Energy-efficient water heating

For your home
Choose the right contractor for the job

When choosing contractors, make sure they are licensed, insured and bonded. They should have a strong understanding of and adherence to mechanical, plumbing and energy codes. They should recommend energy-efficient equipment where applicable. Contractors should provide ongoing training to keep employees up-to-date on the latest technology. In addition, they should secure all necessary permits to ensure that the equipment is installed in accordance with energy codes. A quality home improvement purchase requires both the right product and the right contractor.

Don’t know where to find a contractor?

PSE created the Contractor Alliance Network to help you find contractors who can help you select and install all of your energy-related home improvements. These pre-screened, independent contractors can help you make the right heating choice for your lifestyle and budget to maximize your energy efficiency and lower your overall utility costs. For more information, call a PSE Energy Advisor at 1-800-562-1482 or visit pse.com/can.

In this guide

4 The savings start with your water heater
6 Replacing your water heater
9 Safely install and maintain your water heater
14 Tips for making your water heater more efficient
15 Choose the right contractor for the job

About Puget Sound Energy

Puget Sound Energy is Washington state’s oldest local energy company. We serve 1.1 million electric customers and more than 760,000 natural gas customers in 10 counties. For more information, visit pse.com. Also follow us on Facebook and Twitter.
The savings start with your water heater

Different types of water heaters

**Electric tank**
This type of water heater uses electric heating elements contained within an insulated tank. Usually there is one heating element near the top of the tank and one near the bottom. Typically, the tank is designed so that only one element is operating at a time. The upper heating element is designed to heat the upper 25 percent of the water in the tank. Once the desired temperature has been reached, the upper element shuts off, and the lower element turns on and heats the remaining water. This design allows the unit to quickly recover a full supply of adequately heated water.

**Natural gas tank**
Natural gas water heaters differ from electric tanks and use a natural gas burner under an insulated tank to heat the water, much like you would heat a pan of water on a stove. A thermostat monitors the temperature of the water and activates the natural gas burner as necessary. The natural gas burner is able to heat water quickly and provides more hot water than an electric water heater. The burner is connected to a flue that runs up the center of the tank and connects to a vent pipe (metal chimney) so that combustion gases are vented outside.

**Natural gas tankless (on-demand)**
Tankless water heaters are designed to produce hot water on demand. When a hot water tap is turned on and water begins to flow, the burner in the unit is ignited and begins heating a steady supply of hot water until the tap is turned off. Since tankless water heaters don’t store any of the hot water they produce, there are no standby heat losses. This makes them more energy efficient and often good choices for high-demand applications. Tankless water heaters are also smaller, so they take up less space, and they last longer than storage tank units.

**Heat pump water heater**
A heat pump water heater uses electricity to move heat from one place to another, like a refrigerator in reverse, instead of generating heat directly. It absorbs heat from the surrounding air and concentrates it in the water tank. Because it pulls heat from the surrounding air, it needs 1,000 cu. ft. of air space around it. These water heaters can be two times more efficient than a conventional electric tank and are the most efficient water heaters on the market.
Replacing your water heater

If you are looking to replace your water heater, there are a couple of important terms you should know:

- **Energy factor (EF):** This is a measure of the overall efficiency of the water heater.
- **Gallons-per-minute capacity:** This is the measure by which tankless water heaters are sized. Since hot water is not stored in a large tank, these units must be sized for the peak gallons of water needed per minute.
- **First-hour rating (FHR) or recovery capacity:** This is a measure of the amount of hot water the unit can supply in its first hour of use. The rating is a combination of tank capacity and how quickly the unit heats cold water to a specified temperature.

Before you purchase a new water heater, consider the following steps to make sure you understand your peak water demand, how to select a unit with the right capacity and how to choose the most energy-efficient model. A good contractor should be able to walk you through this process.

### Step 1: Determine your hot water needs

Use the following chart to learn how much hot water is used for typical household activities.

<table>
<thead>
<tr>
<th>Household hot water activity</th>
<th>Gallons per daily activity</th>
<th>Gallons per min.</th>
<th>Your home use (Calculate here)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clothes washing</td>
<td>10–32</td>
<td>.75–1.5</td>
<td></td>
</tr>
<tr>
<td>Showering/bathing</td>
<td>20</td>
<td>1–1.5</td>
<td></td>
</tr>
<tr>
<td>Automatic dishwashing</td>
<td>6–10</td>
<td>.5–1</td>
<td></td>
</tr>
<tr>
<td>Food preparation</td>
<td>5</td>
<td>.5–.75</td>
<td></td>
</tr>
<tr>
<td>Hand dishwashing</td>
<td>4</td>
<td>.5–1</td>
<td></td>
</tr>
<tr>
<td>Shaving</td>
<td>2</td>
<td>.5</td>
<td></td>
</tr>
<tr>
<td>Washing hands and face</td>
<td>2</td>
<td>.5–1</td>
<td></td>
</tr>
</tbody>
</table>

*Average daily usage of hot water is 64 gallons per person

### Step 2: Select the right size water heater

Next, you can estimate how much hot water your family would need during periods of peak demand. This is usually in the morning as household members prepare for school or work. If your peak hour consists of three showers and two shaves, using the information in the table above, you can calculate your total peak demand:

- Three showers x 20 gal per shower = 60 gal per hour
- Two shaves x 2 gal per shave = 4 gal per hour

**Total = 64 gallons per hour**

This tells you how much peak hot water flow you need. You can then compare this number to the first-hour rating on new water heater units you are considering to make sure they meet your peak demand.

If you are considering an on-demand style of water heater (one without a storage tank), be sure the unit is able to meet your hot water delivery needs on a gallons-per-minute basis. Consult your water heating contractor to verify that the new equipment will meet your hot water needs.
**Step 3: Look for the EnergyGuide label**

In addition to proper tank sizing, the most important question to answer about your water heater is how much it will cost to operate. All water heaters are required to display an EnergyGuide label, which provides the estimated cost compared with the most and least efficient models available on the market. The EnergyGuide label makes it easy to compare the estimated operating costs of different models. You should note, however, that the operating costs on the label are based on national averages; your energy costs will vary depending on local rates and your actual usage.

The EnergyGuide label lists the water heater’s first-hour rating (or recovery capacity), so you can compare the ratings for different units with your peak hot water demand, as determined in Step 2.

**Energy factor / ENERGY STAR**

Also look for the highest energy factor rating or look for the ENERGY STAR logo, which tells you how efficiently a water heater operates. Water heaters can vary dramatically in efficiency and annual operating costs. The following chart lists Energy Factors for low-efficiency and high-efficiency electric and natural gas units.

Note that natural gas water heaters typically have lower Energy Factors than electric models, since more energy is lost through combustion. However, since natural gas is often less expensive than electricity, the annual operating cost is usually much less.

Estimate based on average household, electricity at $0.103 per kWh, natural gas at $1.04 per therm and propane at $2.20 per gallon (energy costs vary seasonally).

<table>
<thead>
<tr>
<th>Water heater type</th>
<th>Energy factor (EF)</th>
<th>Estimated annual cost</th>
<th>Typical first-hour rating (FHR)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric tank</td>
<td>0.90 to 0.95</td>
<td>$350 to $370</td>
<td>50 to 70 gallons</td>
<td>Lowest initial cost; highest lifetime cost.</td>
</tr>
<tr>
<td>Natural gas tank</td>
<td>0.58 to 0.67</td>
<td>$175 to $250</td>
<td>70 to 90 gallons</td>
<td>Slightly higher initial cost that electric water heater due to natural gas piping and venting. Sealed combustion and power-vented models can provide more installation flexibility but increase costs.</td>
</tr>
<tr>
<td>Propane tank</td>
<td>0.58 to 0.67</td>
<td>$360 to $510</td>
<td>70 to 90 gallons</td>
<td>Similar installation issues as natural gas; additional fuel tank required.</td>
</tr>
<tr>
<td>Natural gas tankless</td>
<td>0.78 to 0.98</td>
<td>$125 to $150</td>
<td>Can meet continuous demand</td>
<td>Highest initial cost; lowest operating costs if water use habits do not change. Efficient way to supply hot water for high-volume applications like soaking tubs.</td>
</tr>
<tr>
<td>Heat pump water heater</td>
<td>2.0 to 2.5</td>
<td>$150 to $225</td>
<td>55 to 80 gallons</td>
<td>Higher initial cost than electric tank due to the use of heat pump technology; additional labor for condensate drain and other potential plumbing / electric considerations. Most efficient electric water heater on the market.</td>
</tr>
</tbody>
</table>

**Safely install and maintain your water heater**

**Storage tank**

While storage tank water heaters require relatively little maintenance, there are some things you can do to keep your water heater running in peak condition. Flushing your tank can help your water heater run more efficiently by removing sediment build-up and can extend the life of your heater.

Tanks should be flushed per manufacture requirements or as advised during your annual inspection. In PSE’s service territory, flushing is generally advised every other year depending on water quality. The specific steps may vary, depending on which make and model you have but, in general, flushing your tank involves shutting off the water supply, attaching a hose to the drain valve, draining the existing water and refilling the tank.

**Anode replacement**

All storage tank water heaters contain an anode, usually a magnesium rod, which is inserted in the tank. The anode is a readily corrodeable metal that deteriorates first, protecting the water heater to extend the life of the tank. Anode rods should be replaced approximately every five years, depending on water quality. Have your anode rod professionally inspected annually by a qualified plumbing contractor or technician.

**Pressure-relief valves**

The temperature and pressure-relief valve is a faucet-like device mounted on the side of the water heater. The valve is designed to release water if excessive temperature or pressure build-up occurs in the tank, thereby preventing water heater damage and a possible safety hazard.
**Water heater venting**

Most residential natural gas water heaters have a combustion chamber and flue that draw air from the surrounding area and the combustion by-products exhaust through the vent pipe.

Direct-vent, sealed-combustion water heaters keep the air supply and combustion exhaust completely separate from your household air. Sealed-combustion water heaters are designed for installations that do not have a chimney readily available. This model water heater can be installed next to an exterior wall and vented to the outdoors.

Power-vented equipment can use household air for combustion and is generally not recommended unless direct-vent water heaters are not an option for your home. Testing for adequate draft and safe operation should be part of the installation and maintenance of all combustion water heaters.

**Thermal expansion tank**

Heated water expands, and under certain conditions your water heating system can experience excess pressure build-up. This build-up can force hot water back into the cold water supply pipe.

If your plumbing system is a “closed” system, the excess volume of water has no place to go and pressure build-up continues.

When the pressure reaches a certain point, your water heater’s temperature and pressure relief valve will open and relieve the pressure, resulting in a release of hot water from the tank. Over time, these fluctuations in pressure can weaken the tank in your water heater and lead to premature tank failure. To prevent this, local codes typically require installation of a properly sized thermal expansion tank. This allows the excess volume of water to flow into the thermal expansion tank rather than out through the relief valve. For information on thermal expansion tanks and other technical issues, contact a licensed plumbing contractor in your area.

**Tankless (clean and maintain)**

Tankless water heaters have a water filter that should be inspected and/or cleaned every year. Instructions to perform this are in the owner’s manual of your tankless water heater or you can have a qualified plumbing contractor or technician perform this for you. A new tankless may need a larger gas meter and possibly larger gas lines. Customers should call PSE’s new construction services department at 1-888-321-7779 to inquire about potential meter or line size issues.

**Energy IQ**

You have a closed system when any of the following is true about your home:

- Your plumbing system includes a pressure-regulating valve or pressure-reducing valve.
- Your plumbing system includes a backflow preventer or check valve.
- There is high water pressure coming into your home. This may also cause your plumbing to behave as if it were a closed system.
- Your home has a water softener or lawn sprinkler system.

**Heat pump water heater**

**Noise considerations**

1. These units put off 60 decibels of noise. This is a little louder than your refrigerator.
2. It is recommended to install pipe foam around earthquake straps to keep straps from ratting against unit. Straps should be tight.
3. A foam pad between the unit and wall should be used to keep vibration from transferring to the wall.
4. Garage installations or other similar areas are ideal to minimize noise concerns.

**Setting configuration**

1. “Energy Saver” or “E-Heat” mode maximizes energy savings. In this mode the water heater only operates the heat pump to heat the water.
2. “Hybrid” mode uses both heat pump and electric resistance to experience faster recovery times. The heat pump is the primary element and the electric resistance is secondary depending on load.
3. Normal electric resistance mode has no energy savings over a standard electric storage. The water heater will automatically switch to this mode when it senses air temperature is less than 40-45 degrees. It will switch back to previous setting when air temperature rises.
Earthquake straps

Securing your water heater and, if it is a natural gas tank, making sure it is fitted with a flexible natural gas supply line, will greatly reduce the danger of a fire or explosion from a natural gas leak after an earthquake. If your water heater does not have earthquake straps or a flexible natural gas supply line, contact a licensed plumbing contractor.

The illustration below shows earthquake strapping for a typical water heater. Water heaters over 100 gallons and/or water heaters more than 12 inches from a wall require a designed system.

Placement requirements

All water heaters are required to be installed with minimum width and height clearance. Check your local building code and the water heater installation instructions for specific requirements.

Gas storage water heaters located in the garage must also be installed on an elevated stand (usually at least 18 inches high). A qualified plumber can make sure your water heater is installed properly.

General safety tips for natural gas water heaters

- Remove paper, accumulated dust or other combustibles from, on or near the water heater enclosure.
- Avoid using combustible items, like gasoline or paint thinner, nearby, and never store combustibles close to your water heater. If you must use combustible items near your water heater, make sure the pilot light is turned off.
- Periodically inspect the vent pipe for breaks or gaps and check for secure connections.
- Be sure your tank is stable and securely strapped to the wall with earthquake straps.

For more information about maintenance and safety, water pressure issues, fixing leaks in fixtures or pipes, heat traps, automatic controls and how to earthquake-proof your water heater with earthquake straps, contact a PSE Energy Advisor at 1-800-562-1482.

They can also refer a qualified plumbing contractor to perform your annual maintenance inspection.
Tips for making your water heater more efficient

- Use cold water whenever possible when doing laundry and when operating your garbage disposal. Today’s detergents don’t require warm or hot water.
- When washing dishes by hand, use a sink stopper or dishpan so water doesn’t run down the drain. Remember that running hot water unnecessarily wastes not only water, but energy, too.
- Set your water heater to the “low” setting, or about 120 degrees Fahrenheit.
- Take short showers instead of baths. A bath requires 15 to 25 gallons of hot water, while a five-minute shower uses approximately 8-10 gallons.
- Install water-saving showerheads and faucet aerators and repair leaky faucets.
- If you are in the market for a new dishwasher or clothes washer, consider buying an energy-efficient and water-saving ENERGY STAR qualified model. Puget Sound Energy’s appliances brochure has more information on selecting an energy-efficient appliance.
- If you have an older water heater that was installed before 1998, installing an insulation blanket can be an effective do-it-yourself energy-saving step, especially if your water heater is in an unheated basement or space. The insulating jacket will reduce standby heat loss — heat lost through the walls of the tank — by 25 to 40 percent, saving four to nine percent on your water heating bills. Remember to follow installation instructions carefully and leave tank controls with proper clearances. Also make sure to keep any combustion air inlets at the bottom of the tank and the chimney’s draft hood on top of the tank free of any restrictions.
- Insulating your hot water pipes will reduce the amount of heat lost while the water is flowing to your faucet. Pipe insulation comes as either a foam tube or a roll of fiberglass wrap. It should be installed on both the cold and hot water pipes accessible throughout the house.