APPLIANCES

Energy Use for Appliances

Household appliances, including lighting, account for roughly 23 percent of energy consumption in the average Virginia home. Because these appliances are primarily powered by electricity, which is more expensive per unit of energy than other fuels, they comprise a larger share of the average household energy expenditure: roughly 30 percent.

There is a lot you can do to control and reduce appliance energy use. If any of your appliances need replacement, you can select more efficient models. Even if your current appliances don't need to be replaced, it might be a good idea to do a little research now so that when they do go, and you have to rush out to buy replacements, you'll know what you want (as you know, appliances usually fail over holiday weekends when the in-laws are visiting!).

If you're not planning to replace an existing appliance, there are often simple measures that can be taken to improve its energy performance. And, even if your appliances are in perfect working order, adjusting the way you use them can often reduce their energy consumption.

Shopping for New Appliances

Most new appliances tend to be considerably more energy efficient than their predecessors. Energy efficiency alone is rarely enough justification for replacing an old appliance since the energy savings are typically not great enough to justify the cost of the new appliance. However, there are many reasons people decide to replace an old appliance. It may have stopped working completely or it may simply not look right in a newly remodeled kitchen. Regardless of the reason for buying a new appliance, it almost always pays to buy an energy efficient model.

One very useful resource is the Consumer Guide to Home Energy Savings, published each year by the American Council for an Energy Efficient Economy (1001 Connecticut Avenue, N.W., Suite 801, Washington, D.C. 20036)

Energy Star

The U.S. Department of Energy (USDOE) and the Environmental Protection Agency (EPA) have formed a partnership to promote the use of a wide range of energy efficient equipment, products, appliances and even new homes – by awarding the Energy Star label (above) to those items that save energy by meeting specific energy efficiency criteria. This label helps consumers identify products that save money and energy.

Energy Star is also an educational program that provides information to consumers about the benefits of high efficiency appliances, equipment and building components. The payoff is decreased energy consumption, which lowers energy bills over time and reduces the environmental impacts of fossil fuel power generation.

Energy Star is forming partnerships with manufacturers and retailers nationwide. Companies are volunteering to place the Energy Star label on all of their products that meet or exceed the Energy Star criteria, which always surpasses the minimum national efficiency standards.

An Energy Star equipped household can reduce its home energy bill by 40 percent and prevent the release of 70,000 pounds of carbon dioxide over the lifetime of the products.

When shopping for new appliances always be sure to look for the Energy Star label so that you can purchase the most energy efficient dishwasher, refrigerator, or clothes washer that is available. The initial purchase price for an Energy Star labeled appliance may be higher than a less efficient unit but you will save money over the lifetime of the product and you will be helping to preserve the environment as well.

The EnergyGuide label

One of the most useful tools for shopping for energy efficient appliances is the EnergyGuide label. Federal law

requires that EnergyGuide labels be attached to all new refrigerators, freezers, water heaters, dishwashers, clothes washers, air conditioners, heat pumps, furnaces, and boilers. These labels are bright yellow with black lettering and should be prominently displayed. The guide shows the type of appliance, the size, make and model, model's annual energy consumption or energy efficiency rating, the scale range or its annual energy consumption or efficiency rating for models similar in size and type, and the estimated yearly operating cost. The labels do not tell the consumer which appliance is best to buy but do indicate the estimated annual energy consumption and operating cost at a given rate, which allows you to compare models. The following explanation should give you a good idea of exactly what the EnergyGuide labels tell you and how it can help you make an informed decision when shopping for new energy efficient appliances.

It is important to remember that an EnergyGuide label does not mean that the appliance is an Energy Star appliance. But EnergyGuide labels often note whether the product is Energy Star qualified.

The information provided by EnergyGuide labels varies somewhat with different appliances, so we'll take a look at several different categories of appliances and provide examples of labels. EnergyGuide labels are not required on kitchen ranges, microwave ovens, clothes dryers, demand type water heaters, portable space heaters, or lights.

Refrigerators and freezers

For refrigerators (Figure 7-1), you will see a large number at the bottom of the label. This tells you the approximate yearly operating cost for that particular model, and it's the best way to quickly compare one model to another. Keep in mind that all these estimates are based on standardized tests. As with EPA auto mileage ratings, the values are very useful for comparing one model to another, but your real costs may vary.

EnergyGuide labels for freezers are the same as for refrigerators.

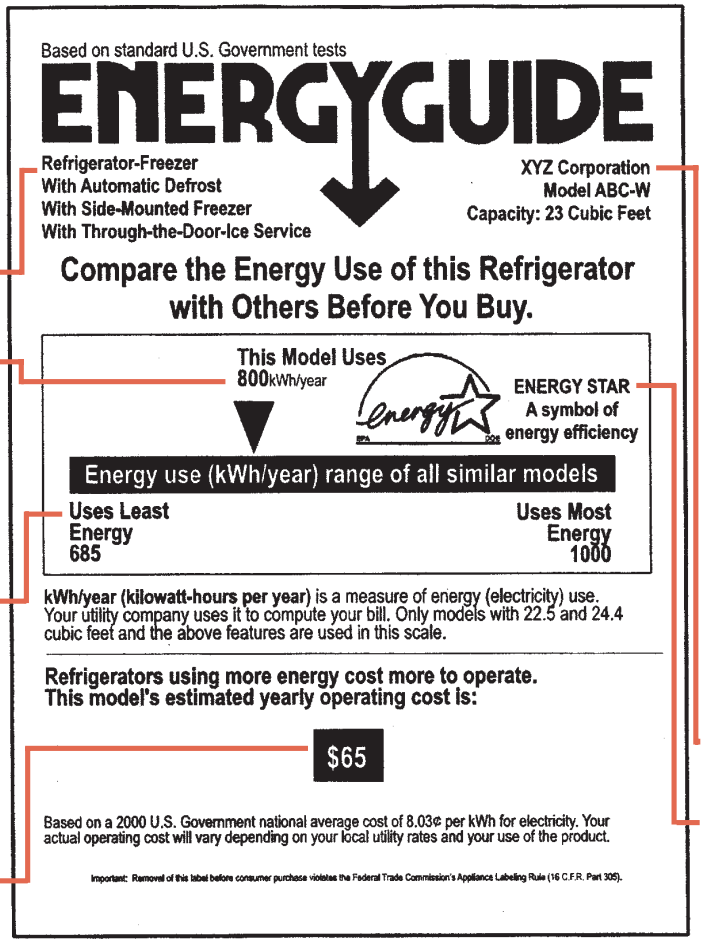


Figure 7-1 - EnergyGuide refrigerator label. Like all EnergyGuide labels, it is bright yellow with bold black letters and numbers.

1. Top of label: Type of appliance and features.
2. Estimates of the appliance's annual energy use or consumption. The lower the number, the more energy efficient the appliance and the less it costs to run.
3. The range of ratings for similar models, from "uses least energy" to "uses most energy." This scale shows how a particular model measures up to the competition.
6. An estimate of the annual cost to run this model or an estimated yearly operating cost. This is based on the average cost of electricity around the country, which changes from year to year. The labels on different models or even on the same models in different stores may have been printed at different times, so the numbers may be a little different. Also, because your electricity costs are probably different from the national average, this may not tell you how much the refrigerator will cost to operate in your area.
5. Size, make, and model information.
6. An Energy Star logo indicates the appliance is Energy Star qualified.

Water heaters

For water heaters, the EnergyGuide label looks just like the label for refrigerators, except that the detailed information provided for determining the actual operating cost is based either on electricity costs or gas costs, depending on the type of water heater. Electricity prices are given in cents per kilowatt-hour and gas prices in cents per therm (100,000 Btu) or cents per ccf (hundred cubic feet) of natural gas.

Water heaters designed for propane should have EnergyGuide labels with energy costs in cents per gallon, although the range may not go as high as your propane cost. If the per-gallon prices listed on the label do not go high enough, divide your actual propane cost by the highest propane cost listed, and multiply the estimated annual cost by that value. Refer to Chapter 6 for more information on water heaters.

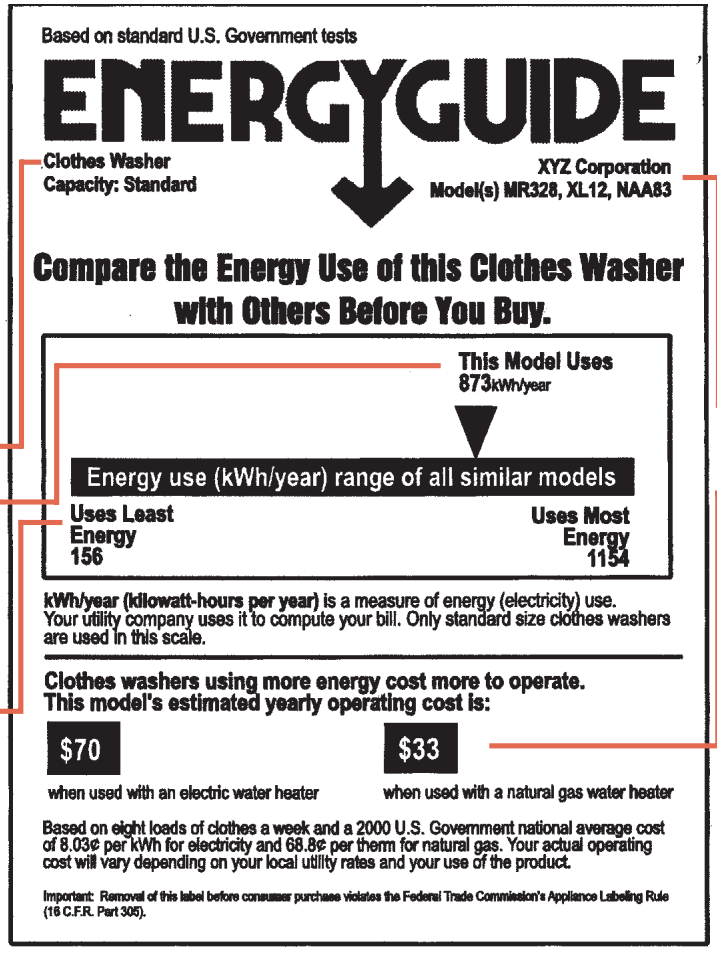
Dishwashers and clothes washers

For appliances that use hot water (dishwashers and clothes washers), the labels are a little different. Most of the energy used by these appliances is for heating the water rather than running the appliance itself. Under typical usage patterns, water heating accounts for about 80 percent of the energy use by dishwashers and 90 percent of the energy use by clothes washers. (The rest of the energy is used for pumps, motors, and an electric drying cycle in dishwashers.) So how much money you spend each year for one of these appliances depends on how you heat your water.

The EnergyGuide labels for these appliances, therefore, provide two sets of numbers– one for electric water heating and one for gas water heating (Figure 7-2).

If you have a propane water heater, you will need to calculate your annual operating cost using the natural gas table. One gallon of propane is equivalent in energy content to .93 therms (or ccf) of natural gas. Because a

Figure 7-2 - EnergyGuide clothers washer label. Clothes washers and dishwashers vary in their operating costs depending on whether you heat your water with electricity or gas. Figures for both are listed on the labels.



1. Type of appliance

2. Estimates of the appliance's annual energy use. The lower the number, the more energy efficient the appliance, and the less it costs to run.

3. The range of ratings for similar models, from "uses least energy" to "uses most energy." This scale shows how a particular model measures up to the competition.

4. Manufacturer and model number information.

5. Estimated annual operating cost. If you have an electric water heater, use the number on the left. If you have a gas water heater, use the number on the right.

gallon of propane is usually a lot more expensive than a therm of natural gas, the tables on the EnergyGuide label probably do not go high enough. Use the following method to calculate your costs if using a propane water heater:

Divide your cost of propane (per gallon) by the highest cost per therm of natural gas listed, and multiply that value by 1.08 (to account for the greater heat content in natural gas). The resulting number is the factor you should use to calculate your expected annual operating cost. Multiply that factor by the annual operating cost listed on the bottom horizontal line of the EnergyGuide label. For example, using the dishwasher EnergyGuide label in Figure 7-2, if you pay $1.28 per gallon for propane, divide $1.28 by $.60 and multiply that value by 1.08 ($1.28 ÷ $.60 x 1.08 = 2.3). If you do six loads of dishes per week, your expected annual operating cost would be $97 ($42 x 2.3 = $97).

Room air conditioners

For room air conditioners (air conditioners that are installed either in a window or into an opening in the wall), the EnergyGuide label includes an energy efficiency rating (EER) instead of an annual energy cost number. The EER tells you how efficient the air conditioner is. An average model on the market has an EER between 8-1/2 and 9-1/2, while the most efficient models have EERs as high as 12.

An EnergyGuide label for room air conditioners is shown in Figure 7-3. For federal recommendations on room air conditioner EER, see Table 5-1.

Choosing And Using Appliances

On the following pages, each of the major home appliances are covered in detail, listing considerations for selection of new equipment, suggestions for improving the efficiency of older models, and tips on how to use the equipment for maximum energy performance.

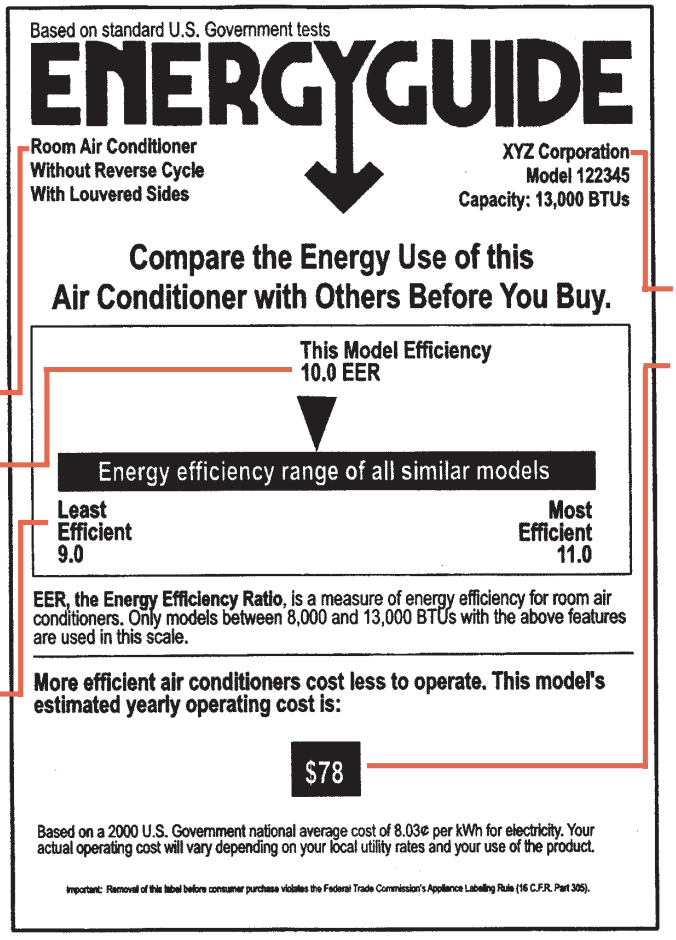


Figure 7-3 - EnergyGuide labels for room air conditioners look much like other EnergyGuide labels except that energy efficiency rather than average annual operating cost is featured most prominently.

1. Type of appliance and features.
2. This model's energy efficiency rating, which is the cooling output (in BTU) divided by the power consumption (in watt-hours). The higher the number, the more efficient the air conditioner.
3. A scale indicating range of efficiency ratings for models similar in size and type.
4. The size, make, and model number.
5. This model's estimated yearly operating cost.

Refrigerators and freezers

If your refrigerator was purchased before 1975, it probably consumes at least twice as much electricity as an energy efficient new model. If your refrigerator is 10 years old or older, it uses as much energy as two of today's Energy Star labeled refrigerators.

The National Appliance Energy Conservation Act (NAECA) sets maxiumum energy use standards for all home refrigerators and freezers. All new equipment for sale must meet NAECA standards. You can save money and energy, however, by buying equipment that exceeds the NAECA standards.

The Federal Energy Management Program (FEMP) lists recommended annual energy use and the energy use of the best refrigerators currently available. The FEMP recommended annual use is also the maximum energy use allowed for *Energy Star* labeling.

When looking for a new refrigerator or freezer, also consider these points:

- Avoid convenience features that you don't really need. In most cases, through-the-door ice dispensers and water dispensers increase energy use.
- Most new refrigerators have heating elements built into the wall of the refrigerator that help prevent condensation from forming. This feature is often not needed and wastes energy if not turned off. Choose a model that has a power saver or energy saver switch to turn off these heating coils when not needed.
- With freezers, manual defrost models are considerably more energy efficient than frost-free models – this difference in efficiency will be reflected on the Energy-Guide labels.

Chest freezers are 10-25% more efficient than upright models because they are better insulated and they don't expel as much air when the door is opened.

Installation of refrigerators and freezers

You will achieve better energy performance from a refrigerator or freezer by observing the following recommendations:

Table 7-1 – Recommended and Best Available annual energy use for refrigerator-freezers according to the Federal Energy Management Program.

Equipment type	Annual Energy Use (kWh)	
	Recommended	Best Available
Single-Door Compact Refrigerators		
<2.4 cu. ft	270	—
2.5-4.4 cu. ft	285	—
4.5-6.4 cu. ft.	305	245
6.5-8.4 cu. ft.	325	—
>8.5 cu. ft.	345	—
Refrigerators with Bottom-Mount Freezer		
<18.4 cu. ft.	505	501
18.5-20.4 cu. ft.	510	—
>20.5 cu. ft.	515	510
Refrigerators with Top-Mount Freezer		
<10.4 cu. ft.	350	—
10.5-12.4 cu. ft.	375	—
12.5-14.4 cu. ft.	400	394
14.5-16.4 cu. ft.	420	372
16.5-18.4 cu. ft.	445	414
18.5-20.4 cu. ft.	465	417
20.5-22.4 cu. ft.	480	457
22.5-24.4 cu. ft.	500	498
>24.5 cu. ft.520	516	
Refrigerators with Side-by-Side Freezer		
<20.4 cu. ft.	590	—
20.5-22.4 cu. ft.	610	568
22.5-24.4 cu. ft.	640	605
24.5-26.4 cu. ft.	665	591
26.5-28.4 cu. ft.	685	—
>28.5 cu. ft.	710	614

- Make sure that air can freely flow across the coils. Don't close the refrigerator into a confined space unless it's a model that is specially designed to be "built in." Leave at least a 1" space on each side of the unit to allow for adequate air flow to carry heat away.
- Install refrigerators and freezers away from heat sources, such as oven and dishwashers, and out of direct sunlight.
- It often makes sense to install freezers in a cooler basement or attached garage, though manufacturers recommend against installation in locations where temperatures can drop below freezing.

Maintenance

- Keep the condenser coils clean. Dust and dirt accumulation on the heat exchanger coils on the back or bottom of a refrigerator will reduce its efficiency. They should be vacuumed off at least once a year– more often if your home is particularly dusty. Follow the manufacturers instructions for cleaning, and as a safety precaution, unplug the unit while moving and cleaning it.
- Check door seals and replace if leaky or worn. To test the seals, close a dollar bill in the door. If the dollar bill pulls out with no resistance, the seals probably should be replaced.
- Check the temperature settings and adjust as necessary. The refrigerator compartment should be between 36°F and 38°F, and the freezer compartment between 0°F and 5°F. Lower temperature settings are unnecessary and waste energy.
- Defrost as necessary. Ice buildup on the coils decreases heat transfer and reduces overall efficiency of refrigerators and freezers. Manual defrost and partial automatic defrost refrigerators and freezers should be defrosted whenever ice builds up more than 1/4" on the coils.

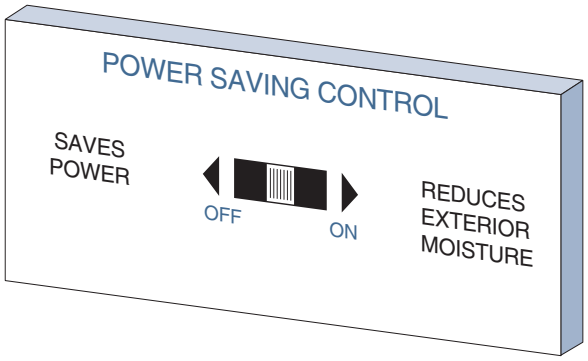


Figure 7-4 - Most new refrigerators have a "power saver" switch like this one to turn off heating elements in the walls when condensation is not a problem.

Operation

- Don't keep your freezer or refrigerator doors open any longer than necessary. Keep your refrigerator and freezer organized so that items can be found without a long search.
- Avoid putting containers of hot food in a refrigerator or freezer. Let them cool first.
- Keep your freezer fairly full– it will perform better than if it is nearly empty. You can fill plastic containers with water and freeze them to fill up extra capacity.
- Rethink that old spare refrigerator running in the basement. It may be costing you as much as $200 per year to keep a couple of six-packs of beer cold. Perhaps your spare refrigerator should be run only when you need the extra space: for holidays, parties, and family gatherings. If you decide to stop using it long-term, unplug it and remove the door for safety.

Dishwashers

Water heating accounts for about 80 percent of the energy use of dishwashers; most of the rest is for the electric drying cycle. As a result, the most important strategies to reduce energy use involve cutting hot water use and limiting usage of the electric drying cycle, as explained under "Operation" on the next page.

Buying a new dishwasher

The EnergyGuide labels on new dishwashers list annual operating cost, but it is important to note that the EnergyGuide ratings are based on very specific operating cycles, and that they do not factor in certain energy saving features.

- Look for an energy saving wash cycle option.

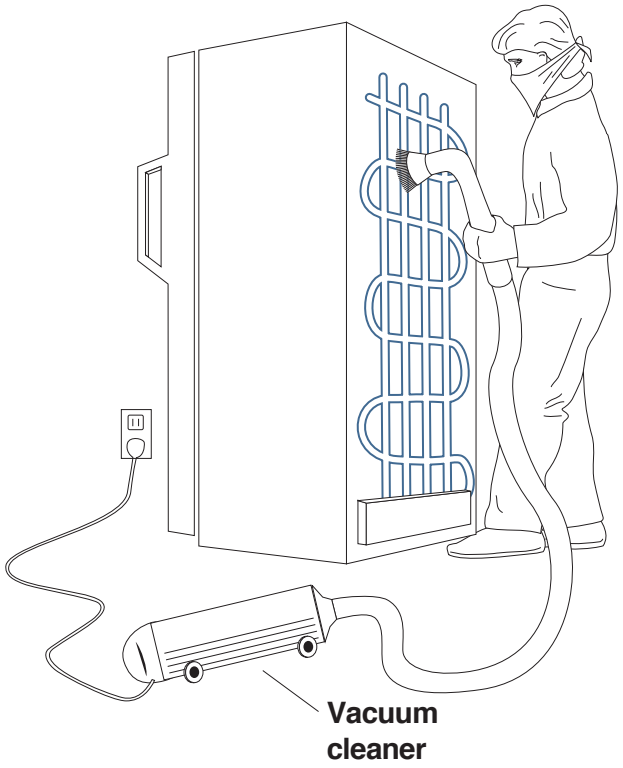


Figure 7-5 - The coils on the back or bottom of your refrigerator need to be cleaned periodically to maintain peak efficiency.

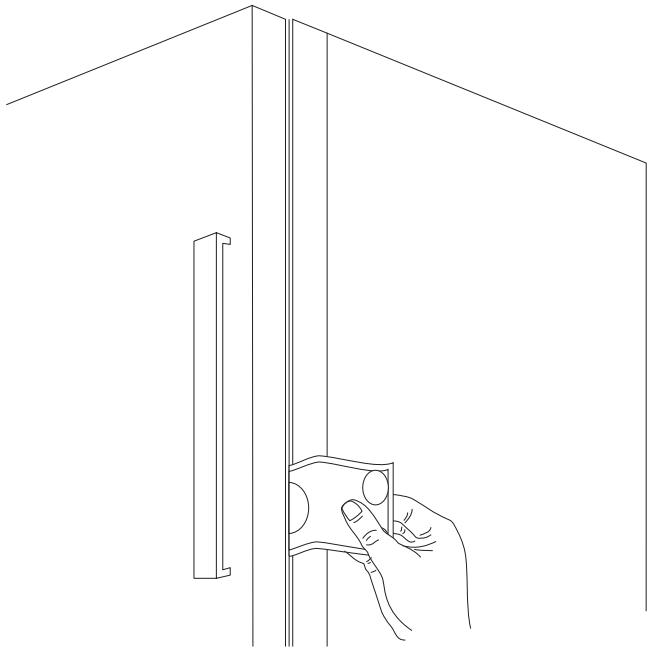


Figure 7-6 - Check the seal in your refrigerator door by closing it on a dollar bill. If the bill pulls out easily the door may not be sealing properly.

Many dishwashers offer a "light wash" cycle that uses less water and operates for a shorter period of time. This cycle will be perfectly adequate for lightly soiled dishes, and it will save energy.

- Buy a dishwasher that has a built-in booster heater. For optimum performance, dishwashers need 140-145°F water. Many dishwashers have booster heaters that can heat water from 110°F or 120°F up to the required temperature. The advantage, from an energy standpoint, is that with a booster heater, you can turn down the temperature setting on your water heater, thereby avoiding unnecessary standby losses.
- Look for dishwashers with Energy Star labels. Energy Star labeled dishwashers have been identified by the U.S. Department of Energy as the most energy efficient dishwashers available, exceeding Federal standards by at least 13%.

Installation

- Position the dishwasher as close as possible to the water heater to minimize the piping run and resulting heat loss.

Operation

- If your dishwasher has a lower water use light-wash cycle, use it whenever possible.
- Use the no heat, air dry feature on your dishwasher. If you have an older model without this feature, you can turn off the dishwasher and open the door after the final rinse cycle to let the dishes air dry. Be aware that drying will take longer, however, and some spotting is possible. Federal law requires that all new dishwashers have a no heat drying option.
- If your dishwasher has a booster heater, turn the thermostat on your water heater down to 120-130°F (check the dishwasher manufacturer's recommendations for minimum water heater setting).
- Avoid the temptation to pre-rinse dishes before putting them in the dishwasher. Most quality dishwashers today do an excellent job without pre-rinsing. Simply scrape off solids and pour out

liquids before loading dishes. If you must rinse dishes first, use cold water. Some advanced dishwashers can sense how dirty the dishes are and adjust the cycles accordingly. These dishwashers don't use more water than is needed to clean the dishes. This saves energy.

- Wash full loads. A dishwasher will use the same amount of water (and energy) whether it is washing a full load or a nearly empty load. If possible, gradually fill up the dishwasher during the day and operate it just once, at night. However, don't overfill the washer to save "even more" energy. You need to leave plenty of room for water to circulate between dishes for proper cleaning.
- If you have a dishwasher but usually wash dishes by hand, you might not be saving any energy. If you tend to leave the water running while washing dishes, you would probably reduce your water and energy use by using the dishwasher instead.
- Look for dishwashers that use the least amount of water. Ask the salesperson how many gallons of water are used during different cycles. Dishwashers that use the least amount of water will cost the least to operate as well as conserve water most effectively.

Clothes washers and dryers

The average energy cost for washing and drying one load of clothes ranges from 17¢ to $1.10 at current Virginia energy prices. As with dishwashers, most of the energy use of washing machines is for heating the water used, so it's best to use less water and cooler settings. With dryers, the primary differences in energy use among different machines relates to how they sense when the clothes are dry. Gas dryers also generally cost a lot less to operate than electric models. You can usually save the most energy (and money) by changing the way you do the laundry. In fact, a load of laundry that is washed and rinsed in cold water, and hung on a line to dry, uses only about 3¢ worth of energy. Tips on buying and operating washers and dryers for maximum energy savings are presented below.

Buying a new washing machine

- Look for Energy Star labeled clothes washers. They come in front loading and top loading models. Both use less water and energy than standard clothes washers. Front loading models typically use less water and energy.
- Compare EnergyGuide labels of the different washing machines you are considering.
- Look for a model that lets you adjust the wash and rinse temperature settings individually. With warm and cold cycles, your energy and dollar savings can be dramatic, as shown in Table 7-2.
- You will need to determine for yourself whether or not the lower temperature wash settings clean your clothes as well as hotter settings. Cold water rinses are just as effective as warm water rinses, so they should always be selected.
- Choose a model that offers different water level settings, allowing you to use less water (and energy) for smaller loads. A typical top-loading machine uses about 20 gallons per load for the smallest setting, and up to 40 gallons per load for the largest.

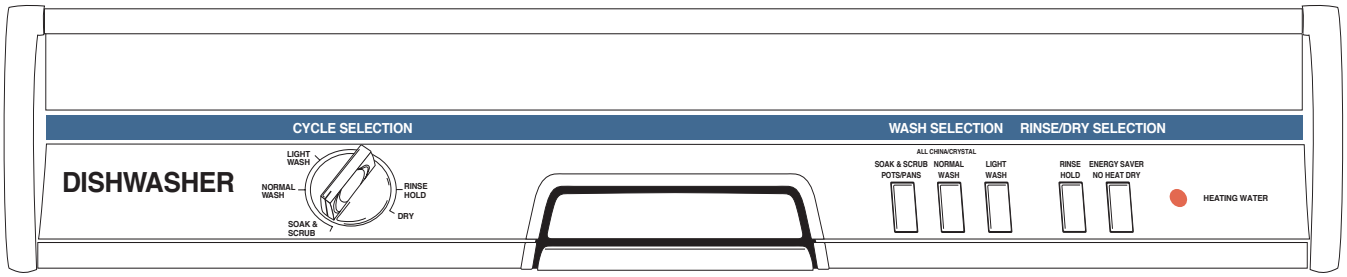


Figure 7-7 - Light/China and no-heat drying options offer substantial energy savings. This model also features an automatic booster heater, allowing you to turn your water heater down to 120-130°F.

- Consider a front loading (horizontal-axis) model instead of a standard top-loader. Front loaders use about half as much water and energy as top loaders, and some say the washing performance is actually better. Along with saving money for water heating, a front loading machine can cut your water and sewage bills (if you are on a municipal system), extend the life of a rural septic system, and save a lot of money on detergent. Energy Star top loading washers use sensor technology to control water temperature and volume, then use high pressure spray rinses to remove soap from clothes.
- Water extraction. The more water your washing machine extracts during its spin cycle, the less your dryer will have to work. Some (but not all) manufacturers list the water extraction specifications in their literature. Energy Star labeled clothes washers remove more water in the spin cycle than traditional washers.

Buying a new dryer

- Choose a dryer that shuts off automatically when the clothes become dry instead of one that can only operate on a timed cycle. If the only option is a timed cycle, you might be wasting a lot of energy by just heating clothes that are already dry– and damaging the clothes as well. The best controls have actual moisture sensors, while others sense only the temperature of the exhaust air.
- Gas dryers are usually much less expensive to operate than electric models– at least if you are

Table 7-2- Cost of washing a load of laundry

Electric Water Heaters			**Gas Water Heaters**		
Wash/Rinse Settings	kWh Used	Avg. Cost Per Load (cents)	Wash/Rinse Settings	Therms Used	Avg. Cost Per Load (cents)
120 F hot water temperature					
Hot/Hot	6.5	52	Hot/Hot	.248	19
Hot/Warm	4.9	39	Hot/Warm	.186	14
Hot/Cold	3.4	27	Hot/Cold	.124	9
Warm/Warm	3.4	27	Warm/Warm	.124	9
Warm/Cold	1.9	15	Warm/Cold	.062	5
Cold/Cold	0.4	3	Cold/Cold	-	3
140 F hot water temperature					
Hot/Hot	8.3	66	Hot/Hot	.329	20
Hot/Warm	6.3	50	Hot/Warm	.247	15
Hot/Cold	4.3	34	Hot/Cold	.164	10
Warm/Warm	4.3	34	Warm/Warm	.164	10
Warm/Cold	2.3	18	Warm/Cold	.082	5
Cold/Cold	0.4	3	Cold/Cold	---	3

Assumptions: Electricity price = $.08 per kWh; Gas price $.60 per therm.. Source: *Consumers Guide to Home Energy Savings*, ACEEE, 1996.

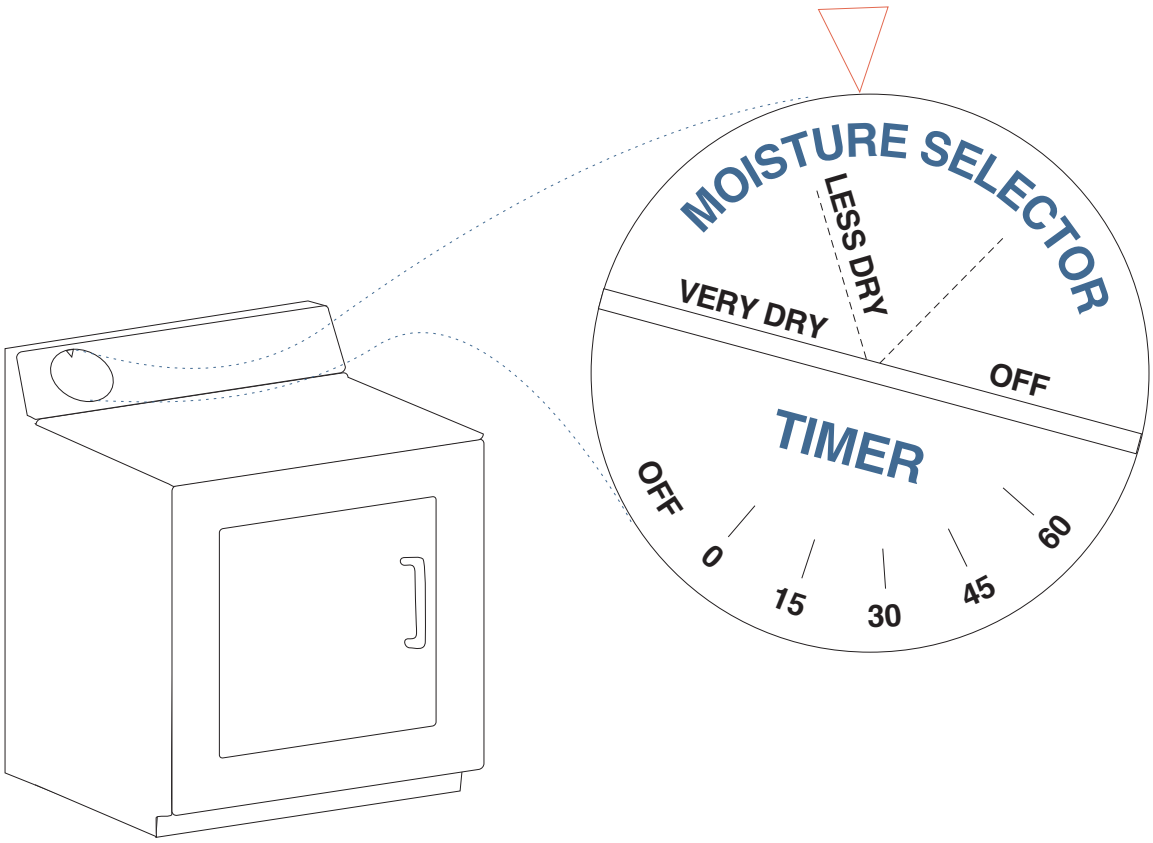


Figure 7-8 - Dryer selector dial. Setting the moisture selector to "less dry" may reduce wrinkling of laundry, thus saving energy for ironing as well as dryer operation.

able to use natural gas rather than propane. All gas dryers sold today are required to have electronic ignition instead of pilot lights. If you are considering buying a used model, be aware that the pilot light can waste a lot of energy.

Installation of washers and dryers

- Install the washing machine as close to the water heater as possible, and insulate the hot water pipes.
- Install a quality dryer vent hood that blocks return airflow. Standard metal vent hoods can result in considerable heat loss and cold air drafts. Dryers should always be vented to the outside. The best vent material is smooth metal ducting, since it does not impede airflow or collect lint. If you use flexible ducting, use the all metal type: it is resis-

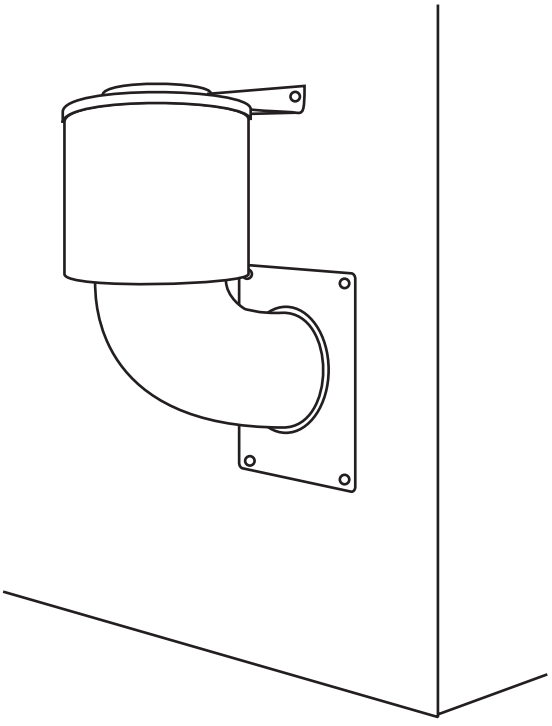


Figure 7-9 - A specially designed dryer vent hood will reduce air leakage into the house when the dryer is not running. Conventional hoods often allow significant leakage, increasing your heating or cooling bills.

tant to crushing and non-flammable. If your existing dryer is connected with flexible plastic ducting, make sure it is not crushed or compressed so as to restrict air flow.

- Never vent a dryer inside – not even an electric model. The exhaust contains chemical contaminants and lots of moisture, which can affect indoor air quality.
- Install washer and dryer in a heated space. Dryers in particular work more efficiently in heated spaces than in unheated spaces (such as garages).

Operation and maintenance

- Turn down your water heater. 120°F water will be adequate for most washing needs that require "hot" water.
- Fill the washing machine to capacity, but don't overload. Most people tend to under load washing machines, necessitating extra loads. When you don't have enough laundry to fill up the washing machine, use a lower water volume setting.
- Use the energy saving wash settings (lower temperature, water volume matched to load size). Cold water washing offers the greatest energy savings, and with detergents specially formulated for cold water, washing performance is usually satisfactory. Always use cold water rinse settings.
- Try to separate your clothes into like fabrics that will dry at a similar rate. Synthetics generally dry much faster than cottons.
- Never add wet clothes to a load of laundry that is already partially dry.
- Use the automatic drying cycle rather than timed drying. Timed drying continues to add heat after the clothes are completely dry, wasting energy.
- Be careful not to overdry clothes. Experiment with the settings on the automatic drying control, as many tend to overdry. You may find that the "less dry" is plenty dry enough. If possible, dry two or more loads in a row to benefit from the residual heat in the dryer.
- Clean the dryer lint trap after each load for improved drying efficiency and safety (follow manufacturer's instructions). Accumulated lint prevents moisture from escaping and can be a fire hazard.
- Periodically check the outside dryer exhaust hood to make sure that it isn't blocked and that the flapper or seal is in proper working order.
- In good weather, hang your laundry outside and use free solar energy to dry your clothes.

Federal Standards for Dishwashers and Clothes Washers

The National Appliance Energy Conservation Act (NAECA) sets maximum energy use standards for dishwashers and clothes washers. All new equipment for sale must meet NAECA standards. You can save money and energy, however, by buying equipment that exceeds the NAECA standards.

The Federal Energy Management Program (FEMP) lists recommended annual energy use and energy use of the best equipment currently available. The FEMP recommended annual energy use is also the maximum energy use allowed for *Energy Star* labeling.

Table 7-3 – Recommended and Best Available annual energy use for dishwashers and clothes washers according to the Federal Energy Management Program.

Equipment	Annual Energy Use (kWh)	
	Recommended	Best Available
Standard Dishwasher	555	277
Clothes Washers		
1.6 – 2.0 cu. ft.	315	239
2.1 – 2.6 cu. ft.	415	248
2.7 – 3.3 cu. ft.	520	309

Cooking appliances

Selecting cooking equipment has gotten a lot more complex in recent years. Along with the old stand-by gas or electric kitchen range with oven and top burners, we now have microwave ovens, high-tech halogen and induction cooktops, downvented ranges with popout grills, convection ovens, slow cook crockpots (insulated ceramic pot with electric heating element), single loaf bread ovens, and sophisticated countertop toaster ovens.

Just as importantly, our living and cooking habits have changed. Two career families need to consider speed and efficiency in cooking, plus the possibility of programming appliances to operate while family members are at work. There are no EnergyGuide labels for cooking equipment, because within a given model category and style there is very little difference in energy use between brands.

Cooktops

Cooktops can be part of a standard kitchen range, or a separate unit built into a counter. Different types of gas and electric cooktops are described below, with ovens discussed separately afterwards.

Gas cooktops

Many cooks prefer gas burners because they offer instant heat and greater temperature control. All new gas cooktops are required to have electronic ignition instead of

Figure 7-10 - Some of the newer technologies used in electric cooktops include solid disk elements, radiant coils or halogen bulbs under a ceramic glass top, and induction burners.

wasteful pilot lights. Some new models have sealed burners which make them easier to keep clean, but do not affect their energy use. You should always operate an exhaust fan when using a gas range to remove products of combustion as well as steam, grease, and cooking odors. Gas cooktops can produce carbon monoxide so be sure to have a UL-rated Carbon Monoxide (CO) detector in your home to determine if there are any unsafe levels of CO in your home as a result of operating a gas appliance.

Keeping the burners clean and making sure that there is no unnecessary flame impingement occurring between the flame and the pot are also good measures in preventing CO. Keep an eye on the bottoms of your pots and pans: if they get sooty from the burner flame, you may have a problem with poor combustion. Have a serviceman check, clean, and adjust the burners.

Electric cooktops

Exposed electric coils are the most common type of electric burner, and generally the least expensive. Several other types of electric cooktops are described below. Of these, only the induction elements offer significant energy savings over standard electric coils, and these elements are so expensive that the cost cannot be justified for energy savings alone.

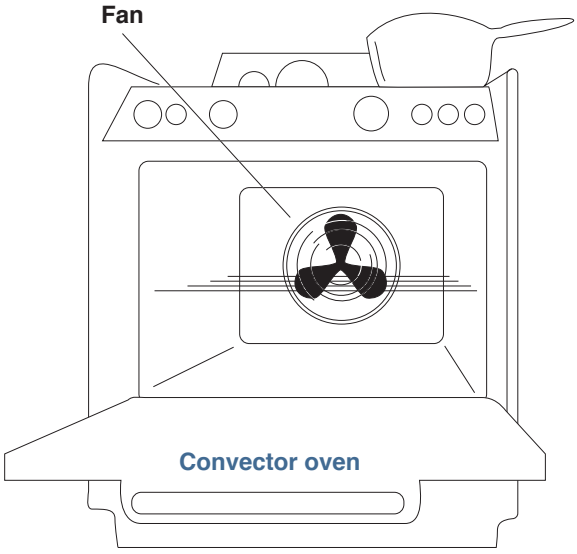


Figure 7-11 - A convection oven cooks more quickly and evenly than a standard oven, using less energy, by continuously circulating air within the oven compartment.

Solid disk elements. Solid disk elements look better and are easier to clean than electric coils, but they take longer to heat up and cool down so they tend to use more energy. The disks transfer heat to pans primarily through direct contact, so it is important to have good flat-bottomed pans for maximum contact between the disk surface and the pan.

Radiant elements under ceramic glass. Ceramic glass cooktops heat up more quickly than solid disk elements, though not as quickly as electric coils. They are more efficient than solid disks, and some are even more efficient than coil elements. Ceramic glass cooktops are quite expensive, however. As with solid disks, flat bottomed pans for good contact are important.

Halogen elements under ceramic glass. Halogen cooktops use halogen lamps under a ceramic glass surface to heat the cooking vessel. The lamps heat up very quickly, offering improved cooking control and providing slightly improved efficiency compared to standard radiant elements under ceramic glass cooktops. As with standard radiant elements, halogen elements require good contact between the pans and the surface.

Induction elements. Induction elements transfer electromagnetic energy directly to the pan containing the food. Since they don't waste any heat on the cooking surface, they are very efficient, using less than half the energy of standard electric coil ranges. Induction elements require the use of ferrous metal pans (iron or stainless steel); aluminum cookware will not work. Induction cooktops are also very expensive, making them hard to justify for energy savings alone.

Ovens

Standard gas and electric ovens are available either combined with cooktops (typical kitchen range), or as independent units. Newer convection ovens and microwave ovens can provide considerable energy savings. Smaller specialized cooking appliances that can be used in

Table 7-4 - Energy costs of various methods of cooking

Appliance	Temp.	Time	Energy	Cost(1)
Electric oven	350deg.	1 hr.	2.0 kWh	16 cents
Convection oven (electric)	325deg	.45 min.	1.4 kWh	11 cents
Gas oven	350deg.	1 hr.	.112 therm	7 cents
Frying pan	420deg.	1 hr.	0.9 kWh	7 cents
Toaster oven	425deg	.50 min.	.95 kWh	8 cents
Crockpot	200deg.	7 hrs.	0.7 kWh	6 cents
Microwave oven	"High"	15 min.	.36 kWh	3 cents

1. Assumes 8 cents/kWh for electricity and 60 cents/therm for gas. Source: *Consumer Guide to Home Energy Savings,* ACEEE, 1996.

place of full-size ovens and cooktops are also potential energy savers. These appliances include slow-cook crockpots, individual loaf bread cookers, and countertop toaster ovens.

Standard ovens

Among standard gas and electric ovens, those with a self-cleaning feature tend to be more efficient, because they have more insulation in the walls. Using this feature too often however (more than once a month) will cancel out any energy savings from the extra insulation, because so much energy is required for the self-cleaning. Ovens with no window in the door will be more energy efficient than those with one. The slight advantage may be lost, however, if the lack of a window makes the cook repeatedly open the door to check the food.

Be sure to keep gas ovens clean and all burners clean to prevent any unsafe levels of carbon monoxide. Always operate kitchen exhaust fans when gas ovens are in use.

Convection ovens

Convection ovens offer considerable energy savings because a fan circulates hot air throughout the oven compartment, allowing cooking temperatures and cooking time to be reduced. (See Table 7-4).

Microwave ovens

Introduction of the microwave oven was the most significant advance in cooking in the last fifty years. Cooking times can be reduced dramatically with many foods, and total energy consumption for cooking can be

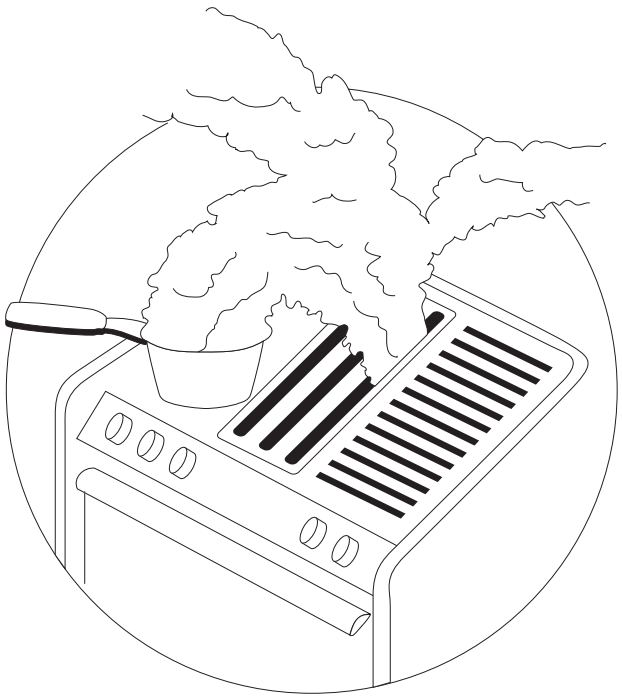


Figure 7-12 - Downdraft style kitchen exhaust fans are powerful. If a makeup air supply is not provided to replace the exhausted air, they can cause backdrafting of other combustion appliances in the house.

reduced by about two-thirds. You can save further by reducing the number of dishes to wash (you can serve food in the dishes it is cooked in), and by introducing less heat into the kitchen (you won't need to operate an air conditioner as frequently).

Ventilation

A range hood or other ventilation fan is very important for exhausting fumes and smells out of the house. When cooking with gas the fan should be running continuously. The exhaust fan must blow the air out of the house, not just recirculate it through a filter. A variable speed fan is the best option, since it allows control over how much air is exhausted.

There is a danger, however, with exhaust fans that are too powerful, particularly the popular downdrafting types, some of which are as large as 1,000 cfm (cubic feet per minute). When operating, these fans depressurize the house, drawing cold outside air in through cracks and gaps in your walls. This depressurization can also cause hazardous backdrafting of combustion appliances. If you do install a large ventilation fan, consider putting in a makeup air supply to balance the exhaust air.

Tips for energy-efficient cooking

- Instead of using your full-size oven for cooking small dishes, use a microwave oven, toaster oven, or slow-cook crockpot. A number of different ways of cooking a casserole are compared in Table 7-4.
- For stovetop cooking of rice, beans, and other foods that require a long cooking time, consider a pressure cooker, which will reduce cooking time considerably.
- For stovetop cooking, use the smallest pan necessary to do the job. With electric cooktops, try to match the pan size to the element size.
- Pans with copper or aluminum bottoms heat up more quickly than steel or cast-iron pans and can thus save energy.
- Clean the burner pans (the metal pans under burners used to catch grease) and keep them shiny so that they will reflect more heat up to your cooking vessel.
- With electric burners, including solid-disk and ceramic cooktops, make sure your pots and pans have flat bottoms to provide good heat contact between burner and pan.
- Cook with lids on your pans. Without a lid, cooking spaghetti can use three times as much energy.
- With gas burners, the flame should be blue. If you have a yellowish flame, the burner might not be operating efficiently. Have your gas company inspect it. Inefficient or dirty burners can produce dangerous levels of carbon monoxide.
- To reduce cooking time, defrost frozen foods in the refrigerator before cooking. When time constraints require quicker defrosting, use the microwave.
- Minimize oven preheat time. With many dishes, preheating the oven is not necessary.
- Avoid the temptation to open the oven door.
- To allow air circulation within an oven, don't lay foil across the grills. Try to stagger pans on the shelves to allow air circulation.
- When possible, cook several dishes at the same time in the oven. Cook double portions and freeze half for another meal. It takes a lot less energy to reheat food than to cook it.
- For oven cooking, use glass or ceramic pans instead of metal. You can usually turn the oven down 25° and not increase the cooking time.
- Avoid overcooking. Use meat thermometers and timers.
- If you have a self cleaning oven, try to use it soon after cooking a meal so that the oven will already be warm. Limit use as much as practical.
- Keep the inside surface of microwave ovens clean to improve efficiency, and cook foods right in microwaveable serving dishes (follow manufacturer's instructions on what type of cookware can be used in a microwave oven).

Table7-5 - Energy Consumption of Miscellaneous Appliances in the Home

Household Product	Typical Wattage	Typical Usage	Cost Per year @ $.076/kWh
Bathroom fan	60	1 hr/day	$1.66
Black & white television	556	0.6 hrs/day	9.15
Bottled water dispenser - (hot & cold)	65	24 hrs/day- 203 kWh/hr	15.43
Ceiling fan	23	hrs/day-5 mos/yr	2.22
Clock	860	24 hrs/day	1.33
Coffee maker	200	2 times/day	10.16
Color television	200	6 hrs/day	33.29
Computer	250	2 hrs/day	11.10
Dehumidifier	200	7 hrs/day-5 mos /yr	19.95
Electric blanket	200	4 hrs/day-5 mos/yr	9.12
Electric mower	900	12 hrs/yr	0.82
Furnace fan	300	1600 hrs/yr	35.36
Garbage disposal	450	22 hrs/yr	0.75
Humidifier	170	360 hrs/yr	4.66
Instant hot water	7000	2 hrs/wk	55.33
Iron	1100	4 hrs/mo	4.01
Spa/hot tub (electric)	2000	3 hrs/day	166.44
Sump/sewage pump	500	80 hrs/yr	3.04
Toaster	1100	2 hrs/mo	2.03
Toaster oven	1500	4 hrs/mo	5.47
VCR	20	4 hrs/day	2.22
Waterbed heater	350	7 hrs/day	67.96
Well pump	750	1.5 hrs/day	31.21
Whole-house fan	375	6 hrs/day-5 mos/yr	25.65
Window fan	200	3 hrs/day-5 mos/yr	6.84

Miscellaneous appliances

There are lots of other energy users around the typical home, some of which can be very significant. A few of them are described below. Others are listed in Table 7-5.

Humidifiers

Humidifiers can make you feel more comfortable in the winter months, when your household air tends to dry out, but some models use a considerable amount of energy to operate. If your home is too dry, consider reducing the natural air leakage (see Chapter 2). By reducing the amount of air exchange between the inside and outside during the winter, you will maintain higher humidity levels indoors. House plants also help to add moisture to the indoor air.

There are three main types of humidifiers on the market today: pad, ultrasonic, and heated.

- In a pad humidifier, a porous pad is kept wet and room air is blown through it, picking up moisture.
- In an ultrasonic humidifier, high-frequency sound waves break water into tiny droplets, which then evaporate in the room air.
- In a heated humidifier, an electric heating element boils water. The steam is then mixed with the room air.

Each of these humidifier types is available both in portable models and in models that permanently install on a furnace or heat pump.

Pad and ultrasonic humidifiers use much less energy than heated humidifiers, since the energy to evaporate the water comes from the room air rather than from an electric heating element. They must be cleaned regularly, however, to avoid a hazard from molds and bacteria (such as *Legionella*) that can grow on their cold, moist surfaces. In general, the ultrasonic models are easier to clean than the pad models. Cleaning is less critical for heated humidifiers, since the high temperatures kill most molds and bacterial.

Dehumidifiers

Used most commonly to keep basements dry, dehumidifiers can use significant amounts of electricity. One way to reduce dehumidifier energy consumption is to find and eliminate some of the moisture sources. Some possible sources are stored firewood in the basement, water leaking into the basement, and inadequate kitchen and bathroom ventilation. Be sure to keep windows closed when running a dehumidifier.

Look for a dehumidifier with the Energy Star label. To qualify for this energy efficient certification, a dehumidifier with the capacity to remove 10 – 24 liters of water from the air per day must have an Energy Factor of 1.30 or greater.

Home Office Equipment

With more people working out of their homes, energy use for computers, laser printers, copiers, and other office equipment is on the increase. When selecting equipment, consider the energy use. Laser printers, for example, use far more electricity than ink-jet printers and dot-matrix printers. Similarly, laptop computers use just a fraction of the electricity of desktop models. With copiers, look for models that have a low-energy-use standby mode.

On the subject of home offices, it is worth noting that the amount of energy you save by working at home and not commuting regularly to work will almost always more than make up for the increased energy use at home.

Be sure to purchase office equipment such as computers, monitors, printers, fax machines, and copiers that carry the Energy Star label.

Computers: An Energy Star qualified computer, in sleep mode uses 70% less electricity than computers without power management capabilities. If left inactive, Energy Star computers assume a low power mode and use 15 watts or less. New chip technologies make power management features more reliable and dependable than just a few years ago.

Monitors: An Energy Star monitor, in sleep mode, uses 90% less electricity than monitors without power management features. Energy Star labeled monitors automatically enter two successive low power modes of less than or equal to 15 watts and eight watts after a period of inactivity. Spending a long time in low power mode will save energy and help the monitor run cooler and last longer.

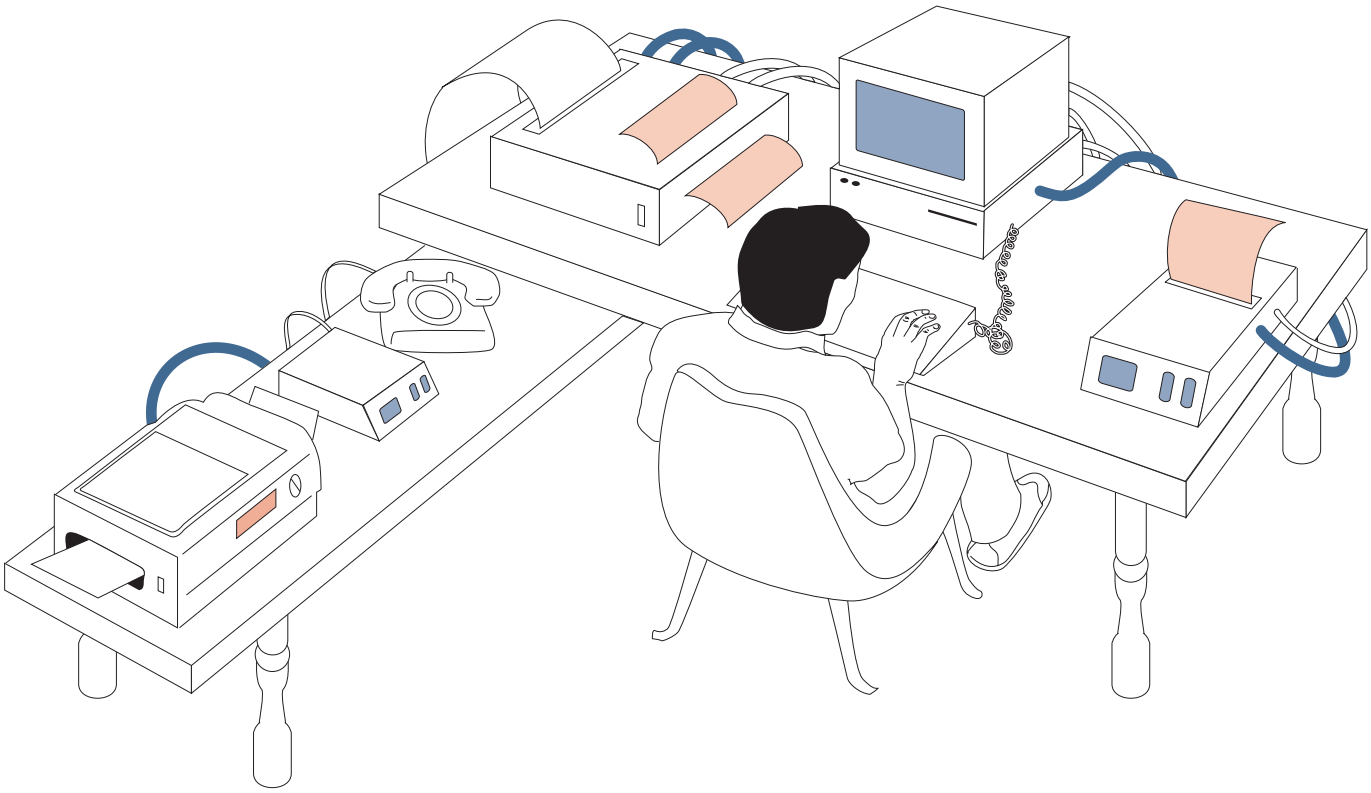


Figure 7-13 - Although home office equipment can use quite a bit of energy, it's almost always less than you would use otherwise by commuting to work.

Printers: Energy Star labeled printers can reduce the electricity usage by over 60%. Energy Star printers automatically enter a low power sleep mode after a period of inactivity and this not only saves energy but increases the longevity of the printer.

Fax Machines: An Energy Star qualified fax machine can save you about $35 in electricity bills over its lifetime. Because they power down, Energy Star labeled fax machines can reduce energy costs by 40%.

Copiers: Copiers can be the biggest energy users in the office because they sit idle for long periods of time. Energy Star copiers "sleep" or power down when not in use, and use 40% less electricity compared to standard models.

Remember that all Energy Star labeled office equipment uses power management features that save energy and reduce the use of electricity – this is good for the consumer and the environment.

Waterbed heaters

Surprisingly, a waterbed can be the single largest electricity consumer in the home, exceeding even the electricity use of a refrigerator. To reduce energy use by your waterbed, be sure to cover it with a comforter during the day, a simple measure that can cut energy use by 30 percent. Insulating the sides of the bed can save another 10 percent. You might also want to put the heater on a timer so that it isn't keeping the waterbed warm all the time. Some people don't use heaters at all, and instead insulate themselves from the waterbed with blankets or foam padding.

Well pumps

In rural areas that are not on municipal water systems, a lot of energy can be required for pumping water out of deep wells. Any measures taken to reduce water use in the home (low-flush toilets, low-flow showerheads, faucet aerators, water-saving cycles on the dishwasher and clothes washer, etc.) will reduce energy used for water pumping. If the pump seems to be coming on more

than it should, there may be a leak somewhere in the system, or the pressure switch may be malfunctioning. Have the system inspected.

Spas and hot tubs

While not found in most homes, spas and hot tubs can be huge energy users. If you have one, be sure to buy and use an insulated cover. When installing a hot tub, insulate well around the sides and bottom.

Color television sets

Some color television sets have an instant-on feature to avoid the long warm-up period. While the convenience feature is nice, it wastes a lot of energy because the TV is never fully off. If you have an older television with this feature, consider installing a switch on the power cord to turn it all the way off when not in use, or unplug it.

Energy Star labeled television sets consume less energy both when they are turned off (in standby mode) and when they are on (in active mode). Energy Star labeled televisions require three watts or less of power when switched off compared to conventional televisions that use up to 12 watts. Energy Star labeled consumer electronics save energy whether you are using them or not.

Cordless phones, answering machines, VCRs and DVD players also expend the majority of their energy during standby – while not in use.

Appliances and Air Conditioning

In summer, a hidden cost of inefficient appliances is in added air conditioning cost. This is because energy wasted by most appliances is dumped into the room as heat. For typical air conditioning system efficiency, each dollar saved in appliance operating cost saves about thirty cents in air conditioning cost.

Energy Tips and Recommendations

1. Consider replacing an appliance if it is over ten years old. Newer models are considerably more energy efficient.
2. Always purchase an appliance that is Energy Star qualified. Energy Star appliances and equipment are certified by the U.S. Department of Energy and the Environmental Protection Agency according to specific energy efficiency criteria and always surpass minimum Federal efficiency standards. Energy Star appliances may cost more initially but will save money over the life of the appliance and also help preserve the environment.
3. Study the black and yellow EnergyGuide label that is required by Federal law to be displayed on most appliances. This label will help you to comparison shop and identify those models that use the least amount of energy and cost the least to operate.
4. Provide all necessary maintenance on appliances and fully utilize any energy saving features that may exist such as power saving switches on refrigerators, energy saving wash cycles on dishwashers, and power management on computers and peripherals.
5. Keeping burners and ovens clean will enhance efficiency.
6. Use kitchen exhaust fans when operating gas ovens or cooktops. Gas appliances can produce carbon monoxide and proper ventilation is very important. Make sure that you have an UL-rated carbon monoxide detector installed in your home.
7. Take full advantage of energy efficient cooking tips. (page 83)
8. Purchase Energy Star labeled office equipment such as computers, monitors, printers, copiers, and fax machines. They possess power management features that save energy when the equipment is on as well as when the equipment is off.