



Peninsula Clean Energy Home Upgrade Program, June 2025

# 120-Volt Heat Pump Water Heater Pilot

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# 1 Executive summary

## Home Upgrade 120V HPWH pilot overview

120V heat pump water heaters (HPWHs) allow residents to seamlessly transition from gas water heaters to electric heat pumps by plugging into a regular electrical outlet. If installed correctly, 120V HPWHs provide customers with all their hot water needs while typically avoiding electrical panel service upgrade and/or panel replacement.

120V units also offer benefits in terms of installation time and may prove especially useful during emergency replacements by avoiding the need to coordinate a new electrical circuit.

However, 120V units cost roughly the same as 240V units. 120V HPWHs typically have high equipment costs and no circuit installation costs; 240V units have lower equipment costs but require circuit installation. These cost differences, in effect, cancel each other out, so the overall cost for both types of units is roughly the same.

240V units allow for greater flexibility for a home's hot water – they can essentially help generate more hot water, faster. Because of this flexibility and the similarities in costs, PCE will continue to focus on 240V HPWH installation. There are two scenarios where we will consider a 120V installation: if the circuit installation cost for a 240V is prohibitively complex and costly, or if a unit's electrical panel is at capacity.

Peninsula Clean Energy (PCE), as part of its mission to reduce greenhouse gas emissions and reinvest in the communities it serves, conducted a six-month Home Upgrade pilot to install and monitor the performance of seven 120V HPWHs. Peninsula Clean Energy has successfully leveraged 120V equipment in its EV charging program, so it explored if using 120V equipment in the home upgrade program has similar potential for success.

## Objectives & results

The 120V HPWH pilot aimed to achieve the objectives listed in Table 1 by installing and assessing 120V HPWHs.

Table 1: Home Upgrade 120V pilot objectives & results

Objective	Results
Install 120V HPWH in 5-10 homes	<ul style="list-style-type: none"> <li>Seven 120V HPWHs installed</li> </ul>
Provide evaluation of pilot implementation	<ul style="list-style-type: none"> <li>Customers reported expected access to hot water</li> <li>Overall positive customer experience reported in survey data</li> </ul>
Aim for an average installation budget lower than those for 240V installations	<ul style="list-style-type: none"> <li>65-gallon 120V HPWH cost about \$1,200 less to install than an equivalent 240V HPWH*</li> <li>80-gallon 120V HPWH cost about \$500 more to install than an equivalent 240V HPWH*</li> </ul>
Define applicable home scenarios for 120V water heaters	<ul style="list-style-type: none"> <li>1-2 bedroom homes</li> <li>Lower occupancy count, no more than 4 people</li> <li>120V circuit present</li> <li>Adequate room for larger 65- or 80-gal unit</li> <li>No other appliances on the same 120V circuit</li> </ul>

\*240V HPWH costs include all materials, labor, new 240V circuit, and permits.

## 2 Key findings & recommendations

The 120V HPWH pilot study revealed critical insights into ideal candidates and incentive estimates, as well as other observations. While these are addressed in various sections, a summary of the recommendations is provided in this section.

### Ideal candidates for 120V HPWHs

Home selection is essential to adequate hot water delivery. Richard Health Associates (RHA) recommends the following elements to maximize the benefits of 120V units:

- They are ideal for 1–2 bedroom homes with an occupancy of no more than four persons.
- There are no more than two bathrooms with showers in the home.
- 120V circuit is present. (If a dedicated circuit is needed, default to 240V unless panel capacity is highly constrained.)
- No other high electrical load appliances are on the same 120V circuit. (It is essential not to overload the circuit. Be aware of microwaves, power tools, gaming centers, or other significant loads on circuits. Be aware of using hair dryers or vacuums on the same circuit.)
- There must be adequate room for a 65- or 80-gallon unit. These larger sizes allow for extra hot water storage, decreasing the likelihood of running out of hot water.
- There must be adequate room volume for air flow or proper ducting of intake and/or exhaust air if in a constrained space.

#### Key findings

- Easier to install for emergency replacements
- Meet all hot water needs when installed in appropriate homes
- Faster installation due to no circuit requirements
- 120V HPWHs are similar in total cost or more expensive than 240V HPWH

### Installation recommendations

Installation recommendations are the following:

- Do not install in exterior closets or sheds due to lower performance at temperatures below 40°F.
- Avoid air blowing on or near occupants by ducting exhaust or relocating the system.
- Avoid noise complaints by installing with sound dampening equipment or relocating equipment.
- Install a 240V HPWH if a new circuit is required, unless panel capacity is constrained.

### 3 Results

This section summarizes the pilot’s outcomes and evaluates success based on the stated pilot goals. It presents the results of customer satisfaction surveys, final installation costs, and monitoring results on water heater performance for seven pilot participants.

### Pilot home details

Table 3 summarizes the water heater cost, total costs, and home details of all pilot participants.

Table 2: Home Upgrade 120V pilot home details & summary of work

	City	San Carlos	South SF	Pacifica	Millbrae	San Mateo	San Bruno	Half Moon Bay
Home details	Beds	2	3	3	3	3	2	2
	Baths	2	2	2	2	2	1	2
	Occupancy	4	1	1	1	4	2	1
	Sq. ft.	1500	1820	1200	1540	1620	1090	1000
	Vintage	1946	1972	1954	1956	1983	1940	1908
	Fuel	Methane gas (natural gas)						
	Panel size (amps)	200	100	100	200	100	125	100
Water heater	Water heating: Pre	NG,30g	NG, 38g	NG, 40g	NG, 40g	NG, 40g	NG, 40g	NG, 50g
	Water heating: Post	120V HPWH, 80g	120V HPWH, 80g	120V HPWH, 80g	120V HPWH, 65g	120V HPWH, 65g	120V HPWH, 65g	120V HPWH, 65g
Costs	Total HPWH (\$)	\$9,050	\$9,050	\$9,050	\$7,150	\$7,150	\$7,150	\$7,150
	Total incl. other elect. (\$)	\$9,050	\$10,015	\$9,050	\$9,690	\$35,609	\$9,165	\$22,050

\*NG: Natural Gas

# Installation

Costs and observations of the installation of seven 120V HPWHs are listed below. All HPWHs were intentionally upsized to account for first hour ratings in the California plumbing code. For reference, the code and upsizing breakdown is included in the Appendix.

## Installation costs

For the 120V pilot, Rheem ProTerra “shared circuit” 120V heat pump water heaters were installed in all seven homes. If a dedicated circuit was required, the home defaulted back to the main program for a 240V HPWH installation. The average material and labor cost across the seven 120V pilot water heater units are included in Table 6.

Material costs include:

- Water heater
- Additional materials (pipes, fittings, drain pans, strapping, etc.)
- Permitting
- Appliance recycling
- New circuit (240V only)
- Condensate pumps (not included, but can add up to \$500 to the cost)

Labor costs include:

- Journeyman labor rate
- Apprentice labor rate
- Travel, including delivery and recycling

Table 3: 120V HPWH installation

Size	Category	Amount
65-gallon	Materials	\$4,153
	Labor	\$2,997
	<b>Total</b>	<b>\$7,150</b>
80-gallon	Materials	\$4,777
	Labor	\$4,273
	<b>Total</b>	<b>\$9,050</b>

## Incremental cost & rebates

The 2023–2024 round of TECH Clean California rebates were \$4,885 per water heater for equity participants. This 120V HPWH pilot study leveraged seven of those rebates for a total of \$34,195. At the \$4,885 rebate level, a participant would be asked to provide about half of the cost of the water heater.

By comparison, the average cost across 15 80-gallon 240V HPWHs in the main program was \$8,569 (including 240V circuit and permits), indicating that the 80-gallon 120V HPWH cost about \$500 more than a 240V HPWH. The average cost across 13 65-gallon 240V HPWHs in the main program was \$8,392 (including 240V circuit and permits), indicating that the 65-gallon 120V HPWH cost about \$1,200 less than a 240V HPWH. Additionally, RSMeans *Contractor’s Pricing Guide*<sup>1</sup> data, as well as San Mateo County contractor estimates, indicate that the typical cost in San Mateo County to replace a 50-gallon natural gas burning water is heater is \$2,870.

<sup>1</sup> RSMeans *Contractor’s Pricing Guide: Residential Repair & Remodeling Costs 2023, 50 gallon: 113015237300*

Incremental costs for replacing natural gas burning water heaters with both 120V and 240V heat pump technology are listed in Table 7.

Table 4: HPWH installation costs relative to natural gas water heater replacement

Size	Category	120V	240V
65-gallon	Installed cost	\$7,150	\$8,392
	Natural gas replacement	\$2,870	\$2,870
	<i>Incremental cost</i>	<b>\$4,280</b>	<b>\$5,522</b>
80-gallon	Installed cost	\$9,050	\$8,569
	Natural gas replacement	\$2,870	\$2,870
	<i>Incremental cost</i>	<b>\$6,180</b>	<b>\$5,699</b>

### Installation observations

The following observations were noted during the installation process:

- Gas lines may need to be relocated if they serve more than the water heater.
- Wi-Fi continuity is problematic. RHA has experienced issues with Wi-Fi modules, as well as weak or intermittent connections due to location (e.g., garage, outside closet).
- Customer education is essential and multi-step, especially for certain customers who may not be comfortable with new technologies or who have language barriers. Even when presented with information in writing, verbally over the phone, and in person, some customers do not understand the basics of a new water heater and require multiple interventions before they understand the interface. Customers need to be trained more on mixing valves and how to safely adjust temperatures.
- Plumbing for drain, T&P, and condensation sometimes requires additional work. For example, a condensate pump may need to be added, and routing to a location acceptable to the local jurisdiction can be difficult or costly.
- Early findings show 120V installations are not necessarily cheaper than 240V installations. While there are savings due to not running a circuit, the equipment itself is more expensive. We do not have conclusive reasoning for why the equipment is more expensive, but we suspect that the manufacturers may be capturing some of the theoretical installation savings.
- 80-gallon units cost more due to equipment and require two workers due to the size of the unit. A 65-gallon unit can often be installed by a single person.

## Customer concerns

Throughout the pilot, RHA addressed customer concerns by providing clear messaging and resolutions.

### **Customer: Will my bill go up?**

You will see an increase in your electric bill, but you will see a decrease in your gas bill. In most cases, the total bill costs go down, but that could vary depending on your hot water usage. In PG&E territory, ensuring the customer is on an electrification-friendly rate (like EV2A) will help ensure savings.

### **Customer: Why does my water heater have a mixing valve?**

Mixing valves installed at the exit of the water heater ensure a constant safe outlet water temperature to prevent scalding. Additionally, adding a thermostatic mixing valve allows one to safely to increase hot water temperature to 140°F which helps increase hot water amount.

### **Customer: What happens when the power goes out?**

In the event of an electric power outage, you will not be producing any more hot water; however, the storage tank will keep the water hot for four hours or more, depending on the insulation of the tank. It is important to note that you will have limited hot water. For safety reasons, please limit hot water use during a power outage.

## Water heater performance

Performance was assessed from participant feedback and analysis of consumption data. All seven 120V HPWHs provided adequate hot water for each of the participating home's needs.

### Key findings

- No customers reported cold water events. A sampling of the data confirms that upper tank temperatures generally stayed within standards for hot water, as evidenced in Table 8 and Figure 2 below.
- Two customers experienced tank temperatures below 105°F more than 2% of the time during the monitoring period.
- Only one customer experienced tank temperatures below 105°F more than 20% of the time and did not report cold water events to RHA.
- Average consumption was 1.66 kWh per day with an average standby power draw of 20 watts and an average operating draw of 435 watts, which was lower than anticipated.
- The average recovery time after a draw event was between 3–4 hours, depending on the volume of the draw event.

## Consumption data

Water temperature and power consumption data for all water heaters were logged via the Rheem EcoNET cloud-based monitoring platform. The likelihood of a cold-water event increases the longer the tank temperature is below 105°F. Water heater tank temperature was set to 120°F; as well as the mixing valves. Table 8 includes the frequency a customer dropped below 105°F (an indicator of potential inadequate hot water).

Table 5: Frequency of a possible cold water event & power consumption

	San Carlos	South SF	Pacific a	Millbrae	San Mateo	San Bruno	Half Moon Bay	Avg
Percent of time <105°F	NEVER	NEVER	21%	2%	1%	NEVER	0.2%	--
Upper tank temp (°F)	N/A	N/A	98	99	96	N/A	102	--
Average consumption (kWh per Day)	1.27	2.16	1.36	0.51	2.08	2.68	1.55	<b>1.66</b>
Standby power (W)	18	32	20	16	20	17	18	<b>20</b>
Heating power (W)	437	455	448	425	434	413	436	<b>435</b>

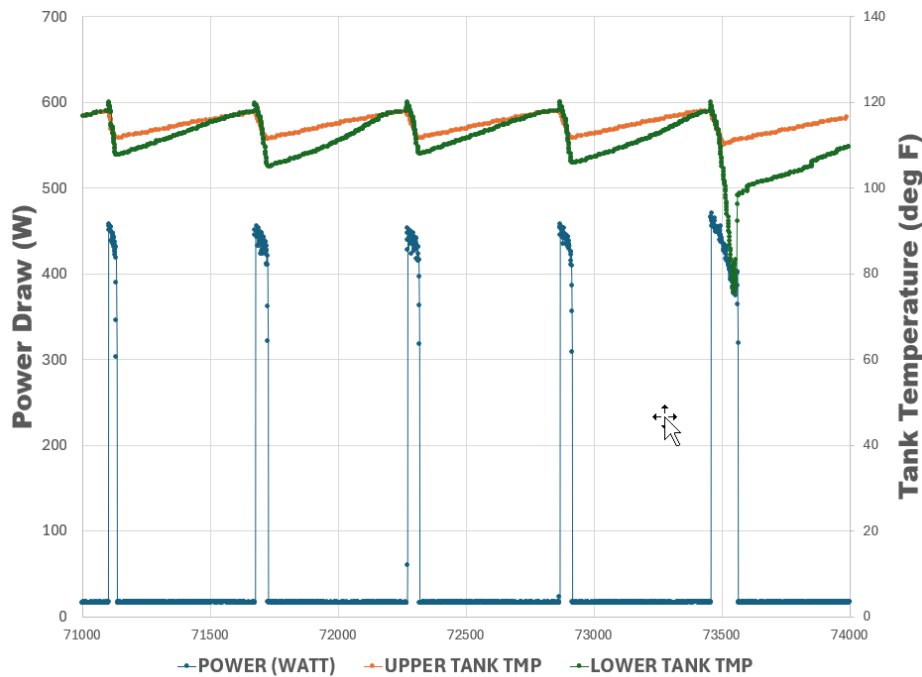


Figure 1: 120V tank temperature & power draw over a one-week period

## Participant feedback

Participants were given the opportunity to respond to both quantitative and open-ended questions at the one month and six-month mark after their water heater was installed. All seven participants responded to both surveys. For survey results, please see the Appendix.

Figure 3 below shows the average responses to the six-month post-upgrade survey questions. An overall satisfaction rating of 4.9 (out of 5) was given for the home meeting the hot water needs, indicating that even after six months, no significant cold-water events were experienced. The overall satisfaction scores were lower after six months, with the main concerns being either utility bill increases or cold air. Both issues could potentially be remediated with ducting.

It should be noted that the negative responses are not unique to 120V units but are general concerns about HPWHs.

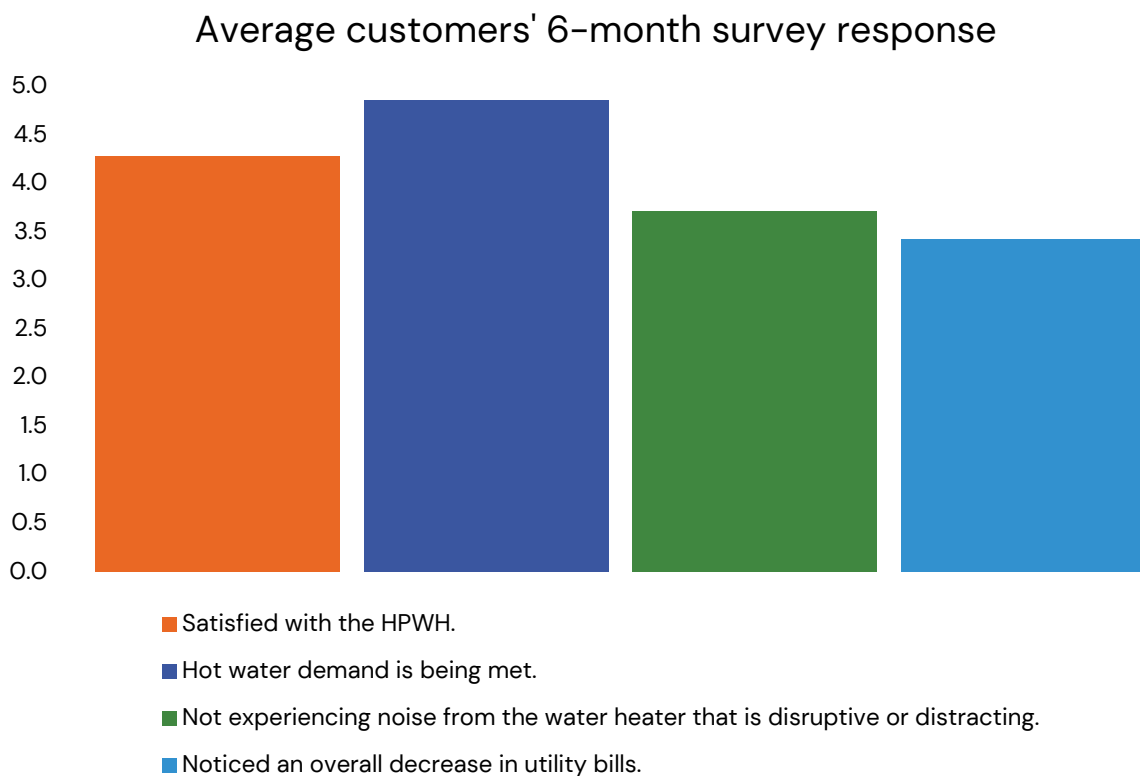


Figure 2: Summary of six-month survey results

## Key takeaways: Survey excerpts

The following survey excerpts highlight some key observations from the surveys' open-ended responses, indicating both positive customer experiences and areas for improvement.

**Q: "Do you have any additional comments or suggestions for how we can improve your experience with the Home Upgrade Program?"**

"Tell people ahead of time that the water heater blows very cold air out into the room as it periodically cools itself. It even makes some of the surrounding lightweight objects blow in the cold breeze. Not good for my heating bill."

-Millbrae Customer, 1-month survey response

**Q: "What has your experience with the water heater been like so far? What do you like or dislike about it?"**

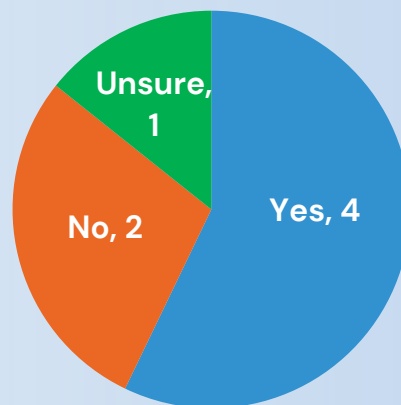
"I dislike the noise, but I like that I can turn it off if it is distracting me. I like that it is now possible to close off the vent pipe through the roof."

-Pacifica Customer, 6-month survey response

"I like it because it provides stable hot water. The noise is weird. It would good if the noise made music so everyone could be happy."

-San Bruno Customer, 6-month survey response

**Q: "I would recommend a heat pump water heater to others. Yes or no?"**



## 4 Final observations

Seven homes in a single climate zone constitute a small sample size to derive many data-driven conclusions, but the pilot outcomes and anecdotal information validates observations made in other programs and larger data sets for 120V HPWHs.

1. 120V HPWHs provide a solution for home configurations with an available circuit in place and do not have adequate space to upsize.
2. There is not a compelling cost difference compared to installing 240V units due to upsizing, manufacturer margins, and other factors. This is validated by external conversations with other contractors outside of the PCE pilot.
3. None of the customer concerns are unique to 120V units when the proper customer selection is done.
4. Larger homes with more than two bathrooms, longer hot water runs, and more occupants are not recommended for 120V units. Data shows there may be some room to loosen criteria, but that should be done cautiously to avoid borderline thresholds that could lead to cold water events.

## 5 Appendix A

### Participating homes

#### San Carlos

- Vintage: 1946
- Home (sqft): 1500
- Bed/bath: 2/2
- Occupancy: 4
- Fuel: Natural gas
- Panel (A): 200
- Existing water heater
  - Type/size/age: Rheem, 29gal, 2008
  - Location: Workshop/in-law unit
  - 120V circuit is present: Yes
  - Recirculation pump: No
  - Space constrained: No
- Replacement water heater
  - Type/size: Rheem 120V-80 gal
  - Location: Workshop/in-law unit
  - Installation date: 10/20/2023
  - Associated electrical remediation: None
- Notes:
  - This HPWH will be serving the laundry in an in-law unit.



## South San Francisco

- Vintage: 1972
- Home (sqft): 1820
- Bed/bath: 3/2
- Occupancy: 1
- Fuel: Natural gas
- Panel (A): 100
- Existing water heater
  - Type/size/age: GE, 38gal, 2011
  - Location: Garage
  - 120V circuit is present: Yes
  - Recirculation pump: No
  - Space constrained: No
- Replacement water heater
  - Type/size: Rheem 120V-80 gal
  - Location: Garage
  - Installation date: 10/18/2023
  - Associated electrical remediation: None



- Notes:
  - Participant expressed concerns about what happens if the power goes out.
  - An existing sprinkler and gas line were in the way of the 80-gallon replacement water heater. The gas line was moved to accommodate the replacement.

## Pacifica

- Vintage: 1954
- Home (sqft): 1200
- Bed/bath: 3/2
- Occupancy: 1
- Fuel: Natural gas
- Panel (A): 100
- Existing water heater
  - Type/size/age: State, 40gal, 1996
  - Location: Garage
  - 120V circuit is present: Yes
  - Recirculation pump: No
  - Space constrained: No
- Replacement water heater
  - Type/size: Rheem 120V-80 gal
  - Location: Garage
  - Installation date: 10/17/2023
  - Associated electrical remediation: None



- Notes: Recommended 80 gal as the participant entertains company frequently.

## Millbrae

- Vintage: 1956
- Home (sqft): 1540
- Bed/bath: 3/2
- Occupancy: 1
- Fuel: Natural gas
- Panel (A): 200
- Existing water heater
  - Type/size/age: GE, 40gal, 2003
  - Location: Laundry closet
  - 120V circuit is present: No
  - Recirculation pump: No
  - Space constrained: No
- Replacement water heater
  - Type/size: Rheem 120V-65 gal
  - Location: Laundry closet
  - Installation date: 10/25/2023
  - Associated electrical remediation: Extended existing circuit/outlet from opposing wall, \$500
- Notes:
  - This was a high need customer with an aging water heater.
  - They required a 120V extension circuit.
  - There were multiple issues with WIFI connection to the monitoring equipment. Intermittent WIFI connection issues continued even after Larratt replaced the circuit board.



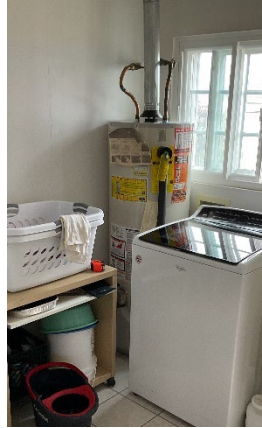
## San Mateo

- Vintage: 1983
- Home (sqft): 1620
- Bed/bath: 3/2
- Occupancy: 4
- Fuel: Natural gas
- Panel (A): 100
- Existing water heater
  - Type/size/age: Unknown, 40gal, unknown
  - Location: Garage
  - 120V circuit is present: Yes
  - Recirculation pump: No
  - Space constrained: Yes (see note)
- Replacement water heater
  - Type/size: Rheem 120V-65 gal
  - Location: Garage
  - Installation date: 10/19/2023
  - Associated electrical remediation: Move appliances
- Notes:
  - The refrigerator had to be relocated to accommodate the HPWH.



## San Bruno

- Vintage: 1940
- Home (sqft): 1090
- Bed/bath: 2/1
- Occupancy: 2
- Fuel: Natural gas
- Panel (A): 125
- Existing water heater
  - Type/size/age: GE, 40gal, 2009
  - Location: Laundry
  - 120V circuit is present: Yes
  - Recirculation pump: No
  - Space constrained: No
- Replacement water heater
  - Type/size: Rheem 120V-65 gal
  - Location: Laundry
  - Installation date: 10/25/2023
  - Associated electrical remediation: None
- Notes:
  - Multiple appliances (rice cooker and another small appliance) were plugged into the plug that would be used for the water heater.



## Half Moon Bay

- Vintage: 1908
- Home (sqft): 1000
- Bed/bath: 2/2
- Occupancy: 1
- Fuel: Natural gas
- Panel (A): 100
- Existing water heater
  - Type/size/age: GE, 50gal, 1996
  - Location: Laundry
  - 120V circuit is present: No
  - Recirculation pump: No
  - Space constrained: No
- Replacement water heater
  - Type/size: Rheem 120V-65 gal
  - Location: Laundry
  - Installation date: 11/04/2023
  - Associated electrical remediation: Extend existing circuit from opposing wall
- Notes:
  - This was a high need customer with an aging water heater.
  - They required a 120V circuit/outlet extension.



## 6 Appendix B

### Installed equipment

All Home Upgrade main program measures were installed per the Program Technical Design Guide in the categories of electrification, energy efficiency, and health and safety measures. For this 120V pilot, a Rheem ProTerra shared circuit 120V heat pump water heater was installed. Only 15A shared circuit water heaters were considered for the pilot. If a dedicated circuit was required, the home defaulted back to the main program for a 240V HPWH installation.

Table 2: Home Upgrade 120V Rheem HPWH

Specification	Rheem
Nominal voltage/ circuit	120V, 15-amp breaker size (shared circuit)
Nominal capacity	65 & 80 gallons
Model number(s)	PROPH65 TO RH120-M PROPH80 TO RH120-M
UEF	3.3 (65g) & 3.5 (80g)
First hour rating GPH	55 GPH (65g) & 72 GPH (80g)
HPWH only cost	\$2,765-\$3,265 (depending on capacity)

The first hour rating was no less than the current chapter 5 of California Plumbing Code minimum guidelines, as summarized in Table 11.

Table 11: California plumbing code first hour rating

Number of bathrooms	1 to 1.5			2 to 2.5				3 to 3.5			
Number of bedrooms	1	2	3	2	3	4	5	3	4	5	6
FHR (gal./hr.) <sup>2</sup>	38	49	49	49	62	62	74	62	74	74	74
120V upsized capacity (gal.)	50	50	50	50	65	65	80	65	80	80	80

<sup>2</sup>First hour rating (expressed in gallons per hour) is the amount of hot water the heater can supply per hour (starting with a tank full of hot water).

# 120V HPWH pilot fact sheet



05\_PCE\_HUP 120v  
Fact Sheet \_20230623

## Customer satisfaction survey responses

Each participant's responses to the one-month and six-month customer satisfaction surveys are included below. The responses to open-ended responses are included, as well.

### Numerical scores: One-month survey

Table 11 lists each participant's responses to the one-month post-upgrade survey questions.

Table 3: Detailed one-month survey results

	San Carlos	South SF	Pacific a	Millbra e	San Mate o	San Bruno o	Half Moon Bay	Avg (1-5 score)
The water heater meets the hot water needs of our household.	5	5	5	5	5	4	5	4.9
I am not experiencing noise from the water heater that is disruptive or distracting.	4	5	1	2	5	3	4	3.4
I am happy with the upgrades I was provided through this program.	5	5	5	5	5	5	5	5.0
							<b>Overall</b>	<b>4.4</b>

## Numerical scores: Six-month survey

Table 12 lists each participant's responses to the 1-month post-upgrade survey questions.

Table 4: Detailed six-month survey results

	San Carlos	South SF	Pacifica	Millbrae	San Mateo	San Bruno	Half Moon Bay	Avg (1-5 score)
I am satisfied with my new heat pump water heater.	5	5	5	1	5	5	4	4.3
The water heater meets the hot water needs of our household.	5	5	5	5	5	5	4	4.9
I am not experiencing noise from the water heater that is distracting or disruptive.	5	5	2	1	5	3	5	3.7
I have noticed an overall decrease in my utility bills.	5	4	3	1	5	4	2	3.4
							Overall	<b>3.9</b>

\*Access to the EcoNET phone application had not yet been given to the participants when this survey was distributed. All participants have been educated and since been given the opportunity to use the EcoNET app.

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