



Home Electrification Fact Sheet

Heat Pump Water Heater

WATER HEATERS & CLIMATE CHANGE

Homes and buildings are the second largest source of greenhouse gas emissions in East Bay cities like Berkeley and Oakland. *Electrification* is a prime strategy for combatting climate change: it means ditching natural gas and powering our homes with electricity from an ever-cleaner grid. A heat pump water heater (HPWH) is a safe, efficient alternative.

HOW DOES A HEAT PUMP WORK?

A heat pump is like a reverse air conditioner: it pulls heat out of the air and puts it into the water. A fan pushes room air across a radiator-like grid filled with cold liquid refrigerant in a closed system of tubing. Heat from the fanned air raises the refrigerant's temperature enough to turn it to a gas. A compressor then increases the pressure of the gas, further raising its temperature. A pump circulates the hot compressed gas down tubes around the cool water in the tank. The heat from the hot compressed gas moves toward the cool water. It warms the water and cools the gas back to a liquid, where it is then pumped back to the radiator, and the cycle repeats.

ENERGY EFFICIENCY

Heat pump water heaters are as much as 3.7 times (and increasing) more efficient than the best gas and electric resistance water heaters. The EPA uses a Uniform Energy Factor (UEF) to compare various appliances. The UEF of heat pump water heaters ranges from 3.7 to 2.3, while gas storage water heaters range from 0.9 to 0.68. Tankless (on-demand) gas water heaters range from 0.97 to 0.86. The EPA does not list any electric resistance water heaters as Energy Star. HPWHs are the most efficient water heaters made.

WATER HEATING EXPERIENCE

Heat pump hot water heaters cool and dehumidify the space where they are located. When operating, they make a noise similar to a dehumidifier. When the tank is depleted of hot water, HPWHs recover slower than other water heaters. However, most have an electric resistance heating element as a backup to quicken recovery during times of heavy use. These are called *hybrid* water heaters. Many hybrid HPWH users report always having plenty of hot water without ever needing to use the backup heating element.

WHO USES HEAT PUMP WATER HEATERS?

HPWHs were first mass-marketed in the 1950s. Their popularity has fluctuated with electricity and fuel prices. With improved technology, they are now approximately 9% of the electric water heater market in new and existing US homes, with most found in new construction. Since 2010, sales of HPWHs have more than tripled, largely driven by purchases in China. Japan is the second market by size, and European sales have nearly quadrupled. The EPA lists over 150 Energy Star heat pump water heaters from over 50 manufacturers.

HEAT PUMP COST & REBATES

Costs: A heat pump water heater costs in the range of \$1300 to \$5000.

Rebates: PG&E is currently offering \$300 rebates on selected heat pump water heater models. More rebates are on the horizon, likely in 2020.

Savings: Because of the efficiency, Energy Star certified heat pump water heaters can save a household of 4 approximately \$350 per year on its electric bills compared to a standard electric water heater and up to \$3,750 over the heat pump water heater's lifetime. Families that typically use more hot water will save even more. While a certified HPWH costs more upfront, the savings will pay back the difference in two years for a household of four.

WHAT DO THEY LOOK LIKE?

Most HPWHs look like traditional tank water heaters, only taller, to accommodate the heat pump on top. Some, like Rheem models, are less tall but bigger around. Sanden water heaters come in two parts: an outdoor heat pump and an indoor tank.



HPWH INSTALLATION

Electrical: Most hybrid heat pump water heaters require a dedicated 240 volt, 30 amp circuit. Heat pump water heaters without the hybrid element often only require a 15 amp circuit.

Permits: Permits are required to install a heat pump water heater. If a vendor or contractor tells you that you cannot replace a gas water heater with a HPWH, or that permits cannot be issued for HPWHs, they are working with outdated information.

Drain: Heat pump water heaters generate a condensate – water – that needs to be routed to a sink, drain, or sump.

Location: HPWHs with the heat pump and tank combined need to be located in a room that has an area of approximately 1000 square feet or a smaller space that can be fitted with a louvered door or ducted. The area should stay in the range of 40° F to 90° F. If the heat pump and tank are separate, these airflow requirements are not necessary for locating the tank. A HPWH produces cool, dry air. If located in a damp basement, it can act like a dehumidifier. Air filter cleaning is required periodically.

Combo Option: There are heat pump systems that combine air heating, air cooling, and water heating. If you are interested in electrifying several home appliances at once, consider a combined system.

HEALTH & SAFETY

Fire safety: HPWHs are safer than gas-fired water heaters. In 2009-2013, over half of home fires caused by water heaters involved gas-fueled equipment, but those fires accounted for all of the fatalities, and most of the civilian injuries and direct property damage.

Earthquakes: All water heaters should have earthquake bracing. Heat pump water heaters are less vulnerable to earthquake damage than natural gas water heaters. About one in four fires after an earthquake is related to natural gas leaks.

Refrigerant Leaks: Though rare, heat pump water heaters can develop a refrigerant leak. Most heat pump water heaters use standard refrigerants like R410, commonly known as Puron. One manufacturer, Sanden, uses CO2 as a refrigerant, which is much more environmentally benign, should it leak.

NEXT STEPS?

If you are interested in a heat pump water heater, we recommend the following next steps:

- Check PG&E's website to see which models qualify for PG&E rebates:
marketplace.pge.com/electric-water-heaters
- Check EnergyStar's website to compare models:
energystar.gov/productfinder/product/certified-water-heaters/
- Contact BayREN to connect with a free energy advisor: bayren.org/energy-advisor
- Use BayREN's Contractor Finder to locate contractors that install HPWHs:
bayrenresidential.org/find-a-contractor
- Request contractors to provide cost estimates in writing and ask for references.



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