# The Energy-

## Choose the right appliances to curb your home's energy appetite

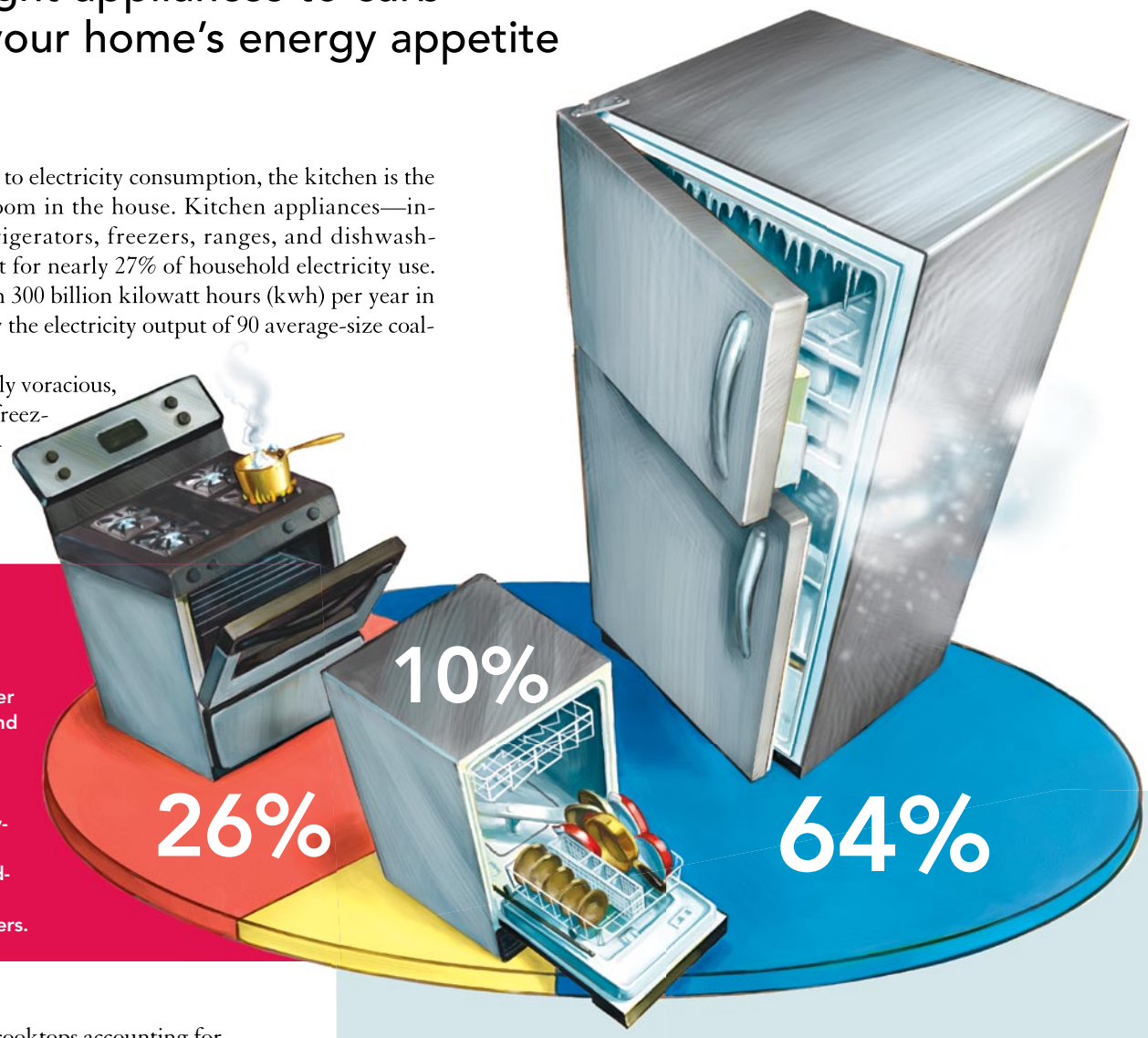
BY ALEX WILSON

When it comes to electricity consumption, the kitchen is the hungriest room in the house. Kitchen appliances—including refrigerators, freezers, ranges, and dishwashers—account for nearly 27% of household electricity use. Collectively, that's more than 300 billion kilowatt hours (kwh) per year in the United States, or roughly the electricity output of 90 average-size coal-fired power plants.

Not all appliances are equally voracious, however. Refrigerators and freezers account for nearly two-thirds of kitchen energy use, with ranges, ovens, and cooktops accounting for a little over one-quarter, and dishwashers the rest. Add in the heating, air conditioning, hot water, and lighting used in a kitchen, and this room is clearly the energy hog of most houses. Putting your kitchen on an energy diet might be one of the best things you can do to save money and resources. Like most diets, it all comes down to making informed choices.

### Where does the energy go?

**Kitchen appliances on average account for more than a quarter of household electricity use, and the appliances we use to keep food cold—refrigerators and standalone freezers—together are the biggest consumers. Ovens, coffeemakers, and cooktops, as a group, are the second-hungriest appliances in the kitchen, followed by dishwashers.**




### Refrigerators are the top energy guzzlers

In a typical American home, the refrigerator accounts for about 15% of total electricity use. Assuming heat and hot water are not electric, that makes the refriger-

### Two tools to measure energy efficiency

The blue Energy Star label and the yellow EnergyGuide sticker help consumers identify energy-efficient appliances. Energy Star labeling indicates compliance with guidelines set by the U.S. Environmental Protection Agency and the U.S. Department of Energy. Appliances rated by the program include dishwashers, refrigerators, and freezers (but not cooking appliances). While Energy Star compliance identifies an energy-efficient appliance, some models exceed the requirements more than others (see www.energystar.gov). Unlike the voluntary Energy Star program, the EnergyGuide label is required by the Federal Trade Commission on all fridges, freezers, and dishwashers (but not on cooking appliances). The label shows the model's capacity, its estimated annual energy consumption and operating costs, and a scale that compares its efficiency to that of similar models. The EnergyGuide label helps in comparison shopping but does not indicate Energy Star compliance.



Drawing: Matt Collins

# Smart Kitchen

## REFRIGERATORS: Style and use determine efficiency

### WHAT TO AVOID

- **Through-the-door ice and water dispensers.** Both the lost insulation and the additional cooling coils in a through-the-door ice and water dispenser increase electricity consumption.
- **Automatic ice makers.** Ice makers consume energy, though exactly how much is difficult to determine.

### WHAT TO LOOK FOR

- **The Energy Star label.** The U.S. Environmental Protection Agency confers its Energy Star label on models that are at least 15% more energy efficient than the federal minimum. Reading the label is an easy way to be sure that the refrigerator you choose is not an energy waster.
- **Freezers on top or bottom.** Side-by-side refrigerators use more energy.
- **Manual defrost cycles.** The most energy-efficient refrigerators and freezers have manual defrost, although they can be hard to find, particularly among high-end models.
- **Door alarms.** Some manufacturers offer an alarm that will sound if the fridge door is left open—helping to save energy and to prevent food spoilage.

### MAINTAINING HIGH PERFORMANCE

- **Place fridges away from heat sources**—especially a range or oven, but also a dishwasher. Radiant heat from these appliances warms the surface of the fridge, requiring more energy to keep the inside cool. If the refrigerator must be adjacent to a heat source, provide space for air circulation.
- **Clean the coils,** at least annually. Dust and dirt buildup on refrigerator/freezer coils reduces the heat-exchange efficiency and makes the compressor work harder. Most refrigerators now have coils that can be accessed from the front, eliminating the need to pull the unit away from the wall.
- **Turn off the condensation-control feature.** Essentially, these are heating elements under the protective shell that consume energy in two ways: by using electricity to warm the outer shell and by increasing the difference in temperature across the unit's insulation. Models with this feature usually have a switch to turn it off; do so, unless condensation becomes a problem.
- **Keep the freezer full.** Frozen food serves as a thermal stabilizer that reduces the amount of on-off cycling. If you don't have a lot of frozen food, freeze containers of water (use plastic, and allow for expansion as the water freezes) to take up the extra space. When you need ice for a cooler, you can use these frozen containers.
- **Don't keep an extra fridge in the garage.** When you buy a new refrigerator, avoid the temptation to keep the old one to store a few six-packs of beer or soda. Recycle it instead.

***Frugal features.*** *The most-popular features with consumers—such as automatic defrosting and through-the-door ice and water dispensers—are not always the most energy efficient. Still, Maytag's new Ice$_2$0 refrigerator meets Energy Star requirements and is equipped with two potentially energy-saving features: an alarm that alerts homeowners to a refrigerator door left ajar, and a vacation mode that saves energy by limiting automatic defrosting when the fridge isn't opened for several days.*

## INNOVATIONS TO WATCH FOR

**Vacuum-panel insulation.** Thermos bottles keep coffee hot because most of the air molecules in the double wall have been removed, keeping conductive heat transfer very low. The same idea has been incorporated into flat vacuum panels. Back in the mid-1990s, Whirlpool produced high-efficiency refrigerators that used inch-thick vacuum panels made by Owens-Corning, which had center-of-panel insulating values of R-75. The technology was dropped, but with a planned tightening of efficiency standards, vacuum-panel insulation could be back. Silica-aerogel insulation is another material that could find its way into refrigerators; it insulates better than the polyurethane foam used in most models (much better if in a vacuum panel).

**Linear, variable-capacity compressors.** Probably the biggest breakthrough put forth by appliance manufacturers and efficiency proponents today, linear compressors can be as much as 23% more efficient than standard reciprocating compressors, according to Korean appliance manufacturer LG. The company currently offers the only refrigerator with linear-compressor technology. Sold in Europe, it has not yet been introduced in the North American market.



Photos: Courtesy of Maytag Corp.

ator a home's single largest electricity consumer. This is the case even though refrigerators have improved dramatically since the mid-1970s; today's models use about a third as much power as those from 30 years ago.

### Cooking options pit efficiency against cost

More-efficient cooking saves energy and money directly, of course, but by keeping waste heat out of the kitchen, it also saves on air conditioning. Although this impact might not be huge in a typical home, it can make a difference. As a rule, electric cooking appliances are more efficient than gas-fueled ones. But the relative price of natural gas versus electricity often makes natural-gas-fueled appliances a more economical choice. Gas cooktops also afford more controllability than their electric counterparts.

Because their functions are so different, it's important to consider cooktops and ovens separately, even though they might be combined in a stand-alone kitchen range.

### Gas ovens draw electricity, too

With ovens, rapid heat-up and cooldown aren't as important as with cooktops, making electric ovens more competitive with gas, even for serious cooks. In fact, it is not uncommon for high-end ranges to have a gas cooktop and an electric oven. Again, electric is more efficient: Electric ovens are 1.8 to 3.5 times as efficient as gas ovens, according to U.S. Department of Energy (DOE) data. Cost efficiency, however, largely depends on which type of fuel costs the least in your area.

Most gas ovens also use a lot of electricity while operating. In nearly all gas ovens today, when the gas burner is operating, an electric glow-bar igniter (some-

# COOKTOPS & OVENS: Electric wins over gas

**Cooktop efficiency is difficult to measure, and relatively little attention has been paid to it, primarily because stovetop cooking accounts for a small percentage of household energy use—about 5%, according to the American Council for an Energy Efficient Economy. My research shows that electric cooktops are the most efficient, and gas the worst. The chart below ranks the most-common cooktop technologies in order of efficiency based on the energy factor, which is the ratio of the amount of energy conveyed to an item being heated to the device's overall energy consumption. Expressed as a decimal, it reflects the proportion of energy used that actually contributes to the cooking of food.**

ELECTRIC

GAS

| COOKTOP TYPE | ENERGY FACTOR |
|---|---|
| **Induction.** Although induction technology initially failed to take off when introduced a decade or so ago, it's back, with more high-end induction cooktops entering the market. On an induction cooktop, electrical energy is transferred directly to ferrous-metal cookware through magnetic induction. Efficiency is the highest of any cooktop (about 84%) because the cookware is heated directly. It's also a safer way to cook: The cooking surface does not heat up, enabling photos like the one at right, where water boils in a cutaway pan while ice cubes rest intact on the "burner's" surface. Induction cooktops also heat up and cool down quickly, providing precise controllability. Downsides include high cost and the fact that only certain cookware can be used. Cast-iron, enameled cast iron, and some stainless-steel cookware work. Test yours to make sure a magnet sticks to it, or look for a label. | 0.84 |
| **Radiant ceramic.** The most common mid- to high-end electric cooktop today, it has relatively fast-heating radiant elements under ceramic glass, providing a sleek, easy-to-clean stovetop surface. Flat-bottom cookware is needed for good surface contact; older-style cast-iron pans are not recommended because burrs on the metal can scratch the glass surface. Radiant-ceramic cooktops heat faster than electric coils and are nearly equal in energy efficiency. | 0.742 |
| **Electric coil.** Available today on only low-cost ranges and cooktops, these old-fashioned open-coil elements are slow to heat up and difficult to clean, but fairly efficient at transferring electric energy to the pot. | 0.737 |
| **Gas** (natural or propane). Cooks prefer gas burners for speed and controllability, but indoor-air-quality experts often recommend against gas for health reasons. Gas cooktops rate worst in terms of energy efficiency, but they are usually more cost efficient because the price of natural gas is typically a lot lower than electricity. Gas cooktops use only about 40% of the energy produced, and if there's a continuously burning pilot light, the overall efficiency is far lower (about 16%). In some areas, propane is nearly as expensive as electricity per unit of delivered energy, making electric cooktops a more economical option. The efficiency of natural gas and propane is essentially the same. | With pilot: 0.156<br>Without pilot: 0.399 |

**From top:** GE Profile induction cooktop **www.geappliances.com** • GE Profile radiant cooktop • GE built-in electric cooktop • Whirlpool Gold gas cooktop **www.whirlpool.com**



Photos: Courtesy of General Electric (top 3). Courtesy of Whirlpool Corp. (bottom).

# MICROWAVE cooking saves energy

Like their cooktop counterparts, electric-oven elements cook food more efficiently than gas. But the real energy champions are microwaves, which are five times as energy efficient as a standard electric oven. You can see how they rank below.


**Additional insulation.** Self-cleaning ovens typically have more insulation than standard ovens, so if you have a choice, go for a self-cleaning model. The extra insulation keeps the outer surface of the range from becoming too hot during the self-cleaning cycle, but it also helps the oven to operate more efficiently.

**A fan.** Convection ovens have a fan in the back that circulates air to maintain more even temperatures. As a result, either the cooking time or the temperature can be reduced. The energy savings from reduced gas or electricity use for cooking easily outweighs the fan's electricity use.

**Top:** GE Profile Advantium oven **www.geappliances.com**
**Bottom:** Premier gas range **www.premierrange.com**

times called a "gas oven igniter") is on, drawing about 375w. (Interestingly, at the International Builders' Show in Orlando this year, not one kitchen-appliance salesperson who was asked seemed to be aware of this fact.) Found in all self-cleaning models, the glow bar ignites the gas when the oven is turned on and reignites it as it cycles off and on during the cooking or self-cleaning process. Those 375w (or even as much as 500w in some ovens) are a significant amount of electricity. If low electricity use is a priority in your home, consider a model without a glow bar, such as ranges made by the Peerless-Premier Appliance Co. (www.premierrange.com), which operate with a pilot or a spark ignition.

## TIPS TO CUT CONSUMPTION

**Lid on or off?** If you use a convection oven, keep the lid off a casserole dish. Otherwise, it will cook no more quickly than in a standard oven. On a cooktop, closing the lid on a pot will retain heat and reduce energy use.

**Consider a Crock-Pot.** Slow-cooking, plug-in crockery pots offer an energy-efficient way to cook soups, stews, and other dishes.

### Microwave ovens are tops in efficiency

First introduced as a practical kitchen appliance in 1965, microwave ovens have revolutionized cooking and offer substantial energy savings over standard ovens. They work by producing non-ionizing microwave radiation (a certain frequency of radio waves) with a magnetron and directing that radiation at the food. The microwave radiation is absorbed by water, fats, and sugars, producing heat. Because the microwaves penetrate the food, heating is more rapid and requires less energy than in a conventional oven. Microwave ovens are about five times as energy efficient as standard electric ovens and more than 10 times as energy efficient as gas ovens.

Increasingly, manufacturers are combining cooking functions with microwave ovens to produce a new generation of "rapid-cook" appliances. These models combine microwaves with electric grilling elements so that food can be browned as well as cooked. Quartz elements are often used to create radiant heat, though General Electric's Advantium microwave oven uses a halogen-lamp element. Convection is another feature offered by the Advantium and some others, such as TurboChef's Speedcook Oven. In the future, most ovens will likely include multiple heating options to speed up cooking and will serve a wider range of functions, from defrosting to reheating to grilling.

### Exhaust fans are important to health

Exhaust fans add to energy consumption, but their importance with regard to kitchen air quality—and the health of your home's occupants—cannot be ignored. Chemical impurities in natural gas, along with incomplete combustion, can result in dangerous levels of carbon monoxide (CO), causing headaches and fatigue at low levels and, at high concentrations, death. Because of this concern, gas ranges should be installed with quality, outdoor-venting range-hood fans, which should be operated when the cooktop or oven is on.

Exhaust fans are most efficient when placed above the cooktop


Top photo: Courtesy of General Electric. Bottom photo: Courtesy of Peerless-Premier Appliance Co.

# DISHWASHERS: Less hot water equals less energy use

## WHAT TO LOOK FOR

- **The Energy Star label.** Energy Star-qualified dishwashers are at least 41% more energy efficient than the federal minimum. Keep in mind that some models exceed the standard significantly more than others; check the EnergyGuide label or the list of qualifying dishwashers at **www.energystar.gov** for high-performing machines.
- **Soil sensing.** With this technology, "fuzzy logic" is used to determine how dirty the dishes are. Water use and wash cycle are adjusted accordingly, saving significant water and energy.
- **No-heat drying.** Most dishwashers have an electric heating element and fan for drying dishes. Make sure the one you buy has a no-heat drying option, which can save a significant amount of energy.

## USAGE TIPS

- **Insulate hot-water pipes** from the water heater so that water stays hot all the way to the dishwasher and doesn't cool off as much between the different wash and rinse cycles.
- **Wash full loads only,** even if it means waiting a day or two.
- **Avoid high-temperature cycles.** Many dishwashers have a setting for more intensive cleaning in which the temperature is boosted, which can significantly increase electricity use per cycle. To conserve energy, don't use this setting.

## INNOVATIONS TO WATCH FOR

**Steam-cycle dishwashers.** LG has introduced a steam-cycle dishwasher that the company claims cleans dishes better. The washing cycle uses steam at over 200°F, apparently saving energy in the process (because it uses a lot less water). The dishwasher was unveiled at the 2007 Kitchen/Bath Industry Show and should be available this fall.

**Drawer dishwashers.** The New Zealand company Fisher & Paykel and KitchenAid both offer drawer-type dishwashers. They can save energy and water by allowing you to use one smaller drawer rather than a partially loaded full-size dishwasher, or by allowing two drawers to be operated at different cycles.

**Condensation drying.** While most dishwashers vent moist air into the kitchen as dishes are drying, Bosch models use condensation-drying technology, which the company claims improves hygiene and saves energy.

***Drawerful of savings.*** *Compact dishwasher drawers can be highly efficient (both of these models from New Zealand manufacturer Fisher & Paykel are Energy Star compliant). An added bonus is that the integrated models, like the one pictured above, blend seamlessly into kitchen cabinetry.*

**Top:** Fisher & Paykel model DD603I **www.fisherpaykel.com**
**Bottom:** Fisher & Paykel model DD603SS



Photos: Courtesy of Fisher & Paykel Appliances. Facing page: Courtesy of Bosch Appliances (top two). Courtesy of LG Appliances (bottom).

***Top performers.*** *Introduced in July, the Bosch Evolution line includes dishwashers that exceed the minimum federal energy-efficiency standard by 147%—far more than any American-made dishwasher, using approximately the same amount of energy as a dishwasher half its size.*


***Easy button.*** *The "EcoOption" button offered on some Bosch dishwashers allows homeowners to reduce energy usage by up to 25%. Activating the feature lowers the wash temperature and extends the cycle by a few minutes.*

***A new way to clean dishes.*** *Recently introduced, the LG steam dishwasher uses only 2.8 to 3.2 gal. of water in an average load.*

**Top:** Bosch Evolution dishwasher, model SHE98 **www.boschappliances.com** • close-up Bosch Evolution SHE68 (800 series) **Bottom:** LG steam dishwasher, model LDF9810 **www.lgusa.com**

or range. Downdraft fans, which are installed at the back or in the center of a range, rely on significant airflow (and power consumption) to ventilate cooking fumes effectively. Because fumes are more easily channeled into a fan installed in a range hood, fan performance is better.

If you can't vent an exhaust fan outdoors, avoid the use of gas cooking appliances. Recirculating range-hood fans can remove odors but should not be relied on to remove combustion gases.

A significant energy-saving feature to look for in a range-hood fan is a variable-speed motor. It allows the fan to operate at a lower airflow rate when full ventilation capacity is not needed, thus saving energy and reducing noise.

## Dishwashers are shaping up

Dishwashers have changed quite a bit in recent years. They use a lot less water, which translates into lower energy use for water heating. In 1978, water use by dishwashers ranged from 11 gal. to 15 gal. for a normal dishwashing cycle. By 2000, that usage had dropped to 6 to 10 gal.

As water use has gone down, total energy use has also dropped, while the proportion of energy use for other than water heating has risen. In 1978, 83% of the total energy use for dishwasher operation was for heating water, with 10% for motor operations and 7% for drying. By 1994, energy use for water heating had dropped to 56%, according to a 2003 Virginia Tech report.

However, that does not mean most dishwashers are as energy efficient as they could be. Nearly all dishwashers today have booster heaters that increase the temperature of incoming water to about 140°F to improve wash performance. An integral electric element provides this heat, and it can use a lot of electricity. Recent independent testing shows that booster heaters operate throughout the dishwashing cycle, resulting in total electricity use per cycle of 2.0 to 3.5 kwh. Used an average of 215 times per year (the frequency DOE assumes), a dishwasher could easily consume more electricity annually than a refrigerator. More research is needed to determine the significance of this electricity use.

Dishwashers vary considerably in their energy use, much more so than refrigerators. For comparison, dishwashers are rated by the federal government according to their energy factor (EF), a measurement based on the energy usage for an average number of cycles (a completely different formula than the one used to rate cooking appliances). The higher the EF, the more efficient the dishwasher: The current federal standard mandates a minimum EF of 0.46; Energy Star dishwashers must meet a minimum EF of 0.65. The most-efficient dishwashers have an EF that approaches or slightly exceeds 1.0. Although the EF is used to compute the annual energy consumption and cost estimates found on the EnergyGuide label on many appliances, the EF itself might not appear there. □

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