



## #6 CLEANING APPLIANCES

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We have come a long way since the days of scrubbing clothes and dishes in a nearby creek. Today, these tasks can be as simple as pushing a button. Dishwashers and clothes washers and dryers are among the most energy-intensive appliances in the home, costing the average household about \$150 annually to power them. More efficient models are available today that can actually produce cleaner clothes and dishes while using less energy and water. Both washing machines and dishwashers consume energy to heat hot water. Considering this heating typically accounts for about 14 percent of your home's utility bill, reducing your hot water usage can be an easy way to save money.<sup>1</sup> For tips on improving your water heater's efficiency, see *Home Energy Brief No. 5: Water Heating*.

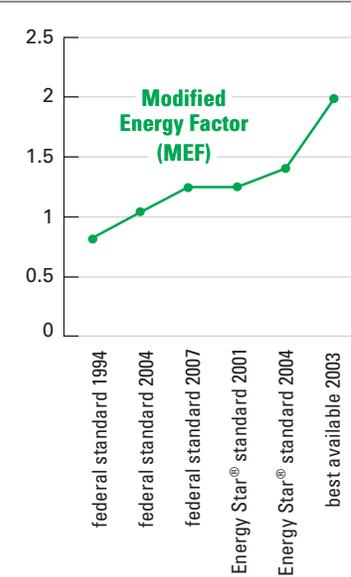
This Brief will cover the following topics:

- Cold water washing:** Clothes don't have to be washed in hot water; in fact, depending on the fabric and its dirtiness, it is often better to wash them in cold water;
- Efficient dryers:** New and better options are available each year;
- Other considerations:** Dry cleaning, detergents, disposing of old appliances, etc.; and
- Dishwashers versus hand-washing:** Dishwashing can be more efficient than handwashing, depending on your habits.

### CLOTHES WASHERS

Whether your clothes washer is fairly new or ten years old, it probably costs you about \$72 a year in electricity bills, and consumes, on average, 870 kilowatt-hours per year. Even if your washer is Energy Star® qualified, it could still consume twice as much electricity as some more efficient models. As Figure 1 shows, there were a number of high efficiency models available in 2003 that were two to four times more efficient than those meeting Energy Star guidelines. The efficiency of a washing machine is measured by its MEF, or Modified Energy Factor. The higher the number, the more efficient the machine. A machine's

Figure 1: Rise in efficiency of clothes washers based on standards compared to current models available



Source: E SOURCE, Residential Appliances; ACEEE, [www.aceee.org](http://www.aceee.org)

MEF is based on tub size and energy consumed for a load of laundry, as well as the moisture content remaining in the clothes at the end of the spin cycle. This number may or may not appear on the product's federal EnergyGuide label, but can be found on the EPA's Energy Star website ([www.energystar.gov](http://www.energystar.gov)). Since heating water accounts for most (85–90 percent) of the energy required to wash clothes, minimizing the use of hot water is the simplest way to reduce energy use

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and utility bills. In addition, saving water in general when washing clothes is very important. Most homes in the United States have vertical-axis (“V-axis”) or top-loading washing machines, although horizontal-axis (“H-axis”) or front-loading washers—which use 30–60 percent less water and 50–70 percent less energy—are becoming more common. H-axis machines only need to fill up partially with water as the clothes are tumbled through the water at the bottom. On the other hand, traditional V-axis machines have to fill up completely as clothes are agitated underwater. There are also some modern V-axis machines that consume small amounts of water by spraying water on the clothes from above. On average, a common V-axis machine will use about 39 gallons per load. In contrast, H-axis and innovative V-axis machines with average tub sizes use only 22–25 gallons per load, with some requiring only 10 gallons per load.<sup>2</sup>

**Operating your washer more efficiently**

As Figure 2 shows, low-temperature washing and rinsing save a good deal of energy and money no matter what kind of machine you have. Half the energy consumed in heating water for washing and rinsing can be saved by changing temperature settings from hot to warm. Warm water has been proven to be very effective for washing most loads.<sup>3</sup> Cold-water washing is adequate in many cases, especially if you use an enzymatic detergent. Also, clothing labels instruct the consumer to use cold water for washing many types of fabric, ranging from cotton to different types of synthetics—like polyester and nylon. Hot water is

actually only necessary for really dirty items, such as diapers or clothes with oily stains, or if someone has been ill. Regardless of the wash temperature, always select the cold-water rinse—warm or hot water doesn’t rinse any better than cold water. In fact, colder temperatures are easier on your clothes. Here are a few other tips for increasing energy efficiency:

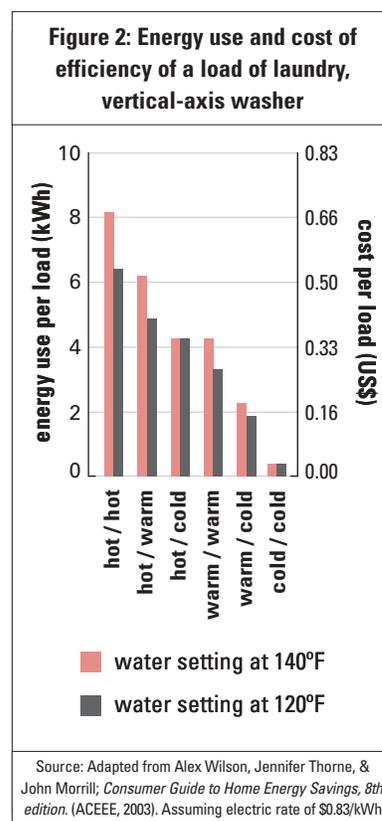
- Wash full loads. If you don’t have enough dirty laundry to fill up the washer, adjust the setting to a lower water level. Using the small-capacity setting can cut water use by as much as 50 percent;
- Insulate exposed pipes;
- When buying a new washer, try to size it to your needs. If you buy a model too small for your household, you may end up washing many small loads, which usually consumes more energy than washing a few large loads; and
- Turn your hot-water heater thermostat down to 120°F, if it isn’t already. This reduction in water temperature will cut the cost of washing clothes by 20 percent, as is shown in Figure 2. This temperature is more than adequate to handle all your cleaning needs.

**New washers**

An efficient clothes washer can pay for its extra cost in just a few years (the average lifespan is 13 years). Even if an efficient washer costs \$300 more to buy than a regular model, with an electricity rate of \$0.083 per kilowatt-hour, this can be paid back in six years or less. Also keep in mind that many of the higher priced efficient clothes washers are actually dryers as well, negating the need for a separate dryer. Most efficient models offer various controls over wash and rinse temperatures, load

size, and presoak cycles, and some also feature a “suds saver” option that saves soapy water from one cycle to the next. In addition, certain machines automatically sense load size, the dirtiness of the water, and even fabric type, and adjust the water level and wash cycles accordingly.

H-axis machines are capable of faster spin-speeds than V-axis machines. Faster spin-speeds mean more water is wrung from the clothes before they are dried, thereby reducing the amount of energy needed to adequately dry the clothes. Other advantages of using highly efficient washers are that they clean clothes better and require less detergent. In some cases you can actually save money on detergent and still have the same quality of service. In addition, studies have shown that more efficient washers tend to cause less wear, thus extending the life of your clothes.



## CLOTHES DRYERS

The clothes dryer is typically the second or third largest electricity- or gas-consuming appliance in your home. An electric dryer typically costs about \$80 per year and consumes about 970 kilowatt-hours per year.<sup>4</sup> Even if you live in a damp or cold climate, it is not necessary to use your clothes dryer all the time. Using a dryer can actually wear out clothing, as the high temperatures damage the fibers. Also, inefficient dryers with poor controls can overheat clothes that are already dry, damaging them even further. Drying clothes outdoors on a line performs the same function without using electricity or generating pollution, it is gentler on your clothes, and it's free. Unless it is raining or the temperature is below freezing, your clothes will generally dry in a day or less. In wet or cold weather, you can still bypass the dryer by hanging clothes inside, although this isn't advisable if your house has a moisture problem. They will also smell fresher and last longer.

**Figure 3: Lint kit**

Lint kits let you reuse the hot air from your dryer in the colder months.



Source: Lambro Industries

### Operating your dryer more efficiently

There are many ways to save energy with your dryer. Here are some tips:

- Run only full loads, as small loads are less economical. However, don't overfill the machine—air needs to be able to circulate around the clothes to properly dry them;
- Dry heavy clothes such as cotton towels, jeans, or jackets separately from light clothing, such as underwear and summer clothing. Lightweight fabrics take less time to dry than heavy fabrics, so preventing them from being overheated or dried too long can extend the life of lightweight shirts, pants, and other items;
- Dry two or more loads in a row and make use of the hot air already in the dryer from the first load;
- Locate your dryer in a heated space. A dryer in a cold or damp basement will have to work harder to get your clothes dry;
- Don't over-dry clothes. If your machine has a moisture sensor, use it. If it has a timer, consider shortening the drying time;
- Clean the fluff out of the filter before every load to allow air to circulate better. And regularly clean the lint from vent hoods and lint kits;
- Check the outside dryer vent. If it doesn't close tightly, replace it with one that does. You'll keep outside air from leaking in, reducing heating and/or cooling bills; and
- If you have an electric dryer, install a lint kit (\$5–10) to vent the exhaust heat and humidity into the house in winter—an easy project. (Exhaust fumes rule out this option for gas dryers.)

### New dryers

As with cooking appliances, dryer manufacturers are not required to meet any minimum energy standards. The basic technology of the most commonly used dryers varies little from one model to another, with energy savings being obtained chiefly through what the industry calls "termination controls"—in other words, controls that shut the machine off. These include simple timers (which require the user to guess how long a given load will take to dry), advanced temperature sensors (which indirectly estimate dryness), and sophisticated moisture sensors (which directly measure dryness). Also, some models allow users to set a start-time so the dryer operates during off-peak hours (e.g., during the night) when electricity rates are cheapest.

A condensing dryer works by sending warm air through the clothes, which absorbs the moisture from the clothes and dries them. The moisture laden air is then sent through a heat exchanger where the moisture condenses out. This type of dryer can be ideal for the home because it does not need a vent and you can install it anywhere. The latest advancement of condensing dryers is called a Heat Pump Clothes Dryer (HPCD). HPCDs are also ventless and utilize the concept of moisture condensation, but they re-use the heat from the exit air stream, making them up to two times as efficient as conventional dryers. This heat can then be used to help heat the home during the winter. Nyle is one company that will be coming out with a HPCD soon. Additional information can be found at [www.nyletherm.com/dryer.htm](http://www.nyletherm.com/dryer.htm).

### Other clothes cleaning considerations

There are many health and environmental concerns associated with the toxic chemical perchloroethylene or “perc,” which is used in dry cleaning. The dry cleaning industry has been working with the EPA to develop safer methods for the dry cleaning process. A water-based system called wetcleaning, which uses large programmable machines to wash and dry clothes, is now available. Wetcleaning does not use perc, but it does consume more water and therefore might just be a stepping-stone towards more environmentally benign processes. The use of carbon dioxide in its liquid form as an alternative to perc is being researched as well. For more information, the EPA offers a “Cleaner Guide” on its website at [www.epa.gov/dfe/pubs/garment/gcrg/cleanguide.htm](http://www.epa.gov/dfe/pubs/garment/gcrg/cleanguide.htm).

Keep in mind the environmental consequences of using the various detergents available. There are plenty of detergents that are not harmful to the environment and clean clothes (and dishes) just as well as those that are. In fact, if you are sensitive to chemicals, using environmentally friendly products could alleviate a range of health-related problems, such as skin irritation and allergic reactions. Keep in mind that if you use biodegradable and natural cleaners, the wastewater from your washer could be used to water your lawn, reducing your water bill. While it is possible to construct a sump pump and piping system, the simplest way to collect “gray water” from a washing machine is to run the water into a large trash can for later use on your lawn. Keep in mind that many states have specific regulations on how “gray water” can be used around the home. Contact your state’s environmental department for more information.

Lastly, if you do decide to replace your washer and dryer with energy efficient ones, remember to dispose of your old ones responsibly. If it is too inefficient for *you*, then it is too inefficient to pass on to someone else. You should check with your local utility to see if it offers rebates for purchasing energy efficient appliances.

### DISHWASHERS

Eight years ago, a dishwasher typically used the equivalent of 700–850 kilowatt-hours of electricity annually. Currently, there are several models available that consume less than 400 kilowatt-hours per year, with the most efficient units using around 204–282 kilowatt-hours per year (see Table 1). As with clothes washers, the majority of a dishwasher’s energy (about 80 percent)<sup>5</sup> is used not to run the machine but to heat the water—which means that the best way to improve efficiency is to cut down on hot-water consumption.<sup>5</sup> Most modern dishwashers have a built-in booster heater, which raises the temperature of the water during wash cycles to 140°F to kill germs and cut grease. While this feature increases the dishwasher’s electricity requirement, it means you can lower the setting on your hot-water heater to 120°F because that’s the highest temperature needed for all other household uses. Be aware that some dishwasher booster heaters are not thermostatically controlled—they turn on regardless of the intake water temperature, which merely adds to the energy waste if you don’t turn down your water heater. The most water-efficient dishwashers currently on the market use about five gallons of hot water per load in light or energy saving cycles, compared to 11 gal-

Table 1: Most efficient dishwashers

Brand	Energy use (kWh/year)	EF	Annual energy cost (\$)
Equator	166	1.29	14
Asko	181	1.19	15
Viking	232	0.93	19

Source: ACEEE, [www.aceee.org/consumerguide/topdish.htm](http://www.aceee.org/consumerguide/topdish.htm)

lons or more for conventional dishwashers in the same mode. Some cycles (e.g., the scrubber cycle) can require twice the hot water of other modes (efficiency cycle). To help you choose an efficient dishwasher, look up its Energy Factor (EF) number; a higher number indicates a more efficient machine. Keep in mind that dishwashers use standby power and do not have a “hard off” switch. This energy consumption is not factored in to their EF number.

Another energy-saving option is a switch that allows you to choose between heated- and unheated-air drying. Heated-air-drying elements draw considerable electricity while circulation fans for unheated-air drying use relatively little. By not using the heated-air for drying, you can save 12 percent of the energy consumed by your dishwasher when you use heated-air.<sup>6</sup>

Furthermore, if you do not use a lot of dishes, then a compact model dishwasher that uses much less energy per load could adequately serve your needs. Avoid rinsing dishes before you load them in the dishwasher, as today's machines are all capable of handling food scraps in the wash cycle. If you must rinse, use cold water, or scrape the food off with-out water.

#### Hand washing

Hand-washing dishes can use less hot water than using a dishwasher, if done efficiently. To find out if hand-washing is right for you, fill up your sink as you would normally when washing the dishes and measure the amount of water in it. You might use only a gallon of hot water for a load of dishes, therefore it would be more efficient to wash your dishes by hand. Or you might use quite a few gallons by continuously running water over the dishes; therefore it might be more efficient to use the dishwasher. If you do use a dishwasher, make sure each load you do is full. Also, you can always stop the dishwasher just before the drying cycle begins and let your dishes air dry.

Hand-washing can require from one gallon to many gallons, depending on the person. A few tips for minimizing your water use when hand-washing are:

- Wash them by the load, not one at a time with the water running;
- If you have two sinks, fill one with hot soapy wash water and the other with cold rinse water; and
- Install an efficient faucet widget on your kitchen sink to make it easier to reduce the water's flow.

## SUMMARY

Dishwashers and clothes washers and dryers all use a lot of energy and water and are responsible for a significant portion of the average household's energy bill. Often, this warrants a change in the equipment being used and/or the habits of those using the equipment. By utilizing the advice in this Brief, you can potentially save up to 50 percent of the energy and water used by washing equipment, without lowering the quality of the service the appliance provides. As a final note, the chemicals you use to clean clothes and dishes will stay in your clothes, in the water used, and in "sinks" (carpets, the air, etc.) in your house. It's important to recognize that such chemicals can make your home an unhealthy place for you and your family.

## ADDITIONAL RESOURCES

**Earth911** — This site is designed to help you find a local recycling center that accepts old appliances and other items. The website also provides mail-in sources if there is not yet a recycling center near you ([www.earth911.org](http://www.earth911.org)).

**Local utilities** — Offer rebates for replacing old appliances, which can save you money! To find out more about what programs are offered in your area, contact your utility. You can often find their internet addresses or other contact information on your billing statement.

**American Council for an Energy-Efficient Economy (ACEEE)** — ACEEE publishes *Consumer Guide to Home Energy Savings* annually. The *Guide* lists brands and models of appliances and their annual energy use and cost ([www.aceee.org](http://www.aceee.org)).

## NOTES

1. National Renewable Energy Laboratory, *Energy Savers: Tips on Saving Energy and Money at Home*, (Golden, CO: NREL, June 2003), DOE/GO-102003-1760.
- 2–4. Ira Krepchin & Jennifer Thorne, *Residential Appliances Technology Atlas*, (Boulder, CO: E SOURCE, 2001).
5. National Renewable Energy Laboratory, *Energy Savers: Tips on Saving Energy and Money at Home*, (Golden, CO: NREL, June 2003), DOE/GO-102003-1760.
6. Natascha Castro, "A New Federal Test Procedure for Dishwashers," *Appliance Magazine*, (November 2003).

Contact your local utility or energy office for information on rebates that may be available in your area on the purchase of new energy-efficient appliances. This publication is intended to help you improve the resource efficiency of your home. You should use your best judgment about your home, and seek expert advice when appropriate. Rocky Mountain Institute does not endorse any products mentioned and does not assume any responsibility for the accuracy or completeness of the information in this Brief. Written by Sarah Goorskey, Andy Smith, and Katherine Wang. © Rocky Mountain Institute 2004.

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