot, we will provide you with a **free** assessment of your home's electric readiness. Our trained technicians will help you identify opportunities and make the right decisions for your home.

Homes across California can benefit from switching to high-efficiency all-electric appliances. Find out if your home is ready by scheduling an electrification readiness assessment—at no cost to you!



By transferring heat rather than creating it, heat pumps deliver hot water 3-4 times more efficiently than conventional water heaters.

Benefits of Participation

A home electrification readiness assessment that will list all necessary tasks to **prepare your home for a heat pump water heater** and other high-efficiency electrical appliances.

Eligibility for up to **$5,500** in incentives to offset the cost of electrical-readiness upgrades, including potential electrical panel, wiring upgrades, or other site preparation work needed to install a heat pump water heater.

Guidance on all incentives available to reduce your out-of-pocket costs, steps for reserving incentives, and support finding an incentive-eligible contractor to complete your heat pump water heater installation and any necessary prep work.

Basic Requirements

Pilot only available to single-family homes.

Only Southern California Edison (SCE) customers are eligible to participate.

SCE employees or affiliates are ineligible to participate.

If you have questions, please check out our FAQs below.

Pilot Participation Steps

1. **Update June 9, 2025: Applications are now closed.**
2. **Schedule.** If you are selected, a representative from the pilot program will contact you to schedule the 75-minute home electrification readiness assessment and you will receive the Customer Implementation Agreement which you must sign to receive the home electrification readiness assessment.
3. **Assess.** The assessor will visit your home during the scheduled time and conduct the home electrification readiness assessment.
4. **Review.** After the assessment is complete, the assessor will review your home energy assessment report with you in-person to help you determine the next steps for preparing your home for electrification and accessing available incentives. If you are not available for an in-person review, a virtual review will be scheduled within three days of the assessment.
5. **Reserve.** Reserve your electrical readiness improvement incentives by following the instructions on your home assessment report.
6. **Install.** Select your eligible contractor from the list provided in your assessment report, install electrification readiness upgrades, and install your new heat pump water heater. Once the installations are complete, your contractor invoice will include all eligible incentives.
7. **Enjoy.** Enjoy your new heat pump water heater and electric-ready home!

Pilot Application

1. Name *

Enter your answer

2. Address *

Enter your answer

3. Email *

Please enter an email

4. Mobile Phone *

Enter your answer

5. Alternative Contact Name

Enter your answer

6. Alternative Contact Email

Please enter an email

7. Alternative Contact Mobile Phone

Enter your answer

8. Please acknowledge and accept all of the following statements in order to qualify: *

Please select 5 options.

- [ ] I acknowledge that an adult representative of the household will need to be present and available during the in-home electrical readiness assessment.
- [ ] I permit the CalNEXT Electrification Readiness Pilot team to contact me by phone call, text message, and email.
- [ ] I permit the CalNEXT Electrification Readiness Pilot team to access historic utility account data through SCE.
- [ ] I am an SCE customer. This pilot is only available to SCE customers. Any applications received from non-SCE customers will be rejected.
- [ ] I am not an SCE employee or an employee of an affiliate. Please note that SCE employees or affiliates are not eligible. Any applications received from SCE employees or affiliates will be rejected.

9. What type of fuel does your current water heater use? *

Select your answer

10. What type of tank does your current water heater have? *

Select your answer

11. Have you replaced your water heater in the last five years? *

Select your answer

12. Have you heard of a heat pump water heater? *

Select your answer

13. Have you considered replacing your existing water heater with a heat pump water heater in your home? *

Select your answer

14. What has prevented you from scheduling an installation?

- [ ] Cost
- [ ] Time
- [ ] Waiting for current water heater end of life
- [ ] Unsure if electrical work is needed first
- [ ] Other

15. Are you interested in any other new high efficiency electric equipment or appliances in your home? *

- [ ] Induction cooktops
- [ ] Electric vehicle
- [ ] Heat pump HVAC system
- [ ] Solar panels
- [ ] None
- [ ] Other

FAQs

Does completing the pilot application below guarantee a free electrical readiness assessment?

No. The pilot will only be conducting ~100 electrical readiness assessments. Final selection of participating single-family homes will be subject to location and scheduling availability of completed pilot applications.

What if I am not selected to receive a free electrical readiness assessment?

The electrical readiness assessment is not the only way to begin your home electrification journey! TECH Clean California provides heat pump water heater and other energy efficiency incentives for Californians. Find out more about incentives available to you right now at switchison.org.

How long will the in-home electrification readiness assessment take?

In-home assessments are expected to last no longer than 75 minutes. The assessor will arrive and ask an adult representative of the household a few questions, then walk around the inside and outside of your property to "assess" electrification opportunities. At the end of the assessment, the representative will review your results and share a digital copy of your assessment report.

Am I guaranteed electrical panel incentives if I complete an electrical readiness assessment?

No. There are limited funds available for electrical panel incentives. Incentives will be available on a first-come, first-served basis.

What electrical panel incentives are available to electrification readiness pilot participants?

If you are selected to participate in this pilot, you will be eligible to reserve up to $5,500 in electrical readiness incentives to help you prepare your home for a heat pump water heater installation. Electrical readiness incentives are limited and available on a first-come, first-served basis. Incentives will be included on your contractor invoice after you complete the electrical upgrades and install your new heat pump water heater.

Electrical Panel Upgrade Rebate	Electrical Wiring, Circuits, and Auxiliary	Maximum Electrification Readiness Incentive
$4,000	$1,500	$5,500

What additional incentives are available for completing my electrification project?

You are eligible to receive existing incentives available to all qualifying SCE customers through TECH Clean California. TECH Clean California offers statewide heat pump water heater incentives to California residents. Visit switchison.org for available incentives and details. Please note that any additional incentives are outside of the jurisdiction of this pilot, are subject to funding availability, and may be determined on a case-by-case basis. After you complete your electrical readiness assessment, you will be provided with a comprehensive guide to all relevant incentives that may be available to you.

How long can I reserve electrical upgrade incentive funds for?

You will have a total of **45 days** from reserving incentives or **until May 31, 2025,** to complete electrical panel upgrades as well as a heat pump water heater installation. The final installation date will default to whichever date arrives first. Additional communication may be required during the contractor selection, estimate, and installation process to allow for unused incentives to be reallocated to others, if needed. Reasonable extensions of the required time period will be granted if the pilot participants clearly communicate such extension requests with the pilot team.

Do I have to pay for the electrical upgrades and heat pump water heater installation up front?

No. All incentives will be included on the invoice from your contractor. **Note: Incentives are only available through eligible contractors.**

Can I use a contractor of my choice?

You are required to use one of the eligible contractors for electrical upgrades and your heat pump water heater installation. A list of eligible contractors in your area will be included in your home assessment report.

Am I required to use the same contractor for electrical and heat pump installation?

Yes, you are required to use the same contractor for your heat pump water heater installation and your electrical upgrades.

What are the benefits of switching to high-efficiency electrical appliances?

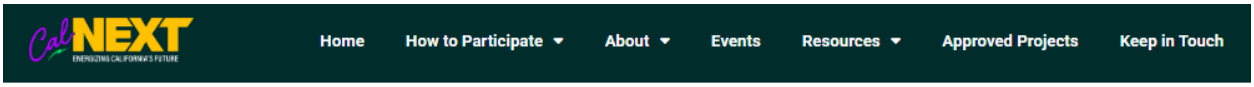
Switching to high-efficiency electric appliances and features in your home can improve indoor air quality and safety, reduce your energy bill, increase your home's efficiency, and lower emissions. For more details, visit switchison.org.

Why should I consider installing a heat pump water heater?

Water heating is the second largest energy use in your home. A heat pump water heater can provide all the hot water you need with a fraction of the energy. A heat pump water heater can be three times more efficient than conventional water heaters and can help you save on the cost of heating your water. For more details on water heating, visit switchison.org/water-heating or download this Heat Pump Water Heating Fact Sheet.

Incentive Reservation Landing Page

https://calnext.com/hpwh-pilot/reserve/



Congratulations on completing your home electrification readiness assessment!

Now that you have completed your home electrification readiness assessment and received your home's electrification readiness report, you are eligible to move on to the second part of the pilot: to partner with an eligible contractor for your home electrification readiness upgrades and complete a heat pump water heater installation.

Your on-site home energy assessor should have reviewed the report with you after completing the assessment. If you are still uncertain about the electrification readiness of your home, please refer to your Assessment Report or contact the assessor listed on your report.

Reminders

- Pilot incentives are not guaranteed until reserved. Reservations will be issued on a first-come, first-served basis.
- You must select one eligible contractor to perform both your heat pump water heater installation and electrification readiness upgrades.
- You are eligible for up to $5,500 in incentives to offset the cost of electrification readiness upgrades, including potential electrical panel replacement, electrical panel upgrades, wiring upgrades, water heater relocation, or other site preparation work needed to install a heat pump water heater.
  - $4,000 for electrical panel upgrades
  - $1,500 for electrical wiring, circuits, and auxiliary work.
  - Please see the What additional incentives are available for completing my electrification project? section of the FAQs for more information on available heat pump water heater rebates.
- You will have a total of 45 days from reserving incentives or until May 31, 2025, to complete electrical panel upgrades as well as a heat pump water heater installation. The final installation date will default to whichever date arrives first.
- Incentives will be passed down to you through your eligible contractor and will be included on your heat pump water heater installation invoice.
- Participants will be required to complete a survey after participation.

If you have questions, please check out our FAQs below.

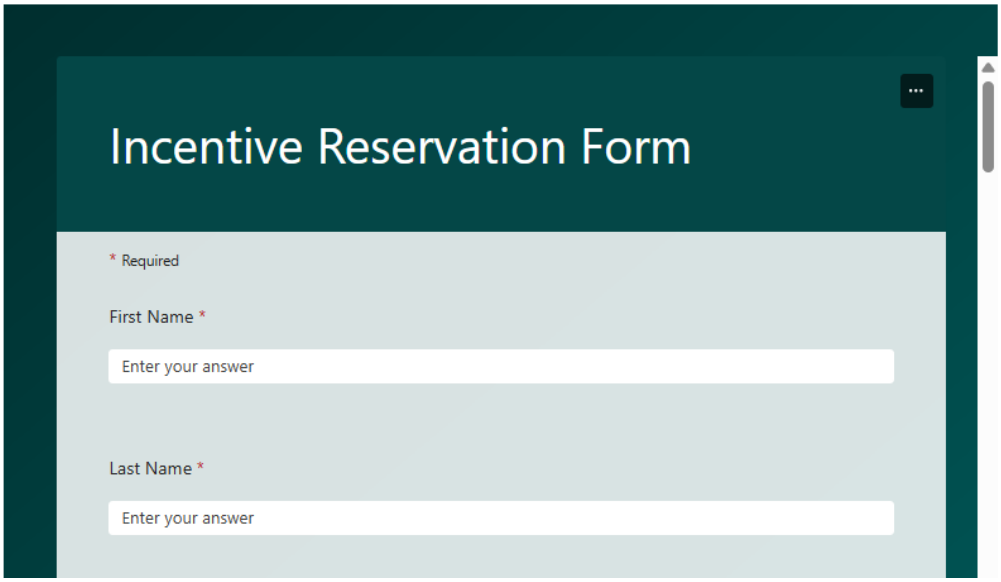
Next Steps

1. **Reserve.** Fill out the Incentive Reservation Form below to reserve your pilot incentives!
2. **Sign.** After submitting your reservation, the pilot team will send you Exhibit B of the Customer Implementation Agreement which you must sign to confirm your incentive reservation.
3. **Select.** Select your eligible contractor from the Eligible Contractor List below.
4. **Install.** Install your electrification readiness upgrades and your new heat pump water heater. Once installations are complete, your contractor invoice will include all eligible incentives.
5. **Enjoy.** Enjoy your new heat pump water heater and electrification-ready home!

Eligible Contractor List

You must use a contractor from the list below to receive pilot incentives. This list will be updated regularly, so check back for additional contractor options.

Company	Phone Number(s)	Email	Website
Sustainable Home Construction	(562) 319-9377	info@greenshc.com	greenshc.com
Synergy Companies	(510) 825-9359	davidprice@synergycompanies.org	synergycompanies.com
California United Plumbing, Inc.	(562) 944-2288 (562) 304-4149	jose@calunitedplumbing.com	calunitedplumbing.com
SolHome	(619) 333-4824	info@mysolhome.com	mysolhome.com
Alpha Energy Group, Inc.	(657) 214-2006	alphaeg10606@gmail.com	alphaeginc.com
Brightside Heating & Air Conditioning, Inc.	(844) 444-3499	brightsideair@gmail.com	4fixx.com
Omega Energy, Inc. dba Evergreen Construction	(213) 215-7054	davjsuh@gmail.com	evergreensmartenergy.com



3. Street Address *

Enter your answer

4. City *

Enter your answer

5. ZIP Code *

Enter your answer

6. Email *

Enter your answer

7. Cell Phone *

Enter your answer

8. Alternative Contact Name

Enter your answer

9. Alternative Contact Email

Enter your answer

10. Alternative Contact Cell Phone

Enter your answer

11. Please read and check all three acknowledgments below: *

Please select 3 options.

- [ ] I acknowledge that pilot incentives will only be reserved upon signature of Exhibit B of the customer implementation agreement.
- [ ] I acknowledge that upon signature of Exhibit B of the customer implementation agreement, incentives will be reserved for a period of **45 days or until May 31, 2025 (whichever arrives first)**.
- [ ] I acknowledge the pilot incentives for electrification readiness will only be issued upon completion of the heat pump water heater installation. Panel and electrification upgrades without an associated heat pump water heater installation will not be incentivized.

12. What upgrades are you interested in pursuing through this pilot? (Select one) *

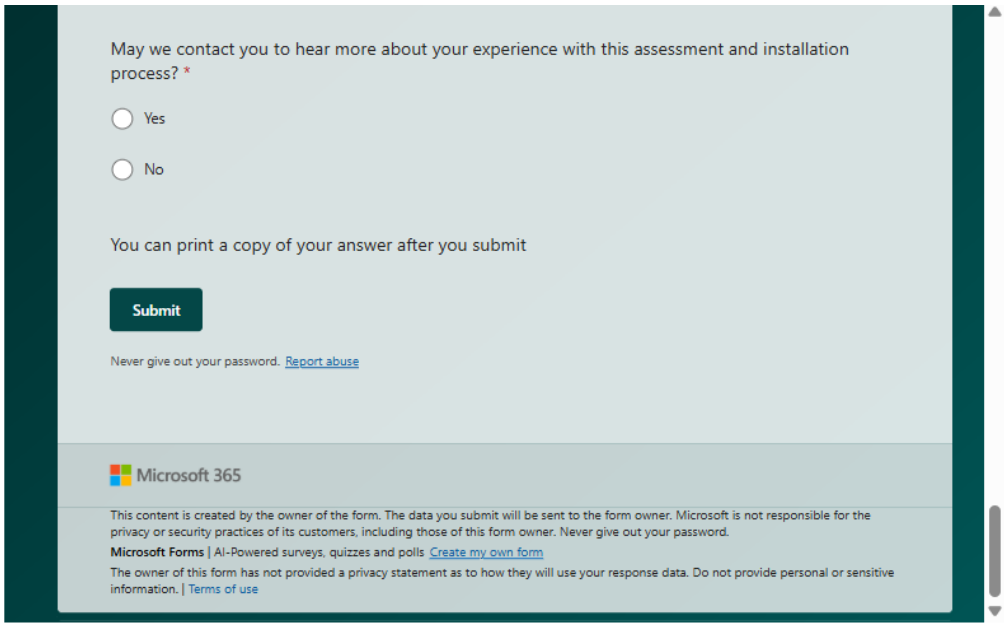
- ◯ Electrical panel/wiring upgrade **and** heat pump water heater installation
- ◯ Only heat pump water heater installation

13. Will you be pursuing any other new high-efficiency electric equipment or appliance improvements in your home? (Select all that apply) *

- [ ] Heat Pump HVAC System
- [ ] Induction Cooktops
- [ ] Electric Clothes Dryer
- [ ] Solar Panels
- [ ] Batteries
- [ ] Electric Vehicle
- [ ] Not at this time
- [ ] Other

14. Did any aspects of the assessment help simplify the process of installing a heat pump water heater? (Select all that apply) *

- [ ] Understanding my home's readiness for a heat pump water heater
- [ ] Learning about available rebates and incentives
- [ ] Understanding potential energy bill impacts
- [ ] Guidance on necessary electrical upgrades
- [ ] No
- [ ] Other



FAQs

If you have any additional questions, please contact the pilot team at CalNEXT@veic.org.

Does completing the Incentive Reservation Form above guarantee me pilot incentives?

No. You must sign Exhibit B of the Customer Implementation Agreement in order to reserve pilot incentives. Incentives will be reserved on a first come, first served basis. Signing Exhibit B of the Customer Implementation Agreement is a prerequisite to receive pilot incentives.

How long can I reserve electrical panel incentive funds for?

After you sign Exhibit B of the Customer Implementation Agreement, incentives will be reserved for **45 days or until May 31, 2025**. During this window, you must select an eligible contractor, complete your electrical panel upgrades as well as the heat pump water heater installation.

Additional communications may be required during the contractor selection, estimate, and installation process to allow for unused incentives to be reallocated to others, if needed. (The pilot will accommodate all participants should reasonable delays occur and are clearly communicated with pilot team.)

Please contact the pilot team at CalNEXT@veic.org and request extending your reservation. The pilot will require all installations to be completed by May 31, 2025.

What if my contractor cannot install my heat pump water heater and electrical upgrades within 45 days?

Please contact the pilot team at CalNEXT@veic.org and request extending your reservation. The pilot will require all installations to be completed by May 31, 2025.

What if I am not selected to receive pilot incentives?

The pilot incentives are not the only way to begin your home electrification journey! TECH Clean California provides heat pump water heater and other energy efficiency incentives for Californians. Find out more about incentives available to you right now at switchison.org.

What electrical panel incentives are available to electrification readiness pilot participants?

You will be eligible to reserve up to $5,500 in electrification readiness incentives to help you prepare your home for a heat pump water heater installation. Electrification readiness incentives are limited and available on a first-come, first-served basis. Incentives will be included on your contractor invoice after you complete the electrical upgrades and install your new heat pump water heater.

Electrical Panel Upgrade Rebate	Electrical Wiring, Circuits, and Auxiliary	Maximum Electrification Readiness Incentive
$4,000	$1,500	$5,500

What additional incentives are available for completing my electrification project?

You are eligible to receive existing incentives available to all qualifying SCE customers through TECH Clean California. TECH Clean California offers state-wide heat pump water heater incentives to California residents. Visit switchison.org for available incentives and details. Please note that any additional incentives are outside of the jurisdiction of this pilot, are subject to funding availability, and may be determined on a case-by-case basis.

Do I have to pay for the electrical upgrades and heat pump water heater installation up front?

No. All heat pump water heater and electrification readiness incentives will be included on the invoice from your contractor.
Note: Incentives are only available through eligible contractors.

Can I use a contractor of my choice?

You are required to use one of the eligible contractors from the list above for electrical upgrades and your heat pump water heater installation. A link to a list of eligible contractors in your area was also included in your home assessment report.

Your contractor can learn more about enrollment by visiting switchison.org/ca/pros.

Your contractor can also start here to begin the enrollment process.

Am I required to use the same contractor for electrical and heat pump installation?

Yes, you are required to use the same contractor for your heat pump water heater installation and your electrical upgrades.

Appendix C: SGIP and TECH Clean California Electrical and Pre-Electrical Upgrades

Upgrade Category	Upgrade Detail	General Market	Equity
Electrical Upgrades	Main service panel upgrade or replacement (up to 200 amps)	X	X
	Main service panel relocation	X	X
	Installation of a smart load center/smart breaker	X	X
	Installation, replacement, or upgrade of a subpanel	X	X
	Behind the meter feeder upgrade	X	X
	Service disconnect/dwelling unit main disconnect upgrade	X	X
Additional Plumbing/Electrical	New branch circuits, circuit breakers, disconnects or any electrical upgrades between panel/subpanel and new HPWH.		X
	Running an outlet or shared-circuit extension for new 120V HPWH		X
	Replacing galvanized or leaking existing pipes within ten linear feet of the existing water heater or newly installed HPWH		X
	Installing of more than 20 linear feet of new piping to connect new HPWH to existing plumbing due to HPWH relocation		X
	Installation of atypical condensate removal and/or major updates to T&P discharge piping (subject to project-specific pre-approval), such as pumped vertical piping, piping into existing behind-the-wall sewer drains, or discharge piping exceeding 25 linear feet		X
	Ineligible: Fixing plumbing or leaks at end uses (showers, tubs, kitchen/bathroom faucets, toilets) Repair, replacement, or new installation of branch circuits unassociated with the newly installed HPWH Installing a new recirculation loop or new recirculation pump		

Upgrade Category	Upgrade Detail	General Market	Equity
Relocation of HPWH	Relocate HPWH – must be a full 1:1 replacement of prior water heater. Includes cost of new HPWH interior space or exterior enclosure (where applicable).		X
	Ineligible: HPWH that is installed in a new dwelling unit or other new location such that it is not serving any of the end uses that were served by the prior water heater.		
Venting	Supply and/or exhaust ductwork for HPWH		X
	Building modifications needed for ductwork (increasing space of HPWH enclosure or penetrations through wall assemblies)		X
	Installing louver(s) at HPWH room/enclosure		X
	Installing a new louvered door and/or replacing existing door to HPWH room/enclosure		X
	Expanding HPWH enclosure if necessary to ensure new HPWH will fit		X
Replace/repair/seal flooring, walls, or ceiling due to leakage or improper venting	Water damage to flooring, walls, or ceiling caused by leaks from prior water heater (photo documentation may be requested)		X
	Water damage to flooring, walls, or ceiling caused by leaks from pipes, rain, or plumbing end uses within ten linear feet of the existing water heater or newly installed HPWH (photo documentation may be requested)		X
	Patching of louvers from prior gas/propane water heaters		X
	Patching of roof/wall vents from prior gas water heater		X
	Expanding HPWH room/enclosure where necessary to ensure new HPWH can fit		X

Appendix D: Participant Data Analysis Tables

Category	Variable	Total Applicants	Selected Applicants	Completed Assessment	Reserved Incentive	Completed Install
Existing fuel type	Electric	31	19	5	4	0
	Electric heat pump	7	0	0	0	0
	Gas	1	1	1	0	0
	I don't know	12	9	0	0	0
	Natural gas	220	195	67	42	6
	Propane	1	1	1	1	0
Existing tank type	I don't know	15	9	2	2	0
	Storage tank	229	190	67	41	6
	Tankless	28	26	5	4	0
Familiar with HPWH	No	149	126	36	22	3
	Yes	123	99	38	25	3
Considered HPWH replacement	No	23	19	9	5	0
	Yes	100	80	29	20	3
Has solar	No	193	179	58	36	5
	Yes	49	46	16	11	1
Care rate	No	182	171	58	40	5
	Yes	60	54	16	7	1

Category	Variable	Total Applicants	Selected Applicants	Completed Assessment	Reserved Incentive	Completed Install
In DAC	No	229	213	72	46	6
	Yes	13	12	2	1	0
FERA rate	No	240	223	73	46	6
	Yes	2	2	1	1	0
Household income	$100,000–$124,999	27	25	5	4	0
	$125,000 and above	86	81	25	15	1
	$15,000–$19,999	5	5	1	1	0
	$20,000–$29,999	10	10	5	3	0
	$30,000–$39,999	8	6	1	1	0
	$50,000–$74,999	38	36	14	6	1
	$75,000–$99,999	44	40	16	11	2
	Below $15,000	4	4	2	1	0
	Undisclosed	20	18	5	5	2
Home Year Constructed	1968 to 1975	101	93	30	20	3
	1976 to 1985	48	45	11	5	0
	1986 to 1995	23	23	11	6	0

Category	Variable	Total Applicants	Selected Applicants	Completed Assessment	Reserved Incentive	Completed Install
	1996 to 2005	36	34	13	10	2
	After 2005	7	7	1	1	1
	Before 1968	10	8	3	3	0
	Undisclosed	17	15	5	2	0
ECDS segment	Creatures of Comfort	20	17	4	3	0
	First Costers	1	1	1	0	0
	Green Activists	6	6	1	1	0
	Green Investors	119	115	34	24	4
	Living in the Now	5	5	1	1	0
	Payback Investors	47	42	19	6	1
	Pragmatists	7	7	1	1	0
	Show-me Participants	15	14	7	7	1
	Tech Frontiersmen	3	2	0	0	0
	Tech to Live	1	1	0	0	0
	Unknown	18	15	6	4	0

Appendix E: Electrification Readiness Assessment Fields and Report

Category	Question
Home information	Number of bathrooms?
	Number of bedrooms?
	Number of stories?
	Building type?
	Do you own or rent your home?
	Do you plan on adding solar in the next 5 years?
	Do you plan on purchasing an electric vehicle (EV) in the next 5 years?
	Existence of basement?
	Existence of garage?
	Has battery backup?
	Has electric generator?
	Has EV(s) charged at home?
	Has other distributed energy resource?
	Has solar?
	Have you reviewed the safety tailboard for this location and date?
	Number of households occupants?
	Primary household language?
	Square feet?
	What are you most interested in learning from your home energy assessment?
	Year built?

Category	Question
Electrical	Electrical panel – full replacement?
	Electrical panel – upgrades optional?
	Pilot next steps?
	SCE residential incentives?
Heating	Age of system?
	Age of system (second unit)?
	Condition?
	Condition (second unit)?
	Fireplace and type?
	Is there a secondary heating system?
	Issues found?
	Issues found (second unit)?
	Location (second unit)?
	Location of primary heating system?
	Primary heating fuel?
	Primary heating system?
	Secondary heating fuel?
	Secondary heating system?
	Size of heating system?
HVAC	Get a pre-season tune-up of the heating system?
	Get a pre-season tune-up of your cooling system?

Category	Question
	Switch from gas furnace to electric heating – heat pump and cold climate heat pump?
	Switch from gas to electric heating – ductless heat pump?
	Upgrade existing electric resistance forced air furnace to an air-source heat pump?
	Upgrade existing zonal electric resistance to a ductless mini-split heat pump?
	Upgrade to a smart thermostat?
Cooling	Age of cooling system?
	Cooling system condition?
	Location dimensions (max space for HPWH install/placement – enter "unobstructed" for very large spaces)?
	Main cooling system type?
Appliance	Appliance: Upgrade to an ENERGY STAR® clothes washer?
	Appliance: Upgrade to an ENERGY STAR® electric dryer?
	Appliances – cooktop?
	Appliances – dishwasher?
Water heating	Age of water heater?
	Condition?
	Existence and proximity to drain for HPWH condensate in water heater location options?
	Issues found?
	Location?
	Primary water heating type?
	Recirculation system present?

Category	Question
	Second water heating system present?
	Water heater in finished room? (Drywalled room or exposed studs with unobstructed access to electrical)
	Water heating capacity?
	Water heating electrical outlets available for replacement install?
	Water heating fuel (main)?
Water heater	Switch from gas to electric water heating – HPWH?
	Upgrade to an HPWH?
Ductwork and ventilation	Condition of ducts?
	Location of ducts?
	Type of ducting?
Envelope	Add/repair attic hatch seals?
	Add/repair exterior door weather-stripping?
	Seal air leaks throughout the home?
	Upgrade existing single pane windows to high-efficiency windows?
	Upgrade the attic insulation (existing attic insulation is 4" or less)?
	Upgrade the floor insulation (existing insulation is 4" or less for site-built homes)?
	Upgrade the wall insulation (no insulation present in the walls)?
Insulation	Attic insulation type?
	Control measures?
	Issues found in subfloor?

Category	Question
	Roof pitch?
	R-value effective?
	Subfloor access?
	Subfloor insulation type?
	Wall insulation?
Electrical	"Slim" breaker capable?
	Existing subpanels?
	Fire or shock hazard?
	Open breakers?
	Open circuits for PV?
	Panel condition?
	Panel location?
	Panel type?
	Sub-panel amps?
	Total number of available slots?
	Total number of slots?
	Type of wiring?
	Will HPWH wiring require access in finished walls/spaces?
Miscellaneous	Add solar to your home?
	Install an EV charger?
	Install battery storage for your home and/or EV?

Category	Question
	Switch to a new or used EV?
Appliances	Cooktop circuit needed?
	Cooktop electrical outlets available for replacement install?
	Cooktop fuel type?
	Dryer fuel electrical outlets available for replacement install?
	Dryer fuel type?
	Range circuit needed?
	Wall oven fuel type?
Customer education	Did the assessment improve your understanding of how installing new equipment could affect your utility bills?
	Were you able to review the assessment report with the customer?

Your CalNEXT Residential Electrification Readiness Assessment Report

Customer Reference Number: ###

Prepared By: Field Assessor

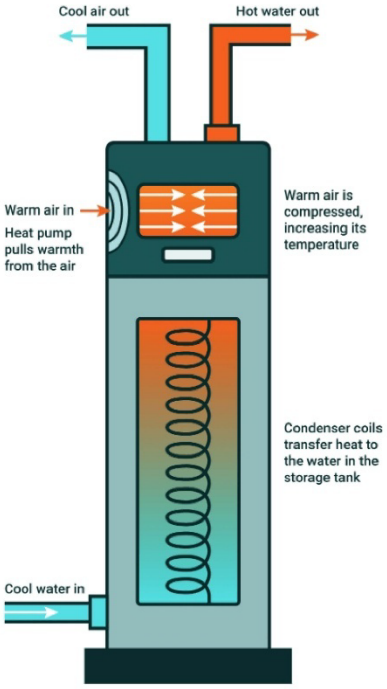
Questions? Please Reach out to:
calnext@veic.org

CalNEXT Residential Electrification Readiness Pilot

The ***CalNEXT Residential Electrification Readiness Pilot*** is designed to help homeowners served by Southern California Edison (SCE) be a part of California's clean energy future – and save on the cost of water heating.

Now that you have completed your electrification readiness assessment, you are eligible to move on to the second phase of the pilot: to partner with an eligible contractor for your home electrification readiness upgrades and complete a heat pump water heater installation.

Water heating is the second largest energy use in most homes. A heat pump water heater can provide all the hot water you need and can be three times more efficient than conventional water heaters, which will help you save on the cost of heating water. For more details on water heating, visit switchison.org/water-heating or download this Heat Pump Water Heating Fact Sheet.



Pilot Participation Steps

- ☑ **Apply** for electrification readiness assessment.
- ☑ **Schedule** electrification readiness assessment.
- ☑ **Complete Assessment.** The assessor will visit your home and conduct the home electrification readiness assessment.
- ☑ **Review.** Review your home energy assessment recommendations and identify available incentives for installing a heat pump water heater.
- ☐ **Reserve.** Reserve available electrification readiness incentives by following the instructions on this home assessment report.
- ☐ **Install.** Select your eligible contractor from the list provided on the Electrification Readiness incentive reservation page, install electrification readiness upgrades, and install your new heat pump water heater. Once the installations are complete, your contractor invoice will include all eligible incentives.
- ☐ **Enjoy.** Enjoy your new heat pump water heater and electric-ready home!

By participating in this pilot, you are eligible to reserve up to $5,500 in electrification readiness incentives to help prepare your home for the installation of a heat pump water heater. Electrification readiness incentives are limited and available on a first-come, first-served basis. You will have a total of **45 days** from reserving incentives to complete electrical panel upgrades as well as the installation of a new heat pump water heater. Incentives will be included on your contractor invoice after you complete the electrical upgrades and installation. **Click here to reserve your Electrification Readiness incentives today.**

CalNEXT Electrification Readiness Incentives		TECH Clean California Incentives
Electrical Panel Upgrade Rebate	**Electrical Wiring, Circuits, and Auxiliary**	**HPWH Installation**
$4,000	$1,500	$3,100*
All incentives will appear on the contractor invoice		

*Additional incentives for installing a heat pump water heater may be available. Please consult with your contractor for more information on additional incentives.

Top upgrades for your home

Opportunity	Recommendation
Consider Installing an Induction Cooktop	Improve your cooking experience while becoming more energy efficient by upgrading to induction technology! There are IRA Tax Credit incentives available for Electric/Induction Stove Electrification and rebates of up to $840! For more information visit: www.rewiringamerica.org/calculator
Get a pre-season tune-up of your cooling system.	Your central air conditioner will use more energy than necessary if it is not properly maintained. In addition to saving energy, maintaining your air conditioner will help the system last longer. Ensure your cooling system is operating efficiently and at its best by having a contractor conduct an annual tune-up.
Improvements to your electrical panel are optional	It appears your electrical panel has adequate capactiy to install a HPWH or electrify other appliances in your home. While electric panel replacements or upgrades may not be needed, Pilot incenitves are available to further future proof your home for future electrification
Switch from gas to an electric heat pump water heater	Consider switching to an electric heat pump water heater that is more efficient and reduces carbon emissions. In addition to incentives offered through this program, you may be eligible for additional IRA tax credits and rebates for heat pump water heaters. To receive more information on the tax credits and rebates visit: www.switchison.org and www.rewiringamerica.org/calculator.
Switch your gas furnace to an electric air sourced heat pump	Consider switching to a efficient ducted electric heat pump that provides both heating and cooling comfort to your home. You may be eligible for additional IRA tax credits and rebates for a heat pump solution. To receive more information on the tax credits and rebates visit: www.switchison.org and www.rewiringamerica.org/calculator.

Notes from Your Energy Advisor

Next Steps

Congrats on completing your assessment! If you would like to take advantage of pilot incentives for home electrification upgrades, visit the Electric Readiness Reservation Page (https://calnext.com/hpwh-pilot/reserve) to learn more about the next steps and reserve your pilot incentives!

HVAC System Unit 1

The existing 80% efficient gas furnace with AC which is approximately 23 years old, is recommended for an upgrade to a heat pump. This upgrade will enhance efficiency, improve comfort, reduce greenhouse gas emissions and provide significant savings, especially when paired with solar installations.

HVAC System Unit 2

The existing 80% efficient gas furnace with AC which is approximately 23 years old, is recommended for an upgrade to a heat pump. This upgrade will enhance efficiency, improve comfort, reduce greenhouse gas emissions and provide significant savings, especially when paired with solar installations.

Condenser Units

Both units are in excellent condition. However, when upgrading to a heat pump, it will be necessary to replace these units to ensure compatibility and optimal performance.

Notes from Your Energy Advisor - continued

50 Gallon Water Heater

The existing 50-gallon electric water heater, which is approximately 23 years old, is recommended for an upgrade to a heat pump water heater. Can be upgraded to a heat pump water heater without any spatial limitations, as it is currently installed in the garage. However, a 240-volt circuit will need to be installed to operate unit. It is advisable to consult with a contractor to discuss installation options.

Electrical Panel

The existing 200 amp panel has 28 spaces, with 2 currently available. While the panel is functioning adequately at present, it may require upgrading in the future to accommodate additional electrical appliances. Upgrading the electrical panel offers several benefits, including increased safety, enhanced capacity, improved energy efficiency, and better functionality. It is advisable to contact a contractor to discuss potential upgrades.

Washer and Dryer

Both units are currently in good condition and functioning well. However, to optimize performance and achieve greater energy efficiency, it is advisable to consider upgrading to newer models in the future. Modern units often come with advanced features that can significantly reduce energy consumption and enhance overall functionality.

Appendix F: Assessment Data

Please see attached spreadsheet labeled “Appendix F – Assessment Summary Data PII Confidential.xlsx.”

Appendix G: Pilot Loaner Water Heater Design Framework

The pilot loaner water heater (WH) design framework is as follows:

- To be eligible for loaner reimbursement, homeowners must complete an HPWH readiness assessment and complete the installation of a new HPWH.
- Homeowners with non-functional WHs, or with WHs displaying symptoms of pending failure, were to be notified of eligibility for a loaner WH should failure occur after the assessment and prior to installation of an HPWH.
- Homeowners were to be provided with guidance within their assessment reports on necessary notification and documentation steps to confirm coverage of costs associated with loaner WH. Homeowners who had a loaner WH installed and then subsequently withdrew their commitment to an HPWH installation would not be eligible for any pilot reimbursements.
- Homeowners identified as having a failed WH must use a participating TECH Clean California WH contractor when installing and removing a loaner WH.
- Contractors installing temporary gas or 120V HPWH loaners were to be reimbursed by the program upon completion of the HPWH installation, an HPWH claim submission to the pilot team, and proof of HPWH installation, including a final invoice and before and after photos from the HPWH contractor.
- HPWH installation contractors were required to be the same contractor who installs and removes the loaner WH. Labor and materials associated with the installation and removal of the temporary loaner WH are eligible for full reimbursement.
- The pilot was to cover 100 percent of loaner costs but reserved the right to limit reimbursable costs to amounts “within reason.”
- Participating loaner WH contractors were limited to a maximum reimbursement of one loaner WH per WH type—gas storage, 120V HPWH, gas on-demand, and electric on-demand.
- If required, the pilot was to identify a storage location for contractors to return pilot-purchased loaner WHs after loaner WH removal and HPWH installation. This storage facility was to act as a WH loaner “library” for the pilot. The pilot was to require contractors to use appropriate and available loaner WHs from the “library” before being eligible for purchase of a duplicate library WH.
    - Subject to participation and demand across a maximum of 40 single-family homes.
    - Contractors were permitted to opt for keeping loaner if no other know homeowners are in need or a similar loaner model.
- Participating loaner WH contractors were permitted to provide their own loaner WH, such as a recently removed and functional WH from another customer location, if readily available, expeditious to the customers and project, and permitted by local regulations.

- The pilot was not to reimburse contractors for the purchase price of any used equipment used as a loaner WH.
- The pilot did not intend to reimburse contractors for repairs of existing WHs but would consider repairs on a case-by-case basis if repair was a more expeditious and economical solution for the contractor.
- The pilot was to reimburse contractors for labor costs when installing a self-source, used loaner WH.

The project team anticipated that a minority of HPWH conversions in this pilot may be enabled by an interim loaner as typical participation will be proactive replacements with existing operational WHsbut due to the lack of loaner situations, this data was not available.

- Total number of 120V loaners installed
- Total number of gas loaners installed
- Loaner BTU and tank size in gallons
- Cost and labor breakdown per loaner WH installation
- Estimated days without hot water without loaner and actual restoration timing
- Qualitative contractor and customer feedback
- Total number of homeowners who opted for a permanent, like-to-like (non-HPWH) replacement when their WH failed or began to display signs of failure

Appendix H: Participant Savings, TRC, and TSB Calculations

Please see attached workbook labeled “Appendix H - Participant Savings TRC & TSB Calculations.xlsx.”

Appendix I: NOMAD, Bass Diffusion Curve, and Delphi Panel Considerations

Quantifying historical market uptake and modeling NOMAD estimated baseline data requires populating key parameters of start year, maximum penetration, a coefficient of growth, and a coefficient of imitation. Key parameters should consider data that incorporates all required minimum features identified in the TFP. Definitions of the key parameters and a Bass Diffusion Curve formula used to plot NOMAD are shown below in Equation 1 and Table 26.

Equation 1: Formula for estimating NOMAD

$$F(t) = \frac{1 - e^{-(p+q)t}}{1 + \frac{q}{p} e^{-(p+q)t}}$$

Where: p = coefficient of innovation (e.g., external influence or advertising effect)
q = coefficient of imitation (e.g., internal influence or word-of-mouth effect)
t = year (e.g., year zero, 1, 2, etc.)

Table 26: Description of inputs, data sources, and methodology for data collection to create NOMAD baseline estimates.

Parameter	Parameter-Specific Instructions	Effect on NOMAD Curve	Recommended Data Source	Methodology for Data Collection
Start year	Estimate the year in which the measure-case technology or efficiency level was first available on the market.	The curve intersects with the x-axis in the Start Year.	Manufacturers	Interviews or surveys requesting "when were HPWHs first made available for sale by your company?" and "when were HPWHs at the current standard for efficiency [to be specified in the survey] first made available for sale by your company?"

Parameter	Parameter-Specific Instructions	Effect on NOMAD Curve	Recommended Data Source	Methodology for Data Collection
Historical market penetration	Estimate market adoption at specific dates since start year.	Reference data point. Used to refine coefficient of innovation and coefficient of imitation.	Manufacturers and/or distributors	Interviews or surveys requesting raw data such as: "What percent of historical sales have been HPWH compared to standard efficiency units for 1 year, 3 years, 5 year, 10 years, etc. after start year." Manufacturers prioritized would be those selling efficient systems into CA, and results would be compared to ENERGY STAR unit shipment data.
Maximum penetration	Estimate the long-term maximum penetration of the measure case without a standard. Consider what persistent barriers would stand in the way of widespread adoption.	This sets the asymptote for the top of the S-curve; the curve will flatline as the curve approaches this value.	Distributors, contractors, ENERGY STAR unit shipment data	Additional modeling incorporating ENERGY STAR unit shipment data.
p ("Coefficient of innovation")	Typical values of p are in the range of 0.0001 to 0.2. Adjust p to match historical data and your estimate of NOMAD over the first measure case lifetime after the effective date.	This sets the base rate of linear growth over time. A higher p means the initial growth is faster	Calibrate coefficient of innovation to closely follow mean data points provided as Historical Market Penetration	See "Historical Market Penetration" above
q ("Coefficient of imitation")	Typical values of q are in the range of 0.05 to 1. Adjust q to match historical data and your estimate of NOMAD over the first measure case lifetime after the effective date.	This sets the rate of exponential growth fed by the current market share. A higher q means a steeper bend in the S-curve.	Calibrate coefficient of imitation to closely follow mean data points provided as Historical Market Penetration	See "Historical Market Penetration" above.

Additional Data Sources for Parameters Used in Calculating NOMAD

- NEEA (Northwest Energy Efficiency Alliance) (2022). Plug-In Heat Pump Water Heaters: An Early Look to 120-Volt Products. Northwest Energy Efficiency Alliance. Retrieved from https://neea.org/resource/plug-in-heat-pump-water-heaters-an-early-look-to-120-volt-products/
- NEEA (2021) Laboratory Assessment of Rheem Generation 5 Series Heat Pump Water Heaters. Northwest Energy Efficiency Alliance. Retrieved from https://neea.org/resources/laboratory-assessment-of-rheem-generation-5-series-heat-pump-water-heaters
- Opinion Dynamics (2022). California Heat Pump Residential Market Characterization and Baseline Study. CPUC TECH program. Retrieved from https://www.calmac.org/publications/OD-CPUC-Heat-Pump-Market-Study-Report-5-17-2022ES.pdf
- Opinion Dynamics (2022). Technology and Equipment for Clean Heating (TECH) Initiative Baseline Market Assessment. CPUC TECH program. Retrieved from https://pda.energydataweb.com/api/downloads/2658/TECH%20Baseline%20Market%20Assessment%20Report_Revised_Final.pdf
- Pacific Gas and Electric (PG&E) (2022). Midstream Heat Pump Water Heater (HPWH) Market Study and Field Test. Emerging Technologies Coordinating Council. Retrieved from https://etcc-ca.com/reports/midstream-heat-pump-water-heater-hpwh-market-study-and-field-test
- SCE (2022). ET21SCE0018 - Residential Water Heating Cost Comparison Tool/Calculator. Emerging Technologies Coordinating Council. More information at https://www.etcc-ca.com/reports/residential-water-heating-cost-comparison-toolcalculator
- SCE (Pending 2024). ET19SCE1100 - Grid Responsive Heat Pump Water Heater (WH) Study Emerging Technologies Coordinating Council. More information at https://www.etcc-ca.com/reports/grid-responsive-heat-pump-water-heater-wh-study
- SCE (2019). DR17.06 - Smart Water Heater Controller Study. Emerging Technologies Coordinating Council. Retrieved from https://www.etcc-ca.com/reports/smart-water-heater-controller-study
- ENERGY STAR Certified HPWH energy savings estimates. More information at https://www.energystar.gov/products/water_heaters/high_efficiency_electric_storage_water_heaters/benefits_savings
- NBI (2023). Pilot project in Seattle shows central heat pump water heaters can act as massive hot water batteries that help reduce carbon emissions. Retrieved from https://newbuildings.org/pilot-project-in-seattle-shows-central-heat-pump-water-heaters-can-act-as-massive-water-batteries-that-help-reduce-carbon-emissions/

In addition to the start year, one or more additional estimates of historical market penetration can be plotted on the NOMAD chart to assist in estimating the coefficients of growth and imitation. See sample historical adoption estimates in Table 27 and orange dots in Figure 25, for example.

Maximum penetration estimates will need to factor industry standard practices, high efficiency cost differences, estimated average payback periods, estimated effective useful life, and purchasing habits at the consumer and contractor levels. Maximum penetration may be limited by adoption practices that consumers, contractors, distributors, or manufacturers deem "efficient enough" but fall short of all minimum requirements for the TFP. Additionally, condensing units and evaporators may be indefinitely repaired on a part-by-part basis, further affecting maximum penetration estimates.

Table 27 and Figure 25 below show an example of the NOMAD chart, as well as how multiple data points, such as estimated historical HPWH saturation, can be backed into the NOMAD chart when refining the coefficients of innovation and imitation.

Table 27: Historical data and estimates to map to NOMAD curve.

Year	Historical Market Penetration (HPWH)	Historical Data and Estimates: Comments	Data Source
2008	<.1%	First year that standards for HPWH were included in the ENERGY STAR residential water heating specification.	NEEA documentation for Advanced Water Heater Specification 6.0
2009	<.1%	Estimated first date of ENERGY STAR qualified HPWH market availability from at least one of the three major HPWH manufacturers.	Rheem website
2014	1.08%	Date when 1.08% of residential electric storage water heaters shipped in the US were HPWHs meeting ENERGY STAR high-efficiency specifications. At this time, the active specification was ENERGY STAR v 3.0.	ENERGY STAR annual unit shipment data for HPWHs
2017	1.74%	Date when 1.74% of residential electric storage water heaters shipped in the US were HPWHs meeting ENERGY STAR high-efficiency specifications. At this time, the active specification was ENERGY STAR v 3.2.	ENERGY STAR annual unit shipment data for HPWHs
2019	2.00%	Date when 2.00% of residential electric storage water heaters shipped in the US were HPWHs meeting ENERGY STAR high-efficiency specifications. At this time, the active specification was ENERGY STAR v 3.3.	ENERGY STAR annual unit shipment data for HPWHs

Year	Historical Market Penetration (HPWH)	Historical Data and Estimates: Comments	Data Source
2022	3.09%	Date when 3.09% of residential electric storage water heaters shipped in the US were HPWHs meeting ENERGY STAR high-efficiency specifications. At this time, the active specification was ENERGY STAR v 4.0.	ENERGY STAR annual unit shipment data for HPWHs

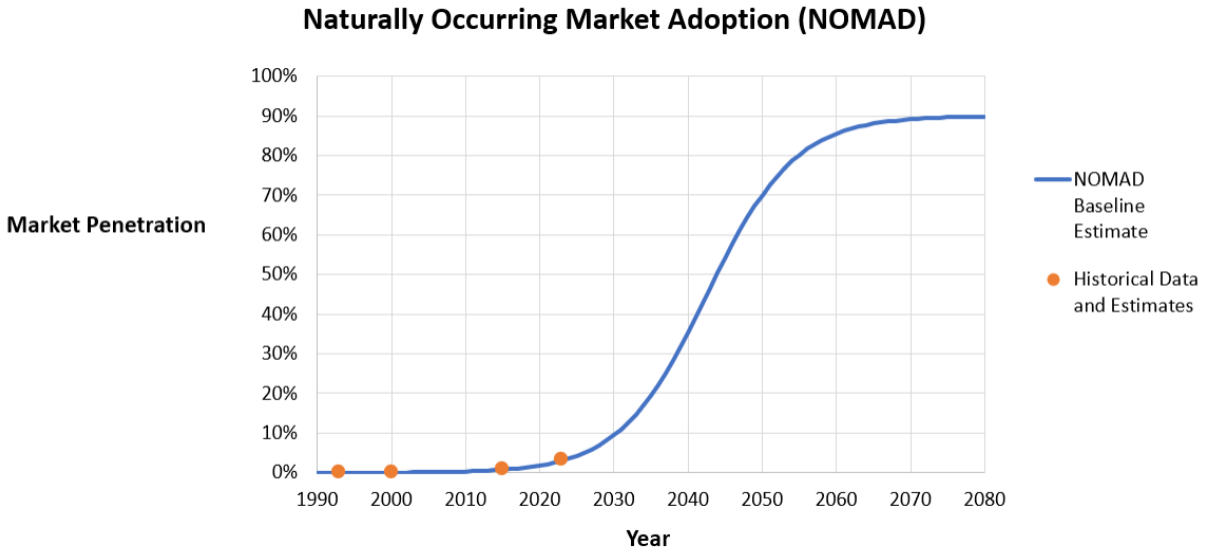


Figure 25: Example of NOMAD estimate.

Delphi Panel Use to Inform Inputs for the NOMAD Calculation

In areas where research alone provides inconclusive data, or when parameter data is not available, a Delphi Panel, consisting of industry representatives and experts, may validate data sources, estimates, and points prior to finalizing NOMAD calculations.

The Delphi Panel members themselves are not required to know the NOMAD formula or definitions of coefficients of innovation or imitation. Instead, the Delphi Panel serves to validate sources and data points to be later included in NOMAD calculations by SMEs conducting those estimates. Those SMEs should first curate the best available data from the sources above prior to utilizing the Delphi Panel, if needed at all. Parties recruiting and employing a Delphi Panel will likely provide compensation to its Delphi members for their participation.

For screening, Delphi members should be from within the industry supply chain and have first-hand knowledge of equipment and sales, as well as future trends within the industry, that will help inform key criteria. Sources of Delphi Panel members may include manufacturer and distributor representatives contacted and interviewed for the Market Characterization Study, as well as outside parties who can be qualified as SMEs. An SME with a focus on federal appliance standards for HPWHs would have additional knowledge and value outside of supply-chain members. A minimum of one manufacturing representative and one distributor representative is suggested.