



Room Heat Pumps

Market Transformation Initiative Plan

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 the strategic interventions, intended market outcomes, and evaluation activities that would 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: Program Development](#) 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. 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 plan. All MTAB meetings are public and interested parties will have an opportunity to comment on these plans via a California Public Utilities Commission (CPUC) application proceeding.

MTI development process by phase



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

The Advancement Plan delivered at the end of Phase I for this MTI can be found at <https://calmta.org/resources-and-reports/>.

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Room Heat Pumps MTI Plan + appendices change log

Date	Description	Document	Page/ location
12/2/25	Updates were made to the total system benefit and cost-effectiveness forecasts as reflected in the formal errata CalMTA submitted to the CPUC during the application proceeding	MTI Plan	9,11, 12, 28
12/2/25		Appendix B	10, 43, 44, 45, 67,68
12/2/25	Based on new learnings, added HVAC distribution channel to scale RHP adoption alongside the retail channel	MTI Plan	9, 10, 11, 13, 16, 21, 23, 24, 27, 42, 49, 55
		Logic Model	Intervention #6 and related outputs and outcomes



List of Abbreviations

Abbreviation	Definition
AC	Air-Conditioning
ACC	Avoided Cost Calculator
AHAM	Association of Home Appliance Manufacturers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BMA	Baseline Market Adoption
CalMTA	California Market Transformation Administrator
CARB	California Air Resources Board
CARE	California Alternative Rates for Energy
CBO	Community-Based Organization
CEC	California Energy Commission
CEDARS	California Energy Data and Reporting System
CEE	Consortium for Energy Efficiency
CEER	Combined Energy Efficiency Ratio
COP	Coefficient of Performance
CPUC	California Public Utilities Commission
EIA	Energy Information Administration
EPIC	Electric Program Investment Charge
ESA	Energy Savings Assistance
ESJ	Environmental and Social Justice
ESRPP	ENERGY STAR Retail Products Platform
GHG	Greenhouse Gas
GWP	Global Warming Potential
HARDI	Heating, Air-Conditioning and Refrigeration International
HEER	Heating Energy Efficiency Rating
HVAC	Heating, Ventilation, and Air-Conditioning
IAQ	Indoor Air Quality
IOU	Investor-Owned Utility
IRA	Inflation Reduction Act
MERV	Minimum Efficiency Reporting Value
MF	Multifamily
MPI	Market Progress Indicator
MT	Market Transformation
MTAB	Market Transformation Advisory Board
MTI	Market Transformation Initiative
NEEA	Northwest Energy Efficiency Alliance
NRDC	Natural Resources Defense Council
NYCHA	New York City Housing Authority
NYSERDA	New York State Energy Research and Development Authority
PAC	Program Administrator Cost
PG&E	Pacific Gas and Electric
PHP	Portable Heat Pump
RFI	Request for Ideas
RHP	Room Heat Pump



Market Transformation Initiative Plan for Room Heat Pumps

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Abbreviation	Definition
SACC	Seasonally Adjusted Cooling Capacity
SCT	Societal Cost Test
SF	Single-Family
TSB	Total System Benefit
TMA	Total Market Adoption
TRC	Total Resource Cost
UEI	Unit Energy Impacts
WHP	Window Heat Pump



Market Transformation Initiative Plan for Room Heat Pumps

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1 Executive summary

CalMTA's Room Heat Pumps (RHP) MTI aims to accelerate market adoption of RHPs to provide efficient heating and cooling in existing small, single-family (SF), and multifamily (MF) households. With a forecasted Total System Benefit (TSB) of \$480 million, RHPs offer a significant, cost-effective opportunity to reduce energy demand and associated infrastructure costs, which are a primary driver of electric rates in California. Over time, the initiative will transform the market and lock in energy savings, grid benefits, and greenhouse gas (GHG) reductions to help meet California's climate goals.

Heating and cooling represent the largest energy consumption end-uses for homes in California, with more than 59%¹ of households still using gas appliances for heating. RHPs provide a more efficient option that can be self-installed and be plugged into a standard 120V outlet without a panel or service upgrade. The technology provides an attractive alternative to low-income consumers who cannot afford the installation cost of other heat pump alternatives or are unable to install permanent equipment due to landlord restrictions.² This initiative includes strategies to bring to market affordable RHPs that low-income consumers can own, take with them in a move, and that will help deliver comfort and climate resiliency benefits to them and their families.

As California pivots to a more electrification-enabling rate structure, RHPs will be a critical solution for replacing zonal gas heating and electric resistance heating, particularly found in multifamily buildings. This MTI Plan is informed by CalMTA's extensive research on the product, market, active programs, and potential market interventions to ensure the adoption of RHPs.³

1.1 Market overview

Currently, single-function heating or cooling products like electric resistance heaters and window air conditioners (AC) dominate the market as the most common choice for consumers. Even with RHPs offering numerous advantages - increased efficiency, dual function and multiple form factors (portable, saddlebag, U-Shape, traditional compact window) - several barriers have inhibited their adoption. The primary barriers include insufficient availability at HVAC distribution and brick-and-mortar stores, limited consumer awareness, higher upfront costs, lack of suitable

¹ EIA RECS 2020; CalMTA recalibration of household population to the American Community Survey (ACS) 2022. This also includes a small percentage of oil and wood stove heating that are binned with gas zonal heating.

² According to Assembly Bill 1550, low-income communities and households are defined as those who live in census tracts or households at or below 80% of the statewide median income or meeting the threshold designated as low-income by the California Department of Housing and Community Development's Revised 2021 State Income Limits. CalMTA uses the term "low-income" to describe individuals or households whose income status poses a barrier to adoption of the technology.

³ For the purposes of this MTI, "programs" are defined as energy efficiency, decarbonization, weatherization, and climate resiliency programs, regardless of their funding source. Examples of such programs are listed in Appendix E. CalMTA will collaborate with such programs to aggregate demand and send a consistent signal to manufacturers to develop California-appropriate room heat pumps.

products for most California climate zones, ineffective product differentiation, and current product configurations that do not fit in casement or slider windows, which are the dominant window types in California.

1.2 Vision

The vision for market transformation focuses on RHPs becoming the norm over less efficient, single-function heating and cooling units in California's multifamily and smaller single-family homes due to their superior efficiency, improved comfort and large market acceptance from increased awareness of these benefits. Achieving this requires market interventions that include engaging with manufacturers for product improvements, facilitating bulk purchase agreements, increasing consumer awareness, and engaging with HVAC distribution and big box retailers to modify stocking practices. The ultimate goal is for this MTI to deliver affordable, climate-appropriate RHPs that fit multiple window configurations to reduce California's reliance on gas systems. Over time, these products will include air filtration options and use lower global warming potential (GWP) refrigerants to reduce the global warming impacts.

1.3 Key Phase II research findings

Phase II research identified several important findings:

- Recent innovation in RHP technology has focused on meeting heating needs in cold climates with outdoor ambient temperatures below 0°F. While these units will perform well in California, there is still a need for lower cost products that have adequate low-temperature performance for milder California winters.
- Through energy modeling, CalMTA found the increased heating efficiency provided by RHPs resulted in average estimated energy savings of 42% and 54% on heating, ventilation, and air conditioning (HVAC) energy in a multifamily home compared to electric resistance and zonal gas heat, respectively.
- Visits to seven major retailer locations demonstrated that there are no available RHP products of any kind, and sales representatives have little to no knowledge about the product. In addition, online storefronts lacked sufficient product labeling to help guide customers to such products.
- New products are needed to serve the California market with high efficiency heat pumps that can fit horizontal sliding and casement windows given that over 50% of California homes contain these window types exclusively. The CalMTA team has found that the highest priority need is for products that fit in slider windows, with products that can fit into casement windows being the second highest priority need.

1.4 Strategic interventions for Phase III

To overcome market barriers and drive market adoption, the following interventions are proposed for Phase III:

- 1) Engage with manufacturers, stimulate demand, and secure bulk purchase agreements to accelerate manufacturer development of RHPs that meet the climate and window configuration needs of the California market.



- 2) Form a national collaborative on performance specifications that represent California needs and influence future ENERGY STAR specifications.
- 3) Gather and share usage and bill impact data across program partners that have supported product installations.
- 4) Build market awareness of product benefits in partnership with aligned organizations and market partners like manufacturers, HVAC distributors and retailers.
- 5) Support inclusion and bundling of product with energy efficiency and climate resilience programs that will reduce initial product and operation cost impacts for environmental and social justice (ESJ) communities.⁴
- 6) Engage HVAC distribution and retail channel with midstream stocking incentives targeting ESJ communities.
- 7) Support California policy and standard-setting bodies in authorizing the use of lower GWP refrigerants by conducting manufacturer engagement, supporting third-party lab testing, and engaging safety experts in policy discussions.
- 8) Support advancement of electrification-enabling rate structures to mitigate bill impacts of moving from gas to electric heating.

1.5 Recommendations

CalMTA will monitor these interventions over the 20-year lifetime of the MTI.⁵ Multiple short-, medium- and long-term outcomes will be tracked with MPIS including product availability, price declines, market share compared to incumbent technologies, HVAC distributor and retailer stocking practices, and many more over the life of the MTI. Regular third-party evaluations of these MPIS will allow for rapid assessments of CalMTA's interventions, monitoring of the market's response, and identifying potential adaptations or shifts needed to the interventions.

CalMTA recognizes other concurrent work in California is being done by stakeholders including policymakers, statewide codes and standards advocacy, and efficiency and research programs. CalMTA intends to continue to collaborate and build on existing work to maximize the MTI's market development phase.

⁴ ESJ communities are identified by the CPUC as those where residents are: predominantly communities of color or low-income; underrepresented in the policy setting or decision-making process; subject to a disproportionate impact from one or more environmental hazards; and likely to experience disparate implementation of environmental regulations and socio-economic investments in their communities. These communities may also include: disadvantaged communities, all Tribal lands, low-income households, and low-income census tracts. <https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/news-and-outreach/documents/news-office/key-issues/esj/esj-action-plan-v2jw.pdf>.

⁵ The term "lifetime" refers to Phase III: Market Deployment only and has a defined "lifetime" of 20 years. While the lifetime of an MTI covers its implementation period, cost-effectiveness analyses include costs and savings from both Phase II and Phase III.

RHPs not only demonstrate a unique opportunity to improve multifamily and small single-family home heating and cooling efficiency, but also provide strong TSB and cost effectiveness (CE) for California in the long term. TSB forecasts, using assumptions learned from Phase II research, indicates a potential of \$480 million. This includes all savings from 2026-2045 and costs from 2024-2045 (which accounts for development costs from 2024 and 2025). The largest share of the benefit can be attributed to mitigated non-refrigerant GHG emissions, with an estimated \$321 million in TSB. The smallest share of the TSB is driven by grid benefits with \$28 million in TSB from substituting heating from fossil gas with electric heat pumps. Finally, energy benefits driven by savings related to electricity and natural gas reductions generate nearly \$143 million in TSB. The contents of this MTI Plan summarize CalMTA's learning from Phase II activities as well as describe the plan for market transformation over the next decade. Table 1 below includes key cost and savings numbers derived from learnings in Phase II. Given the high potential value of this work, CalMTA recommends the Room Heat Pumps MTI to advance to Phase III pending CPUC approval.

Table 1. Overview of the Room Heat Pumps MTI

Market	Residential and multifamily target market, consumer products			
Total Phase III investment needed to achieve TSB forecast (2026-2045):	\$59,128,000			
Phase III investment over initial CalMTA funding cycle (2026-2030):	\$36,447,000			
Phase II investment (2024-2025):	\$3,681,000			
Total investment including Phase II and Phase III investment (2024-2045):	\$62,809,000			
TSB (2026-2045)	TSB - Energy	TSB - Grid	TSB - GHG - NR	TSB - GHG - R
	\$143M	\$28M	\$321M	(\$12M)
TSB - Total	\$480M			
Cost-effectiveness (2024-2045)	TRC	PAC	SCT Base/High	
Negative IMCs included	304.09	7.64	(27.81)/(27.83)	
Negative IMCs set to zero*	5.03	7.64	10.30/10.31	

* CalMTA calculated cost-effectiveness using the negative Incremental Measure Costs (IMCs) estimated for some use cases, per the guidance from the CPUC's Energy Division guidance memo that required negative IMCs to be entered into the Cost-Effectiveness Tool (CET) and not set to zero.⁶ CalMTA also calculated cost-effectiveness results with negative incremental costs set to zero reported in this table.

⁶ [Guidance for Deemed Measures History: CPUC Guidance on the use of Negative Incremental Measure Cost \(IMC\) in the Cost Effectiveness Tool - CEDARS.](#)

2 Market Transformation theory & opportunity

2.1 Theory of Market Transformation

2.1.1 Brief product definition and benefits

The broad category of air-source heat pump technology has been commercially available for several decades, but the subset of RHP products within it has recently seen extensive innovation. RHPs include window and portable units that provide efficient heating and cooling for small spaces ranging from a single room, a modest apartment, or a small home. They are similar in shape and size to typical window AC units and portable AC products. This MTI targets products that utilize highly efficient, variable capacity heating and cooling. These products can be installed without a certified technician and plugged into a 120V outlet.

RHPs fill a critical market gap in their ability to deliver both efficient heating and cooling to smaller spaces, especially in the multifamily market, without requiring expensive, skilled labor for installation like mini-split and central systems. They also serve as a bridge technology to electrification by reducing reliance on gas-powered central systems in some scenarios. To date, market partners have focused their technology development on colder, U.S. climate zones. Thus, the products on the market today are not optimized for most of California's mild climates and are incompatible with slider windows, which are common in California.

This MTI will help create and grow availability of new RHP designs that can be installed in slider windows primarily and casement window frames secondarily. It will also work to enhance availability of Type 2 and 3 RHPs which better serve the more moderate climate needs of California and can likely be produced at lower price points than Type 4, the cold climate versions.⁷ Over time, the program will work to include additional features like air filtration functionality to improve indoor air quality (IAQ) and ensure use of lower GWP refrigerants.

2.1.2 Target market

The target market for this MTI is single-family (SF) and multifamily (MF) existing housing. In some homes, RHPs will fully replace other heating and cooling sources. In other cases, these units can be used as supplemental heating and cooling, reducing reliance on central systems and less efficient zonal systems.

⁷ Based upon the new ENERGY STAR test procedure: **Type 1 heat pump:** A room heat pump that does not have active defrost or for which the specified compressor cut-in and cut-out temperatures are not both less than 40°F. **Type 2 heat pump:** A room heat pump that has active defrost and for which the specified compressor cut-in and cut-out temperatures are both less than 40°F but not both less than 17°F. **Type 3 heat pump:** A room heat pump that has active defrost and for which the specified compressor cut-in and cut-out temperatures are both less than 17°F but not both less than 5°F. **Type 4 heat pump:** A room heat pump that has active defrost and for which the specified compressor cut-in and cut-out temperatures are both less than 5°F.

An initial target market for this MTI will be MF households that still use electric resistance heating. These consumers will benefit immediately through efficiency gains of the HP and won't be impacted by the move from gas to electric heating. Over time, as more electrification rate structures are adopted across California, the MTI can target the broader market.

The market actors that this MTI targets include consumers who own their homes, consumers who rent their homes, MF building owners, and supply chain market actors such as manufacturers, HVAC distributors, retailers, and the programs that serve these markets.

2.1.3 Initiative vision

Through manufacturer engagement coupled with demand aggregation, specification development, leverage of California programs and Inflation Reduction Act (IRA) funding, and building market awareness, this MTI will work to ensure that the market delivers affordable, climate appropriate RHPs to replace inefficient electric resistance heaters and window AC units, and reduce California's reliance on gas systems, with efficient RHPs. Over time, these products will use lower GWP refrigerants to reduce the global warming impacts of RHP refrigerant use and provide air filtration to improve IAQ.

2.1.4 Key market barriers

RHPs face the following key barriers that this MTI needs to overcome before broad market adoption can take place. These are called out in the Logic Model in Appendix A and also mapped to the planned interventions that seek to overcome these barriers in Section 2.2 below.

- Lack of availability of California-suitable products that fit into California windows and are appropriate for California climate needs.
- Low consumer awareness of functionality and benefits.
- Performance metrics and labeling misalignment/ambiguity prevent consumer informed choice.
- Higher purchase price compared to separately purchasing window ACs and space heaters.
- Higher operating costs in fuel substitution scenario. Under many current rate structures, when a consumer substitutes from a less expensive energy source like gas to an electric system, it can increase energy bills despite the efficiency gains. This is especially a barrier for ESJ communities.
- U.S. safety regulations restrict the charge level of A3 refrigerants below the level required for RHPs.

2.1.5 Market opportunities and key leverage points

This MTI will exploit both market opportunities and pre-existing points of leverage. Market opportunities are the market trends and forces that serve as opportunities for this technology to reach greater adoption. These are called out in the Logic Model in Appendix A and are also mapped to the planned interventions that seek to exploit these opportunities in Section 2.2.

- ENERGY STAR is developing a new specification for RHPs that covers both heating and cooling modes. This designation will make RHPs eligible for IRA funding. The Consortium for

Energy Efficiency (CEE) is also releasing a tiered specification for utility programs to be able to incent RHPs. In the future, there may be a federal heating efficiency standard which adapts the ENERGY STAR test method, although there has not yet been a public notice on this topic.

- Public health and clean energy momentum is driving an overall push for heat pump adoption.
- New market entrants, like Gradient and national partners like the New York State Energy Research and Development Authority (NYSERDA), are generating increased manufacturer attention and product innovation in this product category.

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 and product benefits that this MTI will utilize to accelerate market adoption. These include:

- Existing efficiency and climate resilience programs that provide giveaways through direct install programs, consumer incentives to offset upfront costs, and education on heat pump and electrification measures.
- The existing ENERGY STAR Retail Products Platform (ESRPP) program and data collection efforts with national retailers.⁸
- RHPs do not need skilled labor for installation and can be plugged into a 120V outlet.
- RHPs provide both efficient heating and cooling, so are now year-round devices rather than seasonal. They provide greater functionality and convenience without having to be removed at the end of the season.

2.1.6 Conditions that would trigger transitioning out of market

Once this MTI achieves the market conditions detailed below, the market will have sufficient momentum to allow CalMTA to begin to transition out of the market while continuing to monitor adoption progress. This is the point in time when funding levels reduce substantially while benefits continue to grow. For details on MPIs and Milestones that will be tracked please see Appendix F.

- A wide assortment of affordable ENERGY STAR certified RHPs exist in the market, including Type 2 and 3, and are easily installed in the slider and casement window types.
- There is sufficient product selection that includes air filtration capability to improve IAQ.
- RHPs with low GWP refrigerants ($GWP_{100} < 150$) are available for sale in California.⁹
- Consumers are aware of the benefits of these products and increasing market share demonstrates that they choose these products over inefficient heating and separate air conditioning (AC) options.

⁸ The ENERGY STAR Retail Products Platform (ESRPP) is an existing, national collaborative midstream initiative of ENERGY STAR, energy efficiency program sponsors, retailers (i.e., The Home Depot, Lowe's, Best Buy, and independent stores through the Nationwide Marketing Group), and other key stakeholders. Depending on the product category, it is estimated that ESRPP retailers are responsible for the majority of incentivized product sales nationally, including plug-in heating and cooling products.

⁹ When referring to the global warming potential of refrigerants we use the 100-year GWP values as detailed in IPCC 4th annual assessment report, consistent with the CARB refrigerant management program

2.1.7 Market end state

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

- The norm is to purchase an RHP instead of resistance or gas heaters and window ACs.
- RHPs are a key solution for primary heating and cooling in small MF units or homes.
- Provides a key technical solution to displacing GHG from inefficient heating in small spaces.
- A subset of RHPs increasingly incorporate air filtration capability and use lower GWP refrigerants.

2.1.8 Environmental & social justice approach

RHPs address the needs of ESJ communities by filling a product gap for MF and small SF homes that cannot afford or do not have the opportunity to install other heat pump product alternatives. Given California's aggressive goal of six million heat pumps installed by 2030 and plans for zero emission standards for space heating and cooling, RHPs need to be a piece of the heat pump puzzle, especially for ESJ communities.

Key benefits for ESJ households include the following:

- RHPs can be self-installed and owned by a renter or homeowner, not requiring the need of skilled electrician or mechanical contractor.
- RHPs plug into a 120V outlet and provide an affordable, efficient decarbonization option without triggering a panel or service upgrade.
- RHPs can meet the heating, ventilation, and air-conditioning needs of a small home or apartment or for zonal heating and cooling in larger homes, offsetting use of the central system and/or reliance on inefficient supplemental devices like electric resistance heaters.
- RHPs are less expensive to operate for MF households that currently use electric heat. In the future, once California utilities offer more electrification-friendly rates to consumers and RHPs increase their efficiency to help reduce operating costs, this will also be true for consumers moving from gas to electric HVAC.
- With IAQ filtration features, these products will benefit ESJ communities who often suffer from higher levels of compromised air quality.¹⁰

Given these benefits, RHPs provide an attractive alternative to ductless mini-splits for consumers who cannot afford the installation cost or are unable to permanently install HVAC equipment due to building owner restrictions. These products will also be an important tool for weatherization, energy efficiency, direct install, and climate resilience programs that largely serve ESJ communities, since RHPs can provide an affordable, efficient, and resilient HVAC system during extreme weather events.

¹⁰ Small homes are more susceptible to indoor air pollution due to lower total air volumes. Additionally, recent work has shown that households of lower socio-economic status generally experience poorer indoor air quality. Ferguson, L. et. al., Exposure to indoor air pollution across socio-economic groups in high-income countries: A scoping review of the literature and a modelling methodology. *Environment International*, Vol. 143, October 2020, 105748. <https://doi.org/10.1016/j.envint.2020.105748>.

2.1.9 Theory/Assumptions

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


- **If** major manufacturers see large demand from MF building owners and programs, **then** they will be motivated to develop RHPs that meet the needs of California's most prevalent window forms and climate zones.
 - Assumes California continues to work towards its overall climate goals, including six million heat pumps by 2030 and carbon neutrality by 2045.
 - Assumes it is technically feasible to develop Type 2, 3, or 4 versions of efficient RHPs that fit into slider and casement window configurations.
 - Assumes MF building owners see benefits to a RHP that offers both efficient heating and cooling.
- **If** CalMTA works to coordinate with other parts of the country around the need and demand for affordable Type 2 and 3, ENERGY STAR certified RHPs resulting in even greater market influence on manufacturers to develop California appropriate products, **then** manufacturers will have an even larger demand signal to quickly develop these products and bring them to market.
 - Assumes other parts of the country with a similar climate and housing stock to California could benefit from affordable RHPs.
 - Assumes IRA incentives can accelerate the adoption of these products.
- **If** this MTI can gather usage and bill impact data across multiple research efforts to test these products, **then** California programs will have the data required to include these products in their programs, building further demand.
 - Assumes CalMTA generates data through field testing and can acquire the data from other programs.
 - Assumes that this data will inform best use cases for RHPs in homes with multiple other HVAC devices.
- **If** consumers understand the benefits of RHPs offering both heating and cooling capability with, eventually, air filtration, **then** they will demand RHPs over single-function electric resistance heaters and window AC units.
 - Assumes extreme weather events will continue to drive demand for additional cooling and air filtration benefits.
 - Assumes prices for some versions of RHPs decline with product innovations and economies of scale.
- **If** this MTI can serve as an advocacy partner to other organizations working to allow the use of lower GWP refrigerants through manufacturer engagement, support of expert lab testing, and data sharing, **then** California policymakers and regulators will have increased support to allow HVAC manufacturers to utilize lower GWP refrigerants, especially in the case of hermetically sealed products.
 - Assumes partner organizations like Natural Resources Defense Council (NRDC) and Energy Information Administration (EIA) are taking the lead to advocate for lower GWP refrigerants.



- Assumes safety concerns in use of lower GWP refrigerants like propane are allayed.
- **If** retailers and HVAC distributors are rewarded for selling more affordable ENERGY STAR certified RHPs to consumers, **then** RHP market share will grow in these channels and serve as data sources to future ENERGY STAR specifications.
 - Assumes differentiated midstream incentives for affordable RHPs motivate retailers and HVAC distributors to push lower priced products..
 - Assumes consumer awareness of ENERGY STAR RHP benefits grow, driving consumers to demand more products.
 - Assumes over time that the Environmental Protection Agency (EPA) will enact more stringent energy efficiency requirements for RHPs.
- **If** utility rates advance to reward customers (or not dramatically penalize them) for moving off of gas HVAC through more electrification-enabling rate structures, **then** consumers will be more likely to proactively convert from a gas to an electric heating source.
 - Assumes IOUs continue their momentum towards offering consumers electrification rates.

2.2 Strategic interventions

Below are the strategic interventions that this MTI will deploy to overcome barriers in the RHP market. The list includes a general description of the intervention, market barriers the intervention will work to address, market opportunities it will exploit, and key outcomes. Many of the interventions will work to support multiple outcomes as detailed in the graphic Logic Model contained in Appendix A. Please also see the “MTI Evaluability Map” document attached to Appendix F for details on the outcomes, their associated market progress indicators (MPIs), and expected milestones.

<p>Strategic intervention 1</p> 	<p>Influence manufacturer development of window heat pumps that meet the needs of the California market through technology challenges, demand aggregation, and ongoing manufacturer engagement</p> <p>This intervention will include ongoing manufacturer engagement coupled with a release of a “product challenge” built upon the experiences of the tech challenge driven in 2021 by NYSERDA and New York City Housing Authority (NYCHA).¹² The New York challenge was successful in helping bring to market the newest form factor of these products known as “saddlebag” versions built for Type 4, cold climates. California has very different window configuration and climate needs, however, which necessitate further product innovations. This intervention will initially challenge manufacturers to design, test, and commercialize a new configuration of window heat pump (WHP) products that fit into slider (and possibly casement) windows and serve the more moderate climate requirements of California. It may also challenge manufacturers to include air filtration capability. As this intervention evolves, CalMTA will release a second iteration of the specification that will challenge the industry to use lower GWP refrigerants as California standard-setting bodies allow. Coupled with this product challenge, CalMTA will work with California MF housing building owners and programs that primarily serve ESJ communities on an aggregation of purchase agreements to ensure that, if the product is developed and commercialized, there is a sufficient demand signal for manufacturers to invest in this product’s development.</p> <p>This intervention will also involve ongoing engagement with key manufacturers to support efficiency improvements to current products, product features enhancements, improvements to installation process,¹³ consistent and effective consumer labeling, development of comarketing materials that can be deployed through retailers and program partners, and collection of usage data to further inform best use cases and future specification development.</p>
<p>Market barrier(s) addressed and opportunities to exploit</p>	<p>Barriers</p> <ul style="list-style-type: none"> • Product improvements needed for California market • Availability of California suitable products • Performance metrics and labeling misalignment/ambiguity prevent consumer informed choice • Consumer awareness of functionality and benefits of RHPs • US safety regulations restrict the charge level of heat pumps below what is required for RHP products

¹¹ Icon represents interventions with a focus on equity considerations.

¹² <https://www.nypa.gov/news/press-releases/2021/20211220-decarbonize>.

¹³ The product and strategy functions on the RHP team conduct regular meetings with leading manufacturers to ensure ongoing influence in this growing product category. CalMTA will share feedback on the installation strategy pilot lessons learned, ENERGY STAR specifications, marketing and labeling concerns and HVAC distribution/retailer engagement. Manufacturer engagement will continue through 2025 to ensure the RHP MTI is able to quickly scale once approval from CPUC is received for Phase III activities.

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	Opportunities <ul style="list-style-type: none"> • New market entrants and national partners generating manufacturer momentum in product category • Federal test procedure in development with new ENERGY STAR label and IRA funding
	Outcomes
Short-term outcomes (1-2 yrs)	<p>Manufacturers respond to Tech Challenge with product plans and prototypes for California-suitable products.</p> <p>MF building owners value product and begin to purchase.</p>
Medium-term outcomes (3-5 yrs)	<p>Availability of products that include form factors for slider and casement windows and California-suitable temperature performance grows and availability of products that include air filtration capability grows.</p>
Long-term outcomes (6-10+ yrs)	<p>Availability of products that use lower GWP refrigerants grows.</p>
Strategic intervention 2	<p>Engage national collaborative on future ENERGY STAR specifications, possible federal test procedures, and building the market for California-suitable RHPs</p> <p>One key opportunity for this MTI is to take advantage of the national momentum created by the IRA funding and the cascading impacts of a new ENERGY STAR label, CEE specification, and expected utility incentives. Since these efforts were initially driven in the Northeast and Northwest, manufacturers and the product's associated test procedures and certifications are largely built for products that meet Type 4 climate needs and double-hung window configurations. This intervention, in tandem with Intervention 1, will work to bring attention, alignment, and momentum to the needs of more moderate climates like California.</p> <p>California SF and MF homes need RHPs that can fit in their windows, but most do not need the functionality of operations below 5°F (Type 4). Most of the state needs Type 2 or Type 3 products, which are currently unavailable.^{14,15} In addition, CalMTA plans to expand this collaborative by enlisting the participation of other parts of the country like the Southeast and Southwest that have climate and window configurations similar to the California market. As this product category matures and CalMTA is ready to push the market towards inclusion of air filtration and use of lower</p>


¹⁴ Based on California climate data, CalMTA estimates that 2% need of California's consumers need Type 4, 60% need Type 3, 38% need Type 2 for typical weather.

¹⁵ One major manufacturer is planning to bring a Type 3 to market in 2025.

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	<p>GWP refrigerants, this collaborative will also serve as a channel to engage both manufacturers and test procedure/rating label bodies.</p> <p>An informal collaborative is already in place being driven by the Northwest Energy Efficiency Alliance (NEEA) and CEE. CalMTA will work to build upon this work with a broader collaborative that can aggregate feedback on federal proceedings, share data, advocate for products that meet the needs of mild climates and push the industry to embrace more consistent metrics and labeling so consumers can better understand the benefits and applicability of RHPs.</p>
Market barrier(s) addressed and opportunities to exploit	<p>Barriers</p> <ul style="list-style-type: none"> • Product improvements needed for the California market • Performance metrics and labeling misalignment/ambiguity prevent consumer informed choice • Consumer awareness of functionality and benefits <p>Opportunities</p> <p>Possible federal test procedure in development, new ENERGY STAR label, and IRA funding</p>
	Outcomes
Short-term outcomes (1-2 yrs)	ENERGY STAR specification adopted for products that provide both heating and cooling (including the portable forms of products).
Medium-term outcomes (3-5 yrs)	An update to the ENERGY STAR specification that includes separate tiers for moderate and cold climates.
Long-term outcomes (6-10+ yrs)	Federal efficiency standards add heating efficiency and increase stringency for cooling efficiency for all target heat pump products.

<p>Strategic intervention 3</p> 	<p>Gather and share usage and bill impact data across program partners that have supported product installations</p> <p>RHPs can be used in a variety of ways by consumers. They can serve the heating and cooling needs on a small apartment or be used in a portion of a home as a supplemental source of heat or AC. Given this complexity, CalMTA needs to gather more data on how consumers actually use these products and how they then interact with the other heating and cooling products in their home. This is critical information to inform consumer and property manager product placement guidance, programs that might utilize RHPs as a measure, and future test procedure and specification development. This information is also important to help better understand the potential electric bill impacts this product may have on consumers, especially ESJ consumers, as a tool towards future electrification and displacement of gas usage.</p>
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	<p>There are some organizations, programs and research bodies who have tested the installation and consumer use of these products, but data is not centralized and readily available. This intervention will work to gather and centralize data sets, identify additional data gaps, and will then work to fill those gaps in partnership with other programs and research partners. We recognize that sharing and centralizing usage and bill impact data can face challenges between organizations regarding customer confidentiality. CalMTA will engage key partners and develop NDA's and other agreements needed to ensure customer data is protected.</p>
Market barrier(s) addressed and opportunities to exploit	<p>Barriers</p> <ul style="list-style-type: none"> • Product improvements needed for California market • Performance metrics and labeling misalignment/ambiguity prevent consumer informed choice • Electric bill impacts, especially for ESJ communities <p>Opportunities</p> <ul style="list-style-type: none"> • Federal test procedure in development with new ENERGY STAR label and IRA funding • New market entrants and national partners generating manufacturer momentum in product category
	Outcomes
Short-term outcomes (1-2 yrs)	<p>Programs begin to include RHPs as a measure.</p> <p>ENERGY STAR specification adopted for products that provide both heating and cooling (possibly including the portable forms of products).</p>
Medium-term outcomes (3-5 yrs)	More California-suitable products installed in SF and MF homes through California programs.
Long-term outcomes (6-10+ yrs)	Market share of RHPs grow and standalone AC window units and electric resistant heaters decline.
Strategic intervention 4 	<p>Build market awareness of product benefits in partnership with aligned organizations and market partners like manufacturers and retailers</p> <p>Most consumers are unaware of the use cases and benefits of RHPs. As more products that are suitable for California come to market, this intervention will work to create key messages, co-marketing and product selection tools with manufacturers, HVAC distributors and retailers, and build overall awareness. Marketing efforts will likely first focus on key influencers in the SF and MF markets. These include program implementors who could use this technology</p>

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	through their ESJ-focused programs but also on MF property management firms that will be key decision makers for the rental market. This strategy will also work with Intervention 1 to leverage manufacturers marketing and Intervention 2 to leverage and support other key collaborative members' marketing efforts.
Market barrier(s) addressed and opportunities to exploit	<p>Barriers</p> <ul style="list-style-type: none"> • Consumer awareness of functionality and benefits • Performance metrics and labeling misalignment/ambiguity prevent consumer informed choice <p>Opportunities</p> <p>Public health and climate resilience benefits and overall push for heat pumps</p>
	Outcomes
Short-term outcomes (1-2 yrs)	Manufacturers and market partners adopt more consistent product labeling and product descriptions, market confusion declines.
Medium-term outcomes (3-5 yrs)	Consumer awareness of benefits and features grow starting with MF market and their key influencers.
Long-term outcomes (6-10+ yrs)	Market share of RHPs grows and standalone AC window units and electric resistant heaters decline.

<p>Strategic intervention 5</p> 	<p>Support inclusion and bundling of RHPs with California programs that will reduce initial product and operations cost impacts for ESJ communities</p> <p>To lower the upfront consumer cost of RHPs, this MTI will need to leverage utility programs to gain market traction early in the life of this MTI. This is especially true to reach ESJ communities and consumers that are tenants. Currently, there are no statewide programs that provide incentives on RHPs. As the product matures, receives its ENERGY STAR label and access to IRA funding, this is likely to change. In combination with several other interventions, this MTI will work to bring greater product availability, user data, and marketing awareness that will support downstream, consumer facing programs. In addition, for consumers who utilize this product as an electrification tool and aim to reduce their gas usage, this intervention will likely also need to work with electrification programs to help mitigate possible consumer bill impacts. The work of this intervention will initially take the form of coordination with key programs to identify leverage opportunities and ways to support downstream programs.</p>
Market barrier(s) addressed and	<p>Barriers</p> <ul style="list-style-type: none"> • Higher purchase price than the combined cost of a separate window AC and space heater

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opportunities to exploit	<ul style="list-style-type: none"> • Electric bill impacts, especially for ESJ communities • Consumer awareness of functionality and benefits <p>Opportunities Federal test procedure in development with new ENERGY STAR label and IRA funding</p>
	Outcomes
Short-term outcomes (1-2 yrs)	Programs begin to include product as measure in energy efficiency, low-income, and climate resilience programs.
Medium-term outcomes (3-5 yrs)	More California-suitable products installed in SF and MF homes through California programs.
Long-term outcomes (6-10+ yrs)	Market share of RHPs grows and standalone AC window units and electric resistant heaters decline.

Strategic intervention 6 	<p>Deploy midstream incentives that motivate HVAC distributors and retailers to stock and promote room heat pumps</p> <p>As RHP products come to market, manufacturers have shared that they plan to utilize both HVAC distribution and retail channels to market their products to consumers. Some RHPs products, especially the portable and window box form factors, are being sold through retail, but sales are limited as of October 2025. This intervention will work to accelerate this sales process by motivating key HVAC distributors and retailers to stock and market all RHP products through these channels.</p> <p>CalMTA will work with manufacturers to identify and target key HVAC distribution channels on stocking, training of staff, and sales of RHPs products. RHPs serve as an affordable and easily installed product offering that HVAC distributors could market to consumers and building owners who might not be able to make the jump to mini-splits or centralized HP HVAC equipment.</p> <p>The ESRPP is an existing, national collaborative midstream initiative of ENERGY STAR, energy efficiency program sponsors, retailers (i.e., The Home Depot, Lowe's, Best Buy, and independent stores through the Nationwide Marketing Group), and other key stakeholders. Depending on the product category, it is estimated that ESRPP retailers are responsible for the majority of incentivized consumer product sales nationally. Participating ESRPP retail partners in</p>
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	<p>California collectively comprise more than 500 storefronts – a significant distribution channel. Through ESRPP, incentives on qualifying products are paid directly to retailers, which encourages them to purchase, stock, and promote higher efficiency products and influences consumer purchasing decisions through increased availability and visibility of energy-efficient retail products. In turn, the impact of ESRPP on retailer buying practices can motivate manufacturers to design efficiency improvements into consumer products, creating permanent change to the manufacturing processes across entire product categories. By analyzing full category sales data, ESRPP also helps identify promising energy efficiency opportunities, with these insights leveraged to advance ENERGY STAR specifications and state/federal codes and standards, and to enable highly reliable evaluation of program impacts.</p> <p>This intervention will be implemented in tandem with a similar intervention targeting retailers detailed in the Induction Cooking MTI Plan¹⁶. It will build upon ESRPP's existing functionalities to gather statewide data and target products with lower price points. Currently, the RHPs being sold through retail are mostly only available online and are the window box and portable versions. The more efficient Type 4, saddlebag versions are not yet sold through retail. As product availability grows in retail for RHPs across all form factors, this MTI will apply these incentives to all form factors being sold through retail.</p> <p>This intervention also will work to amplify several of the other interventions. It will provide market data for program tracking, consumer buying habits for further engagement with manufacturers on product enhancements, and arm CalMTA with data for future ENERGY STAR specifications that will drive those specifications higher over time. It will also serve as a channel for building awareness on the benefits of RHPs via instore displays, sales staff training, and possible co-marketing opportunities with retailers. CalMTA will also look to engage retailers on coupling RHP promotions with local turn-in events targeting the proper recycling of older, higher GWP window AC units.</p>
Market barrier(s) addressed and opportunities to exploit	<p>Barriers</p> <ul style="list-style-type: none"> • Higher purchase price than the combined cost of a separate window AC and space heater • Market awareness of functionality and benefits • Availability of California-suitable product <p>Opportunities</p> <p>Federal test procedure in development with new ENERGY STAR label and IRA funding</p>
	Outcomes

¹⁶ As of November 20, 2025, the Induction Cooking MTI has received “provisional” approval from the CPUC and is required to submit a revised MTI plan through an advice letter by April 3, 2026. This may impact the degree of leverage that the RHP and Induction MTIs can expect from the ESRPP platform.

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Short-term outcomes (1-2 yrs)	HVAC distributor and retail partners stock and sell more affordable product in ESJ predominant communities year around.
Medium-term outcomes (3-5 yrs)	Prices decline, especially of California-suitable products relative to price of competing AC units and resistance heaters. Consumer awareness of benefits and features grow starting with MF market and their key influencers.
Long-term outcomes (6-10+ yrs)	Market share of RHPs grow and standalone AC window units and electric resistant heaters decline.


Strategic intervention 7	<p>Support California policy and standard-setting bodies in use of lower GWP refrigerants through manufacturer engagement, lab testing, and data sharing</p> <p>RHPs use a small amount of hermetically sealed refrigerant. Given the high GWP of some refrigerants used in heat pumps, this MTI will support the State's efforts to transition to heat pump technology but minimize the impacts of refrigerants in these devices over time. The refrigerant used in these devices sold today is R-32,¹⁷ but this MTI will work to transition these products to lower GWP refrigerants as standard-setting bodies begin to allow them. Because they use a small number of refrigerants and are hermetically sealed, RHPs are good initial candidates for making this transition in California. This has been achieved in Europe for these products already.</p> <p>This intervention will support state regulatory agencies, industry associations, and environmental advocacy groups such as the NRDC and EIA, as they aim to develop and influence regulations on the use of lower and natural GWP refrigerants in California. CalMTA can support advocacy through data and third-party product demonstrations, manufacturer support, product availability, and overall advocacy.</p>
Market barrier(s) addressed and opportunities to exploit	<p>Barriers</p> <p>US safety regulations restrict the charge level of heat pumps below what is required for RHP products</p> <p>Opportunities</p> <p>Public health and climate resilience benefits and overall push for heat pumps</p>
	Outcomes

¹⁷ California passed S.B.1206 in 2022, regulating the types of refrigerants that can be used in HVAC equipment including RHPs. In response, most RHPs products have pivoted to using R-32 refrigerants which has a GWP of <750 (kg CO2 eq/kg). Overtime, as regulations allow, these products could use natural or synthetic ultra-low refrigerants to get to even lower GWP levels.

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Short-term outcomes (1-2 yrs)	Growing number of manufacturers support use of lower GWP refrigerants.
Medium-term outcomes (3-5 yrs)	Key standard-setting bodies (i.e., American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and UL amend guidance to allow the use of lower GWP refrigerants based on safety research, pilot testing, and manufacturer feedback.
Long-term outcomes (6-10+ yrs)	Relevant state and federal regulations have been updated to allow use of lower refrigerants in RHPs.

Strategic intervention 8 	Support advancement of electrification enabling rate structures to mitigate bill impacts of moving from gas to electric heating <p>Under current rate structures moving from gas to electric will, in many cases, have an adverse impact on consumer electric bills. This is not a problem unique to RHPs, but a problem for all electrification measures. This isn't a problem if homes are moving from electric resistance heating to an RHP, but if they are moving from gas heating systems to an electric RHP, the bill impacts could be significant, especially for low-income consumers.</p> <p>In tandem with the induction cooking MTI, this intervention will work to gather consumer behavior usage data, conduct analysis, and will support California advocates and policymakers as they develop rate structures that mitigate increases in the transition to electrification.</p>
Market barrier(s) addressed and opportunities to exploit	Barriers Electric bill impacts, especially for ESJ communities Opportunities Public health and climate resilience benefits and overall push for heat pumps
	Outcomes
Short-term outcomes (1-2 yrs)	N/A
Medium-term outcomes (3-5 yrs)	Prevalence of electrification-enabling rate structures grows across the state.

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Long-term outcomes (6-10+ yrs)	Market share of RHPs grows and standalone AC window units and electric resistant heaters decline.
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2.3 Environmental & social justice

This MTI will support the needs of ESJ communities through the ability of RHPs to provide smaller spaces with efficient heating, cooling, and air filtration. It will be an affordable product option to help ESJ communities transition to heat pump technology and ensure that they are included in California's overall heat pump goals. This product is in early commercialization and there is a product gap of affordable form factors that meet the needs of California's climate or dominant window configurations found in many MF and small residential homes. The MTI will accelerate this product's adoption across the entire market, but the interventions below will primarily work to benefit ESJ communities:

- Strategic Intervention 1 will engage manufacturers on a product tech challenge coupled with a large, guaranteed demand signal from MF property owners, for a product that meets the climate, form factor, and air filtration needs of the California market.
- Strategic Intervention 3 will gather usage data on RHPs which will feed into the inclusion of this product as a measure for programs targeting ESJ communities. This is also an important input to developing the right messaging and guidance on these products' appropriate installation, use, and impacts to electric bills as described in Strategic Intervention 4.
- This MTI will work to support overall movement towards electrification rate structures through Strategic Intervention 8 that will help ESJ communities in this transition.
- Strategic Intervention 5 will work to support inclusion and bundling of product with energy efficiency and climate resilience programs that will reduce initial product and operations cost impacts for ESJ communities.
- To help address affordability, Strategic Intervention 6 will focus on encouraging retailers and HVAC distributors to stock and market more affordable RHP products.

2.4 Workforce development

Some consumers will need help with the installation of RHPs due to their weight. Their installation does not require skilled technicians but could use building staff, local maintenance, or small contractor support. The primary workforce development approach for this MTI will be to collaborate and contract with community-based organizations (CBOs) that are helping communities add this technology for energy efficiency and climate resilience. El Concilio of San Mateo County, which participated in CalMTA's RHP installation Strategy Pilot and has worked with other organizations such as 350 Bay Area installing RHPs, served as a key channel to reaching ESJ communities, and are the type of CBO that could support a workforce development approach. These local CBOs also support community engagement and increase awareness of benefits of this technology.

This MTI will also seek opportunities to ensure the proper recycling of window AC units that RHPs aim to replace to ensure the older, higher GWP refrigerants are dealt with in an environmentally responsible manner. This effort could also involve local CBOs and serve as a workforce development opportunity.



2.5 Total System Benefit (TSB) & Cost-Effectiveness forecast

CalMTA estimated the Total System Benefit (TSB) and cost-effectiveness for the RHP 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 will deliver an estimated \$480 million in TSB over the period 2024 to 2045. Most of these benefits come from GHG reductions associated with product efficiency and fuel substitution, especially in later years of the MTI - after more California appropriate RHP models become available and market adoption accelerates. The initiative will be cost effective over its lifecycle under all test perspectives (Table 3).

Table 2. RHP TSB estimates

TSB (\$M)	Energy (\$M)	Grid (\$M)	GHG Non-Refrigerant (\$M)	GHG Refrigerant (\$M)
480	143	28	321	(\$12)

Table 3. RHP cost-effectiveness estimates*

	TRC	PAC	Base SCT	High SCT
Negative IMCs included	304.09	7.64	(27.81)	(27.83)
Negative IMCs set to zero	5.03	7.64	10.30	10.31

* CalMTA calculated cost-effectiveness using the negative Incremental Measure Costs (IMCs) estimated for some use cases, per the guidance from the CPUC's Energy Division guidance memo that required negative IMCs to be entered into Cost Effectiveness Tool (CET) and not set to zero. Guidance for Deemed Measures History: CPUC Guidance on the use of Negative Incremental Measure Cost (IMC) in the Cost Effectiveness Tool - CEDARS. CalMTA also calculated cost-effectiveness results with negative incremental costs set to zero reported in this table.

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

2.5.1 Market adoption forecast

This section summarizes the forecast of the baseline market adoption (BMA) and total market adoption (TMA) of RHPs. BMA represents the expected "naturally occurring" market adoption, taking into account current and expected market, regulatory, and technological trends. TMA includes the additional adoption resulting from strategic interventions detailed in this MTI plan.

To estimate BMA and TMA, CalMTA employed an s-curve model, characterized by an initial slow growth phase, followed by a rapid growth phase, and eventually a plateau as the market reaches saturation. CalMTA took a multifaceted approach to inform assumptions and parameters of the s-curve model. For baseline adoption, insights were drawn from various sources, including Delphi

panel estimates, qualitative comments, surveys of property managers and households, and discussions with stakeholders such as manufacturers. For adoption influenced by the MTI, the model parameters were aligned with the market interventions, outcomes, and planned milestones specified in the MTI Plan.

The s-curve model estimates annual saturation levels throughout the forecast period, indicating the proportion of existing households expected to adopt RHPs. CalMTA developed separate forecasts for SF and MF households. Figure 1 illustrates the estimated adoption in terms of proportions for SF (left) and MF (right) households, while Figure 2 presents the adoption numbers in thousands of households, based on forecast saturation, assumed units per household, and assumed rate of product re-adoption.

Figure 1. Estimated Proportion of single-family and multifamily households adopting RHPs

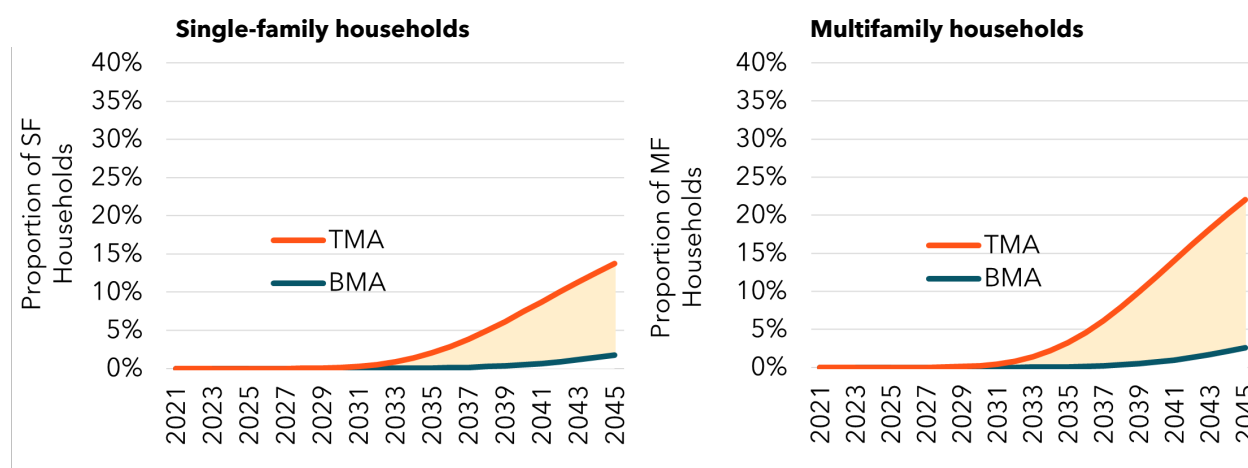
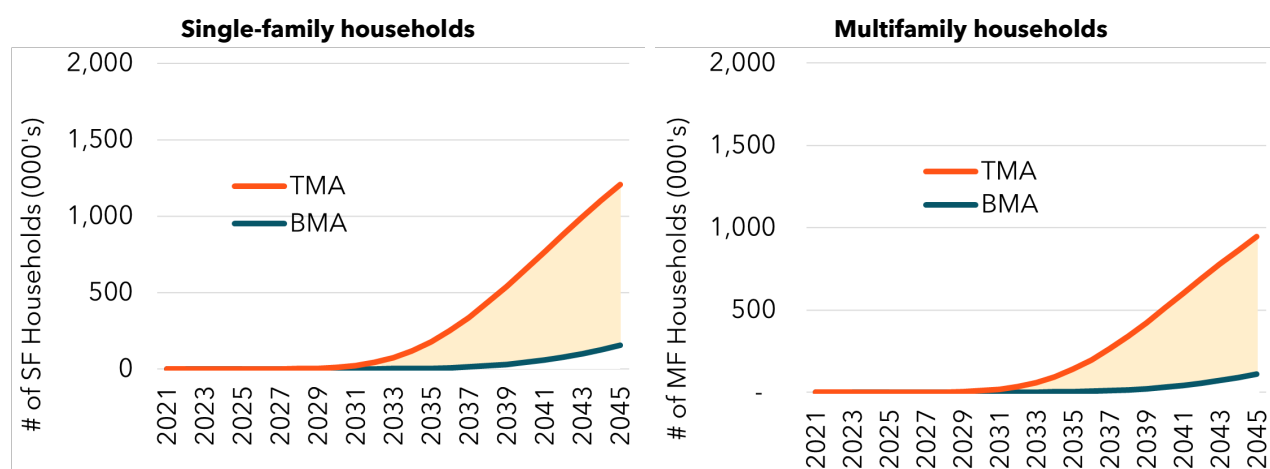


Figure 2. Estimated number of single-family and multifamily households adopting RHPs (in thousands)



After forecasting household saturation, CalMTA estimated the number of RHP units adopted based on assumed units per household and the assumed rate of product re-adoption in replacement scenarios.

In the final step of the adoption forecast process, CalMTA calculated the net incremental unit adoption, which is equal to TMA minus BMA, minus estimated adoption associated with Program Administrators' (PAs) verified savings (this included all PA programs statewide; for IOUs, this included programs reported in the California Energy Data and Reporting System or CEDARS).¹⁸ The net incremental adoption is summarized in the equation below.

$$Y^{N.incremental} = Y^{TMA} - Y^{BMA} - Y^{PA}$$

Where Y represents cumulative adoption of RHPs over the forecast period of 2024 to 2045. The superscripts $N.incremental$, TMA , BMA , and PA represent net incremental adoption attributed to the MTI, Total Market Adoption, Baseline Market Adoption, and PA-verified savings respectively. Columns #2 to #5 of Table 4 below gives TMA, BMA, PA-verified units, and net incremental adoption in terms of units of RHP adopted.

The approach summarized above estimated BMA, TMA, and net incremental adoption at a statewide level. The last two columns of Table 4 show the adoption attributed to households outside the IOU service territories, and the adjusted adoption estimates included in TSB and cost-effectiveness estimates respectively.¹⁹

Table 4. Forecast of adoption of RHPs (in thousands, 2024-2045)

	TMA (Y^{TMA})	BMA (Y^{BMA})	PA-verified units (Y^{RA})	Net Incremental ($Y^{N.incremental}$)	Adoption attributed to non-IOU territory	Adoption for TSB & CE estimation
Single-family households	1,838	242	196	1,400	372	1,028
Multifamily households	1207	144	129	934	251	683
Total	3,045	386	325	2,334	623	1,711

Note: PA verified units include adoption associated with PA programs statewide.

¹⁸ <https://cedars.cpuc.ca.gov/>.

¹⁹ It is important to note that the state of California will realize electric system benefits from statewide incremental RHP market adoption, not only from adoption inside the IOU service territories. While the adjusted values may be the most appropriate values to use for the CPUC's cost-effectiveness tests, as a matter of policy, they do not fully represent the statewide benefits that will result from investment in the RHP MTI. This approach discounts statewide benefits by nearly 26%.

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

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

2.6 Other benefits

The following are additional, unique benefits (i.e., non-energy benefits) of this MTI.

- RHPs provide more California residents with access to efficient AC to endure extreme heat events, increasing climate resilience and comfort.
- If a consumer is ready to electrify and move to a heat pump, RHPs serve as a “bridge technology” by providing efficient HVAC without having to replace and install more expensive heat pump systems.
- RHPs are not permanently installed and offer consumers, especially renters, self-ownership, and portability if they move.
- Because RHPs provide both heating and cooling, they are year-round devices saving consumers space in their homes as well as the time it takes to annually install and store a seasonal appliance.
- As more RHPs also offer IAQ air filtration capability, they will eliminate the need to purchase a separate air purifier or air filtration device.

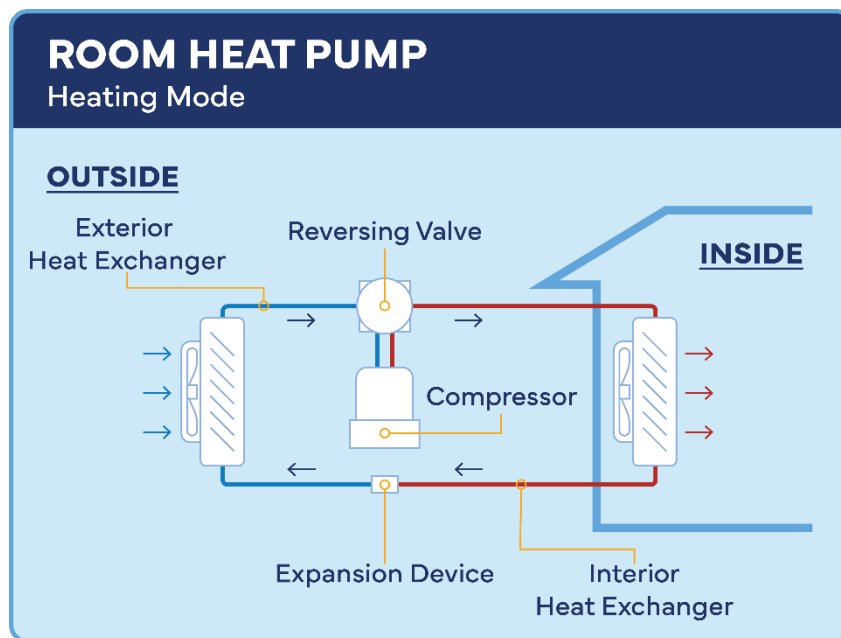
3 Product definition & assessment

3.1 Product definition

The products in the RHP MTI include window, portable, and through-the-wall heat pumps, which are self-contained consumer products that provide efficient heating and cooling for small spaces ranging from a single room, a modest apartment, or small home. They are similar in shape and size to typical window AC units and portable AC products. The product type targeted by this MTI uses variable speed operation providing more efficient cooling in the summer and heating in the winter. These products can be installed without a certified technician and plugged into a 120V outlet.

CalMTA is targeting products with a cooling and heating capacity of approximately 8,000 to 14,000 BTU/h, which are designed to condition approximately 400 to 1,000 ft², due to the relatively mild California winter climate. This MTI is targeting both SF and MF dwellings both as a primary source of space conditioning in smaller dwellings and to displace central HVAC energy use in larger dwellings.

Figure 3. Room Heat Pump technology



The MTI products currently fall into two different categories according to federal appliance standards, both of which only have efficiency standards for the cooling cycle (portable AC starting in 2025) and not for heating. Portable heat pumps (PHPs), seen in Figure 4a, fall under the category of Portable Air Conditioners, which describes moveable products that sit on the floor and connect to outdoor air via one or two ducts running to a window. Window heat pumps (WHPs) and through-the-wall heat pumps fall under the category of Room Air Conditioners with Reverse Cycle. In this category, there are three additional different form factors that are included: saddlebag (Figure 4b), U-shape (Figure 4c), and traditional window units (Figure 4d). These products can be self-installed with their outdoor and indoor components straddling the window sash. Through-the-wall heat pumps have a similar form factor to traditional window air conditioners (Figure 4d), but they slide into a sleeve in an external building wall instead of a window.

Figure 4. The types of heat pumps and form factors included in this MTI: a) dual duct portable heat pump b) saddlebag window heat pump c) U-shaped window heat pump d) traditional window heat pump



Consistent with California Air Resources Board (CARB) regulations, all products must utilize refrigerants with a GWP below 750 and not include any resistance back-up heating. Cooling efficiency is set through the cooling energy efficiency ratio (CEER) which is the same term for room and portable AC product categories, but the values are calculated differently based upon a different test procedure. RHPs in this MTI will align to the federal efficiency standards, which change to CEER >14.4 in 2026.²⁰ The CEER requirements for PHPs vary with capacity but for a 10,000 BTU/h unit a CEER of 7.8 is required.²¹ WHPs have higher efficiency and are prioritized as the preferable product except in cases where window configuration or lease agreements prevent their use. Future requirements on heating efficiency may be set through the heating energy efficiency ratio (HEER) once there is an ENERGY STAR specification, which is expected in late 2024.

²⁰ CEER > 14.4 is for room air conditioner equipment class 11: with reverse cycle, with louvered sides and less than 20,000 BTU/h. Through the wall heat pumps are typically in equipment class 12: with reverse cycle, without louvered sides, and less than 14,000 BTU/h with a minimum CEER of 13.7.

²¹ The full requirements of CEER versus capacity for PHPs can be found in Appendix C: Product Assessment Report.

3.2 Competitive analysis

This section covers some of the key strengths, weaknesses, opportunities, and threats for RHPs. A full analysis of the competitive landscape can be found in Appendix C.

3.2.1 Key strengths

One of the primary strengths of RHPs is their low installation cost. Unlike central HVAC systems or ductless mini-splits, which often require professional installation and can be significantly more expensive, RHPs can be installed by the consumer and do not require alterations or penetration of the building envelope.²² This capability greatly reduces the overall cost, making them an attractive option for budget-conscious consumers looking to avoid installation costs.

RHPs are highly efficient when compared to other electric heating options such as space heaters, baseboards, and fan-forced wall heaters. This efficiency translates into lower operating costs and reduced energy consumption, making RHPs an environmentally friendly option.

Another significant advantage of RHPs is their ability to provide both heating and cooling. This dual functionality is unique among lower-cost consumer appliances. While most window units are traditionally used for cooling only, heat pumps can switch modes to provide warmth in colder weather, offering year-round climate control from a single device. This feature makes them particularly appealing in regions with moderate climates where extreme temperatures are less common.

Lastly, WHPs and PHPs can be removed and installed in a new building, which can provide some advantage to tenants who may not be in a single dwelling for the entire life of the product.

3.2.2 Key weaknesses

Despite their benefits, RHPs are generally more expensive than purchasing a room air conditioner and a space heater separately. This higher initial cost can deter some consumers, particularly those on a tight budget who may not see the value in the added expense for the combined functionality.

The necessity of a single- or double-hung window for installation is another current limitation for the window versions of this technology. This requirement restricts the use of WHPs in buildings with different window designs or those without suitable windows at all. This limitation can reduce the potential market for these units, as not all consumers will have compatible windows for installation.

Under current electric and gas rates some consumers may experience higher heating bills when substituting gas with electric heating, despite the higher efficiency of heat pumps. Gas heating is often cheaper than electric heating, especially in areas where natural gas prices are low. This

²² This MTI product definition includes through-the-wall heat pumps, but with the intention that these would be promoted in instances where an existing through-the-wall AC exists, so that the new HP can be placed in the existing wall sleeve and further envelope alterations are not required.

potential increase in utility costs can be a significant drawback for consumers considering an RHP as an alternative to their existing heating system.

3.2.3 Key opportunities

Consumers who already use window or portable AC units have accepted the form factor and self-installation process. These consumers may be interested in upgrading to a RHP to gain the additional benefit of efficient heating and efficient cooling in a single appliance. Similarly, landlords and property managers with through-the-wall AC units might consider through-the-wall heat pumps as an upgrade option.

Older homes with forced-air furnaces often have certain rooms or floors that are not adequately heated, and RHPs can provide targeted zonal heating, addressing these inadequacies without the need for extensive renovations. Many consumers currently use less efficient space heaters to solve this problem, but these are more expensive to operate and provide less heating capacity than an RHP. There is also a potential that zonal RHP in larger homes could be used as a demand response technique, where central HVAC systems are setback and the RHP provides conditioning only to the occupied zone, allowing a significant reduction in electricity consumption.

Tenants and leaseholders who wish to upgrade their HVAC systems often require self-installed devices due to restrictions on modifications to the property. RHPs, with their low installation costs and ease of installation, are an ideal solution for this demographic, providing an upgrade without permanent changes. The low installation costs can enable landlords to upgrade buildings with aging gas heating systems. By offering a modern, efficient heating and cooling solution, landlords can improve tenant satisfaction and potentially increase property values without significant investment.

Lastly, RHPs can use the increased adoption of AC due to extreme hot temperatures from climate change, as an opportunity to add efficient heating and cooling in one product for households that are adding cooling for the first time.

3.2.4 Key threats

Substituting electric heating for gas can be expensive, depending on the specific circumstances. Under the current gas and electric rate structures, this transition could negatively impact consumers, especially those located in ESJ communities, by increasing utility bills. Ensuring that the move to electric heating does not adversely affect these communities is crucial.

The poor low-temperature heating performance of some RHPs may leave consumers dissatisfied, particularly in regions with harsher winters. Inadequate heating during extreme cold weather events can also pose safety risks, making it essential for manufacturers to address these performance issues.

Many consumers may hesitate to pay the premium for a WHP compared to a window AC unit, especially given the wide availability of inexpensive space heaters. The initial cost difference can

be a significant barrier, and convincing consumers of the long-term benefits and cost savings is essential to drive adoption.

3.3 Product performance

The main metrics of performance for a heat pump are efficiency and capacity for both heating and cooling. Larger residential and commercial heat pumps have standard tests for both heating and cooling, but WHPs and PHPs are still categorized like air conditioners where only cooling performance is tested and regulated.

3.3.1 Cooling performance

The cooling efficiency of portable and room air conditioners (and heat pumps) is measured by their CEER, with a higher number indicating more efficient cooling. In 2026 there will be a major increase in efficiency for RHPs, increasing to a CEER of 14.4 up from the standard of 9.8 that was enacted in 2014.²³ In contrast, the minimum CEER level for a similar room air conditioner without reverse cycle (heating) is 16.0, which is an acknowledgement of the efficiency challenge in balancing heating and cooling. Most products on the market have not reached the 2026-level efficiency with the range of CEER for ENERGY STAR room air conditioners going from 12.7 to 16 for the 157 listed products. As of October 2024, only 11 of the ENERGY STAR products are heat pumps, and six are above a CEER of 14.4.²⁴

The CEER rating for portable air conditioners (and heat pumps) is based upon a different test procedure compared with room air conditioners and the required energy efficiency levels are different as well. The first federal efficiency standards were announced for portable air conditioners in 2016 but will not be effective until the start of 2025. The minimum CEER level changes with cooling capacity and sets a minimum CEER of 7.83 for Seasonal Adjusted Cooling Capacity (SACC) = 10,000 BTU/h and CEER of 8.85 for SACC = 14,000 BTU/h. California Title 20 had been requiring this same level of efficiency since 2020.

3.3.2 Heating performance

As of November 2024, there is no mandatory test procedure for heating performance of RHPs, but the EPA has recently released the final version of the ENERGY STAR voluntary test procedure for heating performance of room air conditioners.²⁵ This test defines a heating efficiency metric,

²³ The CEER of 14.4 is for a room air conditioner with reverse cycle with louvers and a capacity less than 20,000 BTU/h.

²⁴ ENERGY STAR Certified Room AC website, <https://www.energystar.gov/productfinder/product/certified-room-air-conditioners/>, accessed October 16, 2024.

²⁵ ENERGY STAR Room Air Conditioners Test Method to Determine Room Air Conditioner Heating Mode Performance, July 2024. <https://www.energystar.gov/sites/default/files/2024-07/ENERGY%20STAR%20Final%20Test%20Method%20to%20Determine%20Room%20Air%20Conditioner%20Heating%20Mode%20Performance.pdf>.

HEER, and defines four categories of RHP depending upon the operation temperature and defrost strategy:

- **Type 1:** does not have active defrost or for which the specified compressor cut-in and cut-out temperatures are not both less than 40°F.
- **Type 2:** has active defrost and for which the specified compressor cut-in and cut-out temperatures are both less than 40°F but not both less than 17°F.
- **Type 3:** has active defrost and for which the specified compressor cut-in and cut-out temperatures are both less than 17°F but not both less than 5°F.
- **Type 4:** has active defrost and for which the specified compressor cut-in and cut-out temperatures are both less than 5°F.

The majority of RHPs available for purchase today are Type 1 without active defrost. The newly released saddlebag models from Gradient and Midea fall into the Type 4 category with active defrost and operation below 5°F. The development of cold climate RHPs is a great advancement for the product category – demonstrating that these types of products can compete with mini-splits on heating performance. Recently another manufacturer has announced a lower cost WHP with active defrost that operates below 17°F and is within the Type 3 category. While all the details of the performance and cost of this new WHP are yet to be publicly announced, it appears this product will focus on a smaller and lower cost solution compared to Type 4 saddlebag products and may be an important product for the California market, especially for ESJ communities. HEER levels for ENERGY STAR qualification are expected to be finalized by the end of 2024, but as of November 2024, no draft specification has been released. This is a rapidly changing market, and we expect that along with the new ENERGY STAR specification, higher heating efficiency products will enter the market in the near future.

3.3.3 Requirements for California's climate

Heat pump performance is temperature dependent, and RHPs have relatively limited total capacity compared to central systems, so determining the temperature and heating load requirements of the target building sector is critical for this MTI. Fortunately, the majority of California has relatively mild heating seasons. In fact, in a typical weather year 14 out of the 16 climate zones have 70% or more of their heating hours above 40°F, meaning even Type 1 heat pump products can provide some benefit in many locations. Ideally, this MTI has the goal of promoting products that can be the primary source of heating and cooling in some dwellings, so better low-temperature performance is still desirable.

According to ResStock, 70% of MF homes less than 2,000 ft² in California have peak heating and cooling loads below 9,000 BTU/h which is a capacity that can be met by most RHPs available, although this analysis does not account for decreased heating performance at lower temperatures or the number of separate conditioned zones per dwelling.²⁶

²⁶ NREL. 2024. ResStock General Reference Documentation. Golden, CO. National Renewable Energy Laboratory. <https://nrel.github.io/ResStock.github.io/>.

The heating and cooling loads for single family homes are significantly higher than for MF due to the higher surface area of building area exposed to the outside (no shared walls). When adjusting for floor area, the median heating load of a SF home is 84% higher (14.6 versus 7.9 BTU/hr-ft²). These data points show that the opportunity to use small heat pumps as a primary heating source is much greater in MF compared to single family in terms of heating load requirements.

3.3.4 Energy consumption & bill impacts

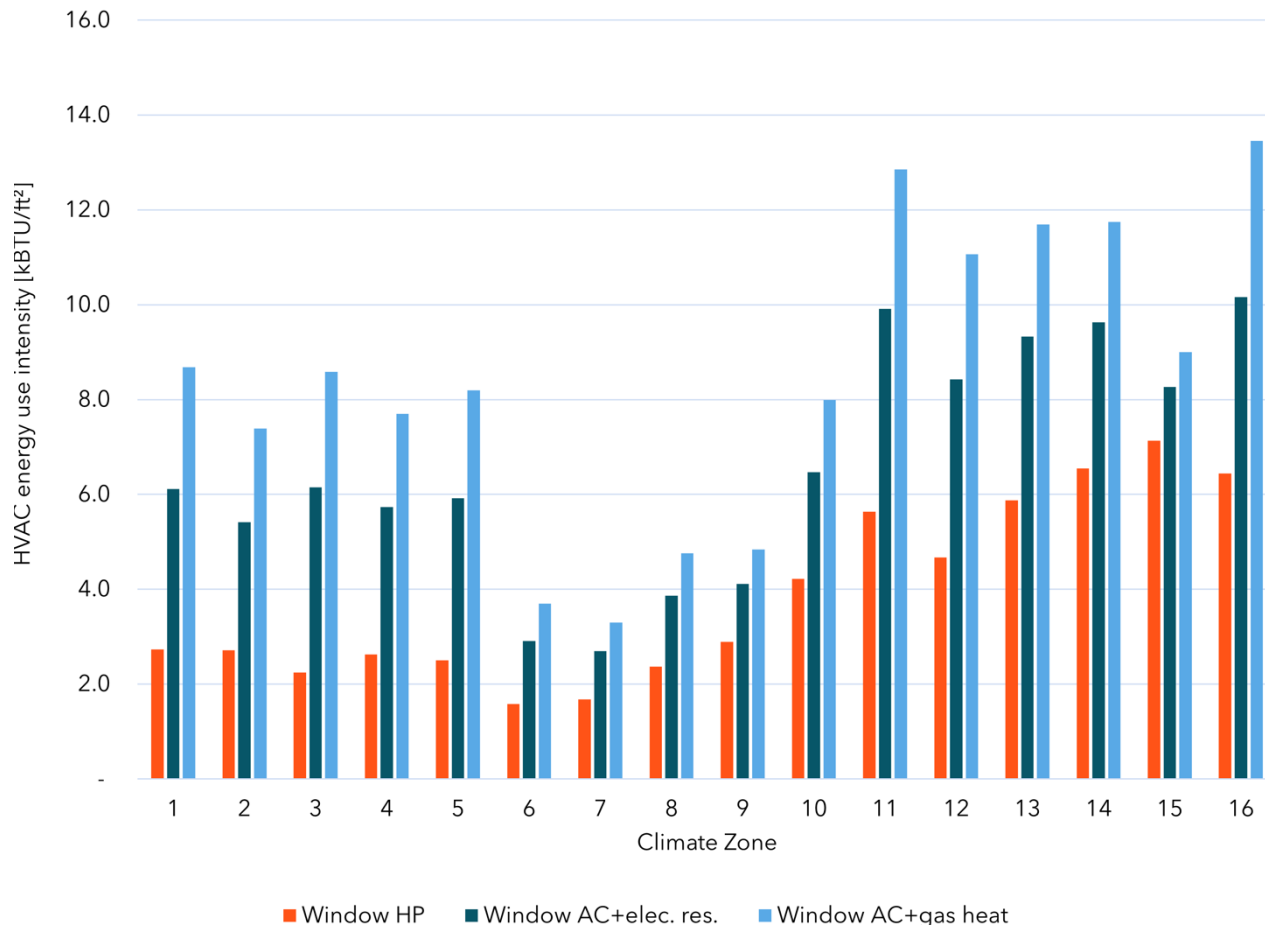
Given the cost of electricity in California, even high efficiency electric appliances can be more expensive to operate at times compared with natural gas, which is an especially large concern for ESJ consumers. The spark gap (ratio of the price of one unit of energy delivered as electricity compared to natural gas) is five or more depending upon the specific residential rate schedule,²⁷ meaning a consumer would have to use at least five times less electricity for heating compared to natural gas to avoid an increase in energy bills. CalMTA assessed bill impacts and energy use by modeling a 24-unit MF building with 1,024 ft² per unit.²⁸ Figure 5 shows the annual energy consumption for each HVAC type in each climate zone.

The average savings over all climate zones is 42% when comparing the WHP to electric resistance heating and 54% compared to zonal gas heating. This analysis compares new HVAC equipment, so the AC efficiency is the same for the window AC and WHP, and the energy savings comes exclusively from heating. The energy savings would be even larger when comparing to the replacement of an existing air conditioner with lower efficiency.

²⁷ Based upon an annual average of hourly time of use rates for the three investor-owned California utilities. See Appendix C for more information on rates and bill impacts.

²⁸ The team used EnergyPlus to model this building in each of California's 16 climate zones using three different HVAC types: window AC and zonal gas heat, window AC and zonal electric heat, and WHP. The energy consumption of all 24 units was averaged to combine the effects of building orientation and shared walls, ceilings, and floors. Zonal gas heat represents forced air and natural convection gas wall furnaces. Electric zonal heat represents electric resistance space heaters, baseboards, and forced air and natural convection electric wall furnaces. The details of energy modeling are found in Attachment 1 on Appendix B and more results and discussion are found in Appendix C.

Figure 5. Annual HVAC energy consumption by climate zone in multifamily building for three scenarios: 1) Window heat pump 2) Window air conditioner + electric resistance heat 3) Window air conditioner + zonal gas heat²⁹

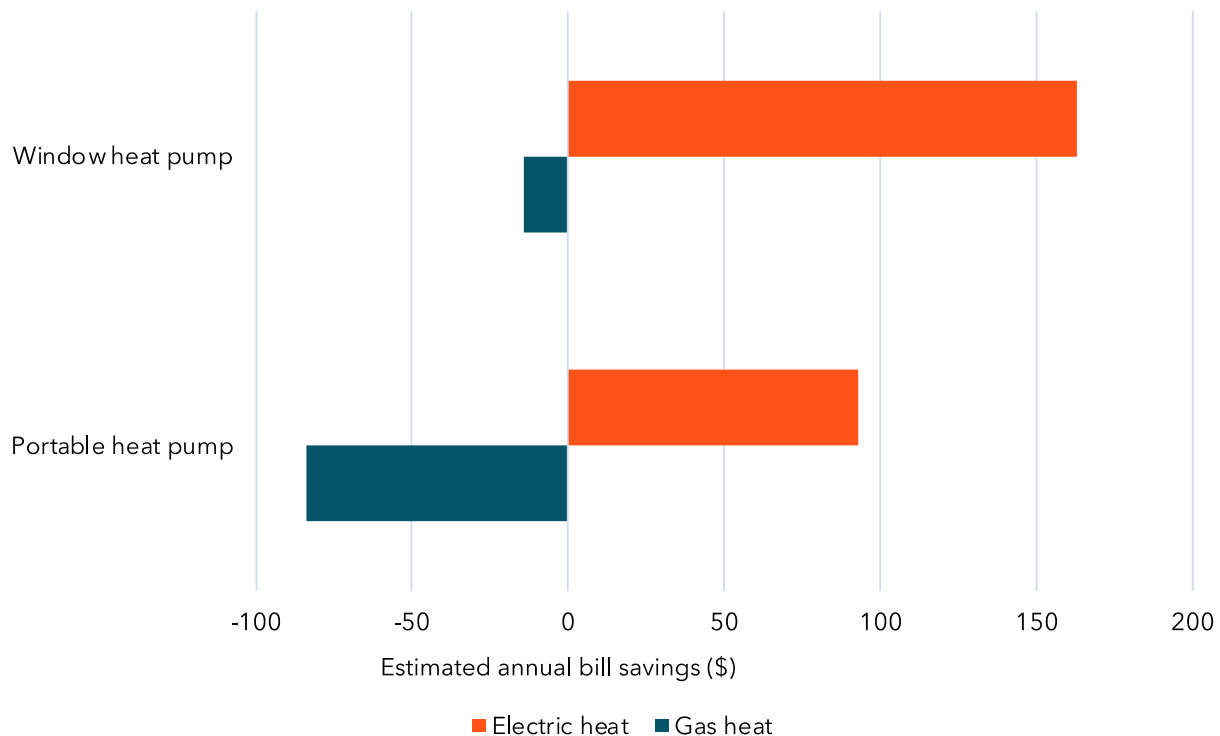


CalMTA then looked at the same energy use through the lens of utility bills for a consumer who is choosing between a WHP or either zonal gas or electric heat (and a new window AC). Substituting gas with an electric heat pump results in an average increase in energy bills of \$14 on an annual basis, with a range from a \$14 savings in climate zone 9 to a \$103 bill increase in climate zone 16. In contrast, substituting an electric resistance heat with a heat pump results in bill savings in all climate zones, with an average annual savings of \$163 (see Figure 6 below) and climate zone-specific savings ranging from \$80 in climate zone 15 to \$239 per month in climate zone 16. According to the market characterization, there are 2.8M MF and 1.5M SF homes that rely primarily on electric resistance heat and could experience significant bill savings under current electricity rates when changing to RHPs.

²⁹ WHP models with the performance of the new Type 4 saddlebag units (CEER = 16, heating coefficient of performance (COP)₄₇ = 4) with heat pump operation down to 0°F. PHP models with a CEER of 8.6, and a heating COP₄₇ = 2.6 and electrical resistance heating below 40°F.

A new WHP does offer better savings compared to existing equipment with lower cooling efficiency. For a consumer with an existing CEER 12 window AC and zonal gas, upgrading to a new CEER 16 WHP will result in a savings annual savings of \$51, instead of an increase of \$14 compared to a new window AC.

Figure 6. Estimated annual bill savings when changing to room heat pumps from existing heating technologies using investor-owned utility (IOU) rates



PHPs have lower efficiency, and thus higher energy consumption compared to the other form factors of RHPs. On average, PHPs consume 40% more energy compared with WHPs across all climate zones. In terms of bill impacts, the average savings for a PHP compared to electric heat is \$97, and the average bill increase when compared to gas heat is \$82. Both types of heat pumps represent an efficiency improvement over electric resistance heat and can result in energy and bill savings when replacing resistance heating equipment. For gas substitution, high-efficiency Type 4 RHPs can often be used with minimal bill impacts, but the PHPs could create significant bill increases in many situations and are better suited as electrical heater replacements at this time.³⁰ In the future, there are likely to be RHP products that span the performance range between the Type 4 saddlebag units and typical PHPs. More electrification-friendly utility rates can accelerate the adoption of new heat pumps replacing existing gas heating equipment. Using California

³⁰ Appendix C contains additional bill impact scenarios, including CARE rates and a municipal utility rate.

Alternative Rates for Energy (CARE) rates, the maximum predicted bill increase is \$23 with an average of \$2 savings annually. The bill impacts for fuel-substituting with CARE rates are more advantageous because the rate reduction is between 29% and 35% for electricity and only 20% for gas, thus giving a slight improvement to electricity compared to the standard rate structure.

3.4 Potential product improvements

Several critical product needs have been identified through the development of the MTI plan:

- Heat pumps that can fit into slider and casement windows. This can be a product with a width of less than 15" or a semi-separated indoor and outdoor unit (maintaining a factory refrigerant seal is vital). ³¹ Currently, only PHPs can fit into these windows, and they do not have active defrost (i.e., Type 1 products).
- Lower cost and small heat pumps that have active defrost and can operate in the range of 10°F to 40°F (i.e., Type 2 and Type 3 products). This fills a need between the high-performance Type 4 saddlebag heat pumps and the existing window and PHPs without active defrost that cannot heat below 40°F.
- Heat pumps that use low GWP (150) and ultra-low-GWP refrigerants. ³² Propane (R-290) has a GWP₁₀₀ of 3 and excellent potential for heat pumps, but it is an A3 refrigerant, which creates significant code restrictions due to high flammability. While this is currently a significant barrier, it should be noted that the charge limit for A3 refrigerants in Europe (500 g versus 114 g in the US) would be sufficient for many RHPs. ³³ This solution may also include the development of new synthetic refrigerants that do not have a high flammability rating.
- Options for improving IAQ, including high-efficiency air filtration, such as Minimum Efficiency Reporting Value (MERV) 13 filters as well as more long-term offerings that include energy recovery ventilation. ³⁴

4 Market characterization

4.1 Current market state summary

4.1.1 Product availability

Currently RHPs are limitedly available, with California appropriate units not available in stores and only limitedly available online. A review of available RHP models found that 18 brands are currently producing room heat-pumps including portable and window form types, with the

³¹ Currently, there are casement window air conditioners that are taller than they are wide. See for example: <https://www.homedepot.com/p/Midea-10-000-BTU-115V-Window-Air-Conditioner-Cools-450-Sq-Ft-with-Remote-Control-in-Gray-KAW10C1AWT/312731023>.

³² CA SB 1206 legislation establishes a definition of Low-GWP Refrigerants as ≤ 150 kgCO₂eq/kg GWP₁₀₀, and Ultra Low-GWP Refrigerants as ≤ 10 kgCO₂eq/kg GWP₁₀₀, where GWP₁₀₀ refers to the 100-year global warming potential. For refrigerants we use the GWP100 values from IPCC 4.

³³ IEC 60335-2-89 sets a charge limit of 500 g while UL 60335-2-40 sets a charge limit of 114 g.

³⁴ Currently, the Gradient all-weather product offers optional MERV 13 filtration capabilities.

majority of available models being portable units. Research found that RHPs are difficult to locate online and unavailable in-store. For example, inconsistent and unclear product labeling on the majority of models for sale online confuses buyers and many verified RHP products are not described as heat pumps. Further, of the 31 models identified through a technical review by the CalMTA team, only about half were available to purchase online from major retailer websites and none were available to purchase in the seven brick-and-mortar locations visited by researchers.

4.1.2 Technology outlook

Manufacturers are motivated to engage in the RHP product space, largely due to federal IRA funding, that has created opportunities for state and utility incentive programs. In the absence of current federal heating standards, there is a gap in the market where the vast majority of products available are only suitable for mild climates. More product innovation is required to produce models that are a good fit for the California climate, as well as more models that fit sliding and casement windows, which are common in California homes. The New York Clean Heat for All Challenge (spearheaded by state and local agencies) challenged manufacturers to develop a new WHP model for cold climates with a commitment to purchase 30,000 units.³⁵ This resulted in the development of two new cold-climate (Type 4) WHP models with innovative design features (saddlebag version) from Gradient and Midea, and potentially other manufacturers. These are exciting products but, because of their suitability for cold climates, only serve a small area of California. A comparable challenge may spark product development specific to the window styles and climate of California. In interviews, manufacturers reported potential interest in a similar tech challenge in California that came with bulk purchase agreements. One suggested that a purchase agreement in the range of 10,000 to 20,000 units could be enough to support the development of a new solution for sliding windows.

4.1.3 Market size

RHPs can provide energy savings and comfort benefits in large homes with central systems by providing supplemental zonal heating and cooling, but they provide the most benefit in smaller applications like traditional MF homes. According to the U.S. Census, 22% of California households lived in a MF building in 2022 (MF being defined as two or more units). Most households (74%) live in a SF detached or attached house, while a small proportion (3%) resided in a mobile home, as shown in Table 5. Low-income households, defined as those at or below 80% of the statewide median income, are more likely to live in a MF building compared to higher income earners (34% compared to 16%, respectively).

According to CalMTA research, 17% of California households own a window AC, wall AC, or portable AC, 18% of the population owns a space heater, and another 9% own both (n=790). The

³⁵ <https://www.nyserda.ny.gov/About/Newsroom/2023-Announcements/2023-09-20-Governor-Hochul-Announces-Installation-Of-Window-Heat-Pumps-For-New-York-City#:~:text=The%20Clean%20Heat%20for%20All%20Challenge%20directly%20supports%20the%20goals,buildings%20by%20the%20year%202030.>

CalMTA survey also found that portable devices (either a room or portable AC, space heater, or both) are much more prevalent in mobile homes and MF housing in comparison to SF, with 61% of mobile homes and 50% of MF households owning at least one portable device, compared to 25% of SF homes.

4.2 Target market overview

Table 5 below summarizes the targeted residential market: who makes, buys, uses, and sells RHPs, and what influences purchasing decisions.

Table 5. Residential market overview

Target market	Single family (8,794,023 Households) and multifamily (4,285,090 Households) existing households.
Who makes the product?	Established HVAC manufacturers as well as new market entrants offering new product designs. The team found 18 different brands of RHP products on the market.
Who buys the product?	Homeowners, renters, building owners/property managers, and PAs.
Who uses the product?	<p>Homeowners and renters in SF and MF homes.</p> <p>RHPs are highly applicable to homes or apartments with a small footprint where one unit can be the primary source of heating and cooling.</p> <p>However, RHPs also offer zonal heating and cooling alternatives (similar to a space heater or window AC) in larger SF homes, thereby displacing other inefficient heating and cooling modes.</p>
How is product sold?	<p>RHPs are not easily found in brick-and-mortar retail locations or through HVAC distributors.</p> <p>Purchasers buy them online from e-commerce retailers or direct from the manufacturer.</p>
Who and what influences purchase decision?	<p>Consumers are influenced by cost, information about energy efficiency, and impact on their electric bills (product information from the manufacturer or from third party labels such as ENERGY STAR), and by product reviews attesting to the performance of the unit.</p> <p>Building owners are influenced by property managers; property managers are influenced by cost, regulatory compliance, and tenant preferences and satisfaction, which will reduce tenant turnover and save money.</p>

4.3 Market actor and end-user insights

4.3.1 Electric bill impact

Surveys and focus groups confirmed an anticipated barrier to the adoption of RHPs: consumers are wary of electric bill increases, seek ways to reduce their electric bill, and look for efficient options when shopping. When asked which factors would prevent them from purchasing an RHP in the future, 30% of survey respondents cited concerns about electric bill impacts. Additionally, customers in the focus groups stated that this was a top consideration for them if shopping for a new heater or AC. Some focus group participants reported the need to forgo central cooling due to the cost on the electric bill, supporting the notion that RHPs could play a role in shifting central cooling to zonal and reduce customers' bills. RHPs can provide efficient space conditioning and lower customer bills when reducing the usage of central HVAC systems or replacing electric space heating, although the bill impacts are not always as beneficial when replacing zonal gas heating.

"I go to see them physically in stores to see which one convinces me. I look at the energy consumption it will have and how many watts it will consume because we have to save a little. They consume a lot of energy. You must look for something that helps you save a little money." -Focus Group participant on purchasing decisions for heaters and ACs

4.3.2 Use of space heaters and portable or room ACs

RHPs have a significant market opportunity and offer an energy savings potential to replace space heaters and displace other heating modes, based on data about how consumers currently use their space heaters. Overall, 18% of total households stated that they owned a space heater (n=790), with 40% of space heater owners reporting daily use and 94% reporting that they typically turned down or turned off any other sources of heating while they used their space heater during the winter months. Additionally, according to the residential survey, 40% of households (n=731) are either *somewhat likely* or *very likely* to purchase a new space heater in the next five years, illustrating an opportunity for a heat pump purchase instead. Slightly fewer households (34%) are likely to purchase a new window or portable AC in the next five years, though these AC purchase decisions can also represent an opportunity for RHPs.

4.3.3 RHPs for rental dwellings

RHPs are highly applicable to small dwellings such as MF apartments, but property manager and renter concerns need to be addressed if there is to be widespread market adoption in this market segment. The residential survey found homeowners were twice as likely as renters to state they would be likely to purchase a room pump for heating needs, and they also were more likely to state they would purchase one for cooling needs.³⁶ Cost barriers, both initial price of the unit and

³⁶ Of homeowners (n=430), 27% reported being *very likely* to purchase a PHP or WHP for heating needs compared to 13% of renters (n=360); 33% of homeowners said they were *very likely* to purchase for cooling compared to 22% of renters; differences were statistically significant at the p<.01 and p<.05 levels, respectively.

long-term operating costs (i.e., impact on bill), were more prevalent concerns for renters compared to owners, and renters were also more concerned about heating performance.

Interviewed property managers saw value in the products for the potential to increase tenant satisfaction and improve rentability, along with liking that they did not require professional installation, and they had the potential to mitigate health risks during severe weather events. The property manager survey revealed that about half of respondents said they would be either somewhat or very likely to install an RHP. However, they had questions about their heating and cooling performance and particularly whether they could rely on them for a primary heating source in their units, concerns about installing window units (aesthetics, improper installation causing safety risks, and condensate drainage), and questions about bill impacts and added electrical load. Additionally, 30% of property managers stated that window units were not allowed in their buildings, even if installed by building staff or maintenance staff, highlighting a key barrier and opportunity to educate and engage MF property managers on the benefits of WHPs and particularly the reduced fall risks of saddlebag form types.

5 External program alignment & coordination

Following guidance provided in the Market Transformation (MT) Framework attached to CPUC D.19-12-021, CalMTA intends for the RHP MTI to complement, leverage, and add value to existing programs serving the target market for the technology. Specifically, CalMTA's approach to engaging key parties working in this market seeks to facilitate mutually beneficial cross-program coordination, ranging from ongoing information-sharing to more formal co-creation or partnerships, with the outcomes of: 1) limiting customer and market confusion, 2) enhancing the ability of programs to achieve their goals, 3) overcoming barriers to a program serving a unique market segment, and 4) ensuring effective use of program and CalMTA resources by aligning activities.

As described below, CalMTA engaged PAs at key stages throughout the MTI development process to create a foundation for the future delivery of a plan for coordination in addition to engagement with other important entities whose work aligns with the target market of this MTI. Collaborating with PAs prior to finalization of the MTI Plan allowed CalMTA to share and receive feedback on the proposed approach to aligning MTI activities with the PAs' energy efficiency (resource acquisition, market support, equity) programs, codes and standards activities, and additional programs such as the ESA offerings. This also included discussion on the goal of this coordination and support the MTI could provide to benefit those programs especially if RHPs is added as a measure in the future.

Over the course of 2025, CalMTA will continue to work with PAs and other programs that adopt an RHP measure to develop and share mutually agreed upon guidance to potential bidders of a future Request for Proposals (RFPs) regarding the needs for coordination on the MTI interventions. This collaboration will continue throughout the life of the MTI.



5.1 Collaboration at all phases of MTI development

Engagement with key parties in support of collaborative development of the RHP MTI occurs throughout CalMTA's three-phase development process (see the purpose section of this document for a graphic) with Phase II activities ongoing in 2025 and Phase III collaboration commencing after the MTI Plan is approved. Prior to finalization of the MTI Plan, CalMTA completed the first two bulleted activities described below and will complete the post-application activities in the coming months.

- **Request for Ideas (RFI) to Phase I MT Idea selection** (Aug. 2023 – Feb. 2024): After identifying a preliminary set of local, state, and national programs for future coordination, CalMTA: 1) conducted a series of introductory briefings to cultivate awareness of the market transformation program and maximize participation in the inaugural RFI; 2) shared MTI development updates and solicited feedback at MTAB meetings and through the CPUC's Public Document Area site; and 3) held recurring meetings with the IOU energy efficiency portfolio directors, IOU Codes and Standards working group, and CalNEXT to maximize alignment and identify additional areas of coordination.
- **Phase II Advancement Plan research to MTI Plan finalization** (Feb. – Dec. 2024): To gain deeper knowledge about other program efforts and their potential impact on the development of the MTI, CalMTA: 1) completed additional research to expand the list of overlapping programs and activities; 2) met directly with key parties to secure at least preliminary agreement on the potential extent of overlap and approach to program alignment; 3) conducted structured interviews with important stakeholders and subject matter experts to inform our market characterization report; and 4) held a series of listening sessions with ESJ community representatives to inform the equity approach outlined in this plan.

Ongoing updates were also shared by CalMTA at MTAB meetings scheduled during this phase of activity. In late 2024, CalMTA also recruited members for an Evaluation Advisory Group and Equity Sounding Board, whose insight will inform future activities related to the RHP MTI.

- **Post-application collaboration and Phase III (Jan. - Oct. 2025)**: After submitting the CPUC application requesting approval for the RHP MTI Plan and throughout Phase III implementation, CalMTA will continue to engage external programs and entities in this market, which are offering or planning to offer incentives or other aspects related to the MTI, to minimize conflicts and create opportunities for collaboration. Critically, CalMTA will conduct ongoing meetings with IOUs 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 any need to adjust MTI strategies.

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



plan, and in the Market Progress Evaluation Reports used to measure progress toward MTI objectives. These activities, in tandem with work to align with the PAs on savings goals and attribution as defined in the MTI Evaluation Plan, will result in implementation work plans co-created with PAs and be shared with the CPUC for approval prior to MTI market deployment.

5.2 Related programs for potential alignment

As described in Appendix E, CalMTA identified nearly 30 programs or organizations with potential relevance to the RHP MTI's target market. Because this is a relatively nascent technology, few incentive opportunities for RHPs currently exist. However, programs promoting space-conditioning heat pumps or offering residential electrification or energy-efficiency measures are well-positioned to support CalMTA by incorporating incentives or no-cost distribution of RHPs.

Table 6 below, which is also included in Appendix E, summarizes the programs with aspects that relate to the RHP MTI.

Table 6. Room Heat Pump-related programs

Program/Organization name	Program description
Statewide Codes and Standards Advocacy Programs	The statewide Codes and Standards Advocacy programs seek to influence agencies that are involved in the development of appliance codes at the state and national level by: (1) Developing Codes and Standards Enhancement studies in support of Title 20 code improvements and submitting comments on federal standards, (2) Supporting the implementation of recently adopted versions of the energy code, (3) Participation in public rulemaking proceedings for both state and federal standards and test procedures, and (4) Facilitating discussions with the California Energy Commission (CEC) and across utilities regarding impacts of codes and standards on future gas and electric operations.
CalNEXT	The statewide electric emerging technologies program identifies, tests, and improves electric energy technologies and delivery methods. Project categories include research and development addressing appliances, HVAC, lighting, process loads, water heating, and whole buildings. Selected projects are tested and potentially incorporated into IOU programs.
Electric Program Investment Charge Program (EPIC)	The CEC's EPIC program invests in scientific and technological research to accelerate the transformation of the electricity sector to meet the state's energy and climate goals.
TECH Clean California	This statewide initiative seeks to accelerate the adoption of residential clean space and water heating technology across California by offering incentives, pilot activities, technical assistance, contractor training, and other market support.

Program/Organization name	Program description
Golden State Rebates	The statewide midstream plug load and appliance program provides instant rebates on efficient water heaters, smart thermostats, room air conditioners, and other measures to residential customers at participating retail locations.
Comfortably CA	This statewide midstream program offers resources and incentives to distributors, manufacturers, and retailers for selling high-efficiency HVAC equipment, and provides no-cost training to contractors and technicians.
ESA Multifamily Energy Savings Program	Implemented in both the Northern and Southern region of the state, the statewide program provides no- and low-cost whole-building and in-unit energy efficiency, electrification, and health and safety upgrades as well as no-cost technical assistance to income-qualifying, MF properties.
Main ESA (Basic/Plus) Program	Implemented in each IOU territory, this trade-ally-driven program offers no-cost energy-saving measures to income-qualified homeowners and renters.
ESA Building Electrification Program	This targeted offering helps eligible homeowners and renters electrify their homes by replacing natural gas and propane appliances with high-efficiency electric equipment at no cost.
ESA Whole Home Pilot	Targeting deeper energy savings than the standard ESA program, this pilot is implemented in each IOU territory and offers a holistic package of no-cost energy-efficiency and decarbonization measures.
The Switch is On	The statewide education and awareness campaign provides information, resources, and tools to help homeowners and renters electrify their homes, as well as tools for contractors.
Air quality policymakers, specifically CARB, Bay Area Air Quality Management District (BAAQMD), and (SCAQMD)	At the state and local level, these entities develop emissions standards and ordinances for space and water heating measures in addition to other appliances.
Public agency programs such as the Integrated Climate Adaptation and Resiliency Program Extreme Heat and Community Resilience Program and California's Low-Income Weatherization Program	Programs like these help vulnerable households access upgrades that offset the impact of climate change and keep homes cool and comfortable.
Local and regional incentive programs such as, Bay Area Multifamily Building Enhancements Program, Marin Clean Energy's Multifamily Energy Savings and Low-Income Families and Tenants programs, SoCal Regional Energy Network (REN) Multifamily Program, 3C-REN Multifamily Home Energy Savings, and Cool LA	While each program is structured differently, these offerings reduce the upfront cost of adoption through rebates on qualifying products.

Program/Organization name	Program description
Local utility online marketplaces like the Pacific Gas and Electric (PG&E) Energy Action Guide, Los Angeles Department of Water and Power's Efficient Product Marketplace, and the Southern California Edison Marketplace	These online marketplaces allow utility customers to shop for energy-efficiency products online and apply instant rebates to qualifying models. They also highlight energy-efficiency financing options, including solutions for income-qualified consumers.
ENERGY STAR	Administered by the EPA, ENERGY STAR is a voluntary labeling program for products that meet energy efficiency specifications set by the EPA. In December 2023, ENERGY STAR released a draft test procedure for micro-heat pumps as an addition to its room air conditioner specification.
Clean Heat for All Challenge	Led by the New York Power Authority (NYPA), NYSERDA, and NYCHA, this partnership seeks to develop and install cold-climate WHP units for existing MF buildings.
NEEA Emerging Technologies program/Product Council	NEEA has completed multiple measure development activities related to RHPs, including consumer research and field testing of three WHP form factors (saddle bag, portable, and classic window units).

This table does not include programs that have not yet launched or are still in early stages of development. However, CalMTA recognizes the importance of coordination with the CEC Equitable Building Decarbonization Direct Install Program, the CEC-administered and IRA-funded High-Efficiency Home Rebate Program and Home Efficiency Rebate Program, the newly formed California Heat Pump Partnership, and other equity-focused residential electrification programs such as PG&E's zonal equity electrification pilot. We will continue outreach leading up to Phase III delivery to identify points of alignment and potential coordination with these programs as they evolve.

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

6 Data management

CalMTA will implement a comprehensive strategy throughout the MTI's life that includes collection and ongoing management and analysis of these data:

- 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



Market Transformation Initiative Plan for Room Heat Pumps
*CalMTA is a program of the California Public Utilities Commission (CPUC)
and is administered by Resource Innovations*

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

6.1 CalMTA MTI program data and materials

CalMTA will create a repository of program data and materials that includes a detailed record of stakeholder and market actor communications, program data including agreements 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 a comprehensive tracking and reporting of activities, outreach, and events. This will act as a record of CalMTA's interventions and their 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 & Reports section that catalogues program material and public communication.

CalMTA will conduct market and product research in support of specific MTI needs, and regularly true up the RHP 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.

6.2 Secondary data and information

CalMTA will collect data from secondary sources regarding population characteristics (such as California household demographic characteristics, 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)
- EIA Residential Energy Consumption Survey Data
- California Residential Appliance Saturation Study
- PA Program and California Energy Data and Reporting System (CEDARS) Data
- Evaluation reports from related California programs

6.3 Product category sales and shipment data

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



Appendix F: Evaluation Plan provides a detailed description of the sales, programs, and shipping data the MTI will maintain, including:

- ESRPP retailer stocking and sales data (source: CalMTA ESRPP data)
- Circana Data (source: Circana, purchased data)
- Other sources of shipment data, such as ENERGY STAR, Association of Home Appliance Manufacturers (AHAM), an appliance trade organization), and Heating, Air-Conditioning and Refrigeration International (HARDI)

6.4 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:

- Residential consumer surveys
- MF property manager interviews
- Property manager (SF and MF) survey
- Manufacturer interviews
- Stakeholder, subject-matter experts and MTI staff interviews
- Brick-and-mortar and online retailer data collection (including retail staff interviews)
- HVAC distributor data collection and staff interviews

6.5 Market Progress Indicators

MPIs correspond with the RHP theory of market transformation, as represented in Appendix A: 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 track the market share of RHPs as a percent of full category sales in California via sales and shipment data from sources that include ESRPP Retailer Stocking and Sales Data, sales data purchased from Circana or others, ENERGY STAR, HARDI, or AHAM, and manufacturer and distributor data, among others. Appendix F: Evaluation Plan provides a detailed description of data sources and the MPI assessment and other evaluation activities that will be conducted under the MTI.

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 D.19-12-021 and the 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 cost-effectiveness, 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 RHP MTI with input from the Evaluation Advisory Group, a group of three independent evaluation experts, the CPUC CalMTA project manager, and the CalMTA market research and evaluation lead (see Appendix F: Evaluation Plan for details).³⁷ Final evaluation plans will be developed by an independent third-party evaluator, to be selected via a competitive bidding process after the MTI advances to Phase III.

7.1 Evaluation approach overview

CalMTA and its third-party evaluator will employ a theory-based evaluation (TBE) approach to evaluating the RHP MTI, which is widely accepted as a best practice for market transformation program evaluation.³⁸ TBE uses the RHP program theory as the point of reference for market progress evaluation - assessing market progress against the theorized short-, medium-, and long-term outcomes and corresponding MPIs, and the extent to which the market interventions addressed the market barriers identified and caused the outcomes theorized in Appendix A: Logic Model.

The evaluation will address these high-level objectives:

- Monitor market dynamics and characteristics; assess market developments
- Review and assess the MTI Logic Model and program theory
- Measure market progress and equity, per the MPIs
- Assess MTI causality per the Logic Model, using evidence-based assessments that use a “preponderance of evidence” approach and established market transformation evaluation best practices
- Identify opportunities to adjust MTI strategy and tactics, to improve MTI effectiveness
- Review CalMTA’s baseline and total market adoption forecasts, and TSB and cost-effectiveness model inputs and assumptions
- Assess ancillary benefits and costs

³⁷ 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>.

³⁸ For more about TBE and references, please see Appendix F: Evaluation Plan.

7.2 Market Progress Indicators

The RHP evaluation plan identifies 20 MPIs that correspond with the RHP program theory. While the ultimate MPI is market adoption of RHPs (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 increase slowly and will accelerate only after the MTI addresses critical market barriers, including availability of products appropriate for California's climate and window types, product availability in brick-and-mortar stores, product differentiation and labeling, and consumer awareness. Therefore, to appropriately evaluate market progress and ensure accountability, the evaluator must assess short- and medium-term MPIs that align with the Logic Model, including these:

- Number of manufacturers engaging with CalMTA
- Number of units covered by bulk purchase agreements
- Number of Type 2 and 3 products for sliding and casement windows available for purchase
- Incremental cost of RHPs versus alternative space heating and cooling products
- ENERGY STAR specification amendments
- Share of RHP units stocked in stores
- Consumer and property manager awareness of product benefits

Appendix F: Evaluation Plan provides a complete list of MPIs and how they will be assessed. It 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 cost-effectiveness. 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 that provide real-time information to inform MTI strategy and improve performance.

CalMTA identified the following primary and secondary data collection activities and associated analysis tasks that would allow the third-party evaluator to evaluate the RHP MTI, which are described in Appendix F: Evaluation Plan.

- Secondary data and literature review
- Homeowner surveys
- Property manager surveys and interviews
- Retailer and manufacturer surveys and interviews
- PA, subject matter expert, community organization, and other stakeholder interviews
- Retailer data collection (via in-store and online stocking studies)
- Sales and shipment data collection

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 breadth of market research 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 help support timely implementation decisions and program effectiveness. For example, the RHP initiative includes a strategic intervention to build market awareness of product benefits because most consumers are currently unaware of the use cases and benefits of RHPs. As the MTI team works to identify compelling messaging and product selection tools, it may benefit from messaging and usability research - which can be utilized to increase the effectiveness of these tactics. CalMTA has included a modest budget for ad hoc research needs and will identify specific research studies over the initiative's implementation.

8 Risks & mitigation

This section in the table below details the key potential risks that could negatively impact the RHP MTI and CalMTA's plan to monitor and mitigate the risks. Please see Appendix G for a full list of possible risks for this MTI. CalMTA is 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 if it comes to fruition.
- **Medium:** This risk has a medium probability of occurring given what is known about the market. The MTI needs to track and have a mitigation plan.
- **Low:** The probability of this risk occurring is low based on what know about the market to date. It could have some impact on the need for resources and timing, so the MTI needs to track.

For "Severity" in the third column, CalMTA is defining:

- **High:** If this risk plays out and our mitigation approach is unfeasible, then the success of the MTI may be in jeopardy.
- **Medium:** This may have an impact on the timing or overall success of the MTI, but 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 the timing or level of resources needed.

Table 7. Risks and mitigation

Risk	Probability of occurring (H, M, L)	Severity (H, M, L)	Possible mitigation approaches
Large enough demand signal for manufacturers: MF building owners do not	M	M	• Work with MF building owner trusted partners to secure additional signed agreements.

Risk	Probability of occurring (H, M, L)	Severity (H, M, L)	Possible mitigation approaches
agree to purchase enough units of product that is described in the Tech Challenge, resulting in a smaller than needed demand signal for manufacturers to invest in the development of the product.			<ul style="list-style-type: none"> • CalMTA could pay a portion of the product costs to reduce cost to building owners or CalMTA develops bulk purchase pricing with manufacturers to help reduce costs. • CalMTA couples promise to purchase with another program like ESA to help offset costs.
Manufacturer response to product that meets California windows: Manufacturers do not respond to Tech Challenge with product roadmaps that meet California window configuration needs.	L	H	<ul style="list-style-type: none"> • Use examples of heat pump appliances from other markets and product categories to demonstrate feasibility. • Reward the one known manufacturer that currently has the product with the entire MF order to stimulate competition and other manufacturers to join. • Build a larger demand signal with California programs and other partners targeting a broader set of MF building owners.
Manufacturer response to product that meets California climate needs: Manufacturers do not respond to Tech Challenge with product roadmaps that meet California mild climate needs.	L	M	<ul style="list-style-type: none"> • Show market that it can be done through one manufacturer that has already done it. • Reward the one known manufacturer that currently has the product with the entire MF order to stimulate competition and other manufacturers to join. • Build a larger demand signal with California programs and other partners targeting a broader set of MF building owners. • Revise specification to be more achievable in the near term.
Product labeling: Manufacturers continue to label and describe RHPs in	L	M	<ul style="list-style-type: none"> • Incorporate streamlined messaging into all RHP marketing partnerships.

Risk	Probability of occurring (H, M, L)	Severity (H, M, L)	Possible mitigation approaches
a variety of conflicting and confusing ways (inverter technology, heat pumps, etc.) which makes retailer and consumer product selection challenging.			<ul style="list-style-type: none"> Require retailers to add "Heat Pump - reverse cycle" filter to online search engines, if they are to receive midstream incentives for qualified RHPs. Continue to advocate for consistent messaging through manufacturers engagement and RHP collaborative partners.
Inclusion in California programs: Programs that provide incentives for efficient products or other offerings that seek to influence consumer adoption (energy efficiency, weatherization, climate resilience programs, equity, etc.), fail to include this measure in their programs.	L	M	<ul style="list-style-type: none"> Support program inclusion through data and market support (manufacturers, retailer, CBOs and marketing support).
Electrification rates in California: California utilities roll out electrification enabling rate structures, especially for ESJ communities, slower than anticipated dampening consumer interest in moving to electric heat pumps.	L	M	<ul style="list-style-type: none"> Across all CalMTA consumer product MTIs (HPWH, RHPs, and Induction Cooking) support policy makers and advocates in the movement towards electrification friendly rates through bill impact information, avoided costs, and other non-energy benefit for the consumer. Focus initial interventions on those customers likely to benefit the most from a switch to RHP (those with inefficient electric heating). Provide stipends to customers who switch to an RHP, and experience bill impacts as temporary measure.

9 Cost estimates

Table 8 shows annual cost estimate by major program activity for the full 20-year MTI lifetime, 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 8. Phase III cost estimates*

Activity	Total Phase III cost estimate
Program implementation including the following line items: <ul style="list-style-type: none"> • MTI oversight, strategy, and management • Marketing and awareness building • Policy development and support • Supply chain management 	\$29,458,000
Market research including the following line items: <ul style="list-style-type: none"> • Market research • Data collection 	\$2,850,000
Mid/Upstream incentives including incentives to HVAC distributors and retailers or builders that are “upstream in the market”	\$17,750,000
Downstream incentives include CalMTA incentives that would be provided to consumers	\$5,250,000
Program evaluation	\$3,820,000
Total	\$59,128,000

*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 \$62,809,000.

10 Appendices

Link to <https://calmta.org/resources-and-reports/room-heat-pumps-mti-plan/> to access the appendices below.

Appendix A: Logic Model

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, Total System Benefit (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 assess market progress and impacts 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: Budget

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.

