Room Heat Pump Self-Installation Practices Strategy Pilot Report

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

Contents

1 Introduction

CalMTA's Phase II research for the Room Heat Pumps Market Transformation Initiative (MTI) identified the need for research to better understand how consumers install, interact with, and utilize this technology. The Room Heat Pumps Self-Installation Practices Strategy Pilot was developed to yield greater insight into two primary assumed benefits of the technology, which are key to the customer value proposition, including: 1) its purported "self-installation" potential, and 2) the relative portability of systems for tenants who own them. This report summarizes the findings from the Strategy Pilot. The CalMTA team would like to thank the manufacturers Gradient, Midea, and Whynter for supporting the pilot.

2 Strategy Pilot background

To implement the Strategy Pilot, CalMTA partnered with three local organizations that (1) have existing connections to environmental and social justice (ESJ) communities, and (2) currently support space conditioning upgrades for multifamily and small single-family residences (both renters and homeowners) in those communities. These organizations include Redwood Energy (Humboldt County), El Concilio (San Mateo County), and the U.S. Green Building Council – California (Los Angeles County). A map of where these organizations run the Strategy Test can be seen below in Figure 1.

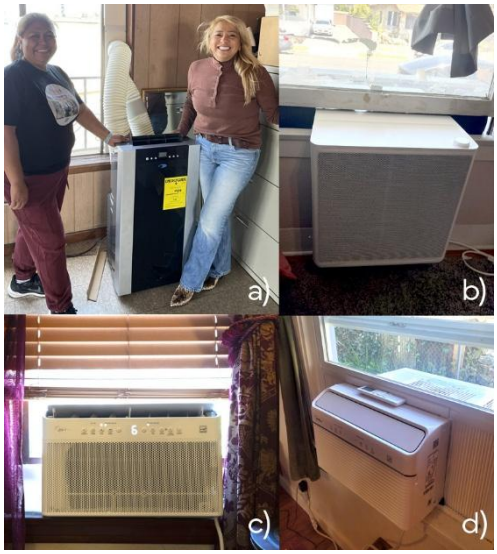
Figure 1. Map of included counties

CalMTA provided these partners with room heat pump units at no cost for distribution and installation. These partners recruited participants to self-install the units and share feedback on their experience through surveys distributed at key intervals after product installation to

determine their experience with the products. Unit installations started in June and ended in November 2024.

CalMTA utilized an array of room heat pumps that covered four of the major form factors considered by the MTI including portable (a), saddlebag (b), U-shaped (c), and window (d), as seen below in Figure 2. It should be noted that the U-shaped units were AC only because the window HP versions were not available at the time of the Strategy Test; all others were heat pumps that provide both cooling and heating. Installation location was first determined by window configuration and size, and next by climate needs.

Figure 2. The four form factors included in the pilot



2.1 Strategy Pilot objectives

As designed by CalMTA, the Room Heat Pumps Self-Installation Practices Program Strategy Pilot targeted the following objectives:

- **Verify the opportunity of room heat pump self-installation.** Manufacturers of both portable and window heat pumps claim that the products can be quickly self-installed by customers in multifamily units and homes. The findings from this Strategy Pilot sought to confirm the capability for self-installation and inform manufacturers about any challenges specific to the various form factors (saddlebag, window, U-shaped, and portable).
- **Verify the consumer value proposition, including value of self-ownership.** Because the technology is relatively new, CalMTA sought to better understand the benefits of portability that room heat pumps offer consumers, especially renters and homeowners in multifamily and small single-family properties. Determining the extent to which target audiences value this feature will be useful in determining the eventual MTI strategies.
- **Understand the impact of technology usage on consumer behavior.** CalMTA sought to understand how pilot participants use their room heat pump versus existing equipment.

This information will provide insight into the viability of RHPs to displace usage of inefficient devices and potential energy usage impacts.

- **Build manufacturer engagement and CalMTA understanding of technical and supply-chain barriers.** The Strategy Pilot will allow CalMTA to engage manufacturers as partners and gain a deeper understanding of technical and supply-chain barriers that impact adoption in California, including product specifications, availability, and installation practices.

3 Evaluation objectives and activities

The following sections outline the evaluation objectives, followed by the approach and the activities done to achieve the objectives.

3.1 Evaluation objectives

The objectives identified for evaluating the Strategy Pilot are listed in Table 1.

Table 1. Evaluation research objectives

Strategy Pilot objectives	Evaluation research objectives or metrics
1. Verify opportunity of room heat pump self-installation	• Quantify the number of installations that were done by a single individual vs. assisted • Categorize and describe specific installation issues participants encountered to aid informed recommendations on product improvements or enhanced installation instructions • Segment installation findings by unit type and heating/cooling sources prior to installation
2. Verify the consumer value proposition, including value of self-ownership	• Assess user satisfaction with the room heat pump unit and potential for future use of product • Measure the likelihood that residents will take the unit with them when they move • Among consumers who move during the study period, track moves and measure experience regarding uninstalls (moving the unit) and reinstalls

3. Understand the impact of technology usage on consumer behavior	• Characterize the space conditioning baseline equipment among participating households
	• Measure use of room heat pumps by:
	  ○ Time of use (hours per day)
	  ○ Room/whole home
	  ○ Function (heating or cooling)
	  ○ Primary or secondary
	  ○ Use of back-up sources°
	• Explore and describe participant behavior change in relation to baseline space heating and cooling equipment†
	• Examine the impact of the heat pump on electric load and bills during summer months after installation§

Strategy Pilot objectives	Evaluation research objectives or metrics
4. Build manufacturer engagement and CalMTA understanding of technical and supply chain barriers*	• Among participating manufacturers, characterize product specifications and feasibilities for improvement • Explore and document manufacturer receptivity, along with technical challenges, to product improvements or affordability and supply chain barriers and opportunities • Identify and document the value proposition for manufacturers to engage with CalMTA during the Strategy Pilot and potential future MTI deployment (i.e., customer insights, bulk volume/sales, industry leadership, financial support) • Capture lessons learned from manufacturer engagement that can be applied to future MTI interventions

° In 2025, CalMTA contracted with El Concilio and Redwood Energy to enlist a subset of those who participated in the original 2024 installation pilot to install data logger devices for tracking the usage hours of the installed RHPs. Use of backup sources will be based on self-reporting.

†As part of this study CalMTA conducted surveys one month after installation to get qualitative feedback on user experience and behavioral changes.

§ A billing impact evaluation was beyond the scope and design of this pilot. CalMTA qualitatively assessed perceived bill changes via a participant experience survey (results reported below).

* Pilot Objective 4 has not yet been evaluated as CalMTA is currently conducting ongoing engagement with manufacturers who participated in the pilot and others who are bringing products to market. Manufacturers' responses to the pilot feedback and how they incorporate changes into future product iterations is a longer-term effort and will be evaluated as part of the overall market progress evaluation in Phase III: Market Deployment.

3.2 Evaluation approach/activities

To evaluate the pilot objectives, the CalMTA team conducted two surveys with participants: 1) a post-installation survey and 2) a user experience survey.

The post-installation (n=126) survey was administered by the implementation partners and completed by participants directly after they installed a room heat pump. If the participant was unable to complete the survey directly after installation, they had an option to complete the paper survey and return it within one-week post-installation. The post-installation survey covered unit information, participants' heating and cooling systems prior to installation, the installation process, and participant satisfaction.

The user experience survey (n=94) was completed 30 days or more after installation in order to capture participants' feedback after using their room heat pump during part of a cooling season.

Findings from the two surveys were then analyzed. Findings from the analysis are presented below.

4 Findings

In addition to findings from the surveys, the following sections also report on general findings from the pilot that were not captured in surveys. Throughout the section, figures may not equal 100% due to rounding.

4.1 Post-installation survey findings

Installations were divided between the three partners, as shown in Tables 2 Table and 3.

Table 2. Installation information

Partner	Number of installs	Percent of total pilot installs
Redwood Energy	34	27%
El Concilio of San Mateo County	46	37%
U.S. Green Building Council - California	46	37%

Table 3. Number of unit types installed by partner/location

Partner	Saddlebag Unit	U-Shaped Unit	Window Unit	Portable Unit	TOTAL
Redwood Energy	24	0	10	0	34
El Concilio of San Mateo County	1	0	0	45	46
U.S. Green Building Council - California	28	18	0	0	46
TOTAL	53	18	10	45	126

Saddlebag units were the most installed (42%, 53 of 126), followed by portable units (36%, 45 of 126). Table 4 displays the types of units installed. It is important to note that participants were not given the choice of unit to install – units were selected for participants based on their climate and understanding of the window type in the home. The saddlebag unit was the most installed due to manufacturer availability and pricing.

Table 4. Installation by unit

Heat pump unit	Number installed in pilot	Percent of total heat pumps installed in pilot
Saddlebag Unit	53	42%
U-Shaped Unit	18	14%
Window Unit	10	8%
Portable Unit	45	36%

Strategy Pilot participants most frequently completed their installation in two hours or less, with an average time of 65 minutes. Table 5 shows the average installation time based on unit type. Participants most frequently had one additional person assisting with the installation process.

Table 5. Average installation time by unit type

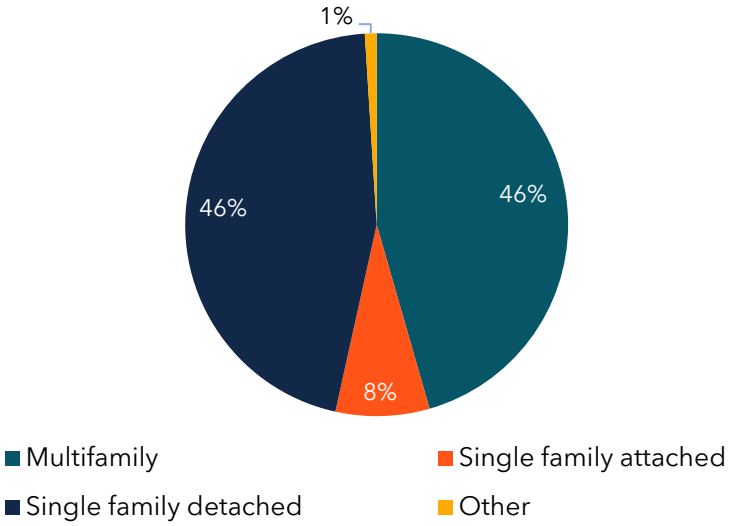
	Installation time (minutes)		
Unit type	Average	Minimum*	Maximum*
Saddlebag unit	66	20	240
U-shaped unit	85	15	210
Window unit	67	30	120
Portable product	56	10	240

*Outliers of 1 minute and 1440 minutes were removed.

4.1.1 Demographics

A majority (69%) of respondents rent their home with the most common housing type among respondents split between multifamily (46%) and single-family detached homes (46%). Figure 3 shows participant housing types.

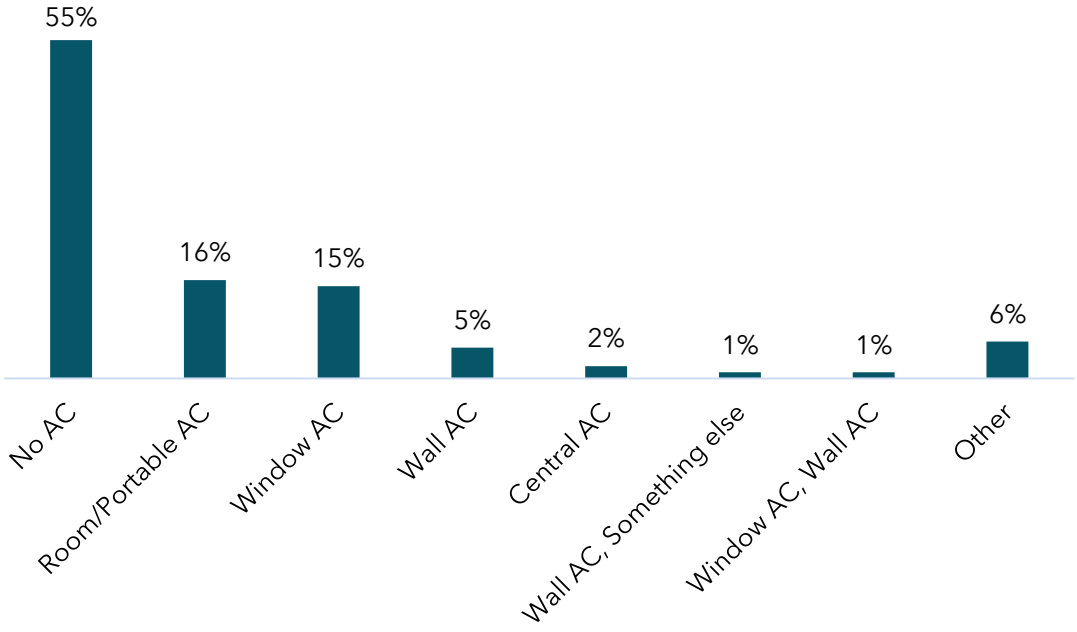
Figure 3. Participant housing type (n=126)



Participants were then asked to report their first language. Over two-thirds of respondents reported their first language as English (68%) with about one-third reporting Spanish as their first language (32%).

Next, participants were asked about the cooling and heating systems in their homes prior to the room heat pump installation. Most (55%) respondents did not have air conditioning in their home prior to installation. Of those who did have air conditioning, the most commonly reported were room/portable air conditioning (16% of total respondents) and window air conditioning (15% of total respondents). Figure 4 shows the distribution of air conditioning system types pre-installation.

Figure 4. Participant air conditioning system pre-installation (n=125)



Additionally, most respondents reported that wall heaters (28%) or central heating (24%) were the primary heating system in their home prior to installation. When asked about the primary heat fuel, most respondents (82%) reported natural gas followed by electric (16%). Figure 5 displays the heating system and Figure 6 shows the fuel type responses.

Figure 5. Heating systems installed pre-installation (n=123)

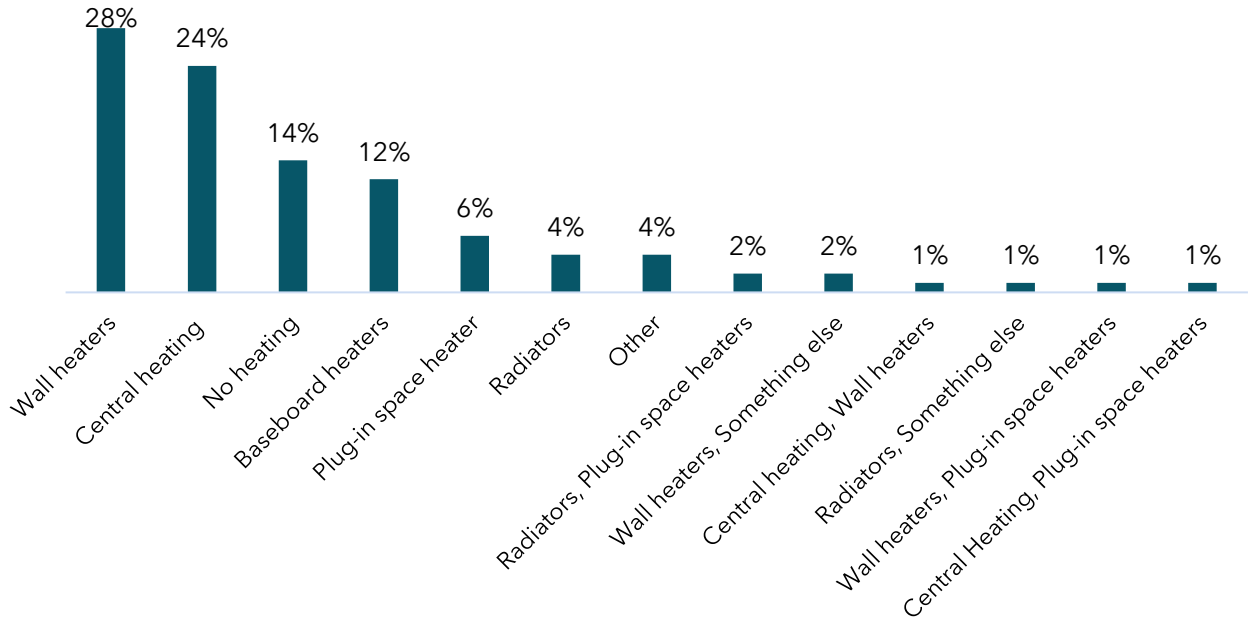
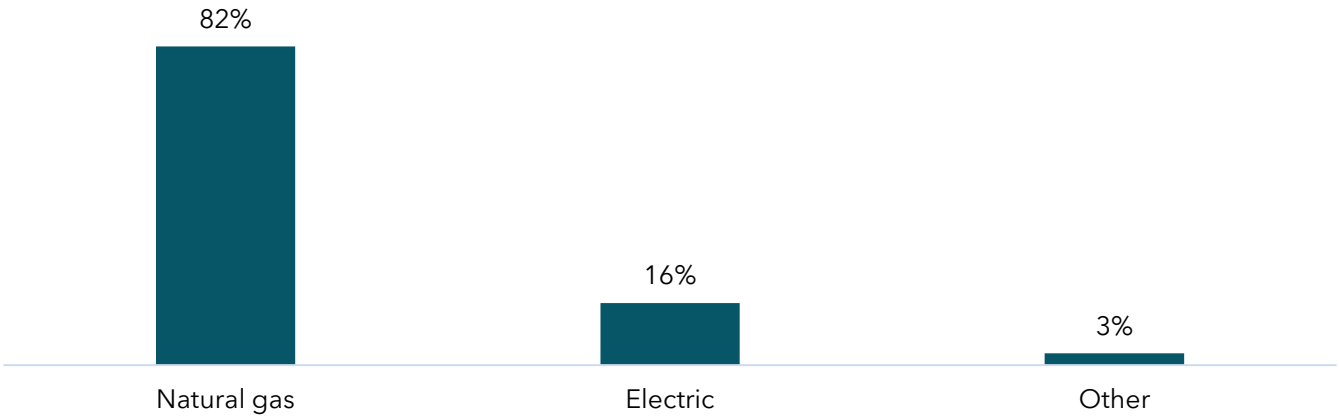


Figure 6. Fuel types of units prior to installation (n=121)



4.1.2 Installation process

This section describes the installation process for the room heat pumps, covering the installation itself, assistance needed with the installation, the instructions provided, post-install, and satisfaction.

The installation process

Participants were asked to describe the installation process beginning with where the room heat pump was installed. Overall, the unit was most commonly installed in the living room (59%), followed by the bedroom (24%), as displayed in Figure 8. Additionally, Figures 9-12 break down installation locations by unit type. Of note, all units were most likely to be installed in the living room.

Figure 8. Area of the home the unit was installed in overall (n=114)

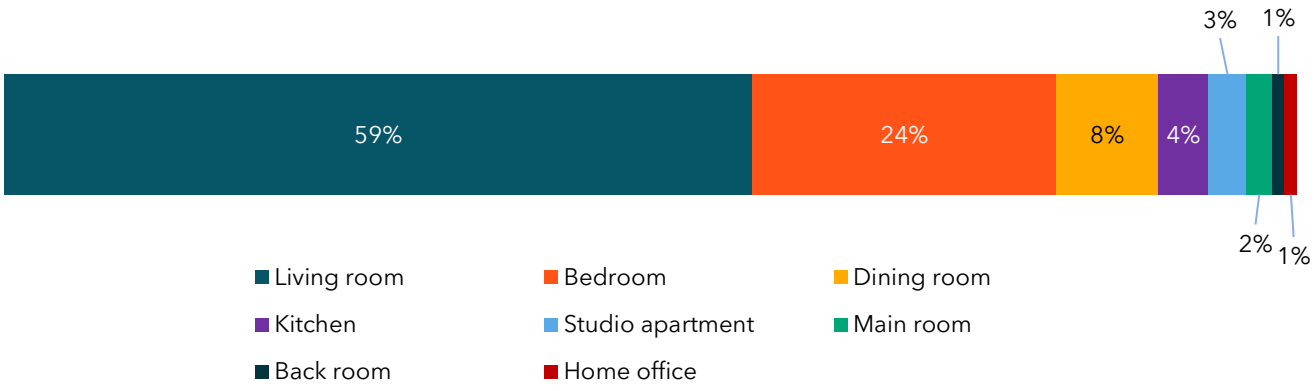


Figure 9. Area of the home the unit was installed: window unit (n=10)

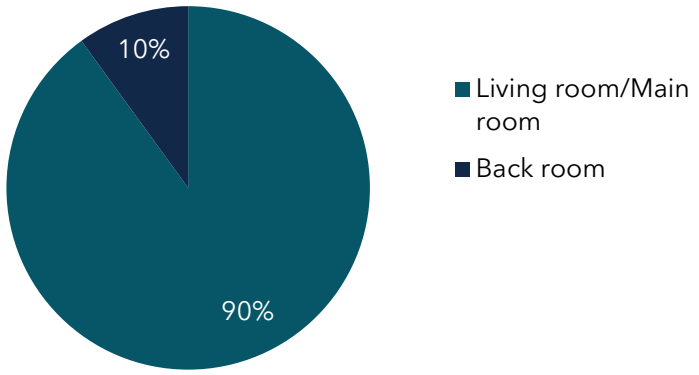


Figure 10. Area of the home the unit was installed: portable unit (n=39)

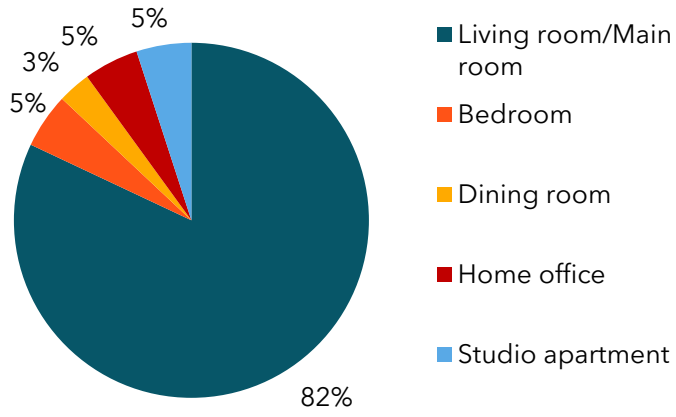


Figure 11. Area of the home the unit was installed: U-shaped unit (n=18)

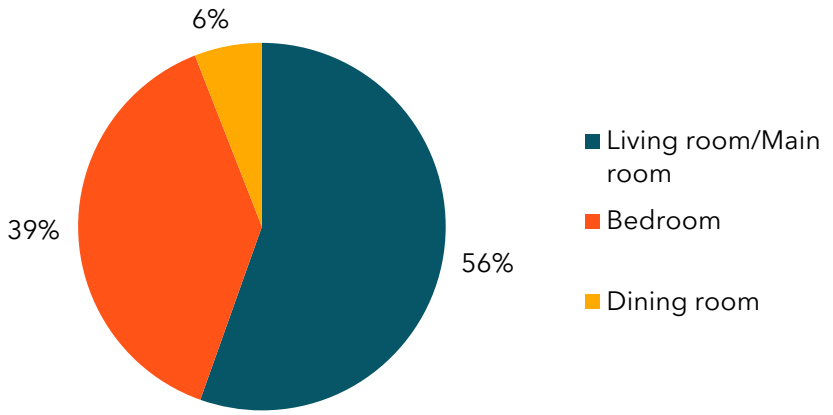
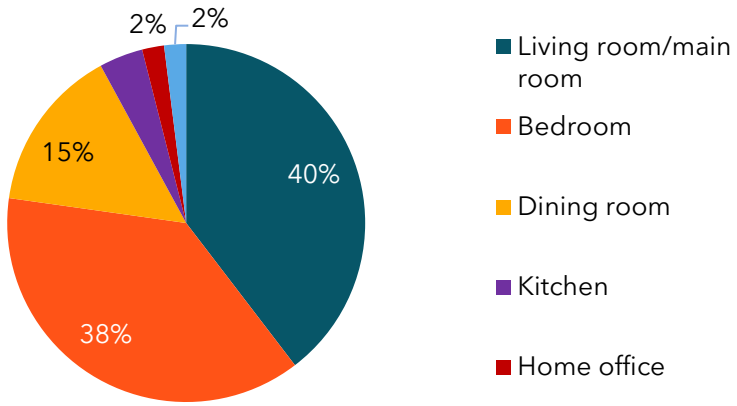


Figure 12. Area of the home the unit was installed: saddlebag unit (n=47)



Next, participants were asked about the tools they used during the installation process. Table 6 lists the tools needed for installation per the instruction manual for each unit type. The tools were not provided by the manufacturer. The most commonly reported tools used were a screwdriver (29%) followed by a drill (11%) and scissors (10%). Table 7 shows a breakdown of the tools actually used by respondents for each unit type, with blue highlights indicating which tools were listed as being needed in the instructional manual. Overall, the saddlebag unit, portable unit, and window unit required many more tools than were specified by the unit instructions. The U-shaped unit accurately reflected the tools required as evidenced by the tools used matching the tools listed in the instruction manual. The saddlebag unit largely specified everything needed with only 12% of respondents using a tool (i.e., drill) that was not listed as needed in the instruction manual.

Table 1. Tools needed for installation as per instruction manual

Unit type	Tools needed as per instruction manual
Saddlebag unit (n=52)	Pins, screws, Allen key, Phillips screwdriver, level, flathead screwdriver, pencil, ruler or tape measure, scissors or knife
U-shaped unit (n=18)	Phillips screwdriver, level, flathead screwdriver pencil, ruler or tape measure, scissors or knife, drill and 1/8-inch bit
Window unit (n=10)	Phillips screwdriver, drill, ½-inch screws, lock frame, sash lock, weatherstripping, window sash seal foam, 3/8-inch screws
Portable product (n=44)	Screws, hose connectors, window slider kit

Table 7. Tools used by participants during installation

Tool category	Saddlebag unit (n=52)	Portable unit (n=44)	U-shaped unit (n=18)	Window unit (n=10)	Total (n=124)
Screwdriver	12%	66%	50%	60%	40%
Drill	12%	7%	50%	50%	19%
Knife	19%	2%	39%	30%	17%
Saw	2%	36%	N/A	10%	15%
Tape measure	19%	11%	6%	10%	14%
Scissors	21%	N/A	17%	N/A	12%
Allen key	27%	N/A	N/A	N/A	11%
Level	13%	N/A	22%	10%	9%
Tools supplied	13%	N/A	11%	N/A	7%
Wrench	8%	N/A	N/A	N/A	3%
Other*	10%	11%	17%	20%	12%
None	2%	7%	11%	20%	5%

NA = Not applicable to this unit.

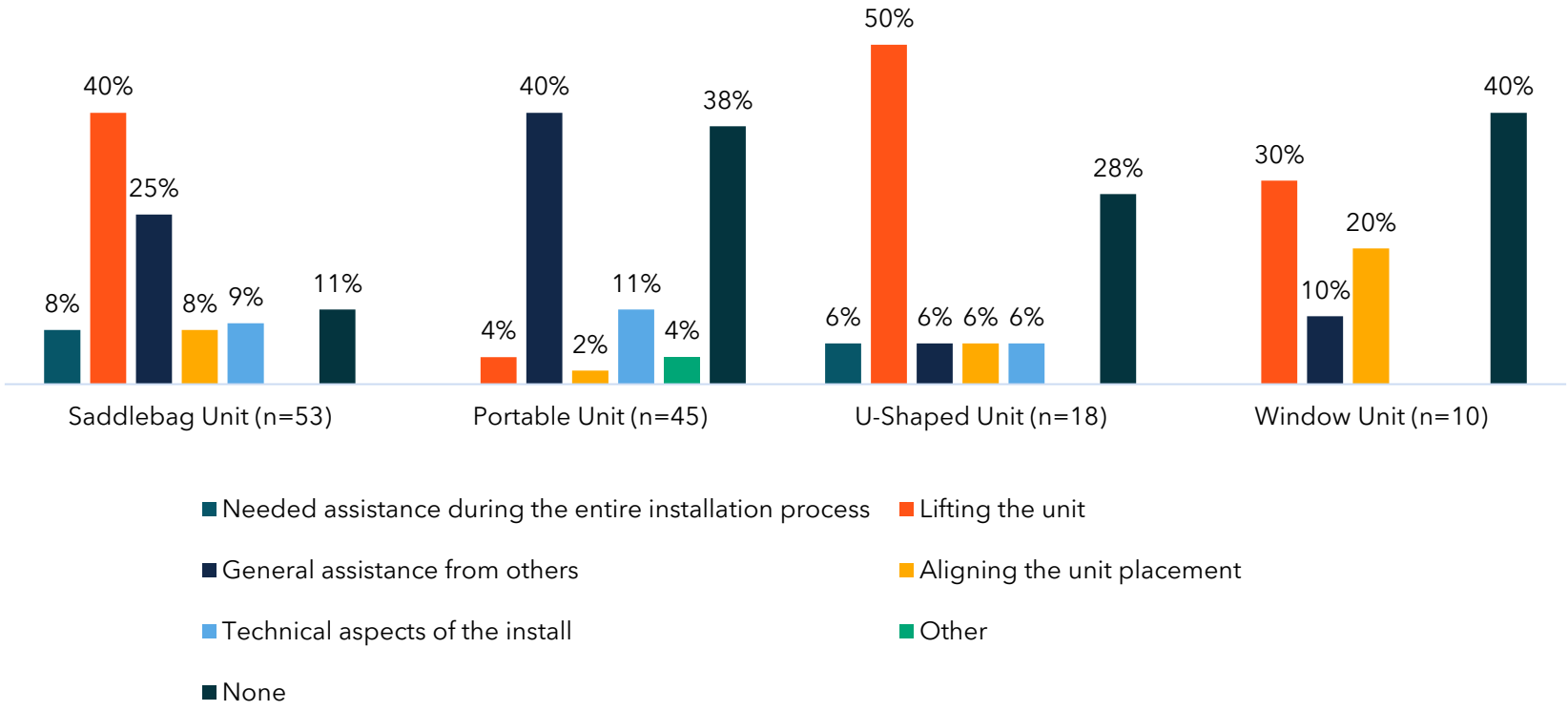
*"Other" includes screw gun, screws, hammer, pliers, duct tape, and other miscellaneous responses. These had 2% or less for each.

Blue highlights indicate tools that were identified as necessary in the instruction manual.

Assistance with installation

Most respondents (75%) reported that they required assistance to complete the installation process. Those who said they needed help most commonly reported that assistance was required for lifting the unit followed by technical aspects, regardless of unit type, as shown in Figure 13. Those with Window Units and Portable Units were the least likely to need assistance with the installation (40% and 38% reported needing no help, respectively).

Figure 13. Installation assistance needed: Qualitative responses (n=126)



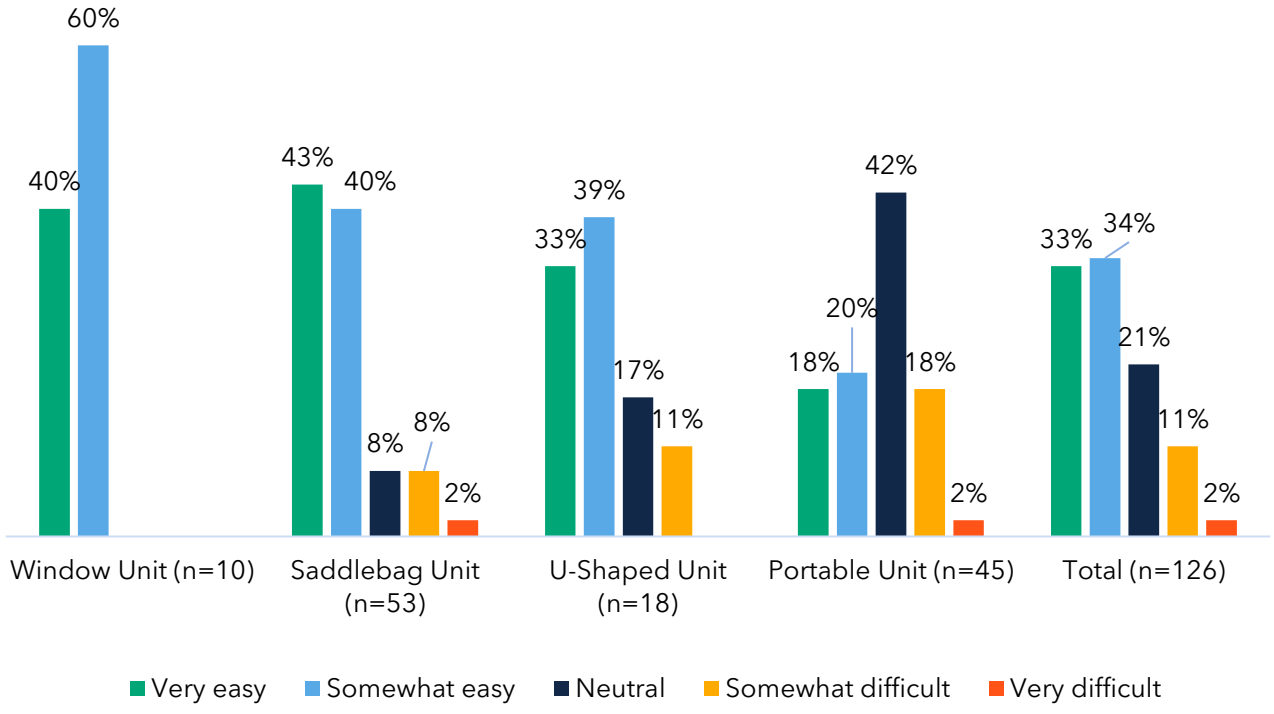
It is unsurprising that assistance was most commonly required for lifting some of the units since units ranged from 54-140 pounds, as shown in Table 8. The weights of the unit types vary due to differing capabilities that are required for colder climate. Assistance was also required for technical aspects including brackets, sealing foam pieces, and phone applications. Brackets were used for saddlebag units and the U-shaped unit.

Table 2. Unit weights

Unit type	Unit weight (total)
Saddlebag unit	130-140 lbs.
U-shaped unit	54-57 lbs.
Window unit	67 lbs.
Portable product	70 lbs.

When asked how easy it was to install the unit, most respondents, regardless of form factor, said it was somewhat or very easy as shown in Figure 14. The easiest units to install were reported as the Window Unit (100% very or somewhat easy) and the Saddlebag Unit (83% very or somewhat easy). The highest proportion of respondents who installed the Portable Unit were neutral on the ease of installation (42%). Further, the Portable Unit was more likely than other unit types to be rated as somewhat difficult (18%) or very difficult to install (2%), followed by the Saddlebag Unit with 10% of respondents reporting it was somewhat or very difficult to install.

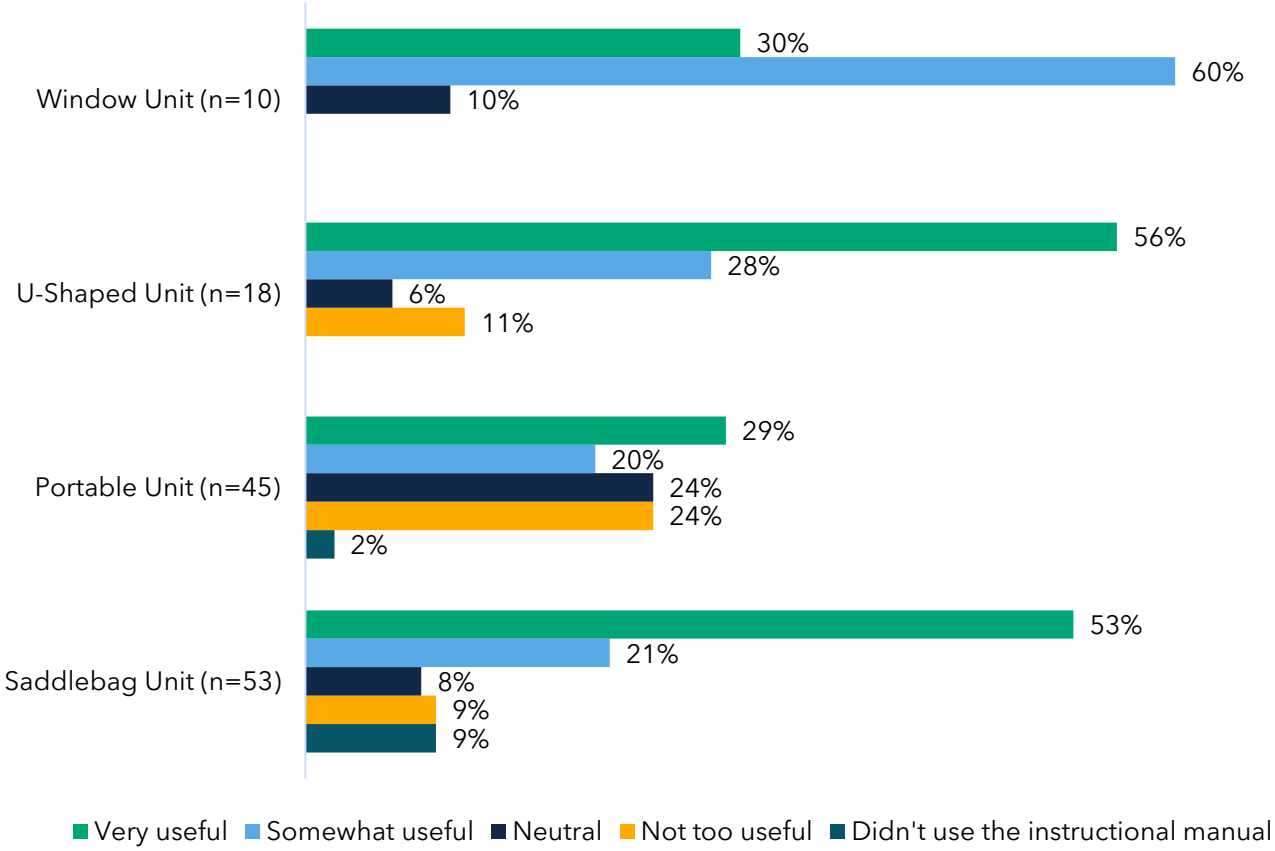
Figure 14. How easy participants found the installation process (n=126)



Instructions provided for the installation

When asked how helpful the instructions were, most respondents, regardless of unit type, stated they found the instructions somewhat or very useful as shown in Figure 15. The instructions for the Window Unit and the U-Shaped Unit were the highest rated in terms of usefulness, with 90% and 84% reporting that the instructions were useful, respectively.

Figure 15. How useful the instructions were during installation by unit type (n=126)



Although participant ratings of the usefulness of instructions was reasonably high, several respondents made recommendations on how to further improve the instructions. The most common response across unit types was to include more pictures, with the exception of the Window Unit where respondents most commonly requested more details (43%). Figure 16 shows participant recommendations on how to improve the instructions by unit type.

Figure 16. How the instructions could be improved by unit (n=83)

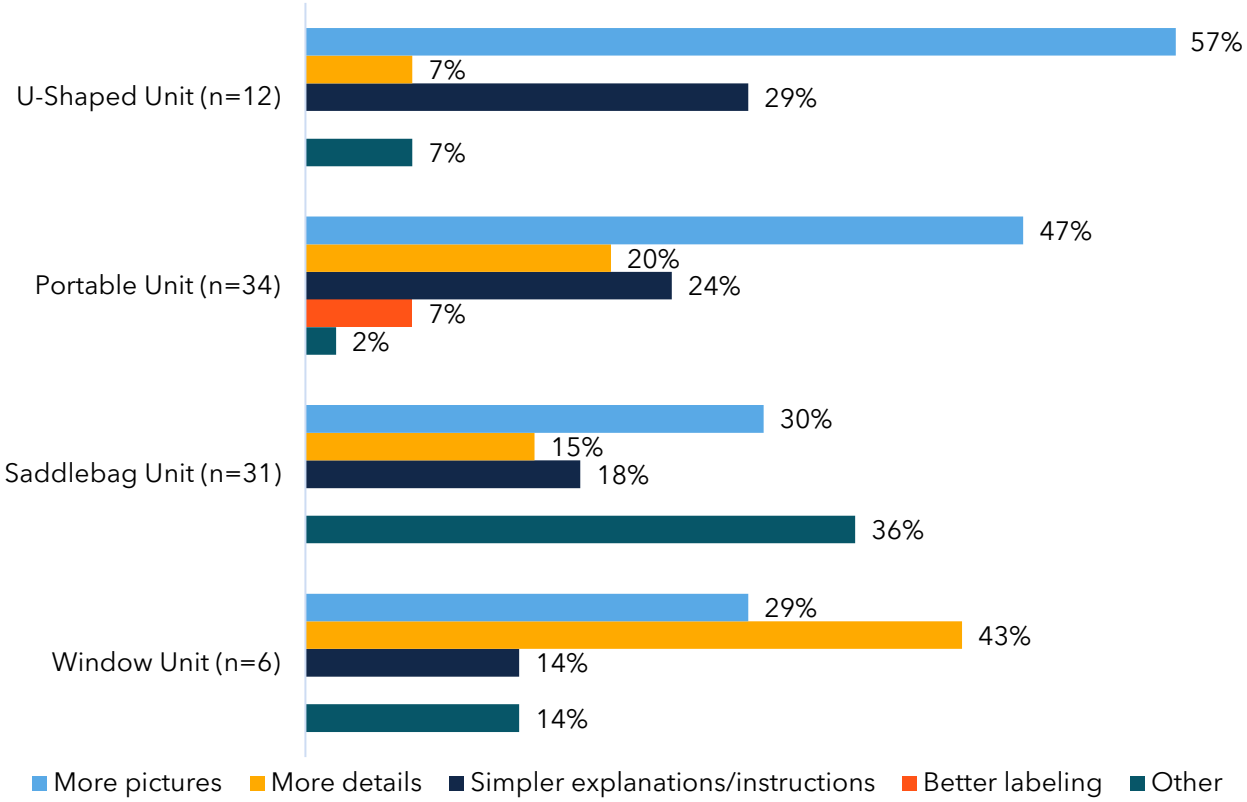


Table 9 outlines the "other" suggestions to improve the installation instructions, broken out by unit type.

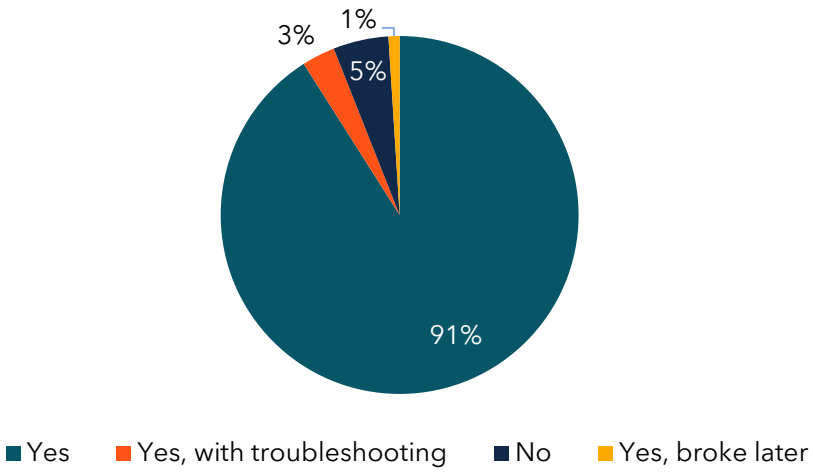
Table 9. "Other" suggestions for improving instructions by unit type (n=18)

Unit type	"Other" suggestions for improvement
U-Shaped Unit	Information about protecting the window and windowsill (n=1). Information on how to set up the foams and foam adhesives (n=1).
Portable Unit	More information on how to use the cold air settings (n=1). Information on how to install the boards (n=1).
Saddlebag Unit	Clarify operation instructions (n=4). Include a QR code to link to the video instructions (n=3). Information on how to set up the foams and foam adhesives (n=3). Live assistance helpline (n=2). The bracket received is different than the bracket in the illustration (n=1). More instructions for the aluminum tubing (n=1). Provide a Spanish translation (n=1). Provide photos that can standalone for installation without writing (n=1). More clarity in the instructions on how many people will be needed for the installation (n=1). Information on how to secure the window after installation (n=1).
Window Unit	More clarity in the instructions on how many people will be needed for the installation (n=1). Clearer instructions on how to place the unit (n=3).

Post-installation

Almost all (91%) respondents said their unit worked properly after installation. Figure 17 shows participants' responses in more detail.

Figure 17. How units worked after installation (n=123)



Most units that did not work after installation, or worked after installation but broke later were saddlebag units (5 out of 6 units). The main issues with the saddlebag unit were:

- Participant was not able to put in the data line cable correctly (n=2)
- The unit is not blowing cool air (n=2)
- It set off the GFCI outlet (n=1)

Three of the respondents reached out to the manufacturer and reported receiving help to troubleshoot the system. All reported issues have since been resolved.

The other unit that did not work after installation was a U-shaped unit. This respondent reported that the system blew the fuse in each outlet they tried. It is unclear whether this issue has since been resolved.

Lastly, participants were asked about any changes they made to the unit post-installation. Most (78%) respondents did not have to make any adjustments to the unit since installation. Of those who did make adjustments (22%), the largest number of adjustments were required for Saddlebag units (n=14), followed by Portable units (n=6). Adjustments made to the units are shown in Table 10.

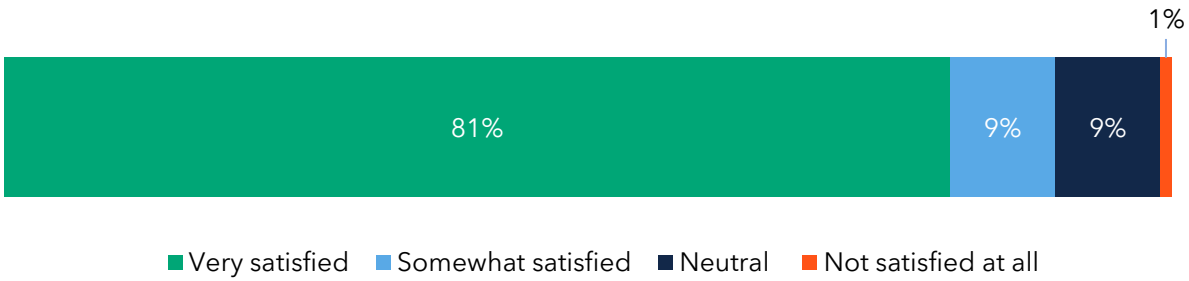
Table 10. Changes to the unit post-installation by unit type (n=20)

Unit Type	Changes made to the unit
U-shaped unit	Sealing additions (n=1) Had to cut side panel (n=1) Added extra supports to hold up the unit (n=1)
Portable unit	Adjustments reported but not specified (n=3) Had to cut side panel (n=2) Pressurized the heat extractor (n=1)
Saddlebag unit	Sealing additions (n=6) Security enhancements to the window itself (n=4) Replaced the unit/in the process of replacing (n=2) Added extra supports to hold up the unit (n=1) Adjusted the settings (n=1)
Window unit	Sealing additions (n=3)

Satisfaction with the unit

Overall, respondents were largely satisfied with their unit. Ninety percent of participants were satisfied, as shown in Figure 18. Almost all (97%) respondents would recommend the unit to friends or family members while the remaining respondents (3%) said their recommendation is to be determined/need more time using the unit.

Figure 18. Participant satisfaction with their unit (n=115)



4.2 User experience survey findings

The following sections explain the findings from the user experience survey that assessed consumer feedback after at least 30 days of room heat pump use during a cooling season. Table 11 outlines the number of survey respondents by type of unit installed.

Table 11. Survey respondents by unit type

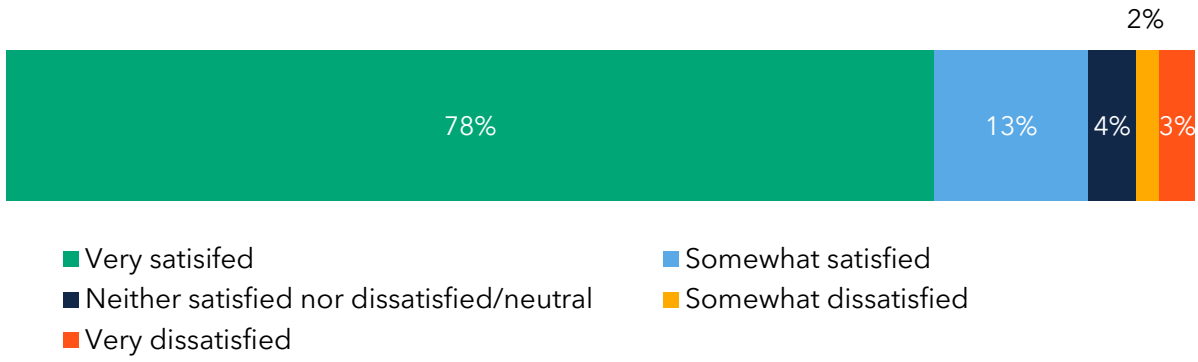
Unit type	Number of survey respondents
Saddlebag Unit	43
Portable Unit	28
U-Shaped Unit	18
Window Unit	6
Total	**95**

4.2.1 Satisfaction

Overall, consumers were satisfied with their room heat pumps after 30 days. This section breaks satisfaction ratings into 1) the cooling performance and 2) the technology. There were no significant differences in satisfaction ratings across heat pump types.

Respondents are largely satisfied with the heat pump cooling performance across types, with 91% reporting that they are satisfied. Figure 19 outlines the satisfaction ratings in greater detail.

Figure 19. Satisfaction with heat pump cooling performance (n=93)



Respondents were largely satisfied with all aspects of the room heat pump experience (installation, performance, comfort, and electric bills) across unit types, with 86% reporting that they are somewhat or very satisfied. Figure 20 and Figure 21 report the satisfaction ratings in greater detail.

Figure 20. Satisfaction with room heat pump overall (n=94)

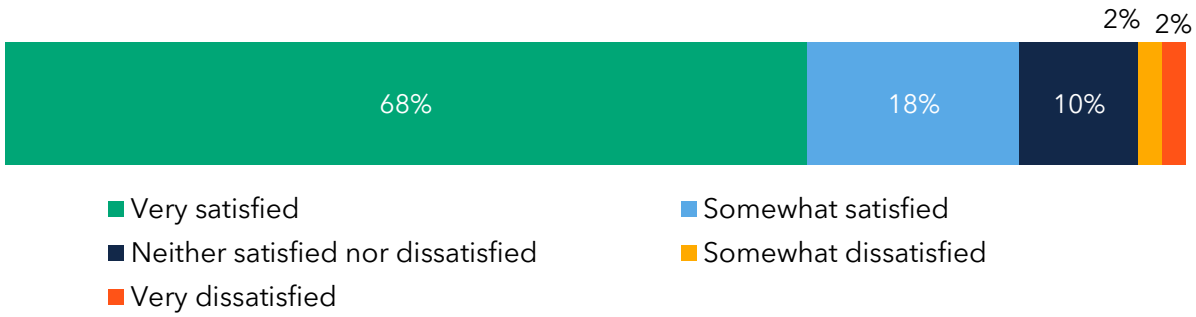
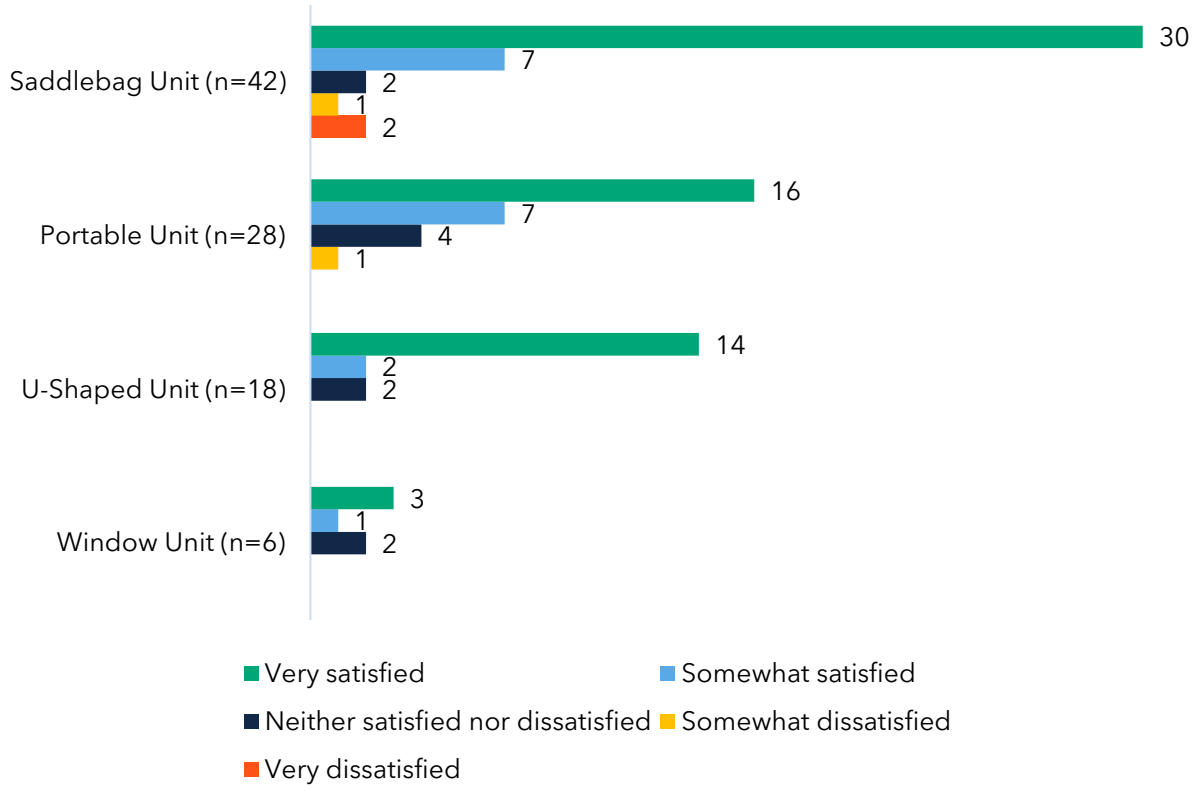


Figure 21. Satisfaction with room heat pump overall by unit type (n=94)



Respondents were then asked to select words that they would use to describe their room heat pump. Most respondents used positive words to describe their room heat pump, and very few used negative words to describe their room heat pump (see Table 12).

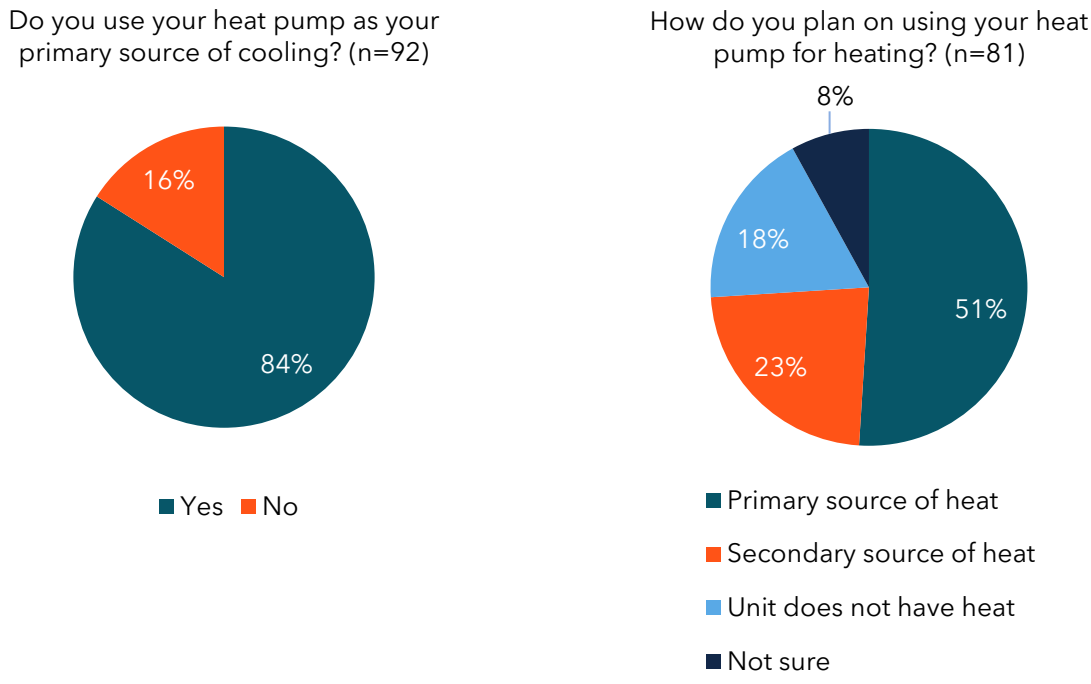
Table 12. Most common words used to describe room heat pump (n=95)

Positive words to describe heat pump	Negative words to describe heat pump
Good at keeping me comfortable (n=54)	Bulky (n=15)
Convenient (n=53)	Noisy (n=5)
Easy to use (n=53)	Unattractive (n=4)
Practical (n=50)	Inconvenient (n=2)
Innovative (n=45)	Impractical (n=1)

4.2.2 Room heat pump usage

The survey also sought to understand how consumers use, or plan to use, their room heat pumps. Most respondents (84%) use their room heat pump as their primary source of cooling. Moreover, most respondents plan to use their room heat pump as their primary or secondary heating source (74%), with just over half planning on using it as their primary source of heating (51%). This shows that respondents were planning on heavily relying on the room heat pump for their heating and cooling needs. Figure 22 summarizes heat pump usage and plans for future usage.

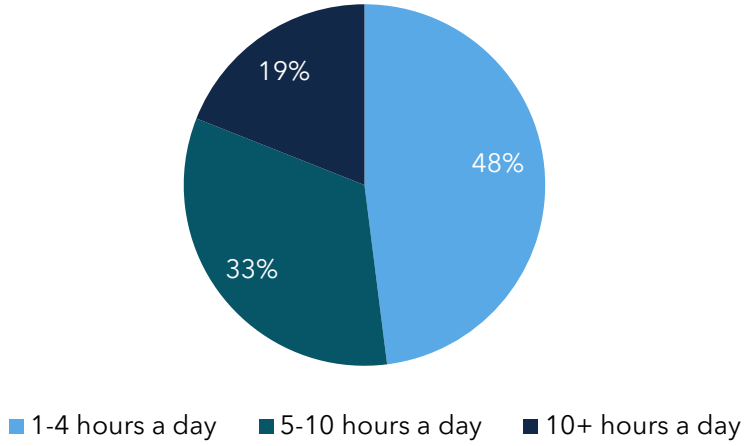
Figure 22. Heat pump usage for cooling and heating



Participants were also asked about the amount of time they used their heat pump. The highest proportion of respondents use their room heat pump for 1-4 hours a day (48%). Figure 23

provides more details on the hours of room heat pump usage. Of those who ran their unit for 10+ hours a day, respondents were mainly located in Los Angeles County.

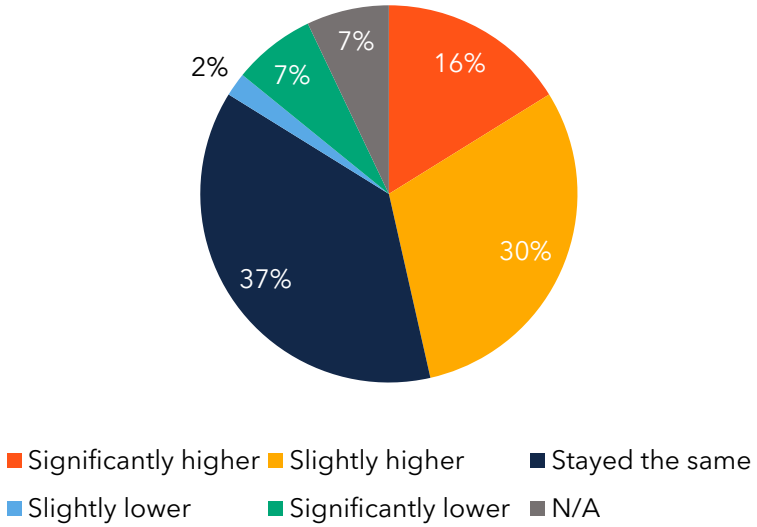
Figure 23. Hours of room heat pump usage (n=91)



4.2.3 Electricity bill impacts

The majority (94%) of respondents pay their own electricity bill. Almost half of respondents (46%) reported that their electricity bill was slightly (16%) or significantly (30%) higher since using their new heat pump (see Figure 24).

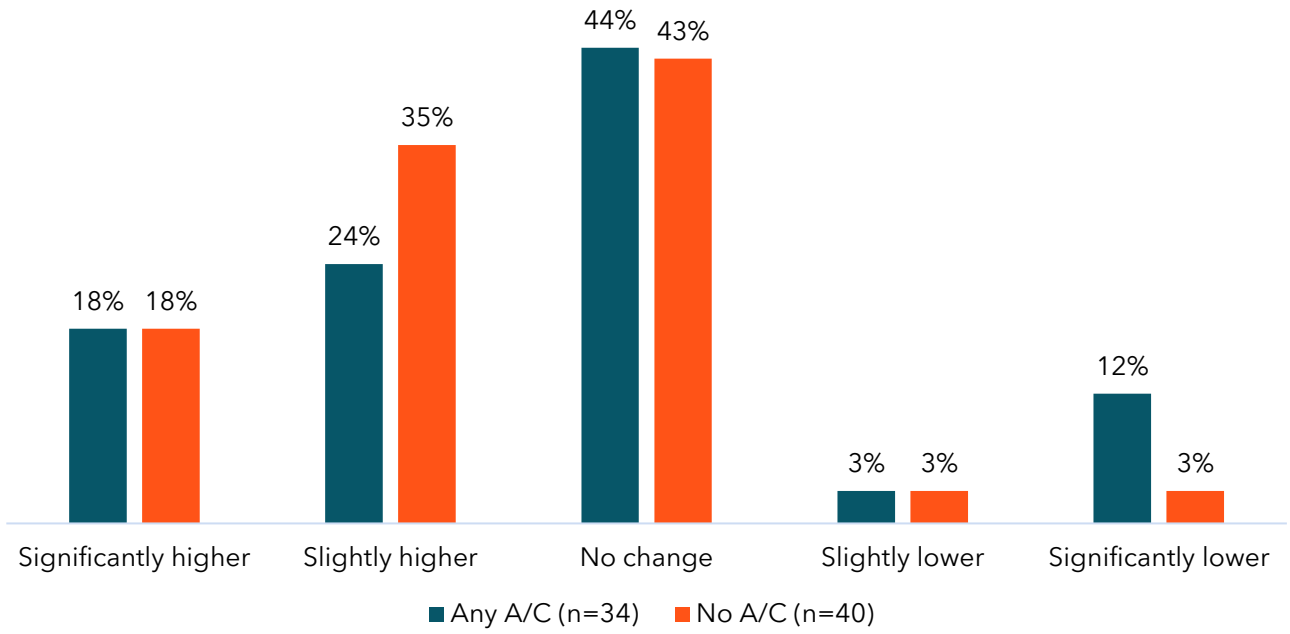
Figure 24. How has your electricity bill changed since installing your room heat pump? (n=87)



CalMTA analyzed reported bill changes by whether respondents had air conditioning prior to installing their room heat pump (Figure 25). A greater proportion (35%) of respondents who

previously had no air conditioning reported that their electric bill was slightly higher, compared to 24% of those who previously had air conditioning. However, 12% of respondents who previously had some type of air conditioning reported that their electric bills were significantly lower after using their new heat pump (Figure 25). Due to the limited number of respondents, these differences should be interpreted with caution. Collection of pre- and post-installation consumption data combined with assessment against a comparison group would be required to reliably assess impacts of the new equipment and was beyond the scope of this pilot report. Robust assessment of bill impacts and compilation of bill impact findings will occur during Phase III. Market Deployment of the MTI.

Figure 25. Reported change in electric bill after using RHP



4.2.4 Issues encountered with room heat pumps

As previously mentioned, satisfaction with the room heat pumps was high overall. However, six percent of survey respondents encountered an issue with their units. The issues were as follows:

- Customer was sent a defective unit (n=3)
- App-related issues (n=2)
- No installation instructions were sent with the unit (n=1)

These issues were reported to customer service representatives and were quickly resolved.

Respondents provided the following recommendations to further improve their experience with the room heat pumps:

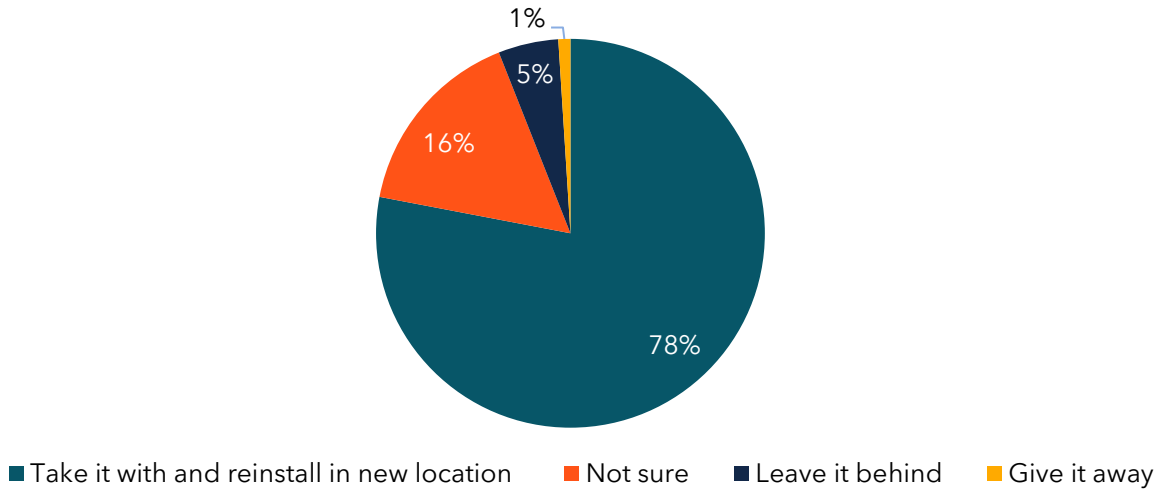
- Provide written installation and operation directions with the unit (n=4)

- Include more information in the instructional video (n=1)
- Provide more instructions in the app (n=1)

4.2.5 Moving the unit

One of the objectives of this survey was to understand the ease with which participants can move their room heat pumps. Participants were asked what they believe they will do with the room heat pump if they move. Most respondents (78%) believe that they will take the room heat pump with them and reinstall it in the new location. Figure 26 highlights the remaining responses.

Figure 26. What would you do with the room heat pump if you move? (n=85)



At the time of the survey, one month after installation, only six respondents had already moved the unit from the original location to a new location, usually a different room within the same home. Of these respondents, three found the move very easy (50%), two respondents found the move very difficult (33%), and one respondent found the move somewhat difficult. The main issue with moving the room heat pump was that participants could not move the unit by themselves.

Figure 27 outlines the ease of moving the unit broken down by the type of unit. Ratings were mixed across and within the unit types. A larger sample size of respondents will be required to pull stronger conclusions on the ease of moving units by type.

Figure 27. Ease of moving unit by type (n=6)

4.3 Partner findings

4.3.1 Window type distribution

During the recruitment phase, this pilot faced a barrier in locating compatible window types. All pilot models, except for the Portable Unit, require a single or double-hung window. All three local partners, located in various parts of the state, experienced significant difficulties finding homes with single or double-hung windows. Our partners found horizontal sliding windows were much more common than single or double-hung windows, especially in low-income neighborhoods. This helped to confirm a preliminary finding from the MTI Plan which demonstrated a large prevalence of horizontal sliding windows in the amount of 49% of the surveys collected. Discovering this finding again in our pilot has sparked additional research efforts by CalMTA to better quantify this issue to effectively demonstrate the need for new products to meet California's needs.

Initial outreach by the U.S. Green Building Council – CA (USGBC-CA) in Los Angeles County began with 176 properties (6,756 units). Eighty properties were immediately screened out for window type using assessment records or publicly available data. Of the remaining properties, USGBC was able to conduct window surveys in 20 properties and only found 9 compatible single or double-hung windows out of 162 total units. Ultimately, only two room heat pumps were installed via this pilot through this initial outreach effort. USGBC-CA's revised outreach tactic specifically targeted single or double-hung windows and this action required USGBC-CA to create a new pipeline and expand their search radius.

This issue was mirrored in San Mateo County when El Concilio surveyed windows for approximately 60 willing pilot participants in low-income neighborhoods in Redwood City, South San Francisco, San Mateo, and East Palo Alto. Only 1 window of the 60 surveyed residences was single or double-hung.

Redwood Energy in Humboldt County experienced similar issues with locating single and double-hung windows in their region. Their outreach began targeted at three potential apartment complexes with single and double-hung windows, but when Redwood Energy needed to find additional pilot participants, it was also difficult for them to locate compatible windows for their remaining units.

5 Summary of findings

The following section summarizes key findings from this evaluation of the Strategy Pilot.

Finding #1: Most pilot participants required some assistance with self-installation. The highest proportion of respondents needed assistance lifting the unit, or general assistance from others.

Finding #2: Participants with saddlebag units, u-shaped units, and window units most commonly had challenges lifting the unit for installation. Portable units, however, were rated as very or somewhat difficult to install by the highest proportion of respondents.

Finding #3: Participants reported high satisfaction with the heat pump cooling performance, as well as the room heat pump experience overall (i.e., installation, performance, comfort, and electric bills).

Finding #4: A few participants raised concerns, including operational problems that required troubleshooting from the manufacturer and window security.

Finding #5: Most participants plan to bring their room heat pump with them and reinstall it in a new location if they are to move.

Finding #6: Most participants (55%) had no AC prior to installing the RHP; room or portable AC were the most common types of air conditioning (31%) among participants who had it.

Finding #7: Natural gas was the predominant heating fuel (82%) among participants who reported having heat (86%).

Finding #8: Most respondents reported using their RHP as their main source of cooling and over half said they plan to use it as their primary source of heating.

Finding #9: When asked about electricity bill changes, 46% reported that their bills had increased at least slightly from prior to using their room heat pump.

Finding #10: The evaluation identified opportunities to improve instructional manuals, as well as identified the need for availability of products that fit horizontal sliding windows.

6 Conclusions and recommendations

Conclusion #1: The pilot validated the value proposition of RHPs. Pilot participants reported high levels of satisfaction with all aspects of room heat pump performance. It remains unclear whether RHP portability is a compelling value proposition. No participants in the sample had moved since receiving the heat pump, but most of them said they would take the room heat pump with them if they do move. Customers may perceive value in the ability to take room heat pumps with them if they move, but the pilot evaluation is inconclusive on this point.

> **Recommendation #1-1:** Reassess whether participants take the room heat pump with them when they move once more time has elapsed since pilot participation.
>
> **Recommendation #1-2:** Conduct marketing research specifically designed to identify compelling value propositions

Conclusion #2: Self installation of RHPs is feasible. Most participants required assistance with the installation, most commonly to help them carry and/or hold the unit during installation, or to work through the instructions. Assistance with lifting was required almost exclusively for the window units, while assistance with the installation instructions was most common with the portable units. There are several opportunities for manufacturers to improve the usefulness of installation instructions.

> **Recommendation #2-1:** Explore options for offering installation support for RHPs, such as offering installation or white-glove service. The need for an additional person to help with lifting, moving, and assembling consumer products is not uncommon, and many retailers and distributors are accustomed to offering this type of service.
>
> **Recommendation #2 -2:** Work with manufacturers to ensure the following improvements are made to installation information:
>
> - Written instructions are thorough and provided in accessible language with the room heat pump. Ensure that information on 1) how to install the heat pump, 2) how to use the heat pump, and 3) how to use the app for the heat pump operation are included.
> - More photos are included in the instructional manual.
> - How-to videos on how to install the heat pump are developed.
> - Have an instructional manual on how to use the app within the app itself.
> - Provide customers with realistic expectations about the amount of time installation takes and the number of people required for a typical consumer.

- Embed a video on the manufacturer website about how to install the unit, measurements, and window compatibility information. Additionally, work with the manufacturer to ensure that the video(s) are uploaded to YouTube as well, if possible.

Conclusion #3: Customers experienced performance issues with some early RHP product models. The CalMTA team should work with manufacturers to ensure they have addressed reported product performance issues as part of MTI market partner agreements.

Conclusion #4: Security concerns could pose a barrier to adoption for some customers.

> **Recommendation #4-1:** A window lock is an important aspect for customer safety. Work with manufacturers to ensure that either, 1) units come with a window lock, or 2) note in the installation instructions that a supplemental lock may be needed to ensure their window cannot be opened from the outside once the room heat pump has been installed.

Conclusion #5: Quantitative assessment of the impact of room heat pumps on electric bills was beyond the scope and design of this pilot and requires further study. Nearly half of pilot participants reported experiencing some increase in their electric bills after using their room heat pump, but the causes of the reported increase cannot be substantiated with the available pilot data.

> **Recommendation #5-1:** Evaluation of bill impacts, particularly for low-income customers, is a priority for the RHP MTI. CalMTA should compile available RHP bill impact assessments and identify information gaps; the RHP Collaborative provides an efficient node to assemble that information. The MTI should follow through on its plans to conduct robust assessment of bill impacts during Phase III. Market Deployment, to fill identified data gaps.

Conclusion #6: Future market adoption of room heat pumps will depend on the availability of products that fit horizontal sliding windows, which dominate California's residential building stock. The pilot validated that existing RHP units are not compatible with much of the existing window stock in California. All units in the pilot, with the exception of the Portable Unit, require a single or double-hung window. However, most windows encountered through the site qualification process were sliding windows.

> **Recommendation #6-1:** CalMTA should augment the window type research included in the 2024 market characterization survey to more fully characterize the window stock, so it can share that information with manufacturers and maximize influence on California appropriate product development.

About CalMTA

CalMTA is a program of the California Public Utilities Commission and is administered by Resource Innovations. We work to deliver cost-effective energy efficiency and decarbonization benefits to Californians through a unique approach called market transformation. Market transformation is the strategic process of intervening in a market to create lasting change by removing market barriers or exploiting opportunities, accelerating the adoption of identified technologies or practices. CalMTA-developed market transformation initiatives also aim to advance state goals on demand flexibility, workforce development and equity. Learn more at www.calmta.org.