Residential Heat Pump Water Heating

Market Transformation Initiative Plan - DRAFT

April 22, 2026

CalMTA is a program of the California Public Utilities Commission (CPUC) and is administered by Resource Innovations

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Purpose

This Market Transformation Initiative (MTI) Plan describes the business case for investment in the MTI including strategic interventions, intended market outcomes, and evaluation activities that will be implemented during Phase III: Market Deployment. This investment would result in long-term energy efficiency and other benefits for California. The MTI Plan was developed using the findings of Phase II assessment and research, which are detailed in the appendices of this document. Development of the MTI Plan followed the stage gate process described in the approved Market Transformation Framework in D.19-12-021 and D.25-11-023. The research findings and plan elements have been shared with CalMTA's Market Transformation Advisory Board (MTAB) throughout development. The MTAB also had the opportunity to review and provide comments and feedback on the plan, which are included in Appendix I of this document. All MTAB meetings are public and interested parties will have an opportunity to comment via a California Public Utilities Commission (CPUC) application proceeding.

MTI development documents by phase

Additional information on CalMTA and the MTI development process can be found at https://calmta.org.

The Advancement Plan for this MTI can be found at https://calmta.org/resources-and-reports/.

Contents

Abbreviation	Definition
AHRI	Air-Conditioning, Heating, and Refrigeration Institute
AWHI	Advanced Water Heating Initiative
AQMD	Air Quality Management District
BAAQMD	Bay Area Air Quality Management District
BIY	Buy-it-Yourself
BMA	Baseline Market Adoption
CAHPP	California Heat Pump Partnership
CalMTA	California Market Transformation Administrator
CARB	California Air Resources Board
CARE	California Alternate Rates for Energy
CBO	Community-Based Organization
CCA	Community Choice Aggregator
CEC	California Energy Commission
CEDARS	California Energy Data and Reporting System
CPL	Certified Product List
CPUC	California Public Utilities Commission
DIY	Do-it-Yourself
DOE	Department of Energy
DR	Demand Response
EPA	Environmental Protection Agency
EPIC	Electric Program Investment Charge
ESJ	Environmental and Social Justice
ESRPP	ENERGY STAR Retail Products Platform
EV	Electric Vehicle
FERA	Family Electric Rate Assistance
GHG	Greenhouse Gas
GWP	Global Warming Potential
HPWH	Heat Pump Water Heating
HPWHs	Heat Pump Water Heaters
IOU	Investor-Owned Utility
MOU	Memorandum of Understanding
MPI	Market Progress Indicator
MTAB	Market Transformation Advisory Board
MTI	Market Transformation Initiative
NEEA	Northwest Energy Efficiency Alliance
NOx	Nitrogen Oxides
PA	Program Administrator
PAC	Program Administrator Cost
PG&E	Pacific Gas and Electric
UEF	Uniform Energy Factor
REN	Regional Energy Network
RFP	Request for Proposal
ROI	Return on Investment
SCT	Societal Cost Test
SPA	Strategic Partnership Agreements

TBE	Theory-based Evaluation
TOU	Time of Use
TSB	Total System Benefit
TMA	Total Market Adoption
TRC	Total Resource Cost
UEF	Uniform Energy Factor
WE&T	Workforce, Education, and Training

1 Executive summary

California Market Transformation Administrator's (CalMTA) Residential Heat Pump Water Heating (HPWH) Market Transformation Initiative (MTI) aims to accelerate the transition to heat pump water heaters (HPWHs) in California's residential markets. HPWHs are a proven, high-efficiency technology and are a key solution for achieving the state's building decarbonization, grid reliability, and climate commitments.

The HPWH MTI represents a strategic opportunity to harness and increase the impacts of the substantial HPWH investments underway across California. This MTI Plan summarizes the investment opportunity and CalMTA's strategy to overcome market barriers, accelerate market adoption, and coordinate across existing utility, state, and local programs while providing California with a strategic long-term approach to market transformation. CalMTA can simultaneously maximize the value of substantial public and ratepayer investments already deployed and address the critical strategic gaps and market barriers that have been impeding market maturation. This MTI Plan outlines CalMTA's proposed strategy to influence product development, aggregate statewide demand in key submarkets, and develop statewide operational infrastructure to accelerate consistent, sustainable growth in California's residential HPWH market.

1.1 Market overview

California's residential water heating market is large and still dominated by fossil fuels. Of the state's approximately 11.5 million households with dedicated water heating systems, an estimated 76% rely on natural gas/propane and 23% on electricity. HPWHs account for less than 2% of installed systems.[1] Approximately 750,000 water heaters are replaced annually in California. Most water heater replacements are time-sensitive decisions because they are largely due to equipment failure. HPWHs currently capture only a small share of this market opportunity and adoption of HPWH technology is strongest in new construction, driven primarily by building codes. In the retrofit market, the approximately 2.5 million homes with electric resistance water heaters represent the most accessible near-term opportunity for HPWH conversion in terms of ease of installation and consumer utility bill savings. The remaining 8.7 million homes with gas/propane water heaters represent the largest potential market conversion, but only some segments of the market have neutral to positive bill impacts under current rate structures.

HPWHs are a technically mature technology with established energy-efficiency and climate benefits. HPWHs eliminate on-site combustion, reducing greenhouse gas (GHG) emissions compared to incumbent systems. In gas-to-electric conversions, utility bill impacts are mixed due to California's electricity and gas price differential. While these conversions generate high system-level avoided costs, including emissions reductions, some households would experience bill increases, which

[1] For more a more detailed description and sources, please refer to the Market characterization section in Section 4.

decreases adoption. However, with electricity rate reform, gas will get more expensive over time, reducing the number of homes that would experience a bill increase by electrifying their water heater, making HPWHs a more approachable choice for consumers and contractors.[2] Compared to conventional electric resistance water heaters, HPWHs use substantially less electricity and can deliver significant household bill savings, with modeled reductions between $448 and $773 per year in typical replacement cases.[3]

Despite growing awareness and substantial public investment from California, multiple market-level barriers continue to constrain HPWH adoption. Up-front cost remains the most significant barrier, with total installed costs typically ranging from $6,000 to $8,000, which is at least $4,000 more than conventional alternatives.[4] Nearly half of surveyed customers and a majority of installers identify cost as a primary reason HPWHs are not selected, a challenge compounded by the prevalence of emergency replacements and limited customer familiarity with water heating options.[5]

Increased market adoption often requires a stable market with clear incentives. HPWHs, however, face an unstable incentive landscape with widespread but fragmented and administratively complex incentives. There are more than 30 active state, utility, and local programs that offer HPWH incentives as of the time this report was drafted, yet installers frequently report declining HPWH installations due to incentive uncertainty, application burden, or funding interruptions.[6] Regions with stable, long-term incentives demonstrate higher installer engagement and adoption, while inconsistent statewide funding undermines market confidence and contractor willingness to invest in HPWH-focused business models. As the statewide market transformation administrator, CalMTA can take a holistic market-level approach to provide support and resources that will help align HPWH programs and related efforts across the California market to increase consistency and provide greater certainty to the entire supply chain.

Uncertainty around household fit in California further limits HPWH adoption. HPWH installations require sufficient space, ventilation, electrical capacity, and condensate management. Approximately 30% of California households may require some form of electrical upgrade to support 240-volt (240V) HPWH installations, particularly in gas-to-electric conversions.[7] Emerging product options, including 120-volt (120V) HPWHs, offer promise for electrically constrained homes but remain limited by performance tradeoffs, unclear application guidance, high costs, and low market awareness.

Awareness and familiarity with HPWHs vary significantly by region and housing segment in California. Many customers, including recent water heater purchasers, remain unfamiliar with HPWH technology,

[2] See Section 3 Product definition and assessment for more detailed breakdown of bill increase projections.
[3] See Section 3 Product definition and assessment for a more detailed description and sources.
[4] See Section 4 Market characterization for a more information on HPWH product costs.
[5] See Section 4 Market characterization for a more information on HPWH installation barriers.
[6] See Section 4 Market characterization for a more context on HPWH programs and incentives.
[7] See Section 3 Product definition and assessment for a more detail on electrical upgrades and HPWHs.

and trained installers and retail availability are uneven across the state.[8] Installers consistently indicate that expanded training, hands-on experience, and clearer market signals would increase confidence and adoption. Customer-facing education at the point of sale is also critical because of the prevalence of do-it-yourself (DIY) and buy-it-yourself (BIY) purchasing pathways.[9]

These findings demonstrate that while HPWHs are a critical and proven solution for decarbonizing residential water heating in California, high upfront costs, fragmented programs, misaligned incentives, product-fit uncertainty, and inconsistent market signals are preventing the market from achieving scale. Addressing these challenges requires a coordinated, statewide market transformation approach that aligns programs, lowers the risks of adoption, and provides durable market signals to manufacturers, installers, and consumers.

1.2 Vision

CalMTA envisions a future in which HPWHs are a mainstream solution across California's housing stock, delivering affordable decarbonization, grid benefits, and long-term market growth. Achieving California's 2030 goal of 6 million heat pumps and the state's carbon neutrality targets of 2045 will require HPWHs to move rapidly from early adopters to widespread deployment across both new and existing homes, with products designed for California's housing stock.[10]

CalMTA's HPWH MTI advances this vision by complementing and aligning existing state and national efforts while supporting statewide coordination and market clarity. Through this initiative, CalMTA will:

- Orchestrate cohesive market transformation by mapping California's housing stock to appropriate HPWH solutions.
- Set shared priorities around low global warming potential (GWP) refrigerants, grid-interactive load shifting, and right-sized form factors.
- Engage closely with California partners, program administrators (PAs), and manufacturers.

By aggregating demand and enabling shared research, data, and messaging, CalMTA will accelerate scale, support private-sector investment, and drive outcomes no single program can achieve alone.

1.3 Key Phase II research findings

Phase II research yielded the following key findings that were used to shape the MTI's strategic interventions and recommendations:

[8] For more detail on the HPWH MTI Market Characterization report, please refer to Appendix D: Market Characterization.
[9] See Section 4.3 and Appendix D: Market Characterization for further information on awareness.
[10] More information about the California Heat Pump Partnership Blueprint and the 6 million heat pump goal can be found here: https://heatpumppartnership.org/blueprint/.

- **Low saturation and market share:** HPWHs represent less than 2% of 11+ million residential California water heaters, and an estimated 5%-6% of **California annual sales.**[11]
- **Upfront cost is a top barrier to HPWH purchase:** Compared to alternatives, HPWHs are about $1,000 more expensive or, with professional installation, about $4,000 more expensive.
- **Incentives to support HPWH adoption are complex:** 30+ active programs exist. Incentives motivate some purchase decisions, but incentive/program complexities also create barriers.
- **HPWH fit is uncertain in some existing buildings:** Physical footprint, ventilation, condensate needs, and electrical capacity can complicate installation and may require additional work for HPWH installation.
- **Bill savings are uncertain to most converting from gas to HPWHs:** Bill savings are a leading benefit and driver of HPWH adoption nationally, but gas customers worry about bill increases in many California service territories.
- **Regional variations leave a disconnect from HPWHs and limit broad adoption:** Limited customer awareness and installer familiarity persists, impaired by limited HPWH availability and visibility. Greater retail engagement may support Buy-it-Yourself (BIY) and Do-it-Yourself (DIY) market segments.

To further research the state of California's existing HPWH market and gather experiences from programs and market actors, CalMTA hosted the Residential HPWH Market Acceleration Summit (Summit) in August 2025 to help illuminate the pathway for market transformation and programmatic support.[12] Recognizing both the importance of aligning with existing programs and the need for greater statewide coordination, CalMTA convened approximately 40 industry leaders to attend. Participants represented a broad cross-section of the market, including utilities, manufacturers, policymakers, workforce and equity organizations, program implementers, and evaluators.

Through facilitated, interactive discussions, participants identified pathways to make HPWHs the preferred water-heating choice for California homes. The discussions surfaced clear gaps that no single program or actor is positioned to address alone, reinforcing the potential role that CalMTA can play in aligning efforts and accelerating progress. Summit participants identified opportunities for CalMTA, including data collection and analysis, to understand HPWH sales and uptake statewide, aggregation opportunities to create market momentum by submarkets, and matchmaking technology for housing stock. These concepts were leveraged to inform CalMTA market transformation strategy and approach to HPWHs to achieve scale.

[11] For more information on data sources, please refer to Appendix D: HPWH Market Characterization Report.
[12] Learn more about CalMTA's HPWH Summit here: https://calmta.org/calmtas-residential-hpwh-summit-unites-a-complex-market-to-find-innovative-mt-pathways/.

Insights from the Summit directly informed the strategies outlined in this MTI Plan and underscored the opportunity to unite the state's collective expertise and resources to drive faster, more durable HPWH adoption for the benefit of California and its residents.

1.4 Strategic interventions for Phase III

Based on what CalMTA learned during Phase II, the team developed several strategic interventions to reduce or remove market barriers, drive market adoption, and achieve lasting market change. The following interventions are proposed for Phase III:

1) **Influence Product Development & Match Technology to Housing Stock -** CalMTA will orchestrate product innovation by mapping California's diverse housing stock to appropriate HPWH solutions. CalMTA will identify critical market and technology gaps and engage California partners, programs, and manufacturers to set clear, coordinated state priorities around alternative form factors tailored to California's unique needs, lower-GWP refrigerants, and load-shifting capabilities.
2) **Aggregate Statewide Buying Power to Attract Market Partners & Build Momentum in Scalable Submarkets -** Partnering with existing energy efficiency and environmental and social justice (ESJ) programs, CalMTA will design and implement an approach to aggregate the collective buying power of programs. This strategy will target specific market segments to rapidly accelerate HPWH adoption, build installer confidence, and strengthen the business case. Initial efforts will prioritize easier installation segments, including homes with electric-resistance water heaters, solar, and simpler gas installations. In parallel, CalMTA will explore opportunities in ESJ communities with strong community-based organization (CBO) support, installer coverage, and low-income programs. Segmentation efforts will then expand to more challenging markets, including complex gas conversions, ensuring focus remains on customers who will not experience bill increases.
3) **Develop, Support, and Coordinate Statewide Operational Infrastructure -** CalMTA will develop and support coordinated, statewide infrastructure for water heater sales and data collection with supply chain and program partners, create consistency in messaging and marketing the benefits of HPWHs, and aligning on shared product criteria. This strategy aims to foster statewide cohesion, align on research priorities, reduce complexity for market actors, and support the maturation of a coordinated HPWH market.

Through these strategic interventions, California can accelerate the adoption of residential HPWHs.

1.5 Recommendations

A range of current factors makes this a pivotal moment for the HPWH MTI for California. State-wide decarbonization goals and policy tailwinds paired with low HPWH uptake and inconsistent incentives present high opportunity for coordinated market transformation activities.

Home electrification of water heating is a critical step in realizing the state's decarbonization goals (6 million heat pumps by 2030 and 2045 clean energy goals). As rates get more time-sensitive, controls matter more – and HPWHs are among the easiest electrification measures to control automatically. California's policy landscape is increasingly favoring HPWHs:

- 2025 Energy Code expanded HP use in new residential construction
- Federal efficiency standards, taking effect in 2029 will shift most common-sized electric storage water heaters to heat pump technology
- Bay Area Air Quality Management District (BAAQMD) rules will begin requiring zero-nitrogen oxides (NOx) water heaters in 2027
- California Air Resources Board (CARB) is developing statewide zero-emission space and water heater standards with a proposed phase-in slated to begin in 2030.

These policy tailwinds will ideally boost some markets in California, but they fail to target large swaths of the California market.

Despite large statewide investment, market adoption of HPWH has been stymied by high upfront costs. Since July 2021, the state has invested more than $103 million in incentives supporting the installation of approximately 21,000 HPWHs statewide, including about 16,000 units in the single-family residential sector and 5,000 in-units in multifamily housing.[13] In spite of this investment, the percent of residential HPWH market share remains lower than expected. The proportion of HPWHs in California's residential sector not expected to increase without changes to state policies and coordinated intervention. In addition, available incentive dollars are expected to be reduced or eliminated entirely (like rebates from the TECH program) in the upcoming years. The HPWH MTI is intended to create lasting, market-level interventions that create the consistency required by the market for HPWHs to gain traction. The MTI will initially target submarkets where residents will see neutral or positive bill impacts through use of products that are well matched to the housing stock and utility rates.

CalMTA forecasts that accelerating market adoption of HPWH in California will deliver high total system benefits for the state—on the order of $500 million:

- $57.09 million in energy savings
- $421.21 million in GHG reduction
- $8.16 million in grid flexibility

[13] Values were calculated using the TECH dataset for single-family and multifamily incentives with a most recent update of March 19, 2026, https://techcleanca.com/heat-pump-data/download-data/.

Given the significant potential for accelerating HPWH adoption and supporting California's climate and electrification goals, CalMTA recommends advancing the HPWH MTI to Phase III.

Table 1 summarizes the MTI investment costs-and projected total system benefits attributable to the CalMTA MTI (net incremental benefits). It is important to note that the values in Table 1 represent only 41% of the MTI's projected statewide incremental statewide benefits; when statewide benefits (including non-Investor-Owned Utility (IOU) territories) and co-created benefits (MTI-verified incremental impacts reported by California PA's in the California Energy Data and Reporting System (CEDARS) are considered, total system benefits (TSB) projected to result from this MTI investment totals $1.21 billion. CalMTA makes these adjustments to conform with CPUC rules about how cost effectiveness should be calculated, and to avoid double counting impacts.[14] Additional details about the subtraction of impacts in non-IOU territory and PA-verified impacts are provided in HPWH MTI Appendix B.[15]

Table 1. Overview of the HPWH MTI

Market	**Residential single-family and multifamily target market, consumer products**			
Total Phase III investment needed to achieve TSB forecast (2027-2046)	$41,821,539			
Phase III investment over initial CalMTA funding cycle (2027-2031):	$25,457,001			
Phase II investment (2024-2027):	$4,584,517			
Total investment including Phase II and Phase III investment (2024-2047):	$46,406,056			
TSB (2028-2047)	TSB - Energy	TSB - Grid	TSB - GHG Non-refrigerant	TSB – GHG Refrigerant
	$57.09M	$8.16M	$451.21M	$-15.67M
TSB - Total	$500.80M			
Cost Effectiveness (2028-2047)	TRC	PAC	SCT Base/High	
	1.67	16.82	2.70/2.69	

[14] Please see the CalMTA MTI Evaluation Framework, Section 2.6.3, for more detail.

[15] For more information, please refer to Appendix B: Market Forecasting and Cost-Effectiveness Modeling Approach, Section 7.1.2.

2 Market transformation theory & opportunity

This section explains how the Residential Heat Pump Water Heating (HPWH) Market Transformation Initiative (MTI) aims to transform the market. It begins with a short overview of the California HPWH market, then describes the theory behind the market transformation approach and the key interventions the California Market Transformation Administrator (CalMTA) proposes. Finally, it highlights the expected benefits – including impacts on environmental and social justice (ESJ) communities, workforce development, and total system benefits (TSB).

2.1 Transforming California's HPWH market

California has a pivotal opportunity to lock in long-term energy savings and sustainably transform the HPWH market – but time is of the essence. With upcoming federal standards and state decarbonization goals, California needs to aggressively scale HPWH installations and align the supporting market ecosystem to maximize coordination.

As of 2026, the state is not on track to meet the 2030 target despite the California Heat Pump Partnership Blueprint (CAHPP) goal to deploy 6 million heat pumps (including water heaters and HVAC) by 2030 and the state's goal to reduce GHG emissions by 80% by the same year.[16] HPWH sales represent just 5%-6% of the state's roughly 750,000 annual dedicated water heater sales.[17] While California has invested substantial funds through more than 30 HPWH incentive programs, adoption is low, implementation has been difficult to navigate, the market is fragmented, and incentive funds are intermittent and exhausted quickly. CalMTA is in a unique position to lead and align the state to bring the CAHPP Blueprint to life. In this complex and crowded market landscape where there are as many obstacles as opportunities, CalMTA stands equipped to unify the state's efforts, align market forces, and establish the coordinated infrastructure needed. CalMTA is forecasting that an additional nearly half million HPWHs would be installed as a result of investing in the HPWH MTI. In addition, although the team assumed that the baseline market adoption (BMA) or the expected "naturally occurring" market adoption, included the full impact of the federal and the BAAQMD standards, the MTI will help ensure that the impending federal standard and recent/expected California gas appliance regulations can achieve their full potential impact. Market research indicates that the impact of those regulations could otherwise be limited by persistent market barriers, such as a complex and inconsistent program landscape.

While many initiatives and efforts are working to drive HPWH sales in the state, no organization has CalMTA's scale and influence to deliver complete market transformation and leverage the current circumstances in a timely manner. CalMTA's MTI seeks to ensure the benefits from HPWH are fully realized and believes that a market-level approach for HPWHs will achieve the intended growth and

[16] More information about the California Heat Pump Partnership Blueprint, which describes near-term strategies to address technical, market, and policy barriers to California heat pump adoption can be found here: https://heatpumppartnership.org/blueprint/.

[17] For more information on data sources, please refer to Appendix D: Market Characterization.

lock in the policy vision. CalMTA, in alignment with stakeholders, will accelerate HPWH adoption by executing the following strategic interventions, as discussed above and in greater detail in Section 2.3:

1) **Influence product development & match technology to housing stock -** CalMTA will orchestrate product innovation by mapping California's diverse housing stock to appropriate HPWH solutions, identifying critical market and technology gaps, and engaging California partners, programs, and manufacturers to set clear, coordinated state priorities around alternative form factors tailored to California's unique needs, lower-GWP refrigerants, and load-shifting capabilities. Key activities include:
    - Use research tools to assess California's housing segments
    - Match housing segments with existing equipment types and identify gaps
    - Support split-system technology development and adoption
    - Leverage existing training efforts to help installers confidently select the right equipment
    - Collaborate with manufactures and energy efficiency programs to develop a product roadmap with pathways for lower GWP refrigerant options and solutions for equipment gaps
2) **Aggregate statewide buying power to attract market partners & build momentum in scalable submarkets -** Partnering with existing energy efficiency and ESJ programs, CalMTA will design and implement an approach to aggregate the collective buying power of programs. This strategy will target specific market segments to rapidly accelerate HPWH adoption, build installer confidence, and strengthen the market's business case. Initial efforts will prioritize easier installation segments, including homes with electric-resistance water heaters, solar, and simpler gas installations. In parallel, CalMTA will explore opportunities in ESJ communities with strong CBO support, installer coverage, and low-income programs. Segmentation efforts will then expand to more challenging markets, including complex gas conversions, ensuring focus remains on customers who will not experience bill increases. Key activities include:
    - Coordinate with existing energy efficiency/ESJ programs on outreach, training, marketing, and incentives using collective buying power to reduce equipment and installation costs and drive additional sales
    - In the near-term, prioritize easy-to-install markets (e.g., electric, solar, propane, new construction, and retail) to build installer confidence, strengthen business case, and drive sales
    - Partner with manufacturers to decrease cost and engage supply chain leaders to champion HPWH adoption
    - Apply lessons learned and market experience to enable market actors to confidently expand into additional submarkets

3) **Develop, support, and coordinate statewide operational infrastructure –** CalMTA will develop and support coordinated, statewide infrastructure for water heater sales and data collection with supply chain and program partners, create consistency in messaging and marketing the benefits of HPWHs and aligning on shared product criteria. This strategy aims to foster statewide cohesion, align on research priorities, reduce complexity for market actors, and support the maturation of a coordinated HPWH market. Key activities include:

   - Develop/support a coordinated, statewide system for water heater sales and data collection with supply chain and program partners
   - Share anonymized data with market and energy efficiency partners to inform resource allocation and program design
   - Collaborate with programs to create consistent, accessible marketing tools and messaging
   - Align supply chain messaging to ensure a consistent customer experience
   - Coordinate with energy efficiency programs to align on and conduct research

With the looming 2029 federal standards, the timing is ripe to attract new manufacturers and expand HPWH product offerings, production, and sales for the estimated 23% of California homes with electric water heating.[18] It is critical that CalMTA leverages this momentum to bring new manufacturers into the California market and use scalable submarkets (i.e., homes with electric resistance water heaters, new construction, homes with solar) as an entry point for installers to gain experience with simpler HPWH installations.

CalMTA is uniquely positioned to pool these necessary resources, work upstream to guide product development to meet the needs of the market, and build the required statewide infrastructure that no one local program can achieve on its own. This is an important turning point in California's continued HPWH market transformation. With CalMTA leading these efforts, California can overcome the remaining barriers and capitalize on the time-sensitive opportunities.

2.2 Theory of market transformation

This section describes the theory behind the market transformation approach.

2.2.1 Brief product definition and benefits

For the purposes of this initiative, CalMTA defines a residential electric HPWH as:

- 240-volt (240V) integrated unit
- 240V split-system
- Shared- or dedicated-circuit 120-volt (120V) integrated unit

[18] Estimates based on U.S. Energy Information Administration, 2020 Residential Energy Consumption Survey, and Appendix D: Market Characterization.

- Shared- or dedicated-circuit 120V split-system
- Certified nominal storage volume less than or equal to 120 gallons
- Comply with the current ENERGY STAR® specification for residential water heaters (version 5.0)[19]

The MTI's scope does not include HPWHs used in nonresidential applications, commercial water heaters, central water heaters, point-of-use water heaters, or other water heating systems composed of multiple heating units.

HPWHs use heat from the surrounding air to efficiently heat water, offering a highly energy-efficient alternative to conventional electric-resistance water heaters and a decarbonization option for conventional gas-fired water heaters. These systems can also provide dehumidification, grid connection, and load shifting benefits.

HPWH systems operate using a refrigeration cycle: a fan draws in ambient air, which passes over an evaporator coil containing refrigerant.[20] The refrigerant absorbs heat and is compressed, increasing its temperature. This heat is then transferred to the water stored in the tank via a heat exchanger.

In a split-system, the heat pump unit (compressor and evaporator) is separate from the water storage tank, providing flexibility for smaller spaces.

An integrated unit combines the heat pump and the water storage tank into a single appliance and has a similar form factor to conventional storage water heaters.

2.2.2 Target market

Residential Market - This initiative will focus on the residential market, specifically addressing properties with dedicated water heating devices, which serve 11.5 million California homes.[21] For the purposes of this initiative, CalMTA defines "residential units" to include single-family homes, multifamily units (with dedicated water heating), and mobile homes encompassing both owner-occupied and rental properties.

CalMTA plans to segment the target market into submarkets to rapidly accelerate adoption, build installer confidence in HPWHs, and prioritize applications that will deliver bill-neutral or bill-positive outcomes for customers. Initially, the MTI will focus on easier-to-install submarkets that don't bring negative economic impacts to customers and are suitable for an integrated 240V HPWH (e.g., the 23% of California homes with electric water heaters). This provides installers with a straightforward installation process to help them gain familiarity with the technology and immediately provide customers with bill savings.

[19] Read more about the ENERGY STAR program requirements for residential water heaters here: https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Residential%20Water%20Heaters%20Version%205.0%20Specification%20and%20Partner%20Commitments.pdf.

[20] Current technology primarily relies upon R134A refrigerant.

[21] Data sources available in Appendix D: Market Characterization.

The initiative will progress segmentation efforts systematically, developing a segmentation tool to identify the largest submarkets with the greatest opportunity for HPWH conversion. Anticipated early targets include: propane or solar customers, areas of the state with no natural gas service, areas with high ESJ potential and existing program support (i.e., rural communities, municipalities with poor air quality, low- and moderate-income households, etc.), customers with electric-friendly rates, California Alternate Rates for Energy (CARE)/Family Electric Rate Assistance (FERA) customers, or simpler gas conversions that do not require a panel upgrade. Segmentation efforts are positioned to rapidly increase market uptake and will not target homes where bills will increase. This MTI is primarily focused on driving fuel substitution adoption due to the upcoming 2029 standard that will effectively require electric water heating adoption, and the segmentation approach reflects this approach.

Over time, the initiative will expand into more challenging submarkets, aligning with product diversification efforts (including split-systems, 120V models, and panel-upgrade-avoidance solutions) and tracking rate reform to avoid promoting fuel substitution that would increase customer costs. As rate reform continues, HPWH will become a realistic opportunity for a growing population of homes and submarkets.

CalMTA will closely monitor HPWH adoption in new construction. We anticipate that the 2025 Title-24 updates and the removal of the gas line extension allowance will make HPWH installations standard practice in new construction. However, if adoption lags, CalMTA will prioritize the new construction market as an easy-to install opportunity and pursue the new construction market to rapidly accelerate HPWH sales.

Target market actors and supply chain partners include HPWH manufacturers, big-box and small to medium retailers, plumbing and HVAC distributors, installers, energy efficiency and electrification program partners serving single-family, mobile home, and multifamily property owners with dedicated water heating systems.

2.2.3 Initiative vision

Our Market Vision

This initiative aims to build a market where HPWHs play an essential role in meeting California's net neutrality targets and 2030 goal of 6 million heat pumps.[22,23] In this future market, HPWHs will serve the majority of California's housing stock, transitioning the state from gas to electric water heating utilizing lower-GWP refrigerants with reliable load shifting capability.

The Vision for CalMTA

CalMTA values the important work already underway to support HPWH adoption nationally and in California. Despite these efforts, the market remains fragmented and significant barriers persist.

[22] More about California's net neutrality targets can be found at https://lci.ca.gov/climate/carbon-neutrality.html.
[23] More about the Heat Pump Partnership can be found at https://heatpumppartnership.org.

CalMTA's HPWH MTI is designed to fill these gaps by strategically complementing existing programs, uniting the state's collective resources, and building the operational infrastructure needed to accelerate adoption and transition the state from gas to electric HPWHs. CalMTA will drive cohesive, statewide market transformation that no single program can achieve alone by:

- Standardizing product development criteria
- Collaborating with the supply chain and California programs offering incentives on targeted submarkets to aggregate buying power to lower installed costs and rapidly increase adoption and build the supply chain business case
- Fostering shared research and messaging
- Coordinating data requests with partners (i.e., manufacturers, distributors, and retailers) and programs to create real-time snapshots of the HPWH market in California to inform the ongoing MTI strategy, other program efforts, and provide beneficial guidance

2.2.4 Key market barriers

In market transformation market research, it is common for findings to center around the well-known "Five A's" of market barriers: Accessibility, Affordability, Awareness, Availability, and Acceptance.[24] These categories have long served as a useful framework for understanding market limitations. However, after years of programmatic efforts, HPWH technology continues to experience limited market adoption, awareness, accessibility, and affordability, thus falling short of the market acceptance goals set by the energy efficiency industry and market actors for over a decade.

Recognizing this persistent challenge, the CalMTA team sought to look beyond the Five A's to understand the underlying causes of limited market adoption. The objective was to identify the "barriers behind the barriers"– the systemic, structural, and behavioral factors that continue to constrain HPWH adoption despite strong policy and programmatic support.

Through Phase II research, including collaboration with program and market partners at the Market Acceleration Summit and leveraging the experience of CalMTA team members in the HPWH market outside of California, CalMTA identified the foundational barriers that must be addressed before broad market adoption can take place.[25] These barriers are discussed below. The Logic Model in Appendix A summarizes these barriers and maps them to the strategic interventions of the MTI.

- **Weak customer value proposition and limited demand result in limited supply chain business case.** The supply chain's business case is weak due to low customer demand stemming from an unarticulated customer value proposition. Most customers do not specifically request or

[24] To learn more about the "Five A's" see https://www.aceee.org/files/proceedings/2004/data/papers/SS04_Panel6_Paper10.pdf.
[25] To learn more about the HPWH Market Acceleration Summit see https://calmta.org/residential-hpwh-market-acceleration-Summit/.

require HPWHs. Consequently, supply chain partners have little incentive to advocate for expanded product offerings or refined feature sets from manufacturers. CalMTA's Market Characterization Report estimated HPWH sales to be only 5%-6% of water heaters sold in California, with the majority in new construction.[26] This makes it challenging for supply-chain market actors to justify the additional investments required to expand product offerings and actively promote and support HPWH adoption.

- **Some California housing characteristics are less than ideal for HPWHs.** California's high prevalence of gas water heaters (76% of all residential homes in California have natural gas or propane water heaters) leads to more complex retrofit requirements, including potential electrical upgrades and space constraints and customers may experience higher energy bills.[27,28] These challenges contribute to installer confusion and uncertainty on appropriate technology recommendations and what specific HPWH technology/form factor to recommend.
- **Complex product requirements that customers do not value.** Customers do not value technically complex features (e.g., load shifting, demand response, and smart connectivity) that contribute to higher product costs, reinforcing the perception of HPWH as premium products and creating added barriers to widespread adoption. Programmatic requirements and the energy efficiency industry's continued emphasis on advanced features often exceed what most customers value or are willing to pay a premium for.
- **Complex and inconsistent California program landscape and requirements for supply chain and customers.** California's complex and inconsistent program landscape, including more than 30 active programs (as of September 2025) spanning air quality, electrification, and energy efficiency efforts, leads to inconsistent and confusing requirements for the supply chain and customers.[29] Many of these programs may have unique requirements, incentive structures, timelines, customer eligibility, messaging, training standards, and data requirements. This complexity creates inconsistency across the market, making it difficult for customers and supply chain partners — particularly those operating or participating across multiple program territories — to navigate offerings efficiently. The result is confusion, increased supply chain staff costs, and reduced market cohesion, all of which hinders large-scale HPWH adoption and further erodes the supply chain business case.
- **High first cost (equipment and installation):**
- **Equipment:** The cost difference between HPWHs and standard equipment is estimated between $3,000 and $4,000.[30] Manufacturers continue to see HPWHs as a premium product. Without

[26] Data sources available in Appendix D: HPWH Market Characterization.
[27] Data sources available in Appendix D: HPWH Market Characterization.
[28] Natural gas water heaters are typically smaller than competing electric technologies and HPWH require more ambient space.
[29] Data sources available in Appendix D: HPWH Market Characterization.
[30] Data sources available in Appendix D: HPWH Market Characterization.

consistent, predictable, market-wide signals and specifications, manufacturers have limited incentives to invest in lower-cost components, simplified feature sets, or expanded manufacturing capacity required for high-volume production runs needed to achieve economies of scale.

- **Installation:** the average installed cost of a HPWH in California is approximately $6,000–$7,000, compared to $2,000–$3,000 for standard equipment,[31] making the technology financially out of reach for many customers, especially in ESJ communities and cost-sensitive households. Installer unfamiliarity with the technology and California-home-specific retrofit challenges (i.e., natural gas storage water heater replacement) have kept average installation costs high. Even with available programmatic incentives, the high upfront cost of installation presents a significant barrier to customer willingness to adopt the technology and constrains overall market growth.

2.2.5 Market opportunities and key leverage points

Market opportunities are the market activities and forces that increase adoption of this technology. These are listed in Appendix A: Logic Model and are also mapped to the planned strategic interventions. CalMTA has identified two primary market opportunities for HPWHs:

- Federal standard requiring HPWH for electric tanks with an effective storage volume greater than or equal to 20 gallons and less than or equal to 120 gallons, effective in 2029. The federal standard will expand HPWH production, attract new manufacturers, and increase sales for U.S. households with electric water heating. CalMTA can leverage this momentum to bring new manufacturers into the California market and use electric resistance water heaters as an entry point for installers to gain experience with simpler HPWH installations.
- California's 2030 Heat Pump Goal (and CAHPP) aims to install 6 million heat pumps. CalMTA will partner closely and stay aligned with this critical work, leveraging the CAHPP Blueprint to inform CalMTA's efforts towards this shared goal.[32]

Key leverage points are points of aggregation that enable the MTI to reach a broader set of market actors at a reduced level of investment. CalMTA has identified several key leverage points that this MTI will utilize to accelerate market adoption. These include:

- **Existing California HPWH programs.** The MTI is well informed by the current program landscape and activities related to the HPWH market. CalMTA understands that changes are occurring and continues to remain engaged with program administrators (PAs) and other programs working in the California HP market to stay current with programmatic efforts.

[31] Data sources available in Appendix D: HPWH Market Characterization.
[32] To learn more about the CAHPP Blueprint see: https://heatpumppartnership.org/wp-content/uploads/2025/03/CAHPP-Blueprint-Fact-Sheet-Final.pdf.

- **Northwest Energy Efficiency Alliance's (NEEA) Hot Water Innovation Prize.**[33] This project focuses on developing solutions for low-rise multifamily properties. CalMTA plans to track this research and identify opportunities to engage manufacturers in similar product development efforts that meet California's housing needs while avoiding duplication.
- **ENERGY-STAR-certified HPWH list.** ENERGY STAR maintains a qualified HPWH product list that identifies high-performing equipment tested to a consensus-based procedure at accredited third-party laboratories. CalMTA envisions leveraging this qualified product list to inform and guide market segment activities, ensuring alignment with nationally recognized product standards while supporting consistency and credibility across California's HPWH initiatives.
- **California Air Resource Board (CARB) and Air Quality Management Districts (AQMDs).** CalMTA will monitor and build on efforts by CARB and local AQMDs, promoting the adoption of lower GWP refrigerants and efforts to limit sales of GHG and NOx emissive water heating equipment.

Actions by these organizations will inform CalMTA's engagement with manufacturers and help shape product development activities and roadmaps. By aligning with air quality goals and emerging refrigerant standards, CalMTA can help accelerate the introduction of next-generation HPWH technologies that support California's climate objectives.

2.2.6 Conditions that would trigger transitioning out of the market

Once this MTI achieves all of the market conditions detailed below, there will be sufficient momentum to allow CalMTA to begin transitioning out of the market while continuing to monitor adoption. At that time, funding levels reduce substantially while benefits continue to grow. For details on tracked Market Progress Indicators (MPIs) and milestones, see Appendix F.

- **Product availability and installer confidence:** A range of HPWH products and installation solutions well-suited to California's housing stock are widely available across the state and trusted by installers as a reliable and preferred technology.
- **Manufacturer innovation:** Manufacturers produce HPWH models that utilize lower-GWP refrigerants and include load flex capabilities.
- **Competitive supply chain:** Robust competition exists across retail and distributor channels, ensuring consistent product availability, pricing transparency, customer choice, and support for DIY/BIY solutions.
- **Widespread market adoption:** HPWHs reach a technology adoption tipping point in existing residential homes, demonstrating strong customer demand and market maturity.

[33] To learn more about the How Water Innovation Prize see https://www.linkedin.com/posts/northwest-energy-efficiency-alliance_hotairhotwater25-energyefficiency-activity-7302801777072947201-w1qn/.

2.2.7 Market end state

CalMTA envisions a market end state where the following scenarios exist:

- **Technology plays a critical role in California reaching its statewide decarbonization goals:** HPWH technology supports the state achieving its 6 million heat pump adoption targets in 2030 and carbon neutrality by 2045.
- **HPWH programs are aligned:** HPWH programs have increased consistency in requirements, and research and messaging align across utilities, state agencies, and local programs to create a predictable and coordinated market environment for supply chain partners and customers.
- **Market dominance of HPWHs:** The overwhelming majority of residential water heaters purchased and installed in California are HPWHs, reflecting sustained supply-chain demand and support and strong consumer acceptance.
- **Lower GWP and load-shifting technology adoption:** HPWHs installed in California utilize lower-GWP refrigerants and include load-shifting capabilities to support grid reliability and climate goals.

2.2.8 Environmental & social justice approach

This MTI is designed to reduce adoption friction across product and delivery so households in ESJ communities can adopt HPWHs with confidence and without disproportionate cost or quality tradeoffs. Many ESJ households face stacked barriers — upfront cost sensitivity, installation complexity (space, noise, venting, circuits/electrical capacity), uncertainty about bill impacts, language and trust gaps, and uneven installer availability.

The HPWH MTI supports adoption in ESJ communities by making products more affordable and accessible in those communities. This will happen through key MTI strategies: the segmentation approach, price reduction strategies, and alternative form factor advocacy.

For the segmentation approach, the MTI will target housing stock that is more common for lower income or rural customers in early submarkets (e.g., homes with electric resistance water heating, mobile and manufactured homes, and propane-heated homes, etc.) The MTI will also aggregate demand with existing income-qualified and low-income programs, CBOs and related initiatives will build scale, reduce HPWH costs, and reach more households.

The MTI supports a variety of price reduction strategies as well. The MTI plan supports increasing HPWH acceptance and competition in the retail channel to drive down supply chain costs and increase accessibility. The strategy will also focus on advancing HPWH availability in rural markets. Finally, the MTI will support creating a pathway for DIY and BIY purchases, which can bring down overall costs.

The strategic intervention of influencing alternative form factors (e.g., split-systems, 120V systems) and installation solutions (e.g., meter collars, panel optimization) also serves the purpose of decreasing price to make the technology accessible to more home segments (e.g., small multifamily) and drive down installation costs.

To support equitable adoption, the MTI will leverage trusted community channels and existing ESJ-focused programs to reinforce clear, multilingual, culturally relevant, plain-language messaging about benefits, costs, and next steps to reduce confusion and help households transition from interest to installation.

Details on ESJ integration within interventions and workforce are in Sections 2.4 and 2.5.

2.2.9 Theory/Assumptions

The following conditions explain the theory of market change for this MTI and the key assumptions the theory is based on.

1) **If** CalMTA aggregates programs to prioritize easy-to-install markets in partnership with manufacturers to build scale where installations are less complex, **then** installer experience and acceptance of the technology will increase and installation costs will decrease.
2) **If** a shared statewide product roadmap is developed leveraging ENERGY STAR and aggregating California technology needs and is paired with sequenced accelerated adoption efforts in submarkets, **then** manufacturers will experience the clarity necessary to build their business case and have a clearer incentive to support new form factor product development and partner on developing a product roadmap, driving innovation and increasing product diversity.
3) **If** shared tools and infrastructure such as unified market messaging, streamlined data platforms and requests, and coordinated research are shared across programs building statewide operational efficiencies and infrastructure, **then** market actors will experience decreased administrative burden and gain greater confidence in California's HPWH programs and be more willing to participate, promote, and sell HPWHs.
4) **If** CalMTA demonstrates clear value to other HPWH programs in California, **then** infrastructure support can expand to include additional requested tools and resources, further enhancing program consistency and market collaboration across the state.
5) **If** CalMTA's efforts ensure that HPWH products with load-shift capabilities are supported and installed in the market, **then** when programs are ready to leverage load shifting, the necessary technology will already be deployed in the field, positioning California to fully capture grid and decarbonization benefits.

2.3 Strategic interventions

Below are the strategic interventions that this MTI will deploy to overcome barriers in the residential HPWH market. The list includes a general description of the intervention, market barriers the intervention will address, market opportunities it will exploit, and key outcomes. Many of the interventions will support multiple outcomes as detailed in the graphic Logic Model contained in Appendix A. Please also see the "Evaluability Map" Attachment to Appendix F for details on the outcomes, their associated MPIs, and expected Milestones.

Market transformation efforts are unique to each market they serve. This initiative is distinct because the product we aim to transform is more than 15 years old and already has substantial program activity underway across California. CalMTA's market research indicates that roughly $74.7 million in incentives have already been spent, and nearly $300 million more is available; however, adoption remains lackluster with minimal growth.

To spur market momentum and remove existing market barriers, CalMTA proposes the following interventions focusing on the areas where CalMTA can aggregate the collective efforts of programs to create consistency, alleviate operational burdens, and provide the greatest impact.

Strategic intervention 1	**Influence Product Development and Match Technology to Housing Stock** CalMTA will use research tools and available data to: • Develop a custom California housing stock database using existing datasets (e.g., Restock, CalEnviroscreen, residential solar maps, etc.) to identify and aggregate attributes that influence ease of adoption in the retrofit market (e.g., panel capacity, utility service area, presence of residential solar) specific to both ESJ and non-ESJ communities. Utilize the database to create retrofit readiness profiles based on adoption-relevant attributes and leverage results to help the team prioritize targeted incentive programs and adoption initiatives. • Develop a dynamic Market Segment Opportunity Assessment Tool to identify submarkets by opportunity size and ease of transformation to inform the initiatives prioritization of submarkets. This tool will support prioritizing advantageous HPWH product installation based on fluctuating variables such as current electric rates and local codes and leverage the housing stock database referenced above.

	• Leverage the housing stock database to assess California housing segments and match those segments with existing equipment types to identify any key product gaps to inform product development activities. • Identify optimal installation scenarios for split-system and 120V HPWHs and collaborate with programs to align on installer recommendations and leverage existing training and program efforts to help installers confidently select appropriate equipment. • Facilitate harmonization of load flexibility protocols across HPWH products and utility programs. CalMTA will build upon its findings and work outlined above to collaborate with energy efficiency programs and partners to create a coordinated and comprehensive product roadmap that charts the evolution of HPWH technology from its current state to where it needs to be to help California meet its electrification and heat pump goals. This roadmap will include pathways for lower-GWP refrigerant and load flex capabilities and solutions that address identified equipment gaps. At a minimum, the Product Roadmap will address: • Development of alternative form factors to meet the needs of California's diverse housing stock (interior closet, multifamily, outdoor installations). • A pathway toward greater product diversity that expands beyond premium products and price points and includes a lower-cost product tier similar to other appliance categories, alternative form factors, and split-systems. • Integration of lower-GWP refrigerants into HPWH products to reduce their carbon footprint. • Ongoing assurance that HPWHs installed in California can shift electric load and are able to support the state's evolving grid infrastructure. • Supporting manufacturers and innovation efforts to increase trust, traction, and adoption of technologies that meet California's specific housing needs (e.g., split-systems, small volume model "low-boys," and 120V options). Although California's market is large enough to generate substantial market pull on its own, CalMTA recognizes that collaboration beyond state borders can further accelerate momentum. By aligning with national and regional energy efficiency programs, CalMTA can amplify manufacturer engagement and help advance shared product development priorities. This collaboration will also inform the development of a market segment assessment tool to identify and prioritize scalable submarkets, supporting the initiative's second intervention: "Aggregate Statewide Buying Power to

	Attract Market Partners and Build Momentum in Scalable Submarkets." By segmenting California's housing stock across both ESJ and non-ESJ communities, CalMTA can pinpoint where today's HPWH technologies are the best fit and where additional innovation is needed. This analysis will ensure product advocacy and Scale-Up strategies focus on the highest-impact opportunities and avoid promoting solutions that are not well suited to certain housing types. Importantly, this strategic intervention directly benefits ESJ communities by expanding product options that avoid panel upgrades and advancing alternative form factors and installation solutions (meter collars and panel optimization) to make the technology accessible to more home segments (ex. multifamily and manufactured housing) and drive down installation costs.
Market barrier(s) addressed and opportunities to exploit	**Barriers** • Some California housing characteristics are less than ideal for HPWHs (e.g., homes with natural gas water heaters where operating costs are highly dependent on electricity rate structure, homes where water heaters are installed in small interior or outdoor closets, multifamily properties, etc.) • Complex product requirements that customers do not value • High first cost (equipment and installation costs) **Opportunities** • 2029 federal standard requiring heat pump technology for electric water heaters with an effective storage volume greater than or equal to 20 gallons and less than or equal to 120 gallons • California 2030 Heat Pump goal and CAHPP work
Outcomes	
Short-term outcomes (1-2 yrs)	• Manufacturers and programs partner with CalMTA on Scale-Up Plans[34] • Increased installer confidence and acceptance of HPWH technology
Medium-term outcomes (3-5 yrs)	• Energy efficiency partners and programs include lower-GWP refrigerants in product tiers/requirements and program offerings • Greater diversity in products with alternative form factors installed in California homes to meet need of California housing stock

[34] Customized plan for each submarket outlining strategies, key partners, roles and responsibilities, and coordination approaches designed in collaboration with market and program partners partnering to accelerate submarket adoption.

	• Increased California program consistency strengthens market and supply chain business case
Long-term outcomes (6-10+ yrs)	• HPWHs reach a technology adoption tipping point for existing residential homes • HPWHs newly installed in California utilize lower-GWP refrigerants and include load shifting capabilities

Strategic intervention 2 	**Aggregate Statewide Buying Power to Attract Market Partners and Build Momentum in Scalable Submarkets** Partnering with existing energy efficiency and ESJ programs, CalMTA will design and implement an approach for aggregating the collective buying power of these programs to target specific market segments and rapidly accelerate HPWH adoption. In the near term, this work will prioritize easy-to-install segments where residents will see neutral or positive bill impacts such as in homes with electric-resistance water heaters, propane, solar, and other submarkets while exploring opportunities in ESJ communities with strong CBO support, installer coverage, and low-income programs. This approach will build the supply side business case, strengthen installer confidence, and rapidly accelerate adoption. This in turn will help manufacturers and supply chain partners see a nearer return on their investments and increase the likelihood of their engagement in the Initiative's product roadmap development. By focusing early on easy-to-install markets, CalMTA can establish a strong foundation of straightforward installations. This early volume will help manufacturers ramp up production and enable installers to build familiarity and confidence with HPWH technology before the federal standard takes effect. This approach supports a smoother transition for customers and supply chain partners, reduces installation complexity, and helps mitigate customer bill concerns. Installation costs in these segments are also expected to fall well below the current statewide average of $6,000–$7,000 because they require significantly less work. After the initial phase, CalMTA will progress segmentation efforts to systematically target increasingly more difficult installation efforts, including simpler gas conversions. Lessons learned from initial efforts and from market and program partner experiences will guide additional submarket strategies. Possible secondary targets include manufactured homes, homes with existing gas water heaters located in a garage or exterior installation, and areas of the state with electric-friendly rates.

	By implementing this segmented approach, CalMTA aims to aggregate the resources of existing programs to rapidly accelerate adoption, strengthen the business case for supply chain partners, and enable manufacturers to begin recouping their investments in HPWH technology, all while supporting incumbent manufacturers in expanding rather than cannibalizing their existing markets. Market segmentation support under the CalMTA foundation will be flexible and responsive to the needs of each targeted submarket. A strategy and suite of tactical tools will be developed for each submarket in partnership with energy-efficiency and ESJ programs, and manufacturers culminating into unique Scale-Up Plans by submarket. Possible tactics and tools included in these plans will leverage lessons learned from other HPWH programs across the country and may include: • Coalition building among programs and partners ready to scale HPWH adoption to achieve volume pricing for both equipment and installation in the targeted submarket. • Generation of qualified leads for installers to decrease the time required to find and sell product into eligible homes. • Focused community/neighborhood technology deployment. • Stacking and braiding incentives to lower first cost for customers. • Leveraging the retail channel to create competition across the supply chain and provide simpler pathways to DIY and BIY installations. • Development of consistent multilingual messaging and marketing/training tools for installers and customers to sell and operate equipment in specific submarkets and understand bill impacts. • Creation of standardized data collection and sharing frameworks to enhance efficiency and coordination. • Elimination of the start/stop incentive problem through partnership commitments and mechanisms to stabilize incentive payments. To further support this work, establish clear roles and responsibilities across programs, avoid duplicating efforts, and articulate a clear vision for program coordination, CalMTA will create a Program Support Roadmap for current activities and support roles CalMTA by submarket.

Market barrier(s) addressed and opportunities to exploit	**Barriers** • Some California housing characteristics are less than ideal for HPWHs • High first cost • Low customer value proposition and demand result in limited supply chain business case • Complex and inconsistent California program landscape and requirements for supply chain and customers **Opportunities** • 2029 federal standard requires heat pump technology for electric water heaters with an effective storage volume greater than or equal to 20 gallons and less than or equal to 120 gallons • California 2030 Heat Pump goal and CAHPP work
Outcomes	
Short-term outcomes (1-2 yrs)	• Manufacturers and programs partner with CalMTA on Scale-Up Plans • Increased HPWH installations in early MTI-identified submarkets • Increased installer confidence and acceptance of HPWH technology • Total installed cost decreases for MTI identified submarkets
Medium-term outcomes (3-5 yrs)	• Retail channel sees an increase in HPWH sales and is competitive with distributor channel • Increased California program consistency strengthens market and supply chain business case
Long-term outcomes (6-10+ yrs)	• HPWHs reach a technology adoption tipping point in existing residential homes • HPWHs newly installed in California utilize lower GWP refrigerants and include load-flex capabilities

Strategic intervention 3	**Develop, Support, and Coordinate Statewide Operational Infrastructure** Market research conducted by CalMTA identified more than 30 active HPWH-related programs operating across California in 2025. These programs collectively represent an investment of nearly $75 million with approximately an additional $300 million supporting uptake of HPWH technology. However, these programs often operate in silos with unique applications, data collection protocols, incentive levels, timelines, qualifying product lists, and installation requirements.

	This lack of consistency has created an administrative burden and confusion for manufacturers, distributors, and installers and has limited supply channel efficiency. CalMTA aims to foster statewide cohesion, aggregating the programmatic efforts to reduce complexity for market actors and support the maturation of a coordinated HPWH market. CalMTA's approach will leverage lessons from the other strategic interventions and begin by demonstrating value through tangible wins, building the opportunity for expanding infrastructure support where partners and stakeholders see clear benefit, and request further collaboration. Early efforts will focus on four primary areas: **Statewide Market Intelligence Hub**[35] CalMTA will develop a data-sharing platform to provide timely data to program partners and market actors with actionable insights into HPWH market performance in California. The hub will establish a robust, reciprocal data relationship with supply chain partners. Participation will be encouraged by offering a business intelligent platform providing relevant analytics that inform strategy and sales performance, while maintaining data anonymity and confidentiality. Building on CalMTA's existing retail partnerships, the platform will expand data collection to include small- and medium-sized retailers and work with distributor partners to create streamlined data submission protocols that align with their business operations. For supply chain partners, a consistent data request will reduce administrative burden, improve data quality, and create a comprehensive snapshot of HPWH market activity and performance relative to other water heating technologies that will be valued by both supply chain and program partners. This enhanced visibility will help market actors and program partners identify growth opportunities, programmatic design, and strategies to refine marketing and stocking strategies and contribute to an environment where the supply chain increasingly prioritizes HPWH sales as a core part of their business. **Messaging and Marketing Tools** CalMTA will work to establish consistency in how California communicates about HPWHs by leveraging and aligning with efforts such as the CAHPP. The goal is to harmonize messaging across supply chain partners, PAs, and installers to ensure a unified and recognizable narrative about HPWH benefits and opportunities.

[35] Data intelligence tool sharing collecting and sharing HPWH sales and programmatic data in California accessible to market partners and programs.

	The MTI will work to ensure multilingual templates, tools, and educational materials exist that programs, manufacturers, and installers can easily adopt, promoting consistent and effective messaging while maintaining flexibility for local branding. CalMTA will closely monitor activity in this area as our role may need to be more focused on influence than creation. Over time, this effort will help ensure that the language, framing, and customer messaging associated with HPWHs are cohesive statewide, building familiarity and confidence among both installers and consumers and creating consistency for supply chain partners who sell and service water heaters across program territory lines and for customers who receive messaging from multiple programs. **Program Alignment and Product Consistency** Through its market segment scale-up and product development activities, CalMTA will collaborate with HPWH programs to create HPWH Product Criteria, aligning around a shared set of product requirements to inform programmatic support and reduce confusion and inconsistency in the marketplace. CalMTA plans to focus on equipment performance rather than installation criteria. This alignment will simplify participation for supply chain partners and support development of the Product Roadmap by illustrating California's strengthening cohesion. **Shared Research and Market Insights** Through the development of this MTI and discussions at the Market Acceleration Summit, CalMTA and its partners identified significant data and research gaps impeding progress (i.e., limited housing stock and sales data). To address these, CalMTA will create a shared Research Plan for HPWH to prioritize, coordinate, and conduct research in collaboration with partners (e.g., CalNEXT, NEEA, the Advanced Water Heating Initiative (AWHI)) and create mechanism to share findings ensuring they are actionable and timely and efforts are not duplicated. Together, these activities will strengthen the foundation for coordinated, data-driven decision making, reduce market friction, and create a more unified and confident market environment for all HPWH stakeholders in California.
Market barrier(s) addressed and opportunities to exploit	**Barriers** • Complex and inconsistent California program landscape and requirements for supply chain and customers • Low customer value proposition and demand result in limited supply chain business case **Opportunities** • California 2030 Heat Pump goal and CAHPP work

Outcomes	
Short-term outcomes (1-2 yrs)	• California program partners align on shared definition of qualified HPWH product, creating consistency for market partners and end customers • Installers, market partners, and programs utilize shared messaging and research to educate and accelerate HPWH adoption • Market and program partners leverage and participate in Market Intelligence Data Hub creating mutually beneficial relationship
Medium-term outcomes (3-5 yrs)	• Data are leveraged by California programs and market actors and create additional value streams to support funding of California's Heat Pump goals • Energy efficiency partner organizations/programs include greater diversity of HPWH product tiers/program offerings to meet market needs • Increased California program consistency strengthens market and supply chain business case
Long-term outcomes (6-10+ yrs)	• HPWHs installed in California utilize lower-GWP refrigerants and include load-shifting capabilities

2.4 Environmental & social justice communities

Many households in ESJ communities face stacked barriers to HPWH adoption composed of upfront cost, installation complexity (space, noise, venting, circuits/electrical capacity), uncertainty about bill impacts, language and trust gaps, and uneven installer availability. In response, this MTI embeds equity considerations across product, delivery pathways, and accountability to reduce adoption friction and help ensure ESJ households have access to HPWH solutions that are practical for common housing conditions and supported by clear expectations about costs and performance.

CalMTA's approach to addressing market-level barriers faced by ESJ communities was developed with thoughtful input from key equity stakeholders, including CalMTA's Equity Sounding Board.[36] A more detailed description of this engagement, key learnings, and actions taken can be found in Section 4 of Appendix E (External Program Alignment & Coordination).

Key elements of this approach include:

- Target housing stock that is more common for lower income or rural customers in early submarkets (e.g., electric-resistance, mobile and manufactured homes, and propane-heated homes).
- Aggregating demand with existing income-qualified and low-income programs, CBOs, and related initiatives will build scale, reduce HPWH costs, and expand reach.
- Increasing HPWH acceptance and competition in the retail channel to drive down supply chain costs and increase accessibility, including by advancing HPWH availability in rural markets and creating a pathway for DIY and BIY purchases.
- Influencing alternative form factors (e.g., split-systems, 120V systems) and installation solutions (e.g., meter collars, panel optimization) to make the technology accessible to more home segments (e.g., multifamily).

To support equitable adoption, the MTI will leverage trusted community channels and existing ESJ-focused programs to reinforce clear, multilingual, culturally relevant, plain-language messaging about benefits, costs, and next steps – reducing confusion and helping households move from interest to installation.

Strategic Intervention 1 – Influence product development and match technology to housing stock aligns California's HPWH market actors around products and configurations suited to the state's residential housing stock, including constraints common in ESJ communities. This includes ensuring solutions for small single-family homes, manufactured homes, multifamily units with

[36] To learn more about CalMTA's equity sound board see https://calmta.org/equity-sounding-board/.

dedicated water heating, and Tribal housing where space and electrical capacity are often limited.

Strategic Intervention 2 – Aggregate statewide buying power to attract market partners and build momentum in scalable submarkets prioritizes targeted HPWH submarkets (including homes with existing electric resistance or propane) to concentrate activity where repeatable installations and coordinated partner support can accelerate uptake. By aggregating demand through existing ESJ-focused programs and partners, the MTI helps strengthen the supply-chain business case, supports sustained market activity, and improves affordability by applying downward pressure on total installed costs over time.

The MTI will initially focus ESJ efforts within submarkets where there is the greatest opportunity for HPWH conversion. Emphasizing areas with established trusted CBO activity (trusted messengers, warm leads, and awareness support) and viable program/financing pathways (improving affordability and mitigating cost impacts). Learning from these early submarkets will inform ongoing submarket segmentation efforts and reduce friction in communities that may currently face more difficult paths to adoption.

DIY/BIY pathways are also recognized as important access points for many customers, including in ESJ communities. CalMTA will work to increase HPWH acceptance and competition in the retail channel to drive down supply chain costs and increase accessibility for this portion of the market.

To support conversion in prioritized segments, the MTI will coordinate with existing ESJ-focused programs and trusted community channels to reinforce consistent, multilingual, plain-language messaging about benefits, costs, and next steps.

To support accountability for equitable market transformation, CalMTA will track ESJ-relevant market progress in parallel with the broader market and use those findings to refine, submarket prioritization, coordination, and messaging where persistent gaps remain. Market progress indicators (MPIs) are described in Appendix F (Evaluation Plan).

2.5 Workforce development

California already has a robust and established HPWH workforce and training ecosystem, supported by long-standing manufacturer and distributor platforms, utility and regional energy network (REN) programs, community colleges and technical schools, apprenticeship pathways, trade associations, and CBOs. The primary workforce challenge for this MTI is not "creating" a workforce but rather strengthening the business case for firms to consistently offer HPWHs by reducing market friction and uncertainty. The MTI will therefore leverage and influence California's existing training infrastructure to address gaps identified through market acceleration activities, product development, and program partners learnings, and ensure training content

and delivery is consistent, easily understandable, multilingual where needed, and accessible through established channels.

This approach is intentionally tied to the barrier of low demand. As the MTI prioritizes and scales targeted submarkets, it will use those segments to create clearer, repeatable, and more predictable installation opportunities – supporting contractor confidence and helping drive sales in the market. In turn, more repeatable jobs can help create clear pathways to profit for installation businesses, motivating investment in on-the-job training, recruitment/retention, and operational readiness. Over time, improved repeatability and fit-for-purpose applications can also help reduce soft-cost surprises that contribute to higher perceived risk and cost for both contractors and customers.

To ensure the MTI stays grounded in real installation conditions, installers will be treated as key partners in market intelligence. The MTI will gather installer feedback across the state (including those serving ESJ communities) to refine submarket activities and identify pain points and emerging training needs. These insights will inform submarket activities, infrastructure needs, training, and messaging recommendations, ensuring installers have what they need to champion HPWH technology.

What this MTI will do for workforce, education, and training (WE&T):

- Leverage targeted submarkets to create real-world, hands-on installation opportunities that build contractor familiarity and confidence through repeatable applications and demonstrate demand, strengthening the business case for installers to invest in HPWH related skills and readiness.
- Leverage and influence existing training and partner channels so practical learnings and best practices can be reflected across the market's established WE&T pathways.
- Use installer-informed market intelligence to reduce installation and adoption friction created by inconsistent requirements, messaging, and customer/contractor experience across programs and territories.

2.6 Total system benefit & cost-effectiveness forecast

CalMTA estimated the TSB and cost-effectiveness for the HPWH MTI, including the Total Resource Cost (TRC), Program Administrator Cost (PAC), and two Societal Cost Test (SCT) results. Table 2 below shows MTI TSB with energy, grid, and GHG impacts. The initiative is cost effective under the TRC, PAC, and SCT perspectives (Table 2).

Table 2. MTI cost-effectiveness estimates – residential HPWH

TRC	PAC	Base SCT	High SCT
1.67	16.82	2.70	2.69

Table 3 shows MTI TSB — in total and broken down by energy, grid, and GHG impacts. The MTI will deliver an estimated $500 million in TSB over the 20-year forecast period from 2028 to 2047. This includes $57 million in energy benefits, $8 million in grid benefits, and $451 million in abated GHG emissions calculated using TRC values specified by the CEDARS Cost-Effectiveness Tool to calculate benefits.

Table 3. Residential HPWH TSB estimates

TSB ($M)	Energy ($M)	Grid ($M)	GHG non-refrigerant ($M)	GHG refrigerant ($M)
500.80	57.09	8.16	451.21	-15.67

To develop the TSB and cost-effectiveness estimates, CalMTA developed a model to forecast incremental units of market adoption resulting from the MTI.

2.6.1 Market adoption forecast

This section summarizes CalMTA's forecast of the baseline market adoption (BMA) and total market adoption (TMA) of HPWHs. BMA represents the expected "naturally occurring" market adoption, considering current and anticipated market, regulatory, and technological trends. TMA includes the additional adoption resulting from strategic interventions detailed in this MTI plan.

To estimate BMA and TMA for existing households, CalMTA developed a discrete choice adoption model that forecasts customer choices between a baseline (electric resistance, or natural gas) water heater and a HPWH product. The main factors influencing customer choice of water heater type included lifetime ownership cost of an HPWH relative to a baseline unit, the confidence and acceptance of installers, forecasted gas and electric utility rates, and forecasted cost declines of HPWHs. The model accounted for the upcoming 2029 federal standard, which will effectively force replacements of electric resistance water heaters to be HPWHs, as well as the BAAQMD residential water-heater rule, which will also drive HPWH adoption, in both the BMA and TMA scenarios. The main drivers of incremental adoption in the model were the removal of barriers to adoption and decreasing installed costs of HPWHs both resulting from MTI interventions.

Table 4 illustrates the estimated annual baseline and total market installations of HPWHs over the forecast period.

Table 4. Forecasted HPWH Adoption

Market Segment	Statewide incremental units	Non-IOU Territory Units	PA	Net Incremental
Group 1 – 120V Fuel Substitution	82,081	18,058	30,091	33,932
Group 2 - 240V Fuel Substitution	417,024	91,745	152,881	172,398
Group 3 – Electric baseline	1,906	420	699	788
Total	**501,011**	**110,222**	**183,671**	**207,118**

Note: Unit adoption may not sum to total due to rounding.

In the next step of the adoption forecast process, CalMTA calculated the net incremental adoption, which is equal to TMA minus BMA within IOU service territory, minus estimated adoption associated with PAs verified savings (this included all PA programs statewide; for the IOUs).

$$Y^{N.Incremental} = Y^{TMA} - Y^{BMA} - Y^{RA}$$

Where Y represents cumulative adoption of HPWHs over the forecast period of 2028 to 2047. The superscripts $N.incremental$, TMA, BMA, and PA represent net incremental adoption attributed to the MTI, TMA, BMA, and verified PA claimed savings, respectively. Table 5 gives TMA, BMA, PA-verified units, and net incremental adoption in terms of HPWH installations. The approach summarized above estimated BMA, TMA, and net incremental adoption at a statewide level. The last two columns of Table 5 show the adoption attributed to households outside the service territories of the IOUs and the adjusted adoption estimates included in the estimation of TSB and cost-effectiveness.

Table 5. Forecast adoption of HPWH units (2028-2047)

Market Segment	Statewide incremental units	Non-IOU Territory Units	PA	Net Incremental
Group 1 – 120V Fuel Substitution	82,081	18,058	30,091	33,932
Group 2 - 240V Fuel Substitution	417,024	91,745	152,881	172,398
Group 3 – Electric baseline	1,906	420	699	788
Total	501,011	110,222	183,671	207,118

In addition to the net incremental adoption estimates attributed to households in the territories of the three IOUs, the TSB and cost-effectiveness calculations also considered initiative costs, incremental measure cost, avoided costs, load shapes, and unit energy impacts.

A detailed explanation of the methodology and approach, models, inputs, assumptions, and results are provided in Appendix B.

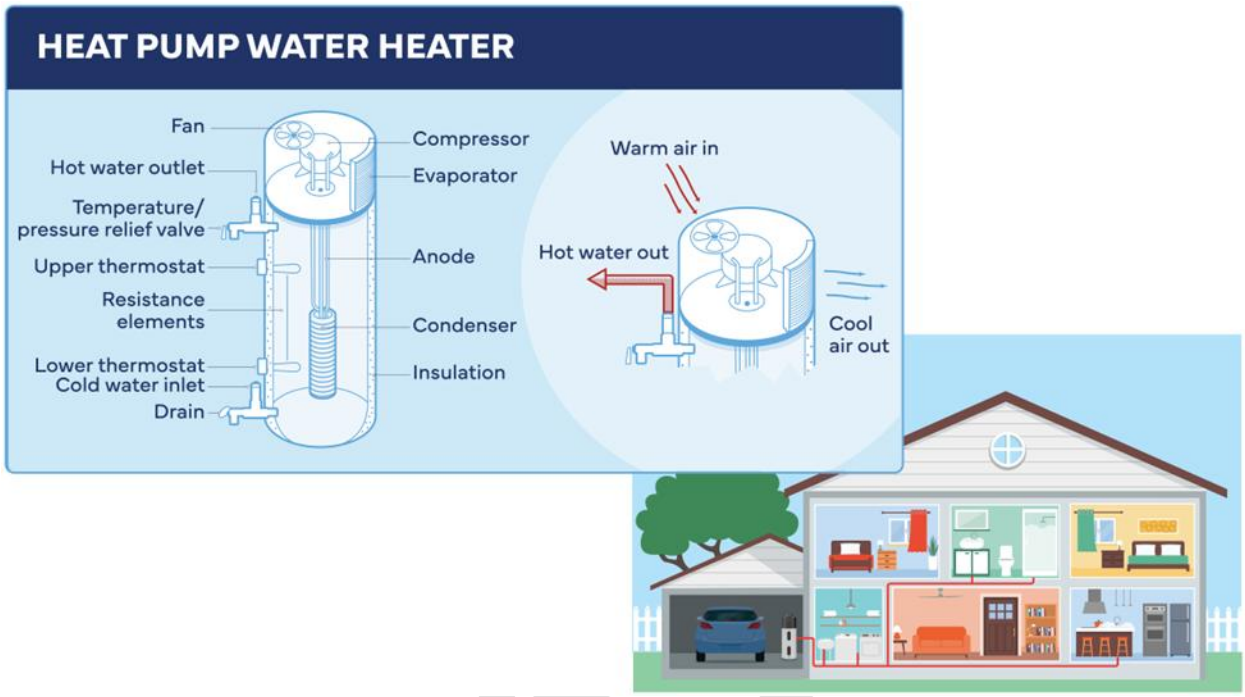
3 Product definition & assessment

HPWHs are water heating systems that use a refrigeration cycle to transfer heat from the surrounding air into water stored in a tank. Figure 1 illustrates both the HPWH process and the primary components of HPWHs. When compared to conventional gas and electric resistance water heaters, HPWHs deliver superior energy-efficiency performance and reduced system-level GHG emissions.[37] They also deliver improved outdoor and/or indoor air quality when replacing conventional gas water heaters.[38]

[37] In this section of the MTI Plan, the term "gas" is primarily used to refer to natural gas, although in general usage it may refer to both natural gas and propane.

[38] Delforge, P. (2020). "Gas Appliances Pollute Indoor and Outdoor Air, Study Shows," Nrdc.Org (blog) (Natural Resources Defense Council, April 29, 2020), https://www.nrdc.org/bio/pierre-delforge/gas-appliances-pollute-indoor-and-outdoor-air-study-shows.

Figure 1. Components and function of a HPWH



This MTI will focus on HPWH models that meet all the following criteria:

- Have either an integrated or split-system design
- Comply with the current ENERGY STAR specification for residential water heaters (v5.0)
- Have a certified effective storage volume of 120 gallons or less
- Support load shifting by, at minimum, including scheduling features that enable consumers to take advantage of time-of-use electricity rates

This MTI product definition excludes the following applications and product types:

- HPWHs used in nonresidential applications
- Commercial water heaters
- Central water heaters
- Point-of-use water heaters
- Other water heating systems composed of multiple heating units

HPWHs meeting the MTI product definition may operate at any power supply voltage (240V, 120V, or otherwise), utilize a shared- or dedicated-electrical circuit, and/or include supplemental electric resistance heat. A future MTI product definition will require more advanced load shifting

capabilities (e.g., compliance with the Air-Conditioning, Heating, and Refrigeration Institute [AHRI] 1430 standard – Demand Flexible Electric Storage Water Heaters) and/or refrigerants with lower GWP.

Aligning the MTI product definition with ENERGY STAR requirements provides stability for manufacturers by defining eligibility for both national and California programs. As a national program with more than 30 years of market presence, ENERGY STAR has demonstrated longevity, brand recognition, and broad stakeholder support. Its long-standing framework offers a durable foundation that manufacturers can confidently design to, reducing regulatory uncertainty and minimizing the need for duplicative product pathways across jurisdictions.

ENERGY STAR incorporates stakeholder input through a transparent, formal specification development process and requires product testing at certified third-party laboratories using the DOE test procedure. This ensures HPWH products meet verified, nationally consistent energy performance standards. The program's established governance structure and periodic specification updates also provide a predictable cadence for incorporating technological advancements while maintaining market stability.

Importantly, ENERGY STAR maintains a publicly available Certified Product List (CPL) that captures the vast majority of high-efficiency HPWH models and, therefore, the bulk of currently available energy savings opportunities in the market. Because manufacturers already seek ENERGY STAR certification to access utility incentives and consumer recognition nationwide, the CPL represents a comprehensive, up-to-date inventory of qualifying products. CalMTA can leverage this existing infrastructure to streamline program administration, simplify eligibility determinations, and exert market influence by aligning incentives, outreach, and compliance pathways with the established ENERGY STAR framework. Utilizing the CPL reduces administrative burden, avoids duplicative product vetting, and ensures that California's market signals are harmonized with a well-recognized national standard.

Additionally, ENERGY STAR appropriately excludes installation requirements, which are beyond the control of manufacturers. This distinction preserves a clear boundary between product performance standards and installation practices, enabling manufacturers to focus on verifiable equipment efficiency while allowing states or utilities to address installation quality through separate programmatic or code-based mechanisms if desired.

3.1 Technical definitions and details

Residential HPWHs are often divided into subtypes based on design and installation characteristics. Common design and installation characteristics used to characterize residential HPWHs (in this MTI Plan and elsewhere) are described below.

Integrated HPWH product: A single-unit system where the entire heat pump (compressor, condenser, evaporator, fan, etc.) and water storage tank are combined in one appliance. Integrated HPWHs are typically installed in a garage or indoors and are the most common design found in today's HPWH market.

Split-system HPWH product: A two-part system where the primary heat pump components are located outdoors and connected via refrigerant lines to the condenser and water storage tank indoors. Figure 2 shows the conceptual difference between split-system and integrated HPWHs. Split-system HPWHs are less common than integrated HPWHs in today's HPWH market.

Figure 2. Conceptual difference between split-system (left) and integrated (right) HPWHs

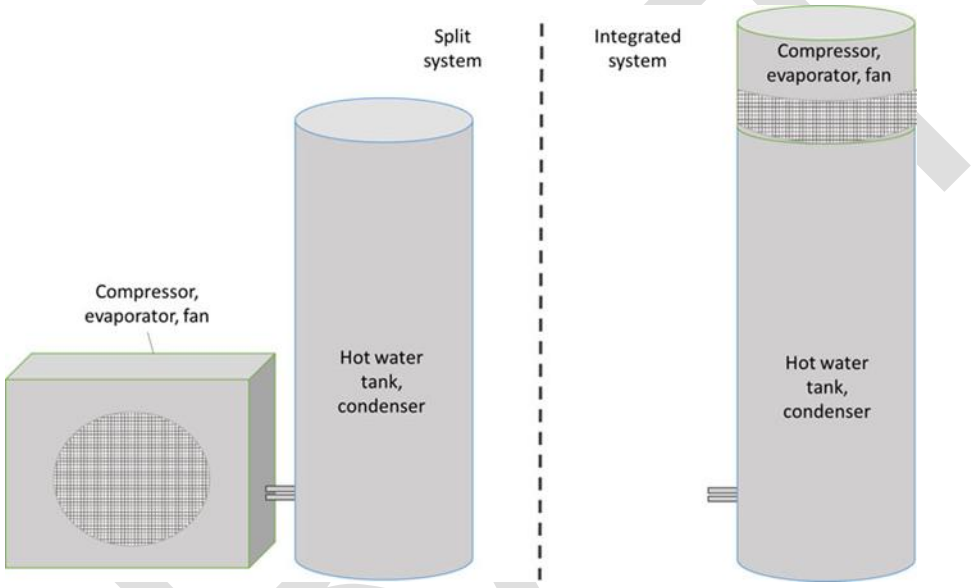


Photo Credit: Scott Dwyer, https://www.yourhome.gov.au/energy/hot-water-systems.

Hybrid HPWH product: A HPWH product that includes supplemental electric resistance elements for faster hot water recovery. Hybrid HPWHs often provide consumers with the option to choose heating type (i.e., heat pump only, heat pump and electric resistance, and electric resistance only). Most integrated HPWHs in today's market are hybrid HPWHs.

Dedicated-circuit HPWH installation: An installation where the powering electrical circuit is exclusively reserved for the HPWH product. Dedicated-circuit HPWH installations are typically required for HPWHs that have higher power supply voltage/amperage needs (e.g., 240V, 30-amps). Higher power supply voltage/amperage enable a HPWH unit to draw more power, primarily used by the electric resistance elements for faster hot water recovery. Most HPWH units on the market today require a dedicated electrical circuit.

Shared-circuit HPWH installation: An installation where the powering electrical circuit may be shared by the HPWH product and other appliances. Shared-circuit HPWHs are designed to operate at a lower voltage and amperage (e.g., 120V, 15-amps).

3.2 Competitive analysis

This section summarizes the primary strengths and weaknesses of residential HPWH equipment. A full competitive landscape analysis can be found in Appendix C.

3.2.1 Primary strengths

With energy efficiency ratings ranging 4.5 to 5.7 times greater than gas storage water heaters and 3.2 to 3.9 times greater than electric resistance storage water heaters, residential HPWHs offer significant energy efficiency gains compared to incumbent water heating technologies.[39] When compared to gas storage water heaters, 240V HPWHs provide significant average system-level GHG emissions reductions of 451 kg-CO2-eq annually (in Case 2 of Table 7) and improved air quality. When compared to electric resistance storage water heaters, HPWHs offer modest average system-level GHG emissions reductions of 253 kg-CO2-eq annually (in Case 4 of Table 7) and annual utility bill savings between $485 and $771 (see Figure 3, standard rates, Case 4 of Table 7) when operating in heat pump mode.

3.2.2 Primary weaknesses

Residential HPWHs have weaknesses that inhibit their broader adoption. When compared broadly to incumbent water heating technologies, these include higher first costs (i.e., equipment and installation costs), unfamiliar installation practices, and efficiency performance that depends on surrounding ambient conditions. Additional weaknesses specific to integrated HPWHs include ventilation requirements that impact installation in tight enclosures, condensate drain requirements, taller and heavier unit dimensions, and unfamiliar compressor noise. Additional weaknesses specific to split-system HPWHs include a need for an HVAC installer and required space and/or permitting for an outdoor unit.

When compared to gas storage water heaters, HPWHs may increase consumer utility bills because of California's high spark ratio.[40] For example, 240V HPWHs may either increase annual utility bills by $224 or reduce annual utility bills by $40, depending on the evaluated rate structure (see Figure 3, standard rates, Case 2 of Table 7). This underscores the importance of identifying households where fuel switching makes economic sense. Additionally, when replacing a gas storage water heater, residential HPWHs may also require an electric panel or electric service upgrade, which increases first cost and can be particularly burdensome in emergency replacement scenarios. A 2024 market study estimates that in California, 14% of single-family

[39] Efficiency comparisons between HPWHs and incumbent technologies are by uniform energy factor (UEF) rating.
[40] The spark ratio is the ratio in cost to the customer of 1 kWh of electricity to the cost of 1 kWh of natural gas. This is a common metric for assessing the economic practicality of fuel substitution.

homes and 13% of multifamily units would require an electrical panel upgrade alone for water heater electrification, while 30% of single-family homes and 41% of multifamily units would require panel optimization only.[41]

3.2.3 Summary and implications

Table 6 provides a high-level performance comparison of HPWH subtypes with incumbent water heating technologies (specifically, gas storage water heaters and electric resistance storage water heaters). The primary technical barriers to broader HPWH adoption include inferior hot water recovery performance, electrical requirements/panel capacity, and space requirements/ventilation needs. Opportunities to address these barriers include the following:

- Smart controls with thermostatic mixing valves
- Split-system HPWHs
- Advanced compressor technologies (e.g., vapor-injection compressors)
- Shared-circuit 120V HPWHs with smart controls
- Dual-voltage HPWHs
- Panel optimization using smart load management devices
- Meter collar adapters
- Flexible demand appliance standards
- Updates to California's Title 24 JA 13
- Panel-readiness audit/optimization programs

Other barriers identifiable from Table 6 include total installed costs and ease of installation. Opportunities to address these barriers include the following:

- Reduced HPWH "feature bloat"
- Lowered manufacturing production costs
- 120V "plug-in" HPWHs
- Dual-voltage HPWHs
- Quick-connect refrigerant lines (for split-system HPWHs)

[41] Guidehouse Inc. and Opinion Dynamics (2024). Fuel Substitution Behind the Meter Infrastructure Market Study. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/building-decarb/fs-infra-ms_overall-report_20240606.pdf.

Table 6. HPWH product performance versus incumbent technologies

Characteristic	240V HPWHs		120V HPWHs
	Versus Gas Storage	Versus ER Storage[42]	Versus Gas Storage
Total Installed Cost	-	-	-
Operating Cost	-	++	--
Energy Savings	++	+	++
Air Quality and GHG Emissions Impact	++	+	++
Hot Water Recovery (First Hour Rating)	-	n	--
Electrical Requirements/ Panel Capacity	--	n	n

HPWH Performance Key:
"++" indicates significantly superior performance
"+" indicates superior performance
"n" indicates neutral (comparable) performance
"-" indicates inferior performance
"--" indicates significantly inferior performance

Note: A 120V HPWH unit would not be used to replace a 240V electric resistance storage water heater; therefore, this table does not compare 120V HPWHs with electric resistance storage water heaters.

3.3 Energy policy landscape

Federal regulations play a key role in supporting the residential HPWH market. Current DOE energy conservation standards for electric storage water heaters greater than 55 gallons require a minimum UEF that is effectively only achievable by HPWHs. Further, new DOE standards, scheduled to take effect in 2029, effectively require electric storage water heaters between 20 and 120 gallons to be HPWHs. These standards effectively phase out electric resistance storage water heaters in favor of HPWHs in most residential applications (an estimated 23% of residential water heaters in California).

California's 2025 building energy code (Title 24, Part 6), which went into effect on January 1, 2026, supports the residential HPWH space with mandatory electric-ready requirements for single-family new construction (i.e., requires a 240V circuit, condensate drain, and dedicated

[42] Electric resistance uses the acronym ER here.

space for a HPWH) and a prescriptive compliance path limited to HPWHs and solar thermal systems (with electric resistance backup). Although a gas storage water heater may be installed under the performance compliance path for single-family new construction, performance requirements and CPUC's elimination of gas line extension allowances for new residential construction in 2023 will make such an installation difficult.[43] 2025 code updates for multifamily new construction include electric-ready requirements similar to those for single-family new construction and include ventilation requirements for tight installation spaces.

Future California air quality regulations may support a shift towards residential HPWHs by eliminating or limiting sales of gas water heating equipment. Intended to be applicable statewide, CARB has proposed a cap-and-trade approach to limit sales of GHG- and NOx-emissive water heating equipment, starting with a 60% emissive equipment sales cap in 2030. Air quality regulations at the district level are also planned. The BAAQMD will enforce zero-NOx standards for water heaters under 75,000 Btu/hr beginning in 2027.

Other energy policy programs affecting residential HPWHs, including voluntary programs, are described in Appendix C. In summary, opportunities for market transformation within the energy policy landscape include the following:

- Supporting electric resistance storage water heater manufacturers with the shift to HPWH technology ahead of future DOE energy conservation standards effective in 2029
- Supporting gas water heater manufacturers by increasing HPWH market share before a CARB emissive-equipment sales cap-and-trade system takes effect
- Incentivizing the installation of thermostatic mixing valves in California's building energy code[44]

3.4 Product performance

The following sections summarize energy modeling, bill impacts, and avoided cost analyses that informed the development of this MTI Plan. Expanded summaries are provided in Appendix C.

3.4.1 Energy modeling

To evaluate residential HPWH product performance, the CalMTA team conducted energy modeling using EnergyPlus and adhered strictly to the California Database for Energy Efficient

[43] California Public Utility Commission (2003). "CPUC Eliminates Last Remaining Utility Subsidies for New Construction of Buildings Using Natural Gas." https://www.cpuc.ca.gov/news-and-updates/all-news/cpuc-eliminates-last-remaining-utility-subsidies-for-new-construction-of-buildings-using-gas-2023.

[44] A thermostatic mixing valve (installed either separate from or integrated in a HPWH unit) blends hot water from the tank with cold water to deliver a safe, consistent temperature at the consumer point-of-use. This allows a HPWH unit to store water in its tank at higher temperatures and, in turn, heat water in advance of (i.e., "load up" before or shift load away from) peak electricity demand periods.

Resources prototype modeling framework published by the CPUC on January 12, 2026. Detailed assumptions and methodologies for the energy modeling analysis are provided in Appendix B, Attachment 2.

Table 7 lists the seven installation cases evaluated by the energy modeling analysis, which compare various HPWH subtypes against gas storage and storage baseline water heating technologies.

Table *7*. Installation cases considered by energy modeling analysis

Case		Baseline Technology		Proposed Technology
1		Gas Storage Water Heater, 50 Gallon, UEF = 0.68	Hybrid Integrated HPWH	80 Gallon, UEF = 2.2, 120V
2				50 Gallon, UEF = 3.3, 240V
3				80 Gallon, UEF = 3.3, 240V
4		Electric Resistance Storage Water Heater, 50 Gallon, UEF = 0.92		50 Gallon, UEF = 3.3, 240V
5				80 Gallon, UEF = 3.3, 240V
6	Hybrid Integrated HPWH	50 Gallon, UEF = 2.3		50 Gallon, UEF = 3.3, 240V
7		80 Gallon, UEF = 2.3		80 Gallon, UEF = 3.3, 240V

Energy modeling results indicate that HPWHs deliver significant energy savings across installation cases. For example, Case 2 (replacing a gas storage water heater) offers, on average, 2,973 kWh in annual energy savings (approximately 75% annual energy use reduction), while Case 4 (replacing an electric resistance storage water heater with the same HPWH product), offers, on average, a lower but still significant 1,442 kWh in annual energy savings (approximately 59% annual energy use reduction).

After applying GHG emissions factors to the energy savings shape of each installation case, results indicate that HPWHs also deliver positive GHG emissions savings across all installation cases. For example, Case 2 (replacing a gas storage water heater) offers, on average, 451 kg-CO_2-eq in annual GHG emissions savings, while Case 4 (replacing an electric resistance storage water heater with the same HPWH product), offers, on average, a lower but still significant 253 kg-CO_2-eq in annual GHG emissions savings.

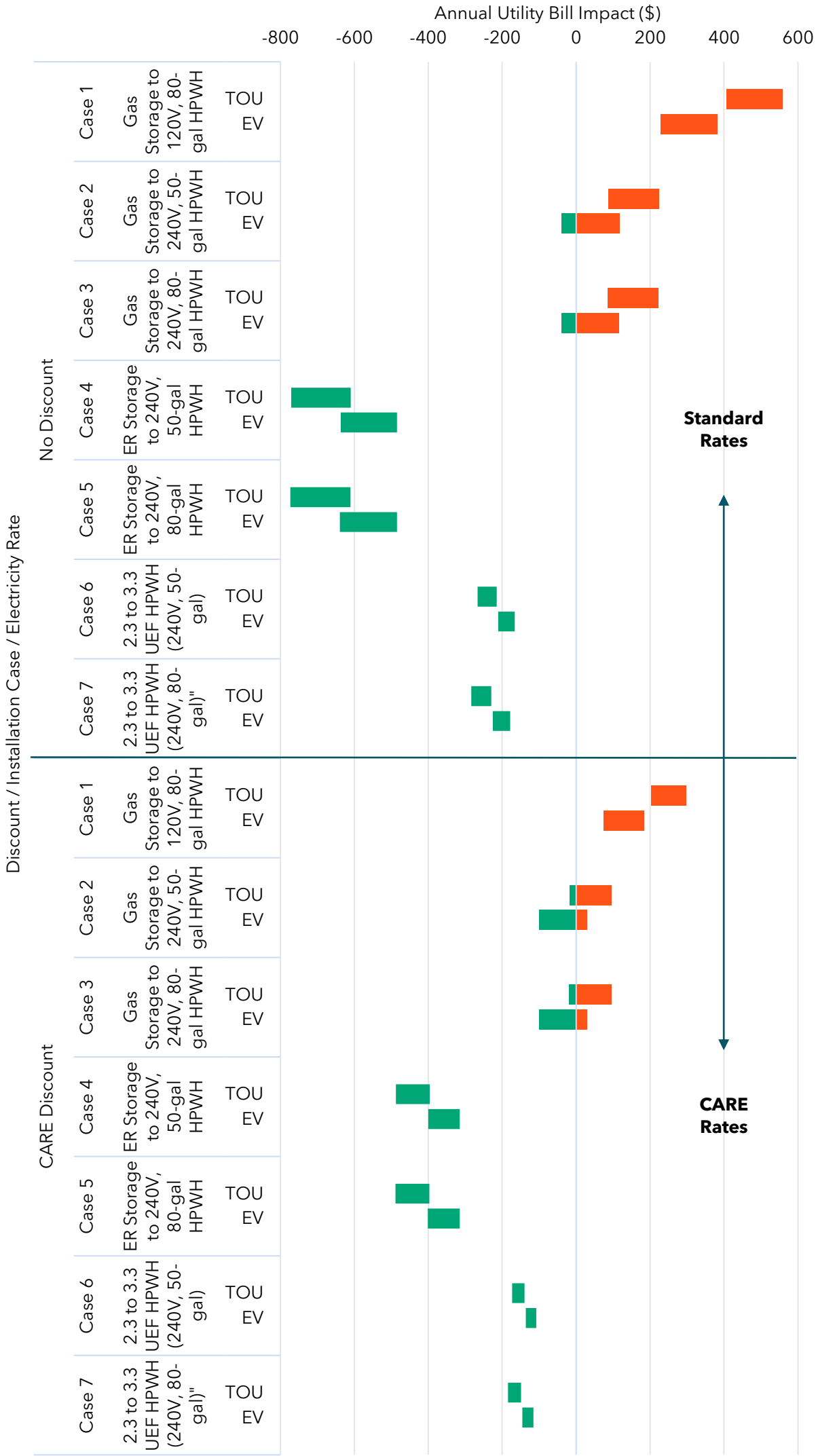
3.4.2 Bill impacts

Utility bill impact modeling shows that replacing an electric resistance storage water heater with a HPWH will always result in utility bill savings, while replacing a gas storage water heater with a HPWH may increase utility bills, depending on electric rates and the efficiency of the baseline and HPWH units. For example, modeling shows Case 4 (replacing an electric resistance storage water heater with a 240V HPWH product) may reduce annual utility bills between $448 and $771 ($37 to $64 per month), while Case 2 (replacing a gas storage water heater with the same HPWH product) may result in anywhere from a $224 increase in annual utility bills ($19 per month) to a reduction of $51 ($4 per month).

Further, modeling shows that the potential for utility bill increases is higher when replacing a gas storage water heater with a 120V HPWH product. Modeling shows Case 1 (replacing a gas storage water heater with a 120V HPWH product) may increase annual utility bills between $257 and $558 ($21 to $46 per month). This difference in modeled bill impacts is a result of greater electricity usage by 120V HPWH products than by 240V HPWH products.

Figure 3 shows potential annual utility bill outcome ranges (electricity and gas, combined) modeled for each installation case. The figure shows outcomes under a time of use (TOU) electricity rate and an electric-vehicle-friendly electricity (EV) rate to highlight the importance of electricity rate structure. In all installation cases, the EV rate decreases potential annual utility bill impacts, with average absolute value range midpoint decreases of $178 in Case 1, $127 in Cases 2 and 3, $1,126 in Cases 4 and 5, and $50 in Cases 6 and 7. Absolute value decreases are favorable for fuel substitution cases (Cases 1 through 3) when annual utility bill increases are modeled under an electric-vehicle-friendly TOU electricity rate, but are less favorable for non-fuel substitution scenarios (Cases 4 through 7) when using the same electric-vehicle-friendly rate.

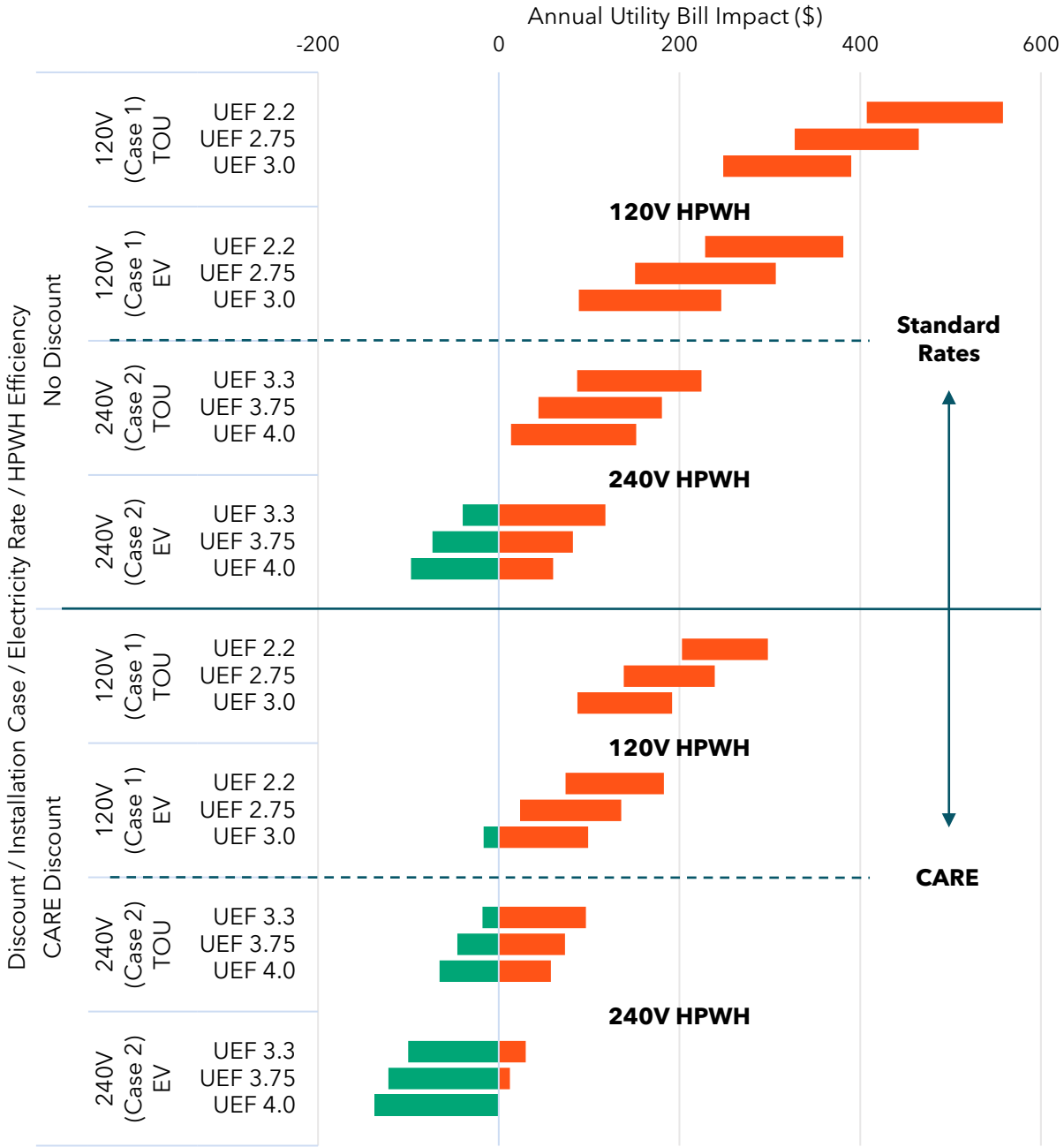
Figure 3. Modeled annual utility bill impact ($) by discount type, installation case, and electricity rate structure, all utilities



Note: Cases 1 through 6 assume a 50-gallon storage volume for the baseline technology, while Case 7 assumes an 80-gallon storage volume for the baseline technology. Bars represent ranges of potential bill impact outcomes modeled across utilities and natural gas rate structures. Potential bill impact outcomes are based on a weighted average of single-family homes (77%), multifamily homes (19%), and mobile homes (4%) representative of California housing stock. Orange bars represent potential annual utility bill increases, while green bars represent potential annual utility bill savings.

Additional utility bill impact modeling revealed that replacing a gas storage water heater with a higher efficiency HPWH product can reduce utility bill increases, and in some cases, can provide utility bill savings. Figure 4 shows potential annual utility bill outcomes modeled for higher efficiency HPWH products under each electricity rate structure for Cases 1 and 2.

Figure 4. Modeled annual utility bill impact ($) by discount type, electricity rate structure, and HPWH product efficiency for fuel substitution cases, all utilities



Note: Cases 1 and 2 assume a 50-gallon storage volume for the baseline gas storage water heater. Bars represent ranges of potential bill impact outcomes modeled across utilities and natural gas rate structures. Potential bill impact outcomes are based on a weighted average of single-family homes (77%), multifamily homes (19%), and

mobile homes (4%) representative of California housing stock. Orange bars represent potential annual utility bill increases, while green bars represent potential annual utility bill savings.

Modeling also assessed bill impacts for low-income California residents eligible for the California Alternate Rates for Energy (CARE) program, which offers a 30%-35% discount on electricity and a 20% discount on gas. These discounts reduce the absolute value of both modeled utility bill savings and utility bill increases. For example, CARE discounts:

- Reduce the midpoint of annual utility bill savings from $628 ($52 per month) to $401 ($33 per month) for Case 4 (replacing an electric resistance storage water heater with a 240V HPWH product);
- Convert the $92 ($8 per month) midpoint of annual utility bill increases into a $2 midpoint of annual utility bill savings in Case 2 (replacing a gas storage water heater with the same HPWH product); and
- Reduce the midpoint of annual utility bill increases from $393 ($33 per month) to $186 ($15 per month) for Case 1 (replacing a gas storage water heater with a 120V HPWH product).

On an absolute basis, CARE discounts reduce utility bill increases more significantly for 120V HPWH products than for 240V HPWH products. CARE discounts reduce the midpoint of annual utility bill impacts by $207 ($17 per month) in Case 1 (replacing a gas storage water heater with a 120V HPWH product) versus $94 ($8 per month) in Case 2 (replacing a gas storage water heater with a 240V HPWH product). This difference is because 120V HPWH products are less efficient and therefore use more electricity than 240V HPWH products.

Finally, modeling alternative scenarios for installation cases where the baseline technology is a gas storage water heater (Cases 1 through 3) show that replacing a gas storage water heater with a HPWH product does not always result in utility bill increases, even for Case 1 (replacing with a 120V HPWH product).

A detailed utility bill impact summary is provided in Appendix C.

3.4.3 Avoided costs

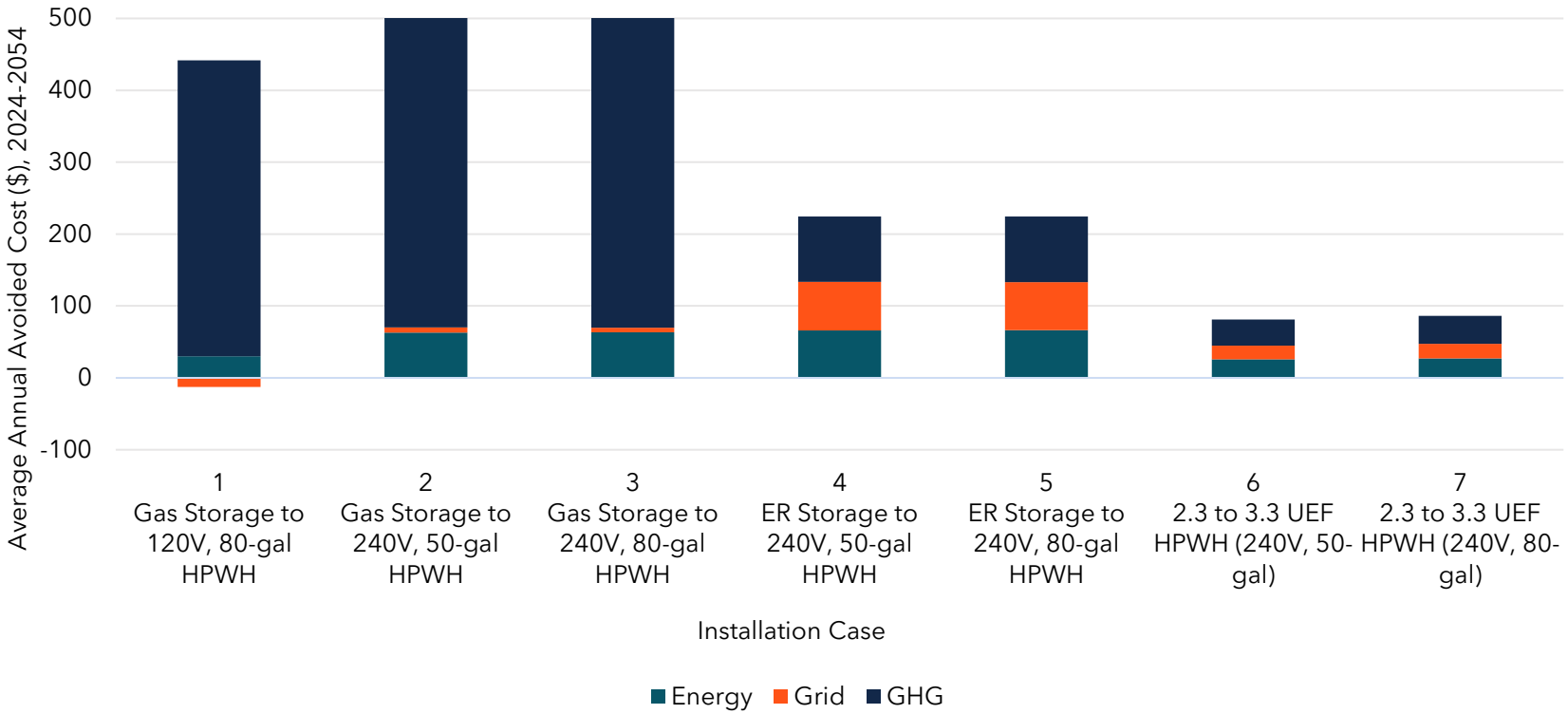
Using the energy modeling results, the CalMTA team conducted a system-level avoided cost analysis on the seven installation cases using the CPUC Avoided Cost Calculator. Detailed assumptions and methodologies for the avoided cost analysis are provided in Appendix B.

Average annual energy, grid, and GHG avoided costs are shown in Figure 5 for each installation case under the total resource cost (TRC) test approach.[45]

Total avoided costs are positive in all installation cases and are greatest in Cases 1 through 3 where a HPWH unit replaces a gas storage water heater. High GHG avoided costs are the primary contributor to high total avoided costs in these installation cases. Notably, grid avoided costs are negative in Case 1 because electricity consumption is highest in this case, outweighing the natural gas grid savings.

[45] The avoided cost factors are divided into three categories for simplification: "energy" includes the Energy factor from the electric model and the Market factor from the gas model. "Grid" includes Generation Capacity, Transmission Capacity, Distribution Capacity, Ancillary Services, and Losses from the electric model as well as Transmission and distribution from the gas model. "GHG" includes Cap and Trade, GHG Adder, GHG Rebalancing, and Methane Leakage from the electric model and Environment, Upstream Methane Leakage, Behind the Meter Methane Leakage, and Gas Air Quality Adder from the gas model.

Figure 5. Annual average avoided cost benefit by installation case, 2024-2054 (TRC test approach)



Note: Cases 1 through 6 assume a 50-gallon storage volume for the baseline technology, while Case 7 assumes an 80-gallon storage volume for the baseline technology.

The CalMTA team conducted a sensitivity analysis evaluating the impact of replacing higher-GWP refrigerants with lower-GWP refrigerants. Unlike gas and electric resistance storage water heaters, HPWHs operate using refrigerants that have GWP and, if leaked, incur a negative avoided cost. Most HPWHs currently on the market use R-134a, since lower-GWP refrigerants incrementally add to manufacturing production costs. Using the CPUC refrigerant avoided cost calculator,[46] HPWHs using high GWP refrigerant like R-134a incur a lifetime refrigerant-related avoided cost of -$227.[47] Transitioning to R-32 (a low-GWP option) reduces this cost to -$107, while transitioning to R-744 (an ultra-low GWP option) reduces this cost to below -$1. These lifetime refrigerant-related avoided costs make up a small portion of the annual GHG-related avoided costs shown in Figure 5, which assumes the HPWHs use R-134a refrigerant.

The team also completed a sensitivity analysis on load shifting impacts to avoided costs. HPWHs with load-shifting capability can benefit the grid, but consumers see most benefit when hot water use occurs during peak electricity pricing periods. In California, hot water demand peaks in the morning while electricity demand peaks in the evening, which, along with uncertainty surrounding load shifting standards, currently limits savings opportunities. Preliminary modeling of an 80-gallon, 240V HPWH product (UEF 3.3) with simple load-shifting controls increased avoided costs by 18% (about $37 per year in savings) accompanied by a 5% increase in annual energy use. Of note, greater benefits may be possible with optimized controls and refined avoidance of peak electricity pricing periods.

3.4.4 Summary and implications

The team's analysis shows that Cases 1 through 3 (replacing gas storage water heaters with HPWHs) deliver the largest system-level benefits, but potential utility bill increases could disincentivize replacing a gas water heater with a HPWH. For Cases 4 and 5 (replacing electric resistance storage water heaters with HPWHs), the analysis shows approximately half the system-level benefits of Cases 1 through 3, but utility bill savings make transitioning from an electric resistance water heater to a HPWH more attractive.

Overall, while replacing gas storage water heaters should be a long-term goal of market transformation in California, a near-term goal should be to replace electric resistance storage waters with HPWHs. Replacing electric resistance storage water heaters as a first step can build economies of scale, improve installer familiarity, and shore up consumer confidence, in turn strengthening HPWH competition with gas storage water heaters for the long-term.

Additionally, while lower-GWP refrigerants and load shifting offer benefits, these benefits are small compared to the benefits associated with switching from either a gas or electric resistance

[46] The refrigerant avoided cost calculations assumed that a HPWH product leaks 1% of its refrigerant each year of useful life and releases 100% of its remaining refrigerant at end of life.
[47] Note the refrigerant cost is a negative benefit. This is the total avoided costs benefit reported here is for the lifetime of a HPWH installed in 2024 with an effective useful life of 20 years.

storage water heater. This indicates that lower-GWP refrigerants and load shifting requirements might be incorporated later in the MTI to avoid slowing initial adoption of HPWHs, increasing total installed costs, and weakening competition with incumbent technologies.

3.5 Product plan

The product plan describes technical activities that may be undertaken during the execution of the MTI across various areas of the product, service, or practice. It focuses on two of the three strategic interventions identified in the MTI logic model: (1) product development and technical matching to housing stock, and (2) aggregate market and programs to build scale and momentum by submarkets.

3.5.1 Product development and technical matching to housing stock

The MTI identifies the following actions that could be taken to determine optimal installation scenarios for 120V HPWHs:

- Short-term actions could include:
  - Conduct a market assessment of plug-in HPWHs. Quantify the number of homes, especially low-income and multifamily units, that can electrify without panel upgrades.
  - Perform equity-focused cost studies to quantify savings from avoiding panel upgrades.
  - Develop a HPWH product expansion roadmap with manufacturers that matches California's current technology gaps and housing needs.
- Long-term actions could include:
  - Maintain and update HPWH product expansion roadmap with manufacturers that match California's current technology gaps and housing needs.
  - Support state efforts to model HPWH energy and load shifting for 120V units.
  - Assess lifecycle economic benefits for low-income and multifamily households by comparing plug-in 120V installations with panel-upgrade scenarios that could support 240V HPWH models.
  - Pilot demonstrations of panel optimization technologies such as circuit-sharing and meter collar solutions to assess options to avoid panel upgrades.
  - Study the feasibility of repurposing photovoltaic meter collars for appliance-level electrification.

The MTI identifies the following actions that could be taken to determine optimal installation scenarios for split-system HPWHs:

- Short-term actions could include:

- Conduct secondary research to characterize current split-system HPWH product barriers and opportunities, focusing on known factors related to load shifting, commissioning, permitting, and trade certification.
- Evaluate the market for quick-connect refrigerant lines. Use modeling and secondary research to assess the impact of line set length and refrigerant charge levels on field performance.
- Monitor the NEEA Hot Water Innovation Prize program for relevant developments.[48]
- Review manufacturer manuals to understand refrigerant charge optimization practices.

- Long-term actions could include:
  - Observe installation and conduct split-system HPWH system field studies to further evaluate installation issues or barriers and to assess in-field performance and user acceptance.

The MTI identifies the following actions that could be taken to facilitate harmonization of load flexibility protocols across HPWH products and utility programs:

- Short-term actions could include:
  - Standardize the CTA-2045-B communication protocol. Collaborate with manufacturers to identify and resolve compatibility issues with proprietary systems.
- Long-term actions could include:
  - Explore embedded implementation of CTA-2045. Work with the CTA and manufacturers to revise protocol specifications.
  - Evaluate conformance of field-installed systems with load shifting requirements.
  - Research integration of HPWHs with smart home systems. Investigate middleware or application programming interfaces that enable platforms like Google Home and Alexa to interpret CTA-2045 demand response signals.

3.5.2 Aggregate market and programs to build scale and momentum by submarkets

- Short-term actions could include:
  - Update and maintain database of HPWHs on the market. Identify most important technology and features to track (e.g., size, amperage).
  - Monitor and assess California AQMD activity and timelines regarding gas water heater zero-NOx requirements.

[48] NEEA (2025). Operations Plan, April 2025.

- Develop a dynamic tool that prioritizes advantageous HPWH product installation based on fluctuating variables like current electric rates and local codes.
- Monitor electricity rates by utility, county, and locale.
- Monitor development of AHRI residential HPWH installation standard.
- Review historical market data on banned refrigerants to inform predicted market behavior and timelines in response to the Environmental Protection Agency's (EPA) American Innovation and Manufacturing Act.[49]

- Short-term actions for the retrofit market could include:
  - Develop a custom housing California housing stock database using existing datasets (e.g., Restock, residential solar maps) to identify and aggregate attributes that influence ease of adoption in the retrofit market (e.g., panel capacity, utility service area, presence of residential solar) specific to both ESJ and non-ESJ communities.
  - Utilize the database to create retrofit readiness profiles based on adoption-relevant attributes and leverage results to prioritize various targeted incentive programs and adoption initiatives.
- Short-term actions for the new construction market could include:
  - Determine needed research and cost analysis to encourage HPWH product installs in new builds.
  - Investigate percent of new builds installing gas water heaters instead of HPWHs, focusing on trade-off metrics and factors influencing the decision to install gas.
- Long-term actions could include:
  - Identify and prioritize technological advancements that facilitate rapid scale intervention, based on characteristics in the custom California housing stock database.
  - Identify HPWH technology changes and external factors, like changes to electricity rates or solar installation, which could enable a household to move from a low priority to a high priority CalMTA target.
  - Investigate the impact of efficiency tiers driving the adoption of premium technologies on up-front cost. Evaluate the potential for lower-cost units that preserve efficiency benefits using fewer premium components.

[49] U.S. Congress, American Innovation & Manufacturing Act of 2020, Pub. L. 116-260, div. S, § 103 (Dec. 27, 2020) (codified at 42 U.S.C. § 7675).

- Identify opportunities and partners to support HPWH-focused revisions to the CPC's FHR requirements.[50]

4 Market characterization

4.1 Current market state summary

4.1.1 Product availability

HPWHs are widely available in California, although there is variability amongst procurement channels and regions. CalMTA research found that both installers and residential purchasers report ready availability of HPWHs from brick-and-mortar big box retailers, online retailers, and manufacturer websites. Installers also said they generally find HPWHs available through distributors and utility programs. Both installers and residential consumers reported that HPWH availability is more limited at smaller retail stores.

4.1.2 Technology outlook

The residential HPWH market is dynamic and quickly evolving. Currently, three established manufacturers – A.O. Smith (also selling under other brand names such as American Standard and Reliance), Rheem (also selling under other brand names such as Ruud), and Bradford White – account for approximately 60% of the residential HPWH market.[51] In addition to these dominant companies, GE recently returned to the HPWH market, and (as of this writing) Bosch, Daikin, Eco-Logical, Embertec LG, Midea, and Mitsubishi recently introduced (or are soon-to-introduce) HPWH products. Other manufacturers may soon bring residential HPWHs to the market as well.

According to multiple stakeholders interviewed by CalMTA, several newer HPWH manufacturer entrants are introducing products designed to overcome the challenges presented by current HPWH products, namely:

- **Space constraints:** HPWHs require more space (including for condensate management) and ventilation than traditional water heaters.
- **Electrical modifications:** Since the majority of ENERGY-STAR-certified HPWHs are 240V models, electrical work may be required to enable some households previously served by gas water heaters to install HPWHs. CalMTA's research points to approximately 30% of all California households needing electrical upgrades prior to HPWH installation.

[50] Cal. Code Regs. tit. 24, pt. 5, § 501.1(2).

[51] The 2024 Water Heating Market Study estimates these manufacturers have nearly 60% of the residential HPWH market in the United States. Opinion Dynamics (2024). https://pda.energydataweb.com/api/view/4024/Water%20Heater%20Market%20Characterization%20Study%20PDA%20Draft1%20_8_25_2024.pdf. *Op cit*. March 29, 2024.

Stakeholders explained that manufacturers are introducing split-systems and units with a smaller integrated form factor, such as "lowboys," which are shorter and more compact water heaters that fit into smaller spaces. In 2025, both Eco-Logical and Embertec began offering new HPWH products with form factors that will allow for targeting California mobile homes. Both manufacturers characterize their newly available systems as "more affordable split-system options."

Recently, subject matter expert guidance has shifted from recommendations for full panel upgrades to less expensive electrical upgrades,[52] where feasible. As another alternative to 240V HPWHs, CalMTA's research suggests that a substantial number of California households may be appropriate for 120V plug-in HPWHs,[53] which offer opportunities for electrically constrained HPWH installations. Further study is needed to determine the types and proportion of California's residential buildings suitable for 120V HPWH installations. As of early March 2026, only three of the 13 manufacturers listed in ENERGY STAR data offered split-systems, and only three offered 120V HPWH systems (one manufacturer offered both split and 120V systems; the other manufacturers are unique to each list).[54]

4.1.3 Market size

The HPWH MTI's market consists of California's existing 11.5 million households with dedicated water heaters. Table 8 shows the breakdown of water heaters by current fuel type and technology, and Table 9 shows the breakdown by housing type.

Table 8. Dedicated residential water heaters in California by fuel type and technology[55]

Fuel	Technology	Estimated Number of Households	Estimated Percentage (Saturation)
Gas/propane, total		8.7 million	76%
Electricity	Total, electric	2.6 million	23%
	Electric resistance	2.5 million	21%
	HPWH	182,900	1.6%
	Total	**11.5 million**	**100%**

[52] This includes subpanels, smart panels, smart circuit breakers, load sharing, or circuit pausers or circuit splitters.
[53] New Building Institute (2023). Plug-In Heat Pump Water Heater Field Study Findings & Market Commercialization Recommendations. https://newbuildings.org/resource/plug-in-heat-pump-water-heater-field-study-findings-market-commercialization-recommendations; additional review conducted based on survey data, stakeholder interview feedback, and saturation rates of existing water heaters by size found in RECS 2020.
[54] ENERGY STAR (2025). Find and Compare ENERGY STAR Certified Heat Pump Water Heaters. https://www.energystar.gov/productfinder/product/certified-heat-pump-water-heaters/results. Accessed March 2, 2025.
[55] Values may not add to expected totals due to rounding.

Table 9. Locations of dedicated residential water heaters in California by building type[56]

Building Type	Number of Households	Percentage
Single family	8.84 million	77%
Multifamily	2.19 million	19%
Mobile/manufactured home	0.41 million	4%
Other	0.06 million	<1%
Total	**11.5 million**	**100%**

An estimated 750,000 dedicated water heaters are sold in California annually, with HPWHs representing a small but growing segment of those replacements. HPWHs represent an estimated 5% to 6% of overall market share (i.e., percent of all residential water heaters sold each year that are HPWHs), with stronger representation in the new construction market, driven by building code.

4.2 Target market overview

Table 10 summarizes the HPWH target market, as well as who makes, buys, uses, and sells HPWH products, and what influences purchasing decisions.

Table 10. Target market overview

Target market	California's 11.3 million existing households with dedicated water heaters that are not already HPWHs, including: • 2.5 million (21%) with electric resistance water heaters • 8.7 million (76%) with gas/propane water heaters
Who makes the product?	Established water heater manufacturers as well as new market entrants offering traditional and new HPWH product designs.

[56] Values may not add to expected totals due to rounding.

Who buys the product?	Across all residential water heater purchasers, CalMTA's research found: • 15% are DIYers • 30% are BIYers • 55% are installers For HPWHs specifically, CalMTA's research found: • 59% are residential purchasers; all were installed by professional contractors • 41% are professional installers
Who uses the product?	Homeowners and renters in single family, multifamily, and mobile homes throughout California. CalMTA estimates that more than a quarter of California residential water heaters are located outside the home and may be affected by outdoor temperature. Households in colder climates more frequently have their water heater indoors.[57] The majority of mobile homes (80%) have water heaters located outside.[58]
How is the product sold?	HPWHs are available for purchase at brick-and-mortar big box retail stores, smaller retail stores, plumbing and HVAC distribution outlets, and online from e-commerce websites.

[57] Analysis uses RECS 2020 regional identifiers of Cold, Hot-Dry, Marine, Mixed-Dry. Cold climate households have 59% water heaters located in the main living space (compared to 15%, 14%, and 34% in Hot-Dry, Marine, and Mixed-Dry, respectively) and only 14% outside (compared to 19%, 14%, and 25% in other climates, respectively).
[58] RECS 2020 indicates 23% of single-family attached dwellings have water heaters outside, and 25% of single-family detached dwellings have water heaters outside. Multifamily breakdowns are not available (reported as Not Applicable).

Who influences the purchase decision?	Since most water heater purchases are emergency replacements due to equipment failure, decision making is often reactive, time sensitive, and led by customers who may not have budgeted for a water heater purchase. Price sensitivity is therefore a key factor in the decision-making process. Installers replacing standard gas or electric water heaters with HPWHs may be advised to purchase HPWHs one or two sizes larger than the incumbent traditional water heater to minimize hot water run-outs. For those purchasing water heaters through retail channels, retail availability is another driving force in purchase decisions. Professional water heater installers, who purchase water heating equipment on behalf of their customers, seek advice and value the expertise of distributors.[59] Installers also go to distributors and manufacturers for training. In addition, CalMTA's research suggests that available incentives – especially instant rebate programs – are key motivators for contractors to sell HPWHs.

4.3 Market actor and end-user insights

4.3.1 HPWH awareness and perceptions

Awareness of HPWHs is not universal among California's residential end users. CalMTA's residential survey found 50% of residential decision makers overall were aware of HPWHs (including 50% of single-family residents, 51% of multifamily residents, and 39% of mobile home residents). HPWH awareness was higher among residents of non-ESJ communities (58%) than residents of ESJ communities (44%).[60] Survey findings revealed little difference in HPWH awareness between California inland residents (47%) and coastal residents (51%). However, the findings showed substantial variation in awareness at the county level, suggesting that customers who reside within some utility, REN, or Community Choice Aggregator (CCA) territories may be more primed to consider HPWHs than others.[61] Residential consumer awareness of HPWHs was limited in regions lacking retail or distribution access to the products and in regions with less installer engagement.

[59] Opinion Dynamics (2021). Ameren Illinois' Market Effects Pilot – Heat Pump Hot Water Market Characterization Report. September 15, 2021.https://www.ilsag.info/wp-content/uploads/AIC-Market-Effects-2021-HPWH-Market-Characterization-Report-FINAL-2021-09-15.pdf.

[60] CalMTA Residential Survey Q. A11: "Have you heard of heat pump water heaters (HPWHs)," analyzed by CalMTA Residential Survey ESJ criteria.

[61] For example, results indicate awareness among San Francisco residents (n=48) at 74%, and awareness of San Diego respondents (n=85) at 33%. Awareness in Ventura County (n=21) is estimated at 19%. CalMTA Residential Survey Q. A11. "Have you heard of heat pump water heaters (HPWHs)?" (n=856).

The majority (83%) of building owners and property managers reported awareness of HPWHs. Awareness among mobile home property owners, however, was lower (59%). Building owner and property manager awareness was similar for those who own or manage buildings in ESJ communities (81%) and non-ESJ communities (84%).[62]

When asked why their customers selected a non-HPWH water heating solution, installers stated that limited customer awareness of the technology was often (37%) or sometimes (54%) the reason.

All of the contractors who responded to CalMTA's installer survey were aware of HPWHs and most reported *somewhat or very* favorable impressions of the technology (92%).[63] When CalMTA segmented responses by trade, the team found more dual trade contractors (i.e., those who install both HVAC and water heating equipment) held *very* positive views of HPWHs (54%), than did plumbers (49%) and handypersons (32%).

Dual trade installers also had the highest confidence in HPWHs across a range of perceptions (e.g., 77% said they were comfortable installing and maintaining HPWHs, and 61% believed HPWHs reliably provide enough hot water). Plumbers and handypersons had less confidence in HPWHs across the board (e.g., 45% of handypersons said they were comfortable installing and maintaining HPWHs; 31% of handypersons said they believe HPWHs reliably provide enough hot water).

4.3.2 HPWH value proposition

HPWHs' greater efficiency means that customers converting from electric resistance water heaters will see bill savings; customers replacing other types of water heaters may also see savings, though impacts vary by territory and utility rates, as well as climate conditions and operation (as discussed in Section 3.4.2).[64,65] In comparison to gas water heaters, HPWHs also offer indoor air quality improvements by eliminating the production of toxic combustion byproducts like carbon

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[62] CalMTA Building owner and property manager Survey Q. A10. " Which electric utility serves most or all of your units?"

[63] Note that while all respondents reported awareness of HPWHs, stakeholder interviews indicated that there are installers that are unaware of HPWHs. Lack of awareness was reported as less common in most urban areas and more likely in the Sierra and Northern non-urban areas.

[64] TECH Clean California (2025). Heat Pump Water Heater Energy Costs and Usage. https://techcleanca.com/about/energy-costs-and-usage/. Accessed February 12, 2025.

[65] ENERGYSTAR shares that, with efficiency of up to three to four times that of standard electric or gas water heaters, an HPWH serving a family of four could save up to $550 annually and have a payback period of three to six years.
DOE (2025). Heat Pump Water Heaters https://www.energy.gov/energysaver/heat-pump-water-heaters. Accessed February 9, 2025. Also ENERGY STAR. February 2, 2024. *What Goes into the Cost of Installing a Heat Pump Water Heater?* https://www.energystar.gov/products/ask-the-experts/what-goes-cost-installing-heat-pump-water-heater. However, the higher rate of gas and propane water heating in California means that general marketing on HPWH benefits may not apply to a larger portion of the population.

monoxide, nitrogen oxides, methane, and volatile organic compounds.[66,67] By eliminating combustion, HPWHs reduce associated risks of fire or explosion that can occur with gas water heaters.[68]

CalMTA's installer survey affirmed that customers appreciate these HPWH benefits. Installers reported their customers' most common reason for choosing HPWHs was efficiency and expected utility bill savings (63%), and the second most common reason was air quality and health benefits (57%). Fewer installers (40%) said that lower carbon footprint/environmental benefits were a primary reason customers purchase HPWHs.

4.3.3 Uncertainty around HPWH-residential building fit

HPWHs have specific requirements for space, electrical capacity, and ventilation that differ from traditional water heaters and can require home modifications or unit relocation, adding cost and complexity that can hinder adoption. More specifically, residents seeking to convert an existing natural gas or propane water heater to a 240V electric HPWH unit may require electrical work or electric panel optimization such as subpanels, smart panels, smart circuit breakers, load sharing, and circuit pausers or circuit splitters. Several recent studies indicate that a meaningful share of California homes are not straightforward 240V retrofit candidates: approximately 30% of all California households would need electrical upgrades prior to HPWH installation and another substantial share of homes would need panel optimization.[69,70,71]

Many water heater purchaser decision makers are cognizant of these HPWH-related challenges. CalMTA's research found 21% of recent water heater purchasers had space constraints affecting the type of water heater they chose, and they typically opted for tankless or traditional water

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[66] BAAQMD (2021). 2022 AQMP: RESIDENTIAL AND COMMERCIAL BUILDINGS https://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/2022-aqmp-residential-and-commercial-buildings-working-group/2022-aqmd-residential-and-commercial-building-wgm-2.pdf?sfvrsn=6.

[67] ENERGY STAR (2025). Considerations for Equity in HPWH Programs. https://www.energystar.gov/partner-resources/products_partner_resources/retailer-resources/heat-pump-water-heater-guide/considerations-equity. Accessed January 22, 2025.

[68] ENERGY STAR (2025). Best Practices and Technical Considerations for Single-Family New Construction. https://www.energystar.gov/partner-resources/residential_new/educational_resources/sup_program_guidance/heat_pump_water_heater_guide. Accessed January 22, 2025.

[69] Guidehouse, Inc. and Opinion Dynamics Corporation (2024). Fuel Substitution Behind the Meter Infrastructure Market Study. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/building-decarb/fs-infra-ms_overall-report_20240606.pdf.

[70] It should be noted that analysis of TECH project data represents an analysis of a specific segment of the market; namely, a segment that has sought an HPWH installation and for which HPWH installation has been found feasible and desirable by the customer and contractor.

[71] TECH Clean California (2025). Data Download of 5-26-2025 data (accessed 9 June 2025).

heaters instead of HPWHs.[72] Seventeen percent of recent dedicated water heater purchasers who did not purchase HPWHs cited incompatibility with their home, a concern echoed by 27% of purchasing building owners and managers.[73] Over half of these respondents cited electrical limitations as the primary barrier; others pointed to space constraints, ventilation needs, and/or condensate management requirements. Installers also reported that electrical constraints are often (24%) or sometimes (52%) a factor in selecting equipment other than HPWHs.

4.3.4 Life-cycle costs may not pencil out for all consumers

HPWHs lack a compelling value proposition for all residential consumers: HPWHs cost more than standard electric and gas water heaters and not all customers will save money on their energy bills after switching to HPWHs. Without clear savings, consumers may not see a reason to switch. When asked why their customers selected a non-HPWH water heating solution, installers most commonly cited customer concerns about energy bill impacts often (41%) or sometimes (41%) as a reason.

4.3.5 HPWH incentives are widespread but can be difficult to navigate, unstable, and insufficiently effective

Many of the 30+ energy efficiency and decarbonization programs supporting HPWH adoption in California seek to lower the up-front cost barrier of HPWHs through rebates to customers and installers.[74] However, California stakeholder and manufacturer interviews revealed that many customers and installers do not engage with incentives due to shifting program offerings and requirements, and to program starts and stops. CalMTA survey data further indicate that end-use customers and installers have trouble accessing incentives due to complex or burdensome program requirements: 60% of installers who were aware of incentives reported they did not choose a HPWH product at least once in the last year due to the administrative burden of incentives. Stakeholders and manufacturers consistently noted that regions with stable, long-term incentives have seen greater installer engagement and higher adoption of HPWHs.

5 External program alignment & coordination

Following guidance provided in the Market Transformation Framework attached to CPUC D.19-12-021 and recent direction from CPUC 25-11-023, the HPWH MTI seeks to complement, leverage, and add value to existing programs serving the target market for the technology. Traditional resource acquisition or incentive programs serve as a point of leverage the MTI will

[72] CalMTA Residential Survey Q. B5. Did any of the following factors influence your decision on the type of water heater you installed? Select all that apply.
[73] CalMTA Residential Survey and CalMTA Building Owner and Property Manger survey Q. C5 What factors prevented you from choosing a heat pump water heater? Select all that apply.
[74] More than 30 are identified as active at the time of this publication. See Appendix B: TSB and Cost Effectiveness for more information

use to drive increased adoption and sustained market change; the strategic market-level interventions identified for the MTI will in turn complement and add value to existing energy efficiency efforts in the state for the mutual benefit of each program. CPUC Decision 25-11-023, which approved CalMTA's first MTIs for market deployment, affirmed this, stating: "Our thinking is most aligned with the comments of the Northwest Energy Efficiency Alliance (NEEA), where they point out that MTIs and resource acquisition programs that are coordinated can achieve synergies and deeper savings than either approach may be able to accomplish on its own."[75]

Although CalMTA applies these guiding principles to each MTI, we recognize the importance of customizing our approach to each market. Since residential HPWHs are a more mature technology that many programs and policies in California have promoted for years, this MTI seeks to fill gaps in market activities not currently addressed by other parties. Our coordination approach therefore focuses on equipping external programs with tools, resources, and support to help accelerate their individual progress toward HPWH installation goals, while simultaneously pursuing market-level interventions that will aggregate demand to reduce upfront product cost and break down remaining barriers to adoption. We also recognize the importance of aligning our strategy with complementary efforts, particularly statewide initiatives like TECH Clean California and the CAHPP.

Important aspects of CalMTA's approach to achieving these coordination and alignment goals with external programs are summarized below. A more detailed description of this work can be found in Appendix E: External Program Alignment & Coordination.

5.1 Collaborating with key external programs

Throughout development of the HPWH MTI, CalMTA has proactively engaged key external programs and parties to ensure the MTI reflects current market conditions. Robust market research, collaborative planning sessions, and opportunities to share direct feedback inform intervention strategies designed to build on past programs' successes and lessons learned at the market level while filling identified gaps in statewide activity with the potential to accelerate HPWH adoption. Core goals for external collaboration and completed or planned activities designed to support these goals are described below.

5.1.1 External engagement throughout MTI development

MTI Plan development has benefited from the market insight and expertise shared by external parties at key stages of development. After the Residential HPWH idea moved into Phase I development, CalMTA engaged with key stakeholders and programs working in this market, to deepen our understanding of current market conditions, challenges, and opportunities. We also periodically shared updates on the MTI for feedback and discussion as a component of recurring

[75] CPUC Decision 25-11-023. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M588/K645/588645495.PDF.

meetings with the IOU energy efficiency portfolio directors, IOU Codes and Standards working group, and CalNEXT to maximize statewide alignment and identify additional areas of coordination.

Once the MTI moved into Phase II research, CalMTA gained deeper market insight through structured interviews with important stakeholders and subject matter experts to inform the Residential HPWH market characterization report. While market research participants are kept confidential, the study included staff and implementation team members representing HPWH-related programs administered by IOUs, RENs, CCAs, CBOs, and local municipalities. We also met directly with key parties to secure at least preliminary agreement on the potential extent of overlap and approach to program alignment.

External programs and entities CalMTA engaged for feedback and collaboration on strategy in Phase I and initial stages of Phase II included:

- AWHI/New Buildings Institute
- BAAQMD
- CARB
- California Energy Commission (CEC)
- CAHPP
- NEEA
- South Coast AQMD
- TECH Clean California (implementation and evaluation teams)
- EPA/ENERGY STAR

In addition to direct engagement around MTI development, CalMTA also worked to share our own learnings with external parties to support a cohesive statewide strategy. Core team members reviewed and contributed feedback on the CAHPP Blueprint outlining near-term strategies to address technical, market, and policy barriers to heat pump adoption and advance the state's goal to install 6 million electric heat pumps by 2030. We also reviewed, provided feedback on, and were acknowledged in CalNEXT's California Multifamily Split-System Heat Pump Water Heater Market Study report.

5.1.2 Collaboration on MTI Plan

Recognizing the critical importance of aligning with existing efforts in this market and ensuring that key external entities had a voice in MTI development, CalMTA created opportunities for engagement throughout Phase II of development. External coordination and alignment were central to one of the MTI team's most significant Phase II milestones: A CalMTA-hosted Residential HPWH Market Acceleration Summit in August 2025, which convened nearly 40 attendees

representing HPWH manufacturers, California utilities, policymaking groups, workforce entities, program implementation and evaluation firms, and ESJ entities to help define pathways with the potential to make HPWHs the preferred choice for California homes.

CalMTA developed the Summit's design, objectives, and attendee list with feedback from key organizations, including TECH Clean California, CAHPP, the CEC, AWHI, and EPA/ENERGY STAR. At the Summit, participants worked to identify innovation pathways to accelerate HPWH adoption and areas where CalMTA's support would be most valuable, which directly inform the strategic interventions proposed in this MTI Plan.

CalMTA shared all information documented at the Summit, key outputs resulting from Summit activities, and draft innovation pathways with participants to further encourage market alignment and future engagement. Follow-up meetings with key organizations that attended the Summit allowed CalMTA to share our evolving market transformation theory and proposed intervention strategies for feedback, yielding market insight that helped refine our approach prior to finalizing the MTI Plan. Regular communication with Summit attendees and other identified priority stakeholders included invitations to join and provide public comment at Market Transformation Advisory Board (MTAB) meetings where components of the MTI Plan were presented, as well as to ensure awareness of the formal public comment process for the MTI Plan through the CPUC Energy Division's Public Document Area site.

5.1.3 Planned coordination and collaboration during market deployment

Prior to moving the HPWH MTI into Phase III implementation, CalMTA will continue to engage external programs and entities working in the California heat pump market to stay current on this rapidly evolving landscape, continue to strengthen relationships and build trust, and ensure the MTI adds value to the market while avoiding duplication of efforts. Because the MTI is unlikely to enter the market deployment phase until mid-2027, we anticipate that new programs will launch and that active programs in this market may ramp down or evolve by then. As such, we will conduct an inventory of current programs (or those planned for near-term implementation) as a priority activity following CPUC approval of this MTI and refine our coordination strategy as needed.

Critically, CalMTA will engage with PAs and third-party implementers of related programs to define activities that will avoid market confusion, ensure points of alignment are maintained and leveraged, and identify opportunities to adjust MTI strategies. Early Phase III collaboration with external programs will be critical to specific MTI activities and will provide important points of leverage. Representative areas of collaboration with external programs identified by CalMTA include:

- In developing the Market Intelligence Hub, the MTI will coordinate data requests with market partners (i.e., manufacturers, distributors, and retailers) and programs to create a real-time

snapshot of the HPWH market in California. This data can be used to inform the ongoing MTI strategy, other program efforts, and provide beneficial guidance to the market.

- Collaborating with the supply chain and California programs offering HPWH incentives on Scale-Up Plans for targeted submarkets will aggregate statewide buying power, while CalMTA's ability to negotiate bulk purchasing agreements with manufacturers will make lower-cost products available to programs and contractors.
- CalMTA's extensive market research and supply chain engagement, coupled with insight from external programs promoting HPWH adoption across California, provide a strong foundation for consistent, market-informed messaging on the technology's benefits that can be collaboratively developed for individual program use.

Through ongoing and active coordination with program leads and implementers, CalMTA will gain real-time feedback into how the MTI's strategic interventions are received by the market and identify opportunities to refine our approach – ultimately enabling both the MTI and external programs to achieve better outcomes more efficiently and cost-effectively than either could alone.

Explicit needs for coordination with existing resource acquisition programs and codes and standards activities will be addressed and prioritized in the request for proposal (RFP) used to solicit an implementation contractor for this MTI, as well as the subsequent contract, implementation plan, and evaluation reports.

5.2 Future coordination with external programs

The robust ecosystem of active programs and organizations working to promote HPWH adoption in California provides this MTI with significant points of market leverage and potential collaboration but requires a strategic market transformation approach to avoid duplication of effort in this crowded market.

Table 11 (which is also included in Appendix E) summarizes currently active programs or organizations identified by CalMTA as important points of alignment and coordination for the HPWH MTI during Phase III: Market Deployment. We recognize the program landscape is dynamic and will update our coordination plan prior to moving this MTI into implementation.

Table 11. HPWH MTI external program coordination approach

MTI alignment goal	Representative programs	Possible reciprocal support from MTI/CalMTA
Codes and standards programs and other regulatory efforts provide a critical point of coordination and leverage as CalMTA seeks to align MTI activities with	IOU Codes & Standards Program CARB BAAQMD	Support product development/ enhancements at the manufacturer level with a focus on increasing availability of products aligned with California housing stock and other market needs

MTI alignment goal	Representative programs	Possible reciprocal support from MTI/CalMTA
California code development/ enforcement and federal test procedures, standard-setting, and qualified product lists. We will seek to understand and encourage opportunities for collaboration, specifically related to preparing the California market for compliance with the 2029 federal standard for residential water heaters, supporting the new construction market to maximize inclusion of HPWHs in alignment with Title 24 2025 requirements, aligning on policies related to use of lower-GWP refrigerants or standards for zero-emissions/zero-NOx appliances, and participating in flexible demand communication and performance validation standards development.	South Coast AQMD DOE ENERGY STAR Consortium for Energy Efficiency Residential Electric Water Heating Specification AHRI 1430	Provide market data as MTI moves into implementation
Existing research and development projects/ programs provide leverage for CalMTA to develop and launch the MTI more quickly. Collaboration on research, including pilots, and data sharing will help stakeholders working in this market better understand product performance and necessary enhancements while minimizing duplication of effort and aggregating any "asks" to manufacturers	CalNEXT (IOUs' statewide electric emerging technologies program) CEC Electric Program Investment Charge (EPIC) program DOE National Labs (e.g., Lawrence Berkeley National Laboratory, Pacific Northwest National Laboratory) and research universities (e.g., University of California, Davis Western Cooling Efficiency Center)	Share relevant market and pilot data to create a shared understanding of current opportunities and challenges regarding product features Support product development/ enhancements at the manufacturer level based on research findings, with the goal of "right-sizing" what the California market is asking of manufacturers
Ongoing coordination with large-scale **statewide programs focused on accelerating heat pump adoption or residential electrification** to ensure that	TECH Clean California CAHPP CEC Equitable Building Decarbonization Program	Support development of a consistent statewide infrastructure that creates alignment across programs, including consistent market-informed messaging and identification of targeted sub-

MTI alignment goal	Representative programs	Possible reciprocal support from MTI/CalMTA
the MTI reflects current California market conditions, leverages these external resources to achieve market transformation more quickly and at greater scale, and fills gaps to help these external entities be even more successful in meeting their own goals. These programs also provide an important opportunity to aggregate demand and send a clear signal to manufacturers. While each statewide program has unique goals, CalMTA's MTI will mitigate market-level barriers and fill gaps not currently addressed by these programs.	The Switch Is On	markets that can quickly aggregate the demand needed to reduce upfront cost Collect and share market data identified as valuable to statewide programs, including aggregated sales data and residential housing stock data, through a central statewide Market Intelligence Hub Provide real-world case studies from deployment of Scale-Up Plans to increase the consistency and impact of statewide marketing efforts
Local energy efficiency programs that install HPWHs will be critical points of leverage for the MTI's Scale-Up Plans. The MTI will equip PAs and implementers with information that can help target customers with a strong value proposition for HPWH installation – including identification of "easy-to-install" households or neighborhoods as well as segmented, market-informed messaging and contractor-training tools – or supplement their existing information by engaging adjacent programs to aggregate efforts across territories. This approach will contribute to these programs' increased success while also creating the market momentum needed to reduce product cost, increase contractor confidence, and accelerate manufacturers' commitment to HPWHs.	HPWH rebates offered by Los Angeles Department of Water & Power (LADWP), Northern Rural Energy Network, Peninsula Clean Energy, Sacramento Municipal Utility District (SMUD), Silicon Valley Clean Energy (SVCE), Sonoma Clean Power, Tri-County Regional Energy Network (3C-REN), and others Bay Area Regional Energy Network (BayREN) Efficiency and Sustainable Energy (EASE) Home Program SCE Clean Appliance Rebates Program	In addition to the statewide infrastructure components described above: Provide program trade allies with the information they need to quickly find households with a clear value proposition for HPWH adoption and therefore a strong likelihood of participation - increasing supply chain confidence in the technology and strengthening the business case for HPWH promotion Facilitate manufacturer connections to enable volume pricing for Scale-Up Plan deployment Develop consistent multilingual messaging and marketing/training tools to promote HPWHs to specific sub-markets, including resources to help understand bill impacts Communicate program participant and implementer feedback to manufacturers to influence product development

MTI alignment goal	Representative programs	Possible reciprocal support from MTI/CalMTA
		Leverage manufacturer engagement to support initial "test bed" of easy, high-value-proposition installations
WE&T programs are critical to ensuring customers across California receive quality HPWH installation, including right-sized products and accurate information. CalMTA's statewide market monitoring will position the MTI to support these programs and help program participants see HPWHs as a valuable addition to their business or practice.	Pacific Gas & Electric (PG&E) Energy Center Courses Southern California Edison Contractor Demand-Building Program Southern California Regional Energy Network (SoCalREN) E-Contractor Program SVCE FutureFit Fundamentals Contractor Training TECH Clean California	Document and share best practices related to HPWH installation and equipment selection/placement, including learnings from specific sub-markets Provide workforce-oriented HPWH messaging aligned with consistent statewide infrastructure to help WE&T program participants grow their business through HPWH installations and create a more consistent experience for end-use consumers Share lessons-learned and key findings from WE&T programs with manufacturers/ distributors to ensure the training they offer reflect the needs of the California market
As the MTI engages the market to develop a shared statewide product roadmap, identify opportunities to leverage the work of **entities outside of California seeking to drive HPWH adoption** to increase market momentum and motivate manufacturer participation.	NEEA AWHI New England Heat Pump Accelerator	Share California market data to ensure national efforts reflect the state's needs and opportunities Collaborate on manufacturer engagement to streamline market asks and create a clear, consistent demand signal that aggregates the voice of the California market
Market feedback indicates that all-electric new construction programs are already including HPWHs as a pathway to Title 24 compliance. However, if data indicates lagging HPWH adoption in the new construction market, the MTI can provide additional support to ensure that this technology is	PG&E California Energy-Smart Homes Program CEC California Electric Homes Program CEC Building Initiative for Low-Emissions Development Program	Facilitate manufacturer connections to increase availability and accessibility (including lower cost) of desired HPWH products Coordinate on bulk purchase agreements or layered incentives for builders and remodelers Communicate program participant and implementer feedback to

MTI alignment goal	Representative programs	Possible reciprocal support from MTI/CalMTA
prioritized by builders and developers.	SCE Rebuilding Incentives for Sustainable Electric Homes (RISE) Homes	manufacturers to influence product development Provide marketing support (i.e., benefits messaging, educational content, manufacturer assets, collateral templates)

More detailed information regarding our analysis of the existing program landscape and approach to engagement/coordination with these stakeholders can be found in Appendix E.

6 Data management

CalMTA will implement a comprehensive data collection, management, and analysis strategy over the life of the MTI *for:*

- MTI program data and materials
- Secondary data and information on population characteristics, market trends, and other programs
- Product category sales and shipment data – either purchased or negotiated as part of the MTI
- Data collected via primary research
- MPIs

Data will be securely stored, allowing for both longitudinal tracking and efficient access for analysis activities. Data will support market progress evaluation and updates/true-up analyses to MTI incremental impacts and CE, as well as assessment of market trends and progress toward MTI goals.

6.1 MTI program data and materials

CalMTA will create a repository of program data and materials that include a detailed record of stakeholder and market actor communications, program data (including agreements with and data provided by market partners), market adoption and cost-effectiveness models and forecasts (with fully documented inputs, assumptions, and calculations), MTI MPIs, and market and product research data and reports.

CalMTA team members log communication with stakeholders, partners, and clients to enable comprehensive tracking and reporting of activities, outreach, and events. This will act as a record of CalMTA's interventions and associated timing and be a resource for evaluators to monitor MPIs and investigate the causal relationship and impact of interventions.

The CalMTA website also includes a Resources and Reports section that catalogs CalMTA program material and public communication.

CalMTA will conduct market and product research in support of the HPWH MTI, and regularly true-up the HPWH products market adoption forecast by incorporating actual sales or shipment data as it becomes available. These program data, market and technology data, summary findings, and other work products resulting from research conducted by CalMTA and third-party evaluators will be securely stored as part of CalMTA's ongoing data management activities.

6.1.1 Secondary data and information

CalMTA will collect data from secondary sources regarding population characteristics (such as California household demographics, home ownership, building types, and equipment saturation), market trends, and other programs. Secondary data and information sources may include:

- U.S. Census American Community Survey (Source U.S. Census, Accessed Annually)
- Energy Information Administration's Residential Energy Consumption Survey data
- California Residential Appliance Saturation Study
- PA Program and CEDARS data
- Evaluation reports from related California programs

6.1.2 Product category sales and shipment data

Data on HPWH product sales and shipments will be critically important for evaluating the MTI incremental impacts, yet such data can be difficult to obtain. Given their importance, CalMTA will negotiate agreements with market partners that include sales or shipment data whenever possible. CalMTA will supplement the data obtained from market partners with other sources of sales and shipment data that can be purchased or acquired via primary research.

Appendix F provides a detailed description of the sales, program, and shipment data the MTI will maintain, including:

- Participating retailer mid-stream incentive ENERGY STAR Retail Products Platform (ESRPP) sales data (source: CalMTA ESRPP data)
- Circana or NeilsenIQ data (source: Circana or NeilsenIQ, purchased data)
- PA and CEDARS data
- Other sources of shipment data such as ENERGY STAR and AHRI, or manufacturer or distributor data obtained through data sharing agreements or bulk purchase agreements

6.1.3 Data collection via primary research

CalMTA will collect primary data through a variety of market research and evaluation activities that generate ongoing market insights to inform MTI strategy and tactics, and support market progress evaluation, including longitudinal tracking of MPIs, and assessment of progress toward milestones and outcomes. Appendix F: Evaluation Plan provides detailed descriptions of data collection activities, which include:

- MTI staff, stakeholder, subject matter expert, and partner program interviews
- Manufacturer, distributor, and retailer interviews
- Water heater installer surveys
- Consumer and building owner/property manager surveys

6.1.4 Market progress indicators

MPIs correspond with the HPWH MTI's theory of market transformation, as represented in the Logic Model, and are critical to ongoing market and MTI performance tracking. The data collection described above will enable CalMTA and evaluators to assess progress against these metrics.

For example, CalMTA will draw on information collected through installer surveys, as well as from interviews and surveys with program partners and supply chain actors (regarding the training and tools/resources they offer) to assess the percentage of ESJ and non-ESJ homes where installers report they are able to match appropriate HPWH technologies to their customers' homes. Appendix F: Evaluation Plan provides a detailed description of data sources and the MPI assessment and other evaluation activities the MTI will conduct.

7 Evaluation & market research

Ongoing evaluation and market research are essential to the development and successful management of market transformation programs. CalMTA and the CPUC's Energy Division will oversee implementation of rigorous and strategically focused evaluation, measurement, and verification practices, which will enable CalMTA management and stakeholders to gauge the performance of CalMTA and MTIs, verify incremental impacts, and improve the design and success of future MTIs. Ongoing program evaluation that provides timely feedback to support program decision making, which is also known as "real-time" or "embedded" evaluation, will provide MTI program managers and implementers with continual feedback, allowing them to pivot strategies as needed to maximize the value delivered to California ratepayers.

Per CPUC Decision 19-12-021 and CalMTA's MTI Evaluation Framework, CalMTA and an independent third-party evaluator each have important evaluation roles in MTI Evaluation. CalMTA will conduct ad hoc market research and develop forecasts of MTI incremental impact

and CE, while an independent third-party evaluator is responsible for evaluating market progress and causal influence of the MTI, and for reviewing estimates of MTI incremental impacts and cost effectiveness. CalMTA developed a preliminary plan for third-party evaluation of the HPWH MTI with input from the Evaluation Advisory Group, a group of three independent evaluation experts, the CPUC project manager, and the CalMTA market research and evaluation lead.[76,77] An independent third-party evaluator, to be selected via a competitive RFP process after the MTI advances to Phase III, will develop final evaluation plans.

7.1 Evaluation approach overview

CalMTA and its third-party evaluator will employ a theory-based evaluation (TBE) approach to evaluate the HPWH MTI, which is widely accepted as a best practice for market transformation program evaluation.[78] TBE uses the HPWH program theory as the point of reference for market progress evaluation: it assesses market progress against the theorized short-, medium-, and long-term outcomes and corresponding MPIs, and the extent to which the market interventions address the market barriers and drive outcomes, identified in the Logic Model (shown in Appendix A).

The evaluation will address these high-level objectives:

- Monitor market dynamics and characteristics; assess market developments
- Review and assess the MTI program theory and logic model
- Measure market progress and equity, per the MPIs
- Assess equity outcomes described in this document and equity research questions described in the Evaluation Plan
- Assess MTI causality per the logic model using evidence-based assessments that take a "preponderance of evidence" approach and follow established market transformation evaluation best practices
- Identify gaps in implementation and opportunities to adjust MTI strategy and tactics to improve MTI effectiveness
- Assess ancillary benefits and costs

[76] For more details, please see Appendix F: Evaluation Plan.

[77] The purpose and roles of the Evaluation Advisory Group are detailed in CalMTA Market Transformation Initiative Evaluation Framework April 2024, https://calmta.org/wp-content/uploads/sites/263/Market-Transformation-Evaluation-Framework-FINAL.pdf.

[78] For more about TBE and references, please see Appendix F: Evaluation Plan.

- Review CalMTA's baseline and total market adoption forecasts (BMA and TMA), unit energy savings, incremental net MTI impacts, and co-created MTI impacts,[79] and cost-effectiveness inputs and assumptions

7.2 Market progress indicators

The HPWH MTI Evaluation Plan identifies 20 MPIs that correspond with the MTI program theory. While the ultimate market progress indicator is market adoption of MTI HPWHs (CalMTA will track this metric from the outset), this metric can be a misleading indicator of success during the first several years of MTI implementation because market share and adoption will accelerate only after the MTI addresses these critical market barriers:

- Customer value proposition and limited customer demand result in limited supply chain business case
- Characteristics of some California housing stock render HPWHs a less-than-ideal water heating solution
- Customers do not value HPWHs' complex program requirements for qualifying products
- Supply chain actors and consumers see a complex and inconsistent California program landscape
- High first costs

To appropriately evaluate market progress and ensure accountability, the evaluator must assess MPIs that align with the Logic Model, including these key indicators:

- Number of energy-efficiency partner organizations/programs supporting HPWHs with a range of form factors
- Percent of active California programs aligning on CalMTA-identified definition of qualified HPWH products and on messaging about HPWH benefits
- Number of manufacturers partnering with CalMTA on Scale-Up Plans
- Supply chain partners supporting/participating in training and using tools and resources to match HPWH technologies to California housing stock
- Percent of homes (in the general population and in ESJ communities) where installers report HPWH technology is "fit for purpose"
- Total installed costs of HPWHs (in ESJ and non-ESJ communities)

[79] Co-created impacts are the total impacts resulting from an MTI's interventions, including those resulting from collaborations with resource acquisition programs.

- Percent of water heaters installed annually in existing residential (ESJ and non-ESJ community) homes that are HPWHs
- Percent of annual HPWH sales in California that use lower GWP refrigerants
- Percent of annual HPWH installations in California that meet AHRI 1430 load shift requirements

Appendix F: Evaluation Plan provides a complete list of MPIs and how the evaluator will assess them. Appendix F also describes data sources and evaluation approaches that the third-party evaluator can use to assess market progress, MTI causality, equity, and CalMTA's estimates of MTI incremental impacts and CE. The evaluator will conduct ongoing market monitoring via secondary data analysis and primary research to evaluate market progress and causality and, importantly, to provide ongoing market insights and real-time information to inform MTI strategy and improve performance.

CalMTA identified these primary and secondary data collection activities and associated analysis tasks that will allow the third-party evaluator to evaluate the HPWH MTI, which are described in Appendix F:

- MTI program data and materials review
- MTI staff, stakeholder, subject matter expert, manufacturer, and program partner interviews
- Distributor, retailer, installer, and consumer surveys
- Secondary data and literature review
- Sales and shipment data collection and analysis

CalMTA anticipates that the independent third-party evaluator will have suggestions for how to improve upon this plan.

7.3 Ad hoc market research

The planned evaluation activities include a range of market research activities that will provide ongoing market insights to support refinements to the MTI strategy and tactics. CalMTA expects there will also be a need for ad hoc research to support timely implementation decisions and program effectiveness. For example, the CalMTA expects that California's 2025 Title 24 building standards code (which took effect on January 1, 2026) will encourage most builders to install HPWHs in newly permitted homes. As of this writing, however, CalMTA does not know if builders will, in fact, include HPWHs in their new homes, or if builders will find ways to work around installing HPWHs while still complying with the code. The third-party evaluator may be able to address this question through the evaluation approach described above, or addressing this question may require additional research. CalMTA has included a modest budget for ad hoc research needs and will identify specific research studies over the initiative's lifetime.

8 Risks & mitigation

This section details the potential risks that could negatively impact the HPWH MTI and CalMTA's plan to monitor and mitigate these risks. The risks listed in Table 12 have been identified as key risks to track. Appendix G includes a full list of possible risks for this MTI. We are defining "high," "medium," and "low" for each risk as follows.

For "Probability of Occurring" in the second column, CalMTA is defining:

- **High:** Through our research and discussion with market actors, CalMTA deems this risk having a high probability of occurring. The program needs to monitor closely and identify a solid backup plan with resources that can be deployed to mitigate the risk.
- **Medium:** This risk has a medium probability of occurring given what we know about the market. The MTI needs to track and have a plan to mitigate.
- **Low:** The probability of this risk occurring is low based on what's known about the market to date. It could have some impact on the need for resources and timing, so the MTI needs to track it.

For "Severity" in column 3 of Table 12, CalMTA is defining these as follows:

- **High:** If this risk occurs and our mitigation approach is unfeasible, then the success of the MTI may be jeopardized.
- **Medium:** This may have an impact on the timing or overall success of the MTI, but a solid mitigation approach exists and the MTI will be able to pivot with more time or resources.
- **Low:** This level of risk will likely require a program intervention adjustment, but it will not jeopardize timing or resources.

Table 12. Risk and mitigation

Risk	Probability of occurring	Severity	Mitigation approach
Manufacturers do not see a Return on Investment (ROI) or pathway to profit: HPWH manufacturers may not perceive a viable or scalable ROI in California. This perception may limit further investment, pricing reductions, and long-term market participation by manufacturers.	H	H	Aggregate demand in submarkets to prove viable business case and accelerate market adoption. Partner with manufacturers during product roadmap and Scale-Up Plan development. Coordinate California partners to align product development needs through a Product Roadmap that would create a clear and consistent set of asks for manufacturers. Maintain robust relationships with manufacturers through proactive and ongoing engagement. Collaborate with other programs/partners outside of California to align and develop consistency.
California market is unprepared for the 2029 federal standard adoption: Market and installer workforce are not ready for the 2029 federal standard where HPWHs will essentially be the only approved electric water heating option. Inexperience with HPWHs may lead to poor installations, underperforming equipment, negative customer experiences, and missed opportunities to scale adoption.	H	H	Aggregate demand in easier-to-install submarkets to build installer experience and confidence. Create, track, and communicate lessons learned and installation best practices by submarket, to influence existing program and supply chain training efforts. Ensure federal standards messaging is clear and consistent to installers and market actors. Work with existing programs/partners and supply chain training efforts to monitor market and workforce.
Duplication of efforts with other HPWH programs and initiatives:	M	H	Dedicated staff (CalMTA and implementation contractor) to maintain and manage relationships with program partners and market actors to monitor

Overlap with IOU, Community Choice Aggregator (CCA), REN, or state HPWH activities may create redundancy, confuse market actors, and reduce the efficiency and impact of CalMTA's efforts. The overlap could increase the risk that ratepayers could fund duplicative activities without added market benefit.			activities and ensure CalMTA efforts are additive and not duplicative and maintain program support roadmap. Proactive engagement with market partners (e.g., coordination meetings, quarterly check-ins, technical working groups) to track market shifts, identify needs, and adjust strategies when conditions evolve. Co-develop product roadmaps and Scale-Up Plans with agreements (e.g., Memorandum of Understand [MOU], Strategic Partnership Agreements [SPA] defining roles, responsibilities, communication approach, and timelines).
ESJ participation gaps in priority segments: ESJ communities may not benefit from aggregated efforts due to landlord barriers, retrofit complexity, or low CBO capacity.	M	H	Develop ESJ-specific Scale-Up Plans with additional time and budget allocated to address barriers. Create robust program support roadmap that aggregates incentive resources and program efforts targeted for ESJ communities. Develop strategies such as stacked incentives, financing options, or program structures that reduce hurdles for landlords and rental properties.
Program partners are unable to meet incentive commitments during submarket scale ups: Program partners may be unable to sustain or deliver committed incentive levels, resulting in incentive start-stop dynamics that erodes market trust and partner relationships.	M	H	Track, monitor, and forecast incentive burn rates in coordination with partners. Conduct regular partner coordination and alignment activities to involve partners in the development and ongoing management of Scale-Up-Plans. Leverage Scale-Up Plans to ensure incentive levels, unit installation goals, timelines, and roles and responsibilities are clear by partner organization. Leverage Scale-Up Plans to create agreements (e.g., MOU, SPA, etc.) that clearly outline program commitment to number of products they are supporting and intended incentive level.
Operating costs for HPWH result in increased utility bills: When a customer converts from natural gas	M	M	Monitor electricity rates by utility, county, and locale as part of submarket aggregation efforts to help inform where the team should focus aggregation efforts.

water heat to a HPWH, they see an increase in their utility bills.			When rates are no longer a barrier to adoption, explore that territory/region for possible submarket aggregation efforts.
Unable to achieve aggregated scale in submarkets: Efforts to aggregate demand across submarkets fail to reach sufficient volume, reducing bargaining power and undermining cost reductions with supply chain.	M	M	Conduct a robust market segmentation and housing stock assessment to identify and prioritize submarkets with the highest aggregation potential and scale. Prioritize program partners and submarkets with demonstrated demand density, supportive policies, and aligned incentives. Partner early with market champions (e.g., trusted CBOs, local leaders, manufacturers, contractor networks) who already show commitment to the technology to anchor aggregation efforts.
Total installation costs do not decline with scale: Despite aggregation and market interventions, total installed costs remain high due to persistent labor, electrical upgrade requirements, permitting, or supply chain barriers. These challenges do not cause the product's installation costs to decrease, thus slowing adoption.	M	H	Design submarket-specific scale-up strategies that anticipate cost drivers, optimize deployment sequencing, and leverage volume efficiencies to reduce overall installation costs. Build strong partnerships with manufacturers, distributors, and installers. Collaborate to secure better pricing and improve product availability with the goal of lower material and equipment costs. Leverage distributors and manufacturers to identify champion installers who will commit support to Scale-Up-Plans. Prioritize early deployment in housing types and regions requiring minimal retrofits or electrical upgrades to accelerate adoption, achieve early cost and installation efficiencies, and give installers opportunities to build experience and reduce installation time over successive projects.

9 Cost estimates

Table 13 contains annual cost estimates by major program activity for the full 20-year program period, representing all Phase III costs required to achieve full market transformation and to validate all impacts. Additional detail, including estimated annual investment by year, can be found in Appendix H.

Table 13. Cost estimates[80]

Activity	Total Phase III cost estimate
Program implementation including the following line items: MTI oversight, strategy, and management Marketing and awareness building Policy development and support Supply chain management	$26,284,000
Market Research including the following line items: • Market research • Data collection	$15,063,000
Program evaluation	$1,599,000
Total	**$42,946,000**

[80] Cost estimates in Appendix B and used in all cost-effectiveness calculations include costs incurred during Phase II: Program Development. Total investments for Phase II and Phase III are estimated to total $46,406,000. Modeling starts in 2028, despite budget starting in 2027, because we only expect the enter the market in the fourth quarter of 2027 and modeling is done on an annualized basis.

10 Appendices

Link to https://calmta.org/resourcereport/residential-heat-pump-water-heating-mti-plan/ to access the appendices below.

Appendix A: Logic Model Packet

This appendix includes the MTI's full Logic Model. The Logic Model is a systematic and visual way of presenting CalMTA's understanding of the interventions necessary to remove barriers, expected outcomes of those interventions, and a pathway to the desired end state.

Appendix B: Market Forecasting and Cost-Effectiveness Modeling Approach

This appendix details the inputs, sources and methods used to develop the market forecasting, TSB, and cost-effectiveness model for this MTI.

Appendix C: Product Assessment Report

This appendix presents the findings on the technology research conducted in Phase II and on behalf of the MTI.

Appendix D: Market Characterization Report

This appendix includes the baseline assumptions and a thorough assessment of the market state, supply chain, market actors, and other programs that support the MTI.

Appendix E: External Program Alignment & Coordination

This appendix describes how CalMTA will communicate and collaborate with key market actors and program stakeholders.

Appendix F: Evaluation Plan

This appendix describes the plan to track the progress and assess the impact of the MTI over time.

Appendix G: Risk Management Plan

This appendix documents the potential risks and obstacles to the MTI and CalMTA plans to mitigate the risks.

Appendix H: Cost Estimate

This appendix details the budget requirements for the MTI.

Appendix I: MTAB Feedback

This appendix contains feedback on the MTI Plan from the Market Transformation Advisory Board