

# Electrify Everything: Heat Pump Water Heater

By Joel Rosenberg, Rewiring America

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Written by Joel Rosenberg  
Edited by Laura Fraser  
Designed by Taylor Roy (Amended by Rewiring America)  
Illustrated by Brian Ritter

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# Heat Pump Water Heater



## RECOMMENDATIONS:

**COLD CLIMATE:** 240V / 15A, with a larger tank and a mixing valve.

**WARM CLIMATE:** Forthcoming retrofit-ready 120V / 15A version, or 240V / 15A, with a larger tank and mixing valve.

**ALL CLIMATES:** Plan where the condensed water will go (it dehumidifies).

**AVOID:** 240V / 30A Heat Pump Water Heater — just get a larger tank.

**AVOID:** Tankless water heater, even if it's electric. A tank will also provide you with backup water in an emergency or natural disaster.

**AVOID:** Solar Thermal water heating — it's much more expensive, much more complicated, and performs worse than a Heat Pump Water Heater.

Compared to switching your home heating and cooling to a heat pump, getting a Heat Pump Water Heater (HPWH) is MUCH more straightforward. It's more like simply replacing your boiler with another one, with a few

**DIFFICULTY:** EASY

**UPFRONT COST:** \$1,500 (DIY) to \$6,500 installed

**IMPACT:** High

**CONTRACTORS:** Plumber (might subcontract electrician if necessary)

**DO NOW:** Find your current water heater and determine how old it is (see below for instructions). Plan to replace it if it's over 10 years old.

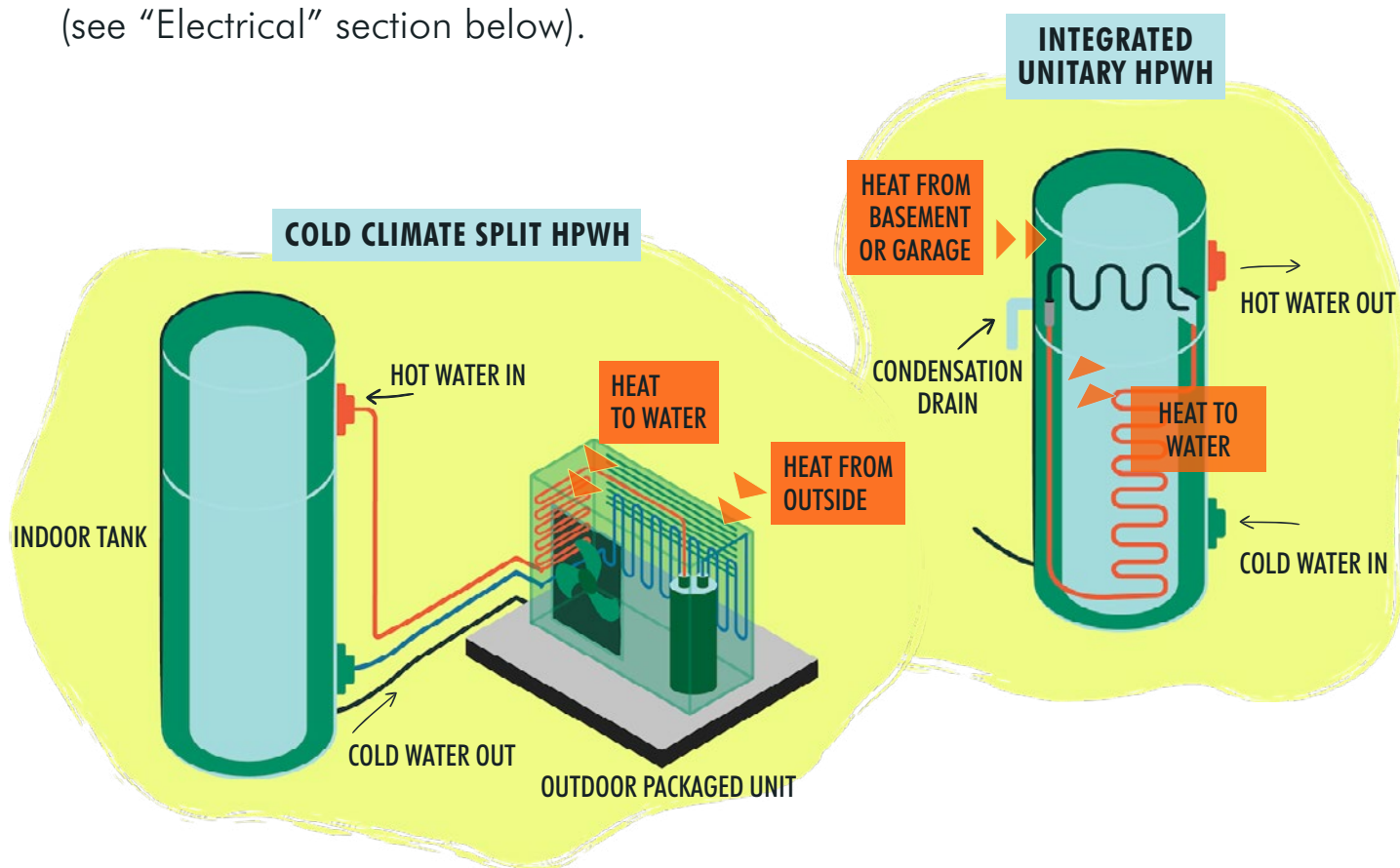
**RENTER:** Show your landlord heat pump replacement options & EnergyGuide savings.

additional considerations. And since your water heater is 10% of your home’s emissions, it’s a great one to target for electrification. Depending on your hot water use, a HPWH might save you hundreds of dollars a year on your utility bill, which would pay for itself in only a few years.

The HPWH works the same as an air source heat pump for space heating, except it doesn’t reverse direction to also cool the water. The heat pump is either integrated with the tank, or it’s split from the tank for colder climates.

Natural gas water heaters last between 8-12 years. You might be able to see how old your existing one is — and how close to replacement it is — by looking at its attached manufacturer label. If the label isn’t there, you can try to decode the serial number using data from this site — [hotwatersolutionsnw.org/news/how-old-is-my-water-heater](http://hotwatersolutionsnw.org/news/how-old-is-my-water-heater).

Before your current water heater fails, you should pick a tank size, pick a location that has enough space heat available, and decide if you want a 240V HPWH, or a forthcoming 120V retrofit-ready version (see “Electrical” section below).



## TANK SIZE

Think of HPWHs as water-based batteries that store energy as hot water instead of electricity. Larger tanks are more efficient, store more hot water, and can help reduce costs by avoiding higher time-of-use electricity rates. Therefore,

your tank size should be a similar size or larger than your existing tank — 80 gallons is a good target if you can fit it. If you currently have a tankless water heater, you'll need a place to put a tank, such as a basement or garage.

**A note on Tankless (aka Demand) water heaters:** Tankless water heaters have been billed as more efficient than Tank (aka Storage) natural gas water heaters, since there is no heat loss from hot water waiting in the tank to be used. But HPWHs are much more efficient than either Tank or Tankless water heaters. Since the heat comes from the surrounding air for the HPWH, any heat loss can just be pumped back into the water to maintain it at a given temperature. In fact, bigger tanks kept at higher temperatures are the MOST efficient.

Here's more info from the Department of Energy on sizing a water heater — [energy.gov/energysaver/sizing-new-water-heater](https://energy.gov/energysaver/sizing-new-water-heater). If you work with a contractor, they should be able to recommend a unit, and you can double-check that it's a good fit.

## GETTING MORE HOT WATER

You can use any of these methods individually or combined to get more hot water from your HPWH:

1. Set the tank to a higher temperature like 140°F. Use a mixing valve to mix it with cold water down to 105°F to avoid scalding, and to make the hot water last longer. This is a best practice that your installer should do whether you need more hot water or not.
2. Select a larger volume tank, such as 80 gallons if you have space. Bigger is better — especially if you're considering a 120V "retrofit-ready" model (see "Electrical" section below).
3. Select a higher power HPWH that is 240V / 30A. This will use more power, and need more space on your electrical panel, but does give you more hot water. This is not recommended for most homes. Even in cold climates a 240V / 15A HPWH should be enough.

## REDUCING YOUR HOT WATER NEEDS

It's worth pointing out that when upgrading to a HPWH, it also makes sense to reduce your need for hot water, which will allow you to buy a lower-power (240V / 15A, or 120V / 15A) unit. This includes fixing leaks, installing low-flow water faucets & aerators, low-flow shower heads, and getting energy

efficient dishwashers and clothes washers (and washing clothes using cold water instead of warm or hot).<sup>1</sup> Renters can do this too.

## **SPACE CONSIDERATIONS**

Since the heat pump is removing heat from the air, the space your HPWH is in needs to be big enough to have enough air to supply the heat. Or if you put it in a smaller space, there needs to be some ventilation to a larger space. A room 10-foot x 9-foot x 8-foot or larger is recommended, ideally one that stays above 45°F all year. Your HPWH also needs enough clearance around it, perhaps 3-feet on the air-inlet side, 5-feet on the air-discharge side, and 6-inches from the back wall.<sup>2</sup> In a warmer climate, the garage can be a good location, and in a colder climate, the basement.

One major advantage of a HPWH vs. a gas boiler is that there is no exhaust from burning fossil fuel that needs to be vented outside. This lets you put the unit anywhere you'd like, and if you're installing a new outlet, you have a lot of flexibility in its placement.

Since the heat pump is acting like an air conditioner for the space it's in, it will also dehumidify the space, which can be another advantage for a damp space like a basement or garage. But you'll need to plan for how to handle drainage for the water that's removed from the air.

Avoid putting a HPWH next to a bedroom if possible, since the noise and vibration, while not too significant, might be disruptive to someone trying to sleep.

## **COST & REBATES**

HPWHs cost between \$1,500-\$2,500, which is more than many natural gas water heaters, but can be much cheaper to operate than a gas water heater. In addition, rebates between \$300-\$1,500 — which can be the whole cost of the HPWH — are becoming available. Check with your utility and state for rebates, and ask your contractor for help identifying and getting the rebates.

If you need to add a 240V outlet, an electrician might charge \$200-\$500 and take a couple hours.



## ELECTRICAL

Many HPWHs require 240V single-phase electricity, and either a 30A or 15A circuit breaker. This requires them to either be installed near an existing 240V appliance-style outlet, or for a new 240V circuit to be installed. If you're having other electrical work done, consider having your electrician install a 240V circuit for a future HPWH at the same time.

"Retrofit-ready" 120V / 15-20A models are becoming available in 2021 from companies like Rheem, GE, and A.O. Smith. The big advantage is that they will have a cord and plug into a regular 120V outlet that's either dedicated to the water heater or shared with other appliances. It will not require an electrician, which can be a big hurdle when your water heater breaks and it's an emergency situation. The tradeoff is that the 120V HPWH is slower to heat water, but a bigger tank will provide more hot water (see "Getting more hot water" section above).

When shopping for a HPWH, get either a 240V / 15A version, or a 120V / 15-20A version, and the biggest tank you can fit. They'll use less energy, and take up less space on your electrical panel.

## PERFORMANCE

The "First Hour Rating" of the HPWH is the amount of water it can deliver in an hour of usage, and can be larger than the tank capacity since the tank can

be heating the incoming cold water as hot water is used. On the EnergyGuide shown to the left, the tank size is 72 gallons, but the First Hour Rating is 87 gallons. Since most U.S. households use about 65 gallons a day, this should be plenty of hot water, especially if used with a mixing valve (see "Getting more hot water" section above).<sup>3</sup>

The Uniform Energy Factor (UEF) is a measure of the energy efficiency of the HPWH. Look for a UEF of at least 3.1. The EnergyGuide label to the left lists the UEF as 4.



## **HYBRID HPWH WITH RESISTANCE BACKUP**

Many HPWHs are “hybrid,” meaning that in addition to the heat pump there is also a resistance heater that will come on if the heat pump can’t source enough heat from the room to maintain the setpoint temperature. The resistance heater can be configured to not turn on, and it will still produce plenty of hot water.

For reference, each resistance backup strip uses 15A. So the 240V / 30A hybrid HPWH has two strips, the 240V / 15A HPWH has one strip, and the 120V retrofit-ready HPWH has no resistance backup at all.

## **COLD CLIMATE HPWH**

While most HPWHs integrate the heat pump and tank into a single unit, the SANCO2 is a split unit that uses CO2 as the refrigerant, and works well in very cold climates, down to -30°F.<sup>4</sup> Other cold-climate models are also becoming available.<sup>5</sup> These units are currently more expensive, and may not be necessary if you can locate a HPWH in your basement or garage that stays above 45°F. But it’s worth considering if you live in a very cold location.

## **DIY INSTALLATION**

If you have a 240V outlet available, or you go with a 120V version, you could potentially install a HPWH yourself. This “Installation Best Practices” guide might be helpful if you want to go that route, or if you just want to know what your contractor is (or should be) doing — [hotwatersolutionsnw.org/preview/resources/best-practices-installation-guide](https://hotwatersolutionsnw.org/preview/resources/best-practices-installation-guide).

## **CONTRACTORS AND INSTALLATION**

Most people will have their HPWH installed by a licensed contractor or licensed handyperson. The HPWH needs to be connected to the electrical service panel, and the existing gas line to your gas water heater needs to be capped. It can take from one to several hours to install.

If you go with a contractor/handyperson, you should get recommendations from friends and family, and then interview them, check references, and request written quotes from at least three of them. You should also check their license status with your state license board, and check for complaints with the Better Business Bureau.<sup>6</sup>



Here are some questions to ask HPWH installers during the interview:<sup>7</sup>

- How many HPWHs have you installed?
- Which model and size do you recommend and why?
- Where do you recommend the unit be installed?
- Where will the condensate drain to?
- Will you be installing a mixing valve?
- Will any electrical upgrades be needed at the installation location or the electrical service panel? Will the cost of the electrical work be included in the estimate?
- Will you help me get all rebates available to me?
- How do you recommend I operate the HPWH for optimal performance and cost savings?

## LIFETIME USE

Heat pump water heaters will last between 10-15 years. They often have a 10-year warranty, and should last longer than gas boilers.

You should clean the heat pump air filter regularly — check the manual for a schedule. You can also consider discharging water from the tank regularly, descaling the tank,<sup>8</sup> and having the unit inspected annually, or as recommended by the manufacturer.<sup>9</sup>

## USEFUL RESOURCES

- Carbonswitch Buyer's Guide — [carbonswitch.co/heat-pump-waterheater-buyers-guide](https://carbonswitch.co/heat-pump-waterheater-buyers-guide)
- Silicon Valley Clean Energy's HPWH Buyer's Guide — [svcleanenergy.org/wp-content/uploads/2020/02/Heat-Pump-Water-Heater-Buyers-Guide-Digital-Updated-2020.pdf](https://svcleanenergy.org/wp-content/uploads/2020/02/Heat-Pump-Water-Heater-Buyers-Guide-Digital-Updated-2020.pdf)
- To search for a unit, use CEE's (Consortium for Energy Efficiency) Directory of Efficient Equipment, and choose "Heat Pump with tank" for Energy Source — [ahridirectory.org/NewSearch?programId=24&searchTypeId=4](https://ahridirectory.org/NewSearch?programId=24&searchTypeId=4)
- NEEA's (Northwest Energy Efficiency Alliance) list of HPWHs that meet their "advanced" requirements — [nea.org/img/documents/HPWH-qualified-products-list.pdf](https://nea.org/img/documents/HPWH-qualified-products-list.pdf)

# Endnotes

1. <https://www.energy.gov/energysaver/water-heating/reduce-hot-water-use-energy-savings>
2. <https://www.contractormag.com/management/article/20874577/hp-water-heaters-where-the-rubber-meets-the-road>
3. <https://www.energy.gov/articles/new-infographic-and-projects-keep-your-energy-bills-out-hot-water>
4. <https://www.eco2waterheater.com/product-info>
5. <https://www.heat2o.com/>
6. <https://www.bbb.org/search>
7. From BayREN's FAQ: <https://www.bayren.org/residentialhpwh>
8. <https://homewatertech.com/ultimate-water-heater-descaling-guide-tank-tankless/>
9. [https://www1.eere.energy.gov/buildings/publications/pdfs/building\\_america/measure\\_guide\\_hpwh.pdf](https://www1.eere.energy.gov/buildings/publications/pdfs/building_america/measure_guide_hpwh.pdf)