Energy Efficient Water Heating:

Purchasing a New Electric Water Heater

EnergyServices

Hot water use has a significant impact on your power bill.

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Water heating accounts for about 18 percent of your energy bill. Only space heating and cooling use more energy in your home. When you purchase a new water heater, energy efficiency features can provide substantial savings. Because residential water heaters typically last 12 to 15 years, these features will provide long term benefits.

This fact sheet describes energy efficiency features to look for when purchasing a new water heater. Included is a comparison of the energy used by typical water heaters with and without these features.

While this fact sheet focuses on purchasing a new water heater, remember you can save the most energy through hot water conservation. Most households use 40 to 60 gallons of hot water per day. Large families may use more. Graph 1 illustrates the impact of hot water consumption on the annual energy used by a standard electric water heater.

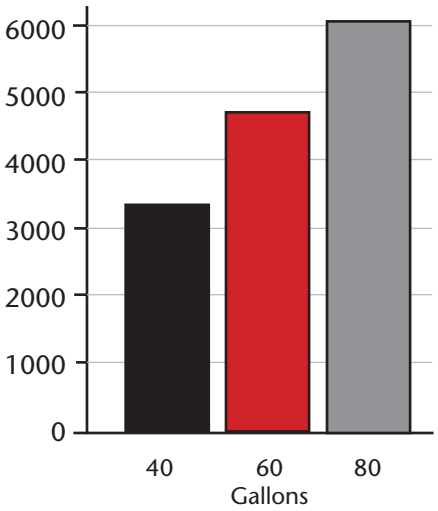
Hot Water Conservation Tips:

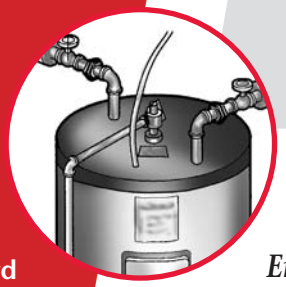
- Set your water heater thermostat to 120 degrees.
- Fix leaky faucets promptly.
- Install low flow showerheads and faucet aerators.
- Select short cycles and cold water rinse in the laundry.
- Only run full loads in the dishwasher.
- Consider water conservation when purchasing a new dishwasher or clothes washer.
- Look for the EnergyGuide label.

Hot water use has a significant impact on your power bill.

Graph 1

Standard Electric Water Heater kWh per Year





Standard Water Heater

Definitions and Abbreviations

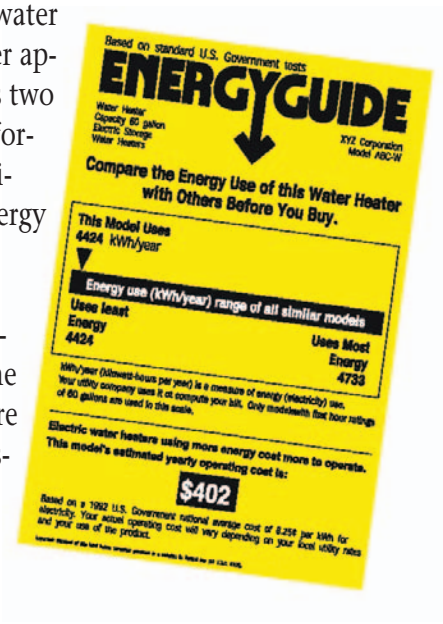
Energy Factor (EF) is the average annual energy efficiency of an appliance as determined by a standard test procedure. The higher the number, the more efficient the water heater. For example: a water heater with a 0.86 EF will deliver hot water at 86 percent efficiency. This rating includes the energy required to meet the water heating demand and make up for heat loss from hot water in storage. Look for the energy factor when reading the water heater's specification sheet.

First hour rating is the number of gallons of hot water a tank can provide in the first hour of operation. This includes the hot water available in storage plus hot water generated by the heaters in one hour. Look for the first hour rating on the water heater's specification sheet.

Kilowatt-hours **(kWh)** is the standard unit of measure for electrical energy use. It is equivalent to 1,000 watts of electrical use for one hour. Each kilowatt-hour will provide 3,413 *British Thermal Units* (BTU) of heat.

Look for the EnergyGuide label

Federal law requires manufacturers to display the yellow EnergyGuide label on water heaters and many other appliances. The label lists two important pieces of information about the appliance: the estimated energy use, and the estimated operating cost per year based on national average electricity costs. The label helps you compare the water heater on display to the most and least energy-efficient models of a similar capacity.



Which water heater is best for you?

Most homes that heat water with electricity have a 40-75 gallon tank with two electric heating elements. Other electric water heating options include heat pump water heaters and instant water heaters. Both can reduce your hot water heating bill, but each has its costs and limitations.

Graph 2 compares the energy use of four different water heaters: a 50-gallon electric storage water heater that meets the minimum federal standards, a similar electric storage water heater with R-24 insulation and heat traps, an instant water heater, and a heat pump water heater.

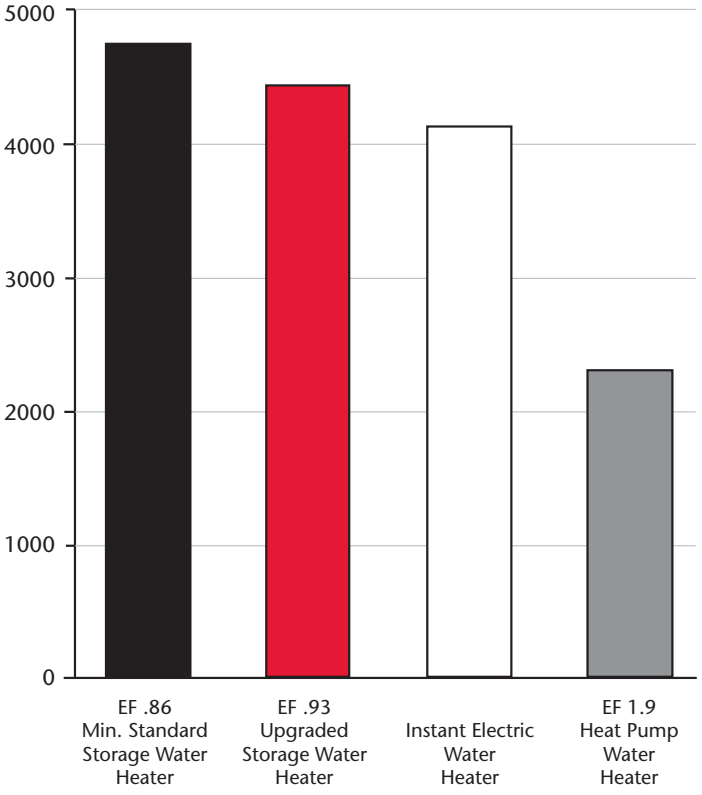
Better insulation and fittings are the most common efficiency options.

All storage water heaters lose heat from the tank and fittings throughout the day. By purchasing a tank with good insulation and heat trap fittings you can improve the annual efficiency of an electric storage water heater. Look for insulation levels of R-20 or higher. Heat trap fittings keep the hot water from drifting into the hot and cold water pipes when there is no demand for hot water. These features are available on all but the least expensive electric storage water heaters.

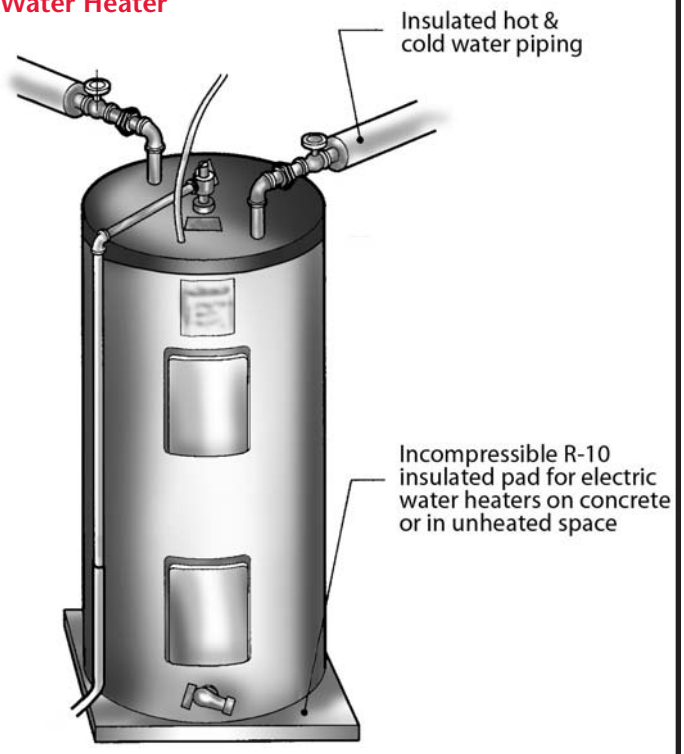
When the water heater is installed insulate hot and cold water pipes to within 18 inches of the water heater, especially those sections that run through unheated areas. If the water heater is placed on a concrete slab, install a 2-inch R-10 foam board under the tank. These measures will help reduce heat loss from the tank.

Graph 2

Electric Water Heater Energy Use: kWh per Year, Based on 60 Gallons per Day



Standard
Water Heater



Ambient Air Heat Pump
Water Heater

Heat pump water heaters

Heat pump water heaters can cut the cost of electric water heating by more than half. Using a mechanical process, heat pump water heaters capture heat from the air and transfer it to the water in the tank. There are two types of heat pump water heaters, *ambient air* and *exhaust air*.

Ambient air heat pump water heaters take heat from the room where they are located and transfer it to the water in the storage tank. This not only heats the water, it also cools the room. Because of this, ambient air heat pump water heaters are most economical in hot climates.

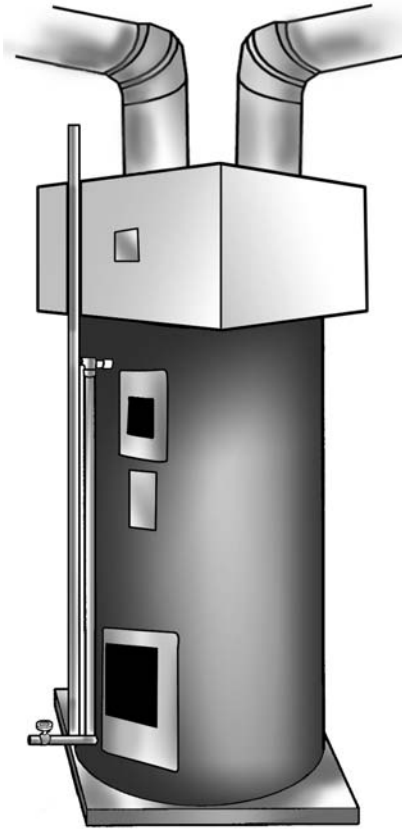
Exhaust air heat pump water heaters capture heat from air that passes through the ventilation system or dedicated ducts. During operation a small volume of warm air is taken from inside the home and passed across the heat pump coil where it transfers heat to the hot water. The cool air that results is exhausted to the outdoors. When cooling for the home is desired, the exhaust fan can be run in reverse. This type of system is most economical in tight new homes that benefit from additional ventilation.

Ambient air heat pumps cost about $700, while exhaust air models cost $1,400 or more. This is a substantial increase in cost when compared to a standard electric water heater. In addition, heat pump water heaters require more maintenance. If your electric rates are high, or you use a great deal of hot water, a heat pump water heater may be a good choice. Check the resources at the end of this fact sheet for additional information on heat pump water heaters.

Instant electric water heaters

Instant electric water heaters heat water as it passes through the heater on the way to the fixture. No hot water storage is required, optimizing the efficiency of the water heater. Instant water heaters have advantages and limitations when compared to storage water heaters. High input instant water heaters will provide a gallon or more per minute. This is enough to shower, or do just about any chore around the house. The limitation is that you will probably only be able to do one chore at a time. While the flow is limited, it is continuous. You can draw hot water without running out.

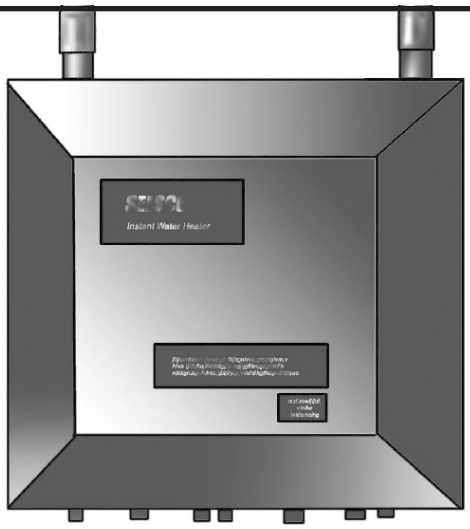
Exhaust Air Heat Pump Water Heater



Large instant water heaters require as much input as your range or electric clothes dryer. A 240-volt, 40-amp service is typical. This level of service may not be available in an existing electrical breaker box. Smaller units are designed for low demand. Some small models are available that can be plugged into a regular electrical outlet.

Make sure you have enough hot water

When shopping for a storage water heater, look for the *first hour rating*. This figure reflects the combined capacity of the hot water in storage plus the heating capacity of the electric heating elements to heat a depleted tank. For electric water heaters, the best strategy is usually to buy a larger storage tank. Increasing the wattage of the heaters will only provide marginal benefits. The first hour rating of typical 50- to 100-gallon electric water heaters is usually slightly greater than the tank's storage capacity.



Instant Water Heater

Instant electric water heater capacity

Instant water heaters are rated for gallons per minute, not hour. Table 1 gives estimates of the volume of hot water produced by different size heaters. This table assumes an incoming cold water temperature of 50 degrees, with a hot water output temperature of 120 degrees – a 70-degree temperature rise. Always consult the manufacturer's literature for specific figures.

Table 1
Instant Electric Water Heater Capacity

Heater Size: Kilowatts	Hot Water Gallons Per Minute
11	1.07
10	0.97
9	0.87
8	0.78
7	0.68
6	0.58
5	0.48

Off peak or time-of-use electric rates and your water heater

If your utility offers *off peak* or *time-of-use* rates you may want to use a storage type water heater. You might also consider additional storage capacity. A growing number of electric utilities offer lower rates to customers who will heat hot water on a schedule that the utility selects.

Utilities offering off peak rates control participating customers' water heaters using a timed or radio-controlled switch. This provides the utility benefits that it passes on to you as a lower electrical rate. Under this arrangement, your water heater's energy use stays the same; it's just on at a different time of day. Usually it means shifting the time the heating elements are on from 7 or 8 a.m. to 11 a.m. or noon.

If your utility offers this type of rate structure, a larger storage tank will be useful. More capacity will make sure you have hot water throughout the morning, even without turning on the heating elements. If you select an instant water heater you will not be able to take advantage of these rates without giving up hot water completely during peak hours.

Contact your electric utility to find out if off peak or time-of-use rates are available in your service area.

Additional resources

Books

Consumer Guide to Home Energy Savings, 8th Edition; by Alex Wilson, Jennifer Thorne, and John Morrill; American Council for an Energy-Efficient Economy; Berkeley, Calif.; 2003. Order a copy for $8.95 at www.aceee.org.

Websites

Residential Heat Pump Water Heaters
www.pnl.gov/fta/3_res.htm
Federal Technology Alerts,
Pacific Northwest National Laboratory

How to Buy an Energy-Efficient Home Appliance
www.ftc.gov/bcp/conline/pubs/homes/applnces.htm
Federal Trade Commission and the
U.S. Department of Energy

Selecting a New Water Heater
www.eere.energy.gov/erec/factsheets/watheath.html
U.S. Department of Energy, Energy Efficiency and Renewable Energy

Energy-Efficient Water Heating
www.eere.energy.gov/erec/factsheets/eewtrhtr.html
U.S. Department of Energy,
National Renewable Energy Laboratory

Energy Savers
www.eere.energy.gov/consumerinfo/energy_savers/
U.S. Department of Energy

Consumers' Directory of Certified Efficiency Raings for Heating and Water Heating Equipment
www.gamanet.org/consumer/certification/certdir.htm
Gas Appliance Manufacturers Association

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