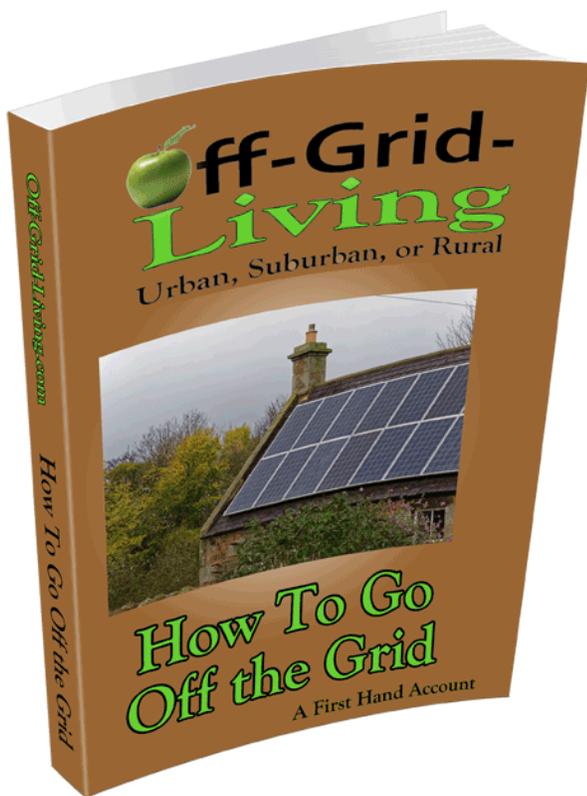




# ff-Grid-Living

In An Urban and Suburban World



**Lesson #15 ...**

**Hot Water Heaters**

***The most important thing you need to take away from this lesson is...***

**Hot water heating accounts for between 11% to 14% of energy usage in a home. Reducing and/or eliminating this usage WILL contribute to significant energy savings.**

Hot water is a part of our everyday life. Without it, cleaning and personal hygiene would be next to impossible. This lesson is going to detail ways in which reducing and/or eliminating energy needed in conventional hot water use.

There are basically four different strategies you can implement to save money.

- Reduce hot water consumption
- Make your existing heating more efficient
- Buy more energy efficient heaters/or use different solutions
- Eliminate hot water bills completely by building a solar hot water heater.

We are going to look at all four strategies in detail. Today we'll look at

- Strategies for reducing hot water consumption
- Way to make your present hot water heater more efficient.

In the next Lesson, we'll look more at long term strategies, including:

- Different hot water heating systems
- Building a solar hot water system for next to nothing.

### **Strategies for Reducing Hot Water Consumption:**

You can lower your water heating costs by using and wasting less hot water in your home. To conserve hot water, you can

- fix leaks,
- install low-flow fixtures,
- and purchase an energy-efficient dishwasher and clothes washer.

## Fix Leaks

You can significantly reduce hot water use by simply repairing leaks in fixtures—faucets and showerheads—or pipes. A leak of one drip per second can cost \$1 per month.

If your water heater's tank leaks, you need a new water heater.

## Install Low-Flow Fixtures

Federal regulations mandate that new showerhead flow rates can't exceed more than 2.5 gallons per minute (gpm) at a water pressure of 80 pounds per square inch (psi). New faucet flow rates can't exceed 2.5 gpm at 80 psi or 2.2 gpm at 60 psi. You can purchase some quality, low-flow fixtures for around \$10 to \$20 a piece and achieve water savings of 25–60%.

## Showerheads

For maximum water efficiency, select a shower head with a flow rate of less than 2.5 gpm. There are two basic types of low-flow showerheads: aerating and laminar-flow. Aerating showerheads mix air with water, forming a misty spray. Laminar-flow showerheads form individual streams of water. If you live in a humid climate, you might want to use a laminar-flow showerhead because it won't create as much steam and moisture as an aerating one.

Before 1992, some showerheads had flow rates of 5.5 gpm. Therefore, if you have fixtures that pre-date 1992, you might want to replace them if you're not sure of their flow rates. Here's a quick test to determine whether you should replace a showerhead:

1. Place a bucket—marked in gallon increments—under your shower head.
2. Turn on the shower at the normal water pressure you use.
3. Time how many seconds it takes to fill the bucket to the 1-gallon (3.8 liter) mark.

If it takes less than 20 seconds to reach the 1-gallon mark, you could benefit from a low-flow shower head.

## Faucets

The aerator—the screw-on tip of the faucet—ultimately determines the maximum flow rate of a faucet. Typically, new kitchen faucets come equipped with aerators that restrict flow rates to 2.2 gpm, while new bathroom faucets have ones that restrict flow rates from 1.5 to 0.5 gpm.

Aerators are inexpensive to replace and they can be one of the most cost-effective water conservation measures. For maximum water efficiency, purchase aerators that have flow rates of no more than 1.0 gpm. Some aerators even come with shut-off valves that allow you to stop the flow of water without affecting the temperature. When replacing an aerator, bring the one you're replacing to the store with you to ensure a proper fit.

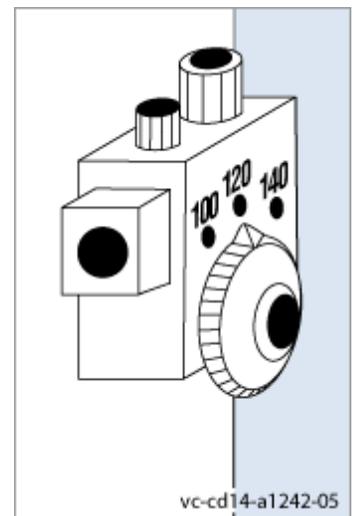
## Lower Water Heating Temperature for Energy Savings

You can reduce your water heating costs by simply lowering the thermostat setting on your water heater. For each 10°F reduction in water temperature, you can save between 3%–5% in energy costs.

Although some manufacturers set water heater thermostats at 140°F, most households usually only require them set at 120°F. Water heated at 140°F also poses a safety hazard—scalding. However, if you have a dishwasher without a booster heater, it may require a water temperature within a range of 130°F to 140°F for optimum cleaning.

Reducing your water temperature to 120°F also slows mineral buildup and corrosion in your water heater and pipes. This helps your water heater last longer and operate at its maximum efficiency.

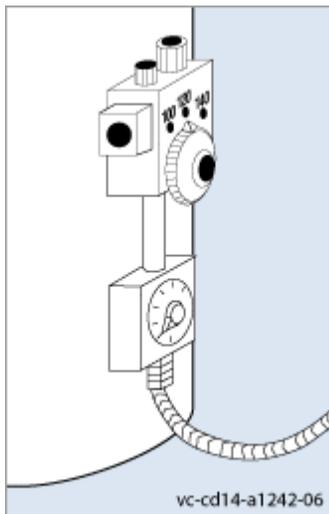
Consult your water heater owner's manual for instructions on how to operate the thermostat. You can find a thermostat dial for a gas storage water heater near the bottom of the tank on the gas valve. Electric water heaters, on the other hand, may have thermostats positioned behind screw-on plates or panels. As a safety precaution, shut off the electricity to the water heater before removing/opening the panels. Keep in mind that an electric water heater may have two thermostats—one each for the upper and lower heating elements.



Mark the beginning temperature and the adjusted temperature on the thermostat dial for future reference. After turning it down, check the water temperature with a thermometer at the tap farthest from the water heater. Thermostat dials are often inaccurate. Several adjustments may be necessary before you get the right temperature.

If you plan to be away from home for at least 3 days, turn the thermostat down to the lowest setting or completely turn off the water heater. To turn off an electric water heater, switch off the circuit breaker to it. For a gas water heater, make sure you know how to safely relight the pilot light before turning it off.

## Install a Timer and Use Off-Peak Power for Electric Water Heaters



If you have an electric water heater, you can save an additional 5%–12% of energy by installing a timer that turns it off at night when you don't use hot water and/or during your utility's peak demand times.

You can install a timer yourself. They can cost \$60 or more, but they can pay for themselves in about 1 year. Timers are most cost effective if you don't want to install a heat trap and insulate your water heater tank and pipes. Timers aren't as cost effective or useful on gas water heaters because of their pilot lights.

Contact your utility to see if it offers a demand management program. Some utilities offer "time of use" electricity rates that vary according to the demand on their system. They charge higher rates during "on-peak" times and lower rates during "off-peak" times. Some even offer incentives to customers who allow them to install control devices that shut off electric water heaters during peak demand periods. These control devices may use radio signals that allow a utility to shut off a water heater remotely anytime demand is high. Shut-off periods are generally brief so customers experience no reduction in service.

## Strategies for Reducing Hot Water Consumption

### Insulate Your Water Heater Tank for Energy Savings

Unless your water heater's storage tank already has a high R-value of insulation (at least R-24), adding insulation to it can reduce standby heat losses by 25%–45%. This will save you around 4%–9% in water heating costs.

If you don't know your water heater tank's R-value, touch it. A tank that's warm to the touch needs additional insulation.

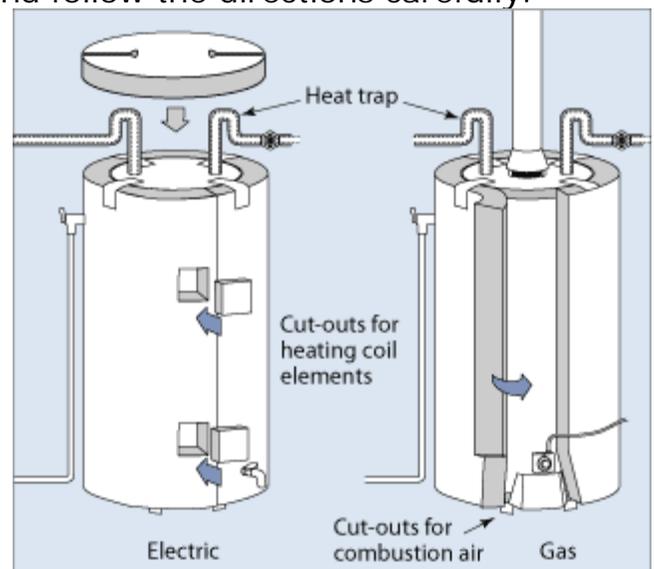
Insulating your storage water heater tank is fairly simple and inexpensive, and it will pay for itself in about a year. You can find pre-cut jackets or blankets available from around \$10–\$20. Choose one with an insulating value of at least R-8. Some utilities sell them at low prices, offer rebates, and even install them at a low or no cost.

### Insulating an Electric Water Heater Tank

You can probably install an insulating pre-cut jacket or blanket on your electric water heater tank yourself. Read and follow the directions carefully. Leave the thermostat access panel(s) uncovered. Don't set the thermostat above 130°F on electric water heater with an insulating jacket or blanket—the wiring may overheat.

You may want to see our instructions for [installing an insulation blanket on an electric water heater](#).

You also might consider placing a piece of rigid insulation—a bottom board—under the tank of your electric water heater. This will help prevent heat loss into the floor, saving another 4%–9% of water heating energy. It's best done when installing a new water heater.



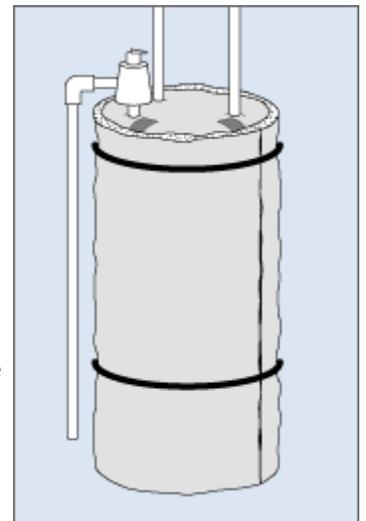
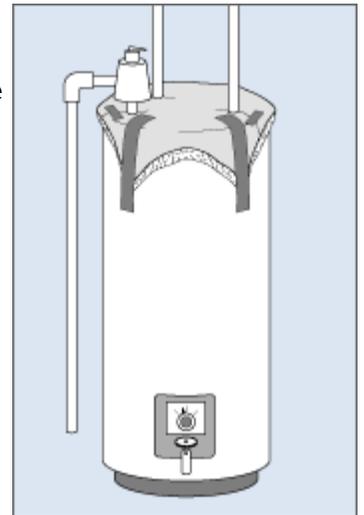
## Insulating a Gas Water Heater Tank

The installation of insulating blankets or jackets on gas and oil-fired water heater tanks is more difficult than those for electric water heater tanks. It's best to have a qualified plumbing and heating contractor add the insulation. If you want to install it yourself, read and follow the directions very carefully. Keep the jacket or blanket away from the drain at the bottom and the flue at the top. Make sure the airflow to the burner isn't obstructed. Leave the thermostat uncovered, and don't insulate the top of a gas water heater tank—the insulation is combustible and can interfere with the draft diverter.

## Installing an Insulation Blanket on an Electric Storage Water Heater

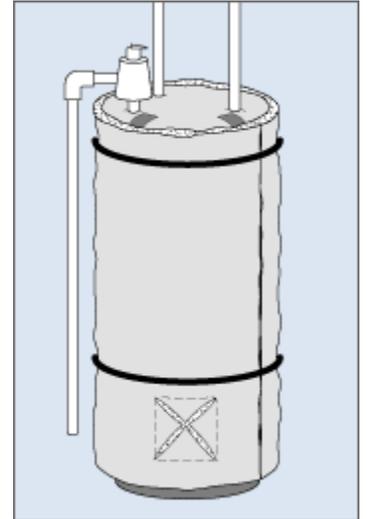
Here are step-by-step instructions for installing an insulation blanket on an electric storage water heater. If the insulation blanket you've purchased comes with instructions, read and follow those.

1. Cut the tank top insulation to fit around the piping in the top of the tank. Tape the cut section closed after the top has been installed.
2. Fold the corners of the tank top insulation down and tape to the sides of the tank.
3. Position the insulating blanket around the circumference of the tank. For ease of installation, position the blanket so that the ends do not come together over the access panels in the side of the tank. Some tanks have only one access panel.
4. Secure the blanket in place with the belts provided. Position the belts so they do not go over the access



panels. Belts should fit snugly over the blanket but not compress it more than 15%–20% of its thickness. The installation is easier with two people. If working alone, use tape to hold the blanket to the top until you get the belts into position.

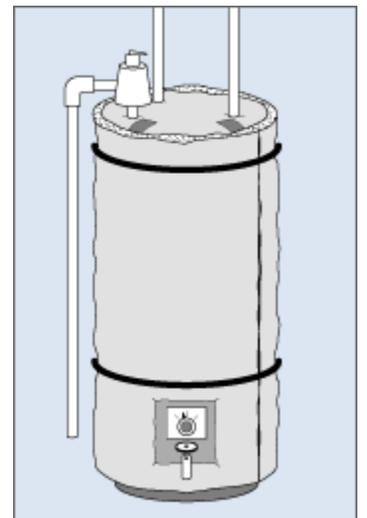
5. If your water heater has the temperature/pressure relief valve and the overflow pipe on the side of the tank instead of on the top, install the blanket so these items are outside of the blanket. Depending on the piping arrangement and location, you may need to compress (or even cut) the blanket.
6. Locate the four corners of the access panel(s). Make an x-shaped cut in the insulating blanket from corner to corner of each access panel.



7. Fold the triangular flaps produced by the cuts underneath the insulating blanket.
8. Repeat steps 6 and 7 for the rating/instruction plate.

Note: The blanket must not be installed on a leaking tank. If your tank leaks, you need a new water heater.

Don't set the thermostat above 130°F. The wiring may overheat.



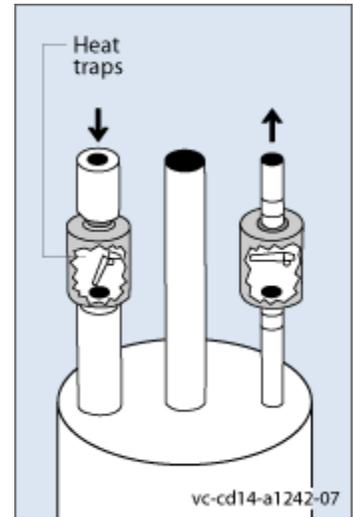
## Install Heat Traps on a Water Heater Tank for Energy Savings

If your storage water heater doesn't have heat traps, you can save energy by adding them to your water heating system. They can save you around

\$15–\$30 on your water heating bill by preventing convective heat losses through the inlet and outlet pipes.

Heat traps—valves or loops of pipe—allow water to flow into the water heater tank but prevent unwanted hot-water flow out of the tank. The valves have balls inside that either float or sink into a seat, which stops convection. These specially designed valves come in pairs. The valves are designed differently for use in either the hot or cold water line.

A pair of heat traps costs only around \$30. However, unless you can properly solder a pipe joint, heat traps require professional installation by a qualified plumbing and heating contractor. Therefore, heat traps are most cost effective if they're installed at the same time as the water heater. Today, many new storage water heaters have factory-installed heat traps or have them available as an option.

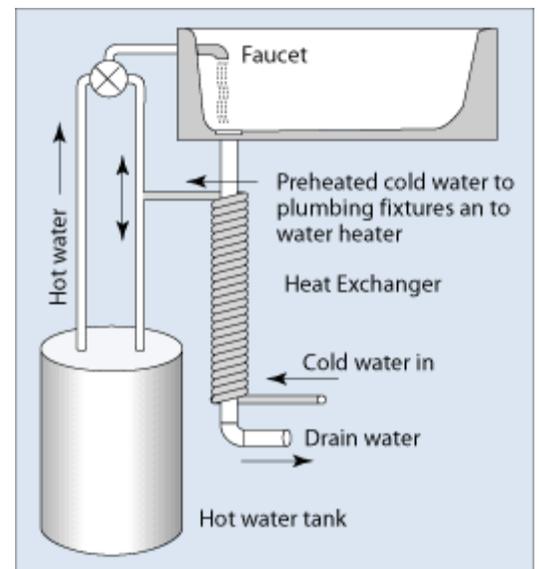


## Drain-Water Heat Recovery

Any hot water that goes down the drain carries away energy with it. That's typically 80–90% of the energy used to heat water in a home. Drain-water (or greywater) heat recovery systems capture this energy to preheat cold water entering the water heater or going to other water fixtures.

### How It Works

Drain-water heat recovery technology works well with all types of water heaters, especially with demand and solar water heaters. Also, drain-water heat exchangers can recover heat from the hot water used in showers, bathtubs, sinks, dishwashers, and clothes washers. They generally have the ability to store recovered heat for later use. You'll need a unit with storage capacity for use with a dishwasher or clothes washer. Without storage capacity, you'll only have useful energy during the simultaneous flow of cold water and heated drain water, like while showering.



Some storage-type systems have tanks containing a reservoir of clean water. Drain water flows through a spiral tube at the bottom of the heat storage tank. This warms the tank water, which rises to the top. Water heater intake water is preheated by circulation through a coil at the top of the tank.

Non-storage systems usually have a copper heat exchanger that replaces a vertical section of a main waste drain. As warm water flows down the waste drain, incoming cold water flows through a spiral copper tube wrapped tightly around the copper section of the waste drain. This preheats the incoming cold water that goes to the water heater or a fixture, such as a shower.

By preheating cold water, drain-water heat recovery systems help increase water heating capacity. This increased capacity really helps if you have an undersized water heater. You can also lower your water heating temperature without affecting the capacity.

### **Cost and Installation**

Prices for drain-water heat recovery systems range from \$300 to \$500. You'll need a qualified plumbing and heating contractor to install the system. Installation will usually be less expensive in new home construction. Paybacks range from 2.5 to 7 years, depending on how often the system is used.

### **Insulate Hot Water Pipes for Energy Savings**

Insulating your hot water pipes reduces heat loss and can raise water temperature 2°F–4°F hotter than uninsulated pipes can deliver, allowing for a lower water temperature setting. You also won't have to wait as long for hot water when you turn on a faucet or showerhead, which helps conserve water.

Insulate all accessible hot water pipes, especially within 3 feet of the water heater. It's also a good idea to insulate the cold water inlet pipes for the first 3 feet.

Use quality pipe insulation wrap, or neatly tape strips of fiberglass insulation around the pipes. *Pipe sleeves* made with polyethylene or neoprene foam are the most commonly used insulation. Match the pipe sleeve's inside

diameter to the pipe's outside diameter for a snug fit. Place the pipe sleeve so the seam will be face down on the pipe. Tape, wire, or clamp (with a cable tie ) it every foot or two to secure it to the pipe. If you use tape, some recommend using acrylic tape instead of duct tape.

On gas water heaters, keep insulation at least 6 inches from the flue. If pipes are within 8 inches of the flue, your safest choice is to use fiberglass pipe-wrap (at least 1-inch thick) without a facing. You can use either wire or aluminum foil tape to secure it to the pipe.

## What You Can Do Starting Today

Water heating is the third largest energy expense in your home. It typically accounts for about 13% of your utility bill. There are four ways to cut your water heating bills: use less hot water, turn down the thermostat on your water heater, insulate your water heater, or buy a new, more efficient model.

### Water Heating Tips

- Install aerating, low-flow faucets and showerheads.
- Repair leaky faucets promptly; a leaky faucet wastes gallons of water in a short period of time.
- Lower the thermostat on your waterheater; water heaters sometimes come from the factory with high temperature settings, but a setting of 120°F provides comfortable hot water for most uses.
- Take more showers than baths. Bathing uses the most hot water in the average household.
- Insulate your electric hot-water storage tank, but be careful not to cover the thermostat. Follow the manufacturer's recommendations.
- Insulate your natural gas or oil hot-water storage tank, but be careful not to cover the water heater's top, bottom, thermostat, or burner compartment. Follow the manufacturer's recommendations; when in doubt, get professional help.
- Insulate the first 6 feet of the hot and cold water pipes connected to the water heater.
- If you are in the market for a new dishwasher or clothes washer,



consider buying an efficient, water-saving ENERGY STAR model to reduce hot water use.

- Install heat traps on the hot and cold pipes at the water heater to prevent heat loss. Some new water heaters have built-in heat traps.
- Drain a quart of water from your water tank every 3 months to remove sediment that impedes heat transfer and lowers the efficiency of your heater. The type of water tank you have determines the steps to take, so follow the manufacturer's advice.
- Although most water heaters last 10–15 years, it's best to start shopping for a new one if yours is more than 7 years old. Doing some research before your heater fails will enable you to select one that most appropriately me

PS...Don't forget you can get personalized coaching at [Off-Grid-Living.com/](http://Off-Grid-Living.com/)  
For some this is the ideal way to get hands on experience as well as personal attention needed to make this work for you.

### **Coming Up Next ...**

Lesson #16: "Solar Hot Water Heaters"

In the next lesson we'll be looking at solar hot water heaters and how to build your own.