THE COMPLETE GUIDE TO

SAVING ENERGY IN THE HOME

The Complete Guide to Saving Energy in the Home

Everyday Steps to Lower Your Energy Bills

Home Energy Savings Checklist

A home, whether you own it or rent it, requires a financial commitment. That commitment includes the bills you pay every month for the energy you consume at home. You pay to power your home with electricity. You pay to heat and cool it. All these things add up.

Making your home energy efficient can go a long way toward lowering those bills, but it's not something you can do in one day. It's a series of changes—some small, some large—that you make over time to increase your home's efficiency.

An efficient home is one that uses the energy you pay for with as little waste as possible. This means the money you spend to run your home stays in your home; it doesn't leak out because of poor insulation, air leaks, or other inefficiencies.

Making your home more efficient reduces the amount of energy you use, which means paying less on your energy bills. Lower energy bills will leave you more money to invest in your home and your family.

You can start taking these steps this afternoon, this week, or this month. The most important thing is to recognize the changes you can make to create a more efficient home and make them whenever you can.

In Every Room

Today:

- [ ] Adjust your thermostat. Set it high in the summer, to 78 degrees. It should be warm but still feel comfortable. Turn on a fan before turning on the air conditioner. In the winter, set the thermostat at 68 degrees, and reach for a sweater before turning it up. For every degree you turn down the temperature, you'll save up to 5 percent in heating costs, or about $45 during the winter heating season. Five degrees can save up to $225!

- [ ] Turn down the water temperature. If you have an electric water heater, set it to 120 degrees. This will save you energy and save you from scalding hot water. If you have a gas water heater, it probably doesn't have degree settings. Instead it has a dial with three marked settings: HOT, WARM, and VACATION. Use a setting between WARM and HOT.

- [ ] Unplug your second refrigerator. A second refrigerator can use a lot of energy. About 7 percent of your home's energy use goes to powering your refrigerator—and that's doubled if you own two. You can save up to $250 on your annual electricity costs by using just one refrigerator. Make it an ENERGY STAR® model for additional savings.

This week:

- [ ] Look at your lighting. Count all the lights in your home and decide how many you can replace with light-emitting diode (LED) lightbulbs. It's a small change, but it will save you money, because typically LED bulbs use about 25 to 80 percent less energy than traditional incandescents and last 3–25 times longer.

- [ ] Use the sleep features on computers and other office equipment. Also consider investing in an energy-saving power strip with auto-switching technology. It will automatically turn off power when not in use to save energy.

- [ ] Buy an insulating blanket for your water heater. If your water heater has a storage tank, an insulating blanket can make it more efficient. A blanket costs between $10 and $20 and reduces heat loss by 25 to 45 percent. You can install it yourself on an electric-powered water heater; gas systems are best left to a professional because blankets pose a fire hazard if installed incorrectly.

This month:

- [ ] Find out if your home is leaking air—then seal it. Your home can leak air through doors, windows, the attic, and other spaces. If it does, the air you pay to heat and cool is going outdoors. Sealing air leaks can cut your energy bill by 5 to 10 percent, according to the U.S. Department of Energy.

- [ ] Purchase a programmable thermostat. You save money by turning the heat down while you're away from home during the day and while you sleep at night. A programmable thermostat makes this easy because it can automatically change the heat settings, saving up to $150 every year, according to ENERGY STAR.

- [ ] Insulate pipes near your hot water heater. The hot water can cool down as it travels through the pipes in your home. Insulating these pipes reduces heat loss and raises the water temperature by two to four degrees. You should insulate all hot water pipes you can reach and all cold water pipes within three feet of the water heater.

This year:

- [ ] Tune up your heating or cooling system. Heating can account for one-third of your home's energy bill. A professional tune-up will ensure that your system runs as efficiently as possible and save you money. You should also replace air filters once a month to maximize efficiency.

- [ ] Look for the ENERGY STAR label. If you need to buy a new appliance, choose one certified by ENERGY STAR. This government program certifies energy-efficient appliances, including clothes washers, dryers, dishwashers, refrigerators, freezers, room air conditioners, and dehumidifiers. Choosing these models will lower your energy bill because they meet stricter energy efficiency standards than other appliances.

- [ ] Think about adding more insulation. It helps protect your home from heat loss in the winter and heat gain in the summer and can save you up to 20 percent on your heating and cooling bill.

Kitchen

Today:

- [ ] Check the settings on your refrigerator. The temperature should be set between 36 and 38 degrees, and your freezer should be set to zero degrees. Also, make sure to use any power-saver or energy-saver features on your refrigerator.

This week:

- [ ] Stop hand washing your dishes. You can save 5,000 gallons of water per year and $40 in utility bills by using an ENERGY STAR–rated dishwasher.

This month:

- [ ] Defrost your refrigerator. If your refrigerator is a manual-defrost or partial-automatic-defrost model, it needs to be defrosted regularly. If it's not, then ice will build up on the coils and make the refrigerator work harder to keep the temperature cold, wasting energy.

This year:

- [ ] Consider replacing an older refrigerator. Refrigerators more than 15 years old are usually a good target for replacement. ENERGY STAR–certified refrigerators save energy and money.

Living Room

Today:

- [ ] Turn off the TV when no one is watching it. This is the easiest way to save money on your home electronics. Remember that your TV doesn't need to be on to record programs.

This week:

- [ ] Check your window coverings. They should keep the heat out in the summer and in during the winter. Close coverings on south-, east-, and west-facing windows during the day in summer. In winter, keep curtains open during the day and close them at night.

This month:

- [ ] Buy power strips for your home electronics. Electronics can draw energy even while they're off—and that costs money. Prevent this by plugging electronics into a power strip and flipping the switch off when you aren't using the electronics. Don't do this with televisions, though, because many TVs need to be reprogrammed if they're completely turned off.

This year:

- [ ] Upgrade inefficient windows. Consider replacing them with ENERGY STAR–rated energy-efficient windows or reinforcing them with weather stripping and storm windows to keep the heat inside your home during the winter.

Bedroom

Today:

- [ ] If you own a water bed, make the bed every day. Your bedspread and sheets will insulate the bed and reduce the amount of heat it uses, saving up to a third of the energy the bed uses. Heated water beds can cost you up to $205 per year, according to the New York State Energy Research and Development Authority.

This week:

- [ ] Use fans. When your home gets warm, turn on a fan before turning on the air conditioner. Fans use less energy and are very effective. If you have a ceiling fan, use it. In summer, ceiling fans make you feel about four degrees cooler, even though they don't lower the actual temperature of the room.

In winter, set the fan's blades to turn clockwise, so they'll pull cool air up and push heated air down. You can turn your thermostat down by four degrees and your home will still feel the same temperature.

This month:

- [ ] Adjust your sleep cycle. Instead of running your heater overnight in the fall or spring, add extra layers of bedding to keep you warm at night. If you can't stand getting out of bed when it's cold, install a timer or programmable thermostat and set it to turn up your furnace automatically 30 to 60 minutes before you get up.

This year:

- [ ] If your bedroom has an older room air conditioner, consider upgrading it. You can save more than $50 on electricity by replacing a 15-year-old model with a new ENERGY STAR–rated one. Make sure your machine is away from TVs and other electronics that produce heat, which may cause the air conditioner to run longer than necessary.

Bathroom

Today:

- [ ] Reduce your water use. Take a shorter shower. Turn the water off while you brush your teeth.

This week:

- [ ] Buy low-flow showerheads. With regular showerheads, a family of four can use 700 gallons of water each week if each person takes a daily five-minute shower. Low-flow showerheads cut that water use in half—saving you both water and the energy used to heat the water.

This month:

- [ ] Repair leaky faucets. Even a slow drip can waste up to 450 gallons of water a month. If it's hot water leaking, then you're also wasting the energy used to heat that water.

This year:

- [ ] Think about replacing your toilet. If your home was built before 1992 and the toilets haven't been replaced, you could save five gallons of water per flush by installing a high-efficiency toilet.

Laundry Room

Today:

- [ ] Run the clothes washer only when you have a full load of laundry. If you must wash a small load, always put the water level on the lowest possible setting.

This week:

- [ ] Wash your laundry with cold water whenever possible.

This month:

- [ ] If it's warm, hang your laundry outside instead of using the dryer. If you must use the dryer, separate quick-drying clothes and slow-drying ones into different loads so the machine runs only as long as it needs to.

This year:

- [ ] Consider replacing an old washing machine and dryer with ENERGY STAR–rated models, and think about a front-loading machine, which uses less than 25 gallons of water for each wash cycle, while conventional top-loaders use 40 gallons.

Yard

Today:

- [ ] Let your grass grow. Taller grass loses less water to evaporation. Mowing too frequently means your yard will need more water.

This week:

- [ ] Be smart about watering. Use a shut-off nozzle on your hose to water plants, and make sure your sprinkler isn't watering your neighbor's lawn. Don't leave hoses or sprinklers unattended: outdoor faucets can flow at more than 264 gallons per hour.

This month:

- [ ] Think about switching your outdoor lights to energy-efficient LED lightbulbs. Make sure you buy bulbs designed for outdoor use. Also think about installing a motion sensor to make your home safer without leaving the lights on all the time.

This year:

- [ ] Consider planting trees that lose their leaves in the fall on the south, east, and west sides of your home. This protects your home from the summer sun and allows sunlight to warm your home in the winter, once the leaves are gone.

Know Your Energy Bill

Your energy bill doesn't come with a tidy receipt listing how much energy each appliance in your home uses. It takes some work to find the biggest energy guzzlers in your home—and then more work to fix them. It helps to understand where most homes use the most energy.

More than one-third of your energy bill is spent on simply heating and cooling your home. That's more than you spend to heat water, power lights, and run all of your electronics—combined. But smaller items add up, too. You spend 7 percent of your total energy bill just running your refrigerator. Stoves, ovens, computers, and flat-screen TVs also add to the bill.

The lesson is that these costs add up, but your savings can add up, too, if you reduce your energy use in both big and small ways.

Getting Started

You can pinpoint where your home uses the most energy by performing a simple home energy audit. This book will show you how to do one. It will also give you room-by-room guidance on how to lower your energy bills.

The energy audit determines which parts of your home use the most energy; these are the areas where you should begin your efforts. You can also contact your local utility company or your state's energy office to see if they offer a low-cost or no-cost energy audit.

To reduce your energy bills, you need to understand how you pay for energy. Your home usually needs several types of energy, and you pay for each of them. You pay for electricity to power your appliances. You pay to heat your home with natural gas, heating oil, propane, or electricity. You pay another bill for your water—and that's something you can lower, too, along with your energy use.

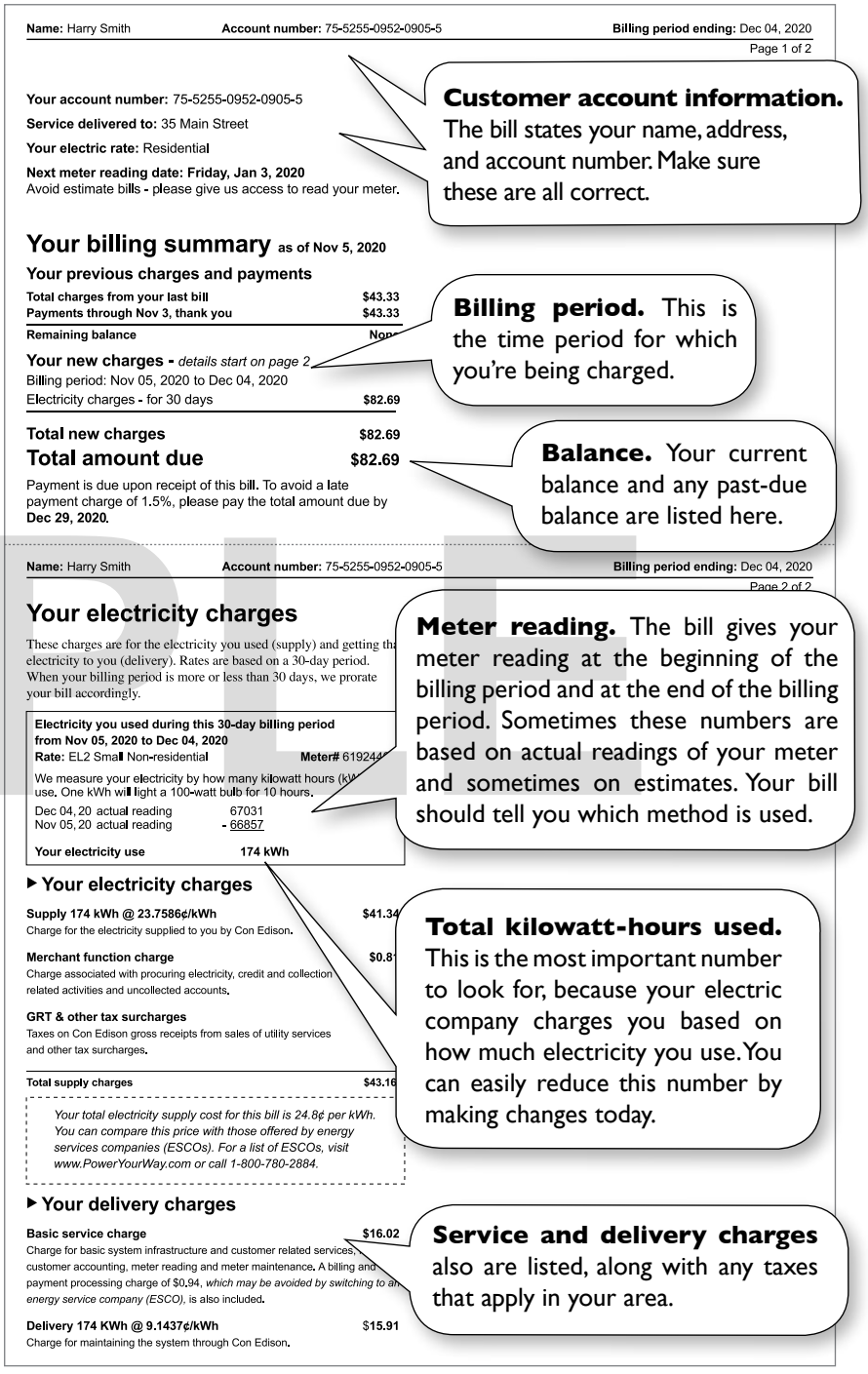
Knowing where these different types of energy come from—and what you use them for—is the first step to saving money on each bill.

Electricity

Typically, your home's electricity is created in a generation power plant that burns coal or natural gas or uses hydropower or nuclear power, or, in some cases, electricity is generated through renewable sources like wind and solar. Once it's produced, electricity is funneled into large transmission power lines that bring it to substations where the voltage is stepped down. Then it reaches your neighborhood through power lines that run either underground or atop tall poles on the side of the road. This network of power lines is often referred to as the "grid."

The electricity moves from the grid into your home through your electric meter. Your electric utility uses the meter to keep track of how many kilowatt-hours of electricity you use.

How to Read Your Electric Bill



Natural Gas

Natural gas is harvested from wells drilled deep into the earth. The gas flows through the well and into a large pipeline that takes it to businesses and homes, where it's used for heating.

On the way, a foul-smelling chemical is added to the gas to make it smell like rotten eggs. Because natural gas is normally odorless, the chemical helps people know when there's a gas leak. If you smell this odor in your home, contact the fire department or your utility company immediately.

The amount of natural gas you use is measured in one of two ways: either in British thermal units (Btu) or in cubic feet (CCF, which means 100 cubic feet). The price you pay for each Btu or CCF of gas will depend on the amount of gas being produced and on the severity of the winter weather. In cold weather, there's more demand for natural gas, which usually raises the price.

Heating Oil

Fewer than 10 percent of homes in the United States use heating oil as their main source of heating fuel. Most of them are in the Northeast, where older homes were built to rely on heating oil. In other regions, older homes have largely been converted from heating oil to natural gas heat.

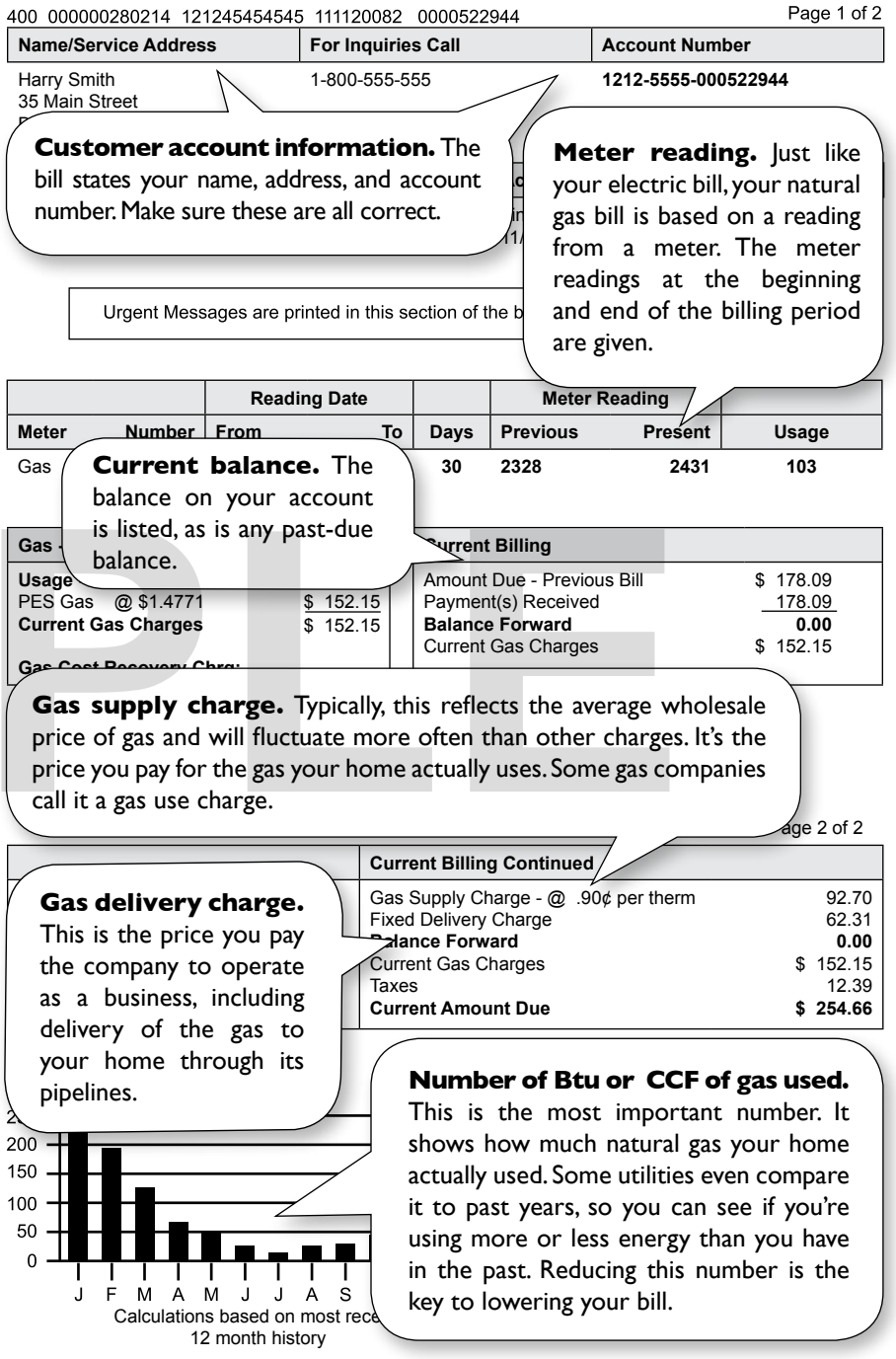
Heating oil is produced by oil refineries, usually on a seasonal schedule. The refineries make heating oil only when they're not making other products, and they typically don't produce much heating oil in the winter. This can affect the price you pay for it.

Heating oil is delivered directly by tanker truck and stored in a large tank, usually in your basement. But few homes have tanks large enough to hold all the oil needed for the entire winter, so many need to be refilled as many as four or five times during the winter. Prices go up during the winter because the demand for heating oil is highest then. In the Northeast, homes use an average of 660 gallons of heating oil during the winter but very little the rest of the year.

To buy heating oil, you need to find a local heating oil company. Prices and service can vary significantly among companies. Time spent comparing your options may have a large payoff. The price of heating oil can vary by as much as $1 per gallon. Because a tank typically holds up to 250 gallons of oil and needs to be refilled more than once each winter, your savings can add up quickly.

When you sign a contract with a heating oil company, they usually will come to your home on a regular schedule so you don't run out of oil. But make sure to check the tank periodically, just to be safe.

How to Read Your Natural Gas Bill



When you compare companies, the first thing to ask each of them is what price they charge per gallon for their heating oil. Then ask whether they offer capped or fixed rates, which can protect you from increases in the price of heating oil during the winter.

You should also ask:

- *What is the cost of a service contract with their company? Is that cost included in the price? If not, how much extra is it?*
- *How long is the contract term?*
- *Can the contract be terminated? If so, is there a penalty?*
- *What type of service do they offer? This becomes more important as your furnace gets older. If it's 10 or 15 years old, you might want a company that offers 24-hour repair service.*

Propane

While not as well known as other home heating fuels, propane is a versatile way to heat homes, heat water, cook, dry clothes, and fuel gas fireplaces.

Propane heating is most common in rural areas. If your home uses propane, the price you pay for it depends on several factors. Because propane does many things—from powering barbecue grills to producing petrochemicals—the price you pay depends in part on the price propane reaches in these other markets. The price is also higher if it has to travel a long distance to reach your home.

Relighting Your Home

Have you ever wondered how many light fixtures you have in your home? Look at the chandelier hanging in the hallway or above your dining room table. Don't forget the lights on the front porch and on the patio out back. How many light fixtures do you have? Thirty? Forty? More?

These days, homes come equipped with recessed lighting, rail lighting, multiple-socket fixtures, and several outside lamps. We love our lights. Unfortunately, most (if not all) of these fixtures are filled with various styles of incandescent lightbulbs that can be expensive to operate.

There are more types of lightbulbs available than ever before. You can pick the light source, size, and color of the light to fit your home. The most efficient lightbulbs are LED bulbs. This lighting uses a completely different method of producing light than the traditional incandescent bulb. An electrical current passed through semiconductor material illuminates many tiny LEDs, which together equal the light output of a traditional lightbulb. The bottom line is that LEDs create more light with less electricity and last longer. And an ENERGY STAR–qualified LED bulb lasts 35–50 times longer than a traditional incandescent.

There's a catch: LED bulbs may cost more than incandescent bulbs. But you save money in the long run because LED bulbs save so much electricity—and you don't have to replace them as often as incandescent bulbs.

Standard Incandescent Bulb

Standard LED Bulb

How Much Money Will You Save?

To predict how much money you can save, you need to know a few things:

How many of your incandescent lightbulbs can be replaced with LED bulbs?	
What wattage of incandescent bulb are you currently using?	
What wattage of LED bulb would you use?	
How many hours a day do you use the light?	
How much do you pay for 1 kilowatt-hour of electricity?	

Once you have your answers, plug them into this formula:
Watts saved (wattage of incandescent bulbs *minus* wattage of LED bulb) *times* number of fixtures in the home that can be replaced with LED bulbs *times* number of hours lights are used per day *times* 365 days per year *divided* by 1,000 watts =_____.

This is the number of kilowatts you will save each year.

To find the amount of money you'll save, simply multiply this number by the cost you pay for each kilowatt-hour of electricity as found on your electricity bill. This is how much you'll save each year simply by changing your lightbulbs.

Most people who use incandescent bulbs for more than two hours a day will save money switching to LED bulbs—even though LED bulbs cost more at the store.

You'll save more money if:

- *You replace more incandescent bulbs with LED bulbs.*
- *You replace larger bulbs.*
- *The cost of LED bulbs decreases.*
- *The cost of electricity increases.*

Selecting Which Fixtures to Relight

To begin your relighting project, conduct a simple lighting audit. This will tell you how many fixtures you have in each area of your home, which of them should be fitted with LED bulbs, and how many watts of electricity you can save by switching.

Use the Relighting Audit Worksheet (at the end of this chapter) to conduct a walk-through inspection of your home.

When you look at a light fixture, pay close attention to the type of bulb currently being used. Normal incandescent lightbulbs, like those found in table lamps, are different from the reflective bulbs used in recessed lighting. Likewise, fancy bulbs found in chandeliers need special replacements.

Finding the Right LED Bulb

There are two basic factors to consider when selecting the right LED bulb for the job: size and style. For almost every fixture in your home there will be an appropriate one.

The wattage of an LED bulb will be significantly lower for the same amount of light. For example, a 60-watt incandescent lightbulb can be replaced by a 9-watt LED bulb, which will produce about the same amount of light. To make sure you're getting the amount of light you want, pay close attention to the bulb's lumen output—the measurement of the amount of light the bulb produces.

To figure out the lumen output, use this chart to find the right wattage bulb. It shows what wattage to look for in an LED bulb to produce the same lumen output as the old incandescent bulb.

Lumens	Incandescent	LED
450	40W	7W
800	60W	9W
1600	75W	13W
2600	100W	18W

The Right Color of Light

Incandescent bulbs typically have a warm yellow glow, while LED bulbs glow differently depending on the bulb you purchase. That's because of the difference in the warmth of the visible light. Warmth is measured in kelvins (K) and is called the **correlated color temperature** (CCT). The higher the CCT rating is, the cooler the light appears. The CCT doesn't affect your ability to see using a LED bulb.

LED bulbs produce light in a variety of shades, from yellow to white to blue. Check the kelvins (K) on the package to find the right color for you.

- **Warm yellow light** (2700–3000K) is the standard for incandescent bulbs.
- **Cool white light** (3500–4100K) is good for kitchens and work spaces.
- **Blue light** (5000–6500K) is good for reading and other detailed tasks.

Safety First

Compact fluorescent lamps (CFLs), the type of lightbulb usually characterized by a swirl shape instead of a bulb shape, contain a very small amount of mercury, about five milligrams, or roughly the amount needed to cover the tip of a ballpoint pen. If a CFL bulb breaks, take extra precautions during cleanup. The mercury is sealed inside the bulb's glass tubing. None of it is released unless the bulb is broken.

When a CFL burns out or is replaced, it's important to dispose of it properly. Check with your local solid waste agency or look for a local recycling center that can dispose of them properly. Many hardware stores have CFL recycling dropoffs as well. You can check www.epa.gov/bulbrecycling for local CFL recycling options.

Some states allow used or broken CFLs to be disposed of with regular garbage. If that's the case in your area, seal the bulb in two plastic bags and put it into your outdoor trash can. Do not dispose of CFLs in an incinerator.

If a CFL breaks, the U.S. Environmental Protection Agency recommends following these cleanup guidelines:

Open a window and leave the room for 15 minutes or more.

Using stiff paper or cardboard, carefully scoop up the glass fragments and the powder, and then put them inside a plastic bag and seal it. Do not use your bare hand to do this. Use disposable rubber gloves, if possible.

Wipe the area clean with damp paper towels or disposable wet wipes. Put the disposable towels or wipes into the same plastic bag. Do not use a vacuum or broom to clean up the bulb.

Place all of your cleanup materials in a second plastic bag. Put the first bag into the second bag, seal it tight, and put it in an outdoor trash container. If your city requires that CFLs be recycled, keep the bag in a protected outdoor area until you take it to the local recycling center. Wash your hands after you dispose of the bag.

If a CFL breaks on a rug or carpet, remove everything you can without using a vacuum cleaner. Use sticky tape or duct tape to pick up small pieces of glass and powder. If the area must be vacuumed, do so only after picking up all visible pieces. Vacuum the area, and then remove the vacuum bag (or empty and wipe the canister) and put the bag or vacuum contents into two sealed plastic bags in the outdoor trash for disposal. If you're required to recycle CFLs, put the bag in a protected outdoor area until you take it to the recycling center.

Relighting Audit Worksheet

In each room of the house, inventory the light fixtures and number of bulbs. Mark each bulb in the appropriate column—incandescent (INC), fluorescent (FLUO), fancy (FANC), or other (OTH)—and make sure to note its wattage. Also note fixtures with dimmer switches and three-way sockets.

You must also determine how many hours a bulb is on during a typical day. Remember, only those used at least one-and-a-half to two hours per day should be considered for replacement.

Kitchen

Types of Lighting Fixtures	No. of Bulbs	Watts	Type of Bulbs INC	FLUO	FANC	OTH	Hours of Daily Use	Replace? Yes	No
Ceiling light									
Recessed lighting									
Over the sink									
Other									
Other									
Other									

Living Room

Types of Lighting Fixtures	No. of Bulbs	Watts	Type of Bulbs INC	FLUO	FANC	OTH	Hours of Daily Use	Replace? Yes	No
Table lamp 1									
Table lamp 2									
Ceiling light									
Floor lamp									
Recessed lighting									
Other									

Office / Other

Types of Lighting Fixtures	No. of Bulbs	Watts	Type of Bulbs INC	FLUO	FANC	OTH	Hours of Daily Use	Replace? Yes	No
Ceiling light									
Table lamp									
Floor lamp									
Recessed lighting									
Other									
Other									

Laundry Room / Hall

Types of Lighting Fixtures	No. of Bulbs	Watts	Type of Bulbs INC	FLUO	FANC	OTH	Hours of Daily Use	Replace? Yes	No
Ceiling light 1									
Ceiling light 2									
Floor lamp									
Recessed lighting									
Other									
Other									

Bathroom

Types of Lighting Fixtures	No. of Bulbs	Watts	Type of Bulbs INC	FLUO	FANC	OTH	Hours of Daily Use	Replace? Yes	No
Ceiling light									
Mirror light									
Tub/shower light									
Recessed lighting									
Other									
Other									

Bedroom 1

Types of Lighting Fixtures	No. of Bulbs	Watts	Type of Bulbs INC	FLUO	FANC	OTH	Hours of Daily Use	Replace? Yes	No
Ceiling light									
Table lamp									
Floor lamp									
Other									
Other									
Other									

Bedroom 2

Types of Lighting Fixtures	No. of Bulbs	Watts	Type of Bulbs INC	FLUO	FANC	OTH	Hours of Daily Use	Replace? Yes	No
Ceiling light									
Table lamp									
Floor lamp									
Other									
Other									
Other									

Garage / Outdoor

Types of Lighting Fixtures	No. of Bulbs	Watts	Type of Bulbs INC	FLUO	FANC	OTH	Hours of Daily Use	Replace? Yes	No
Ceiling light									
Security light									
Porch light									
Recessed lighting									
Other									
Other									

Chapter 4

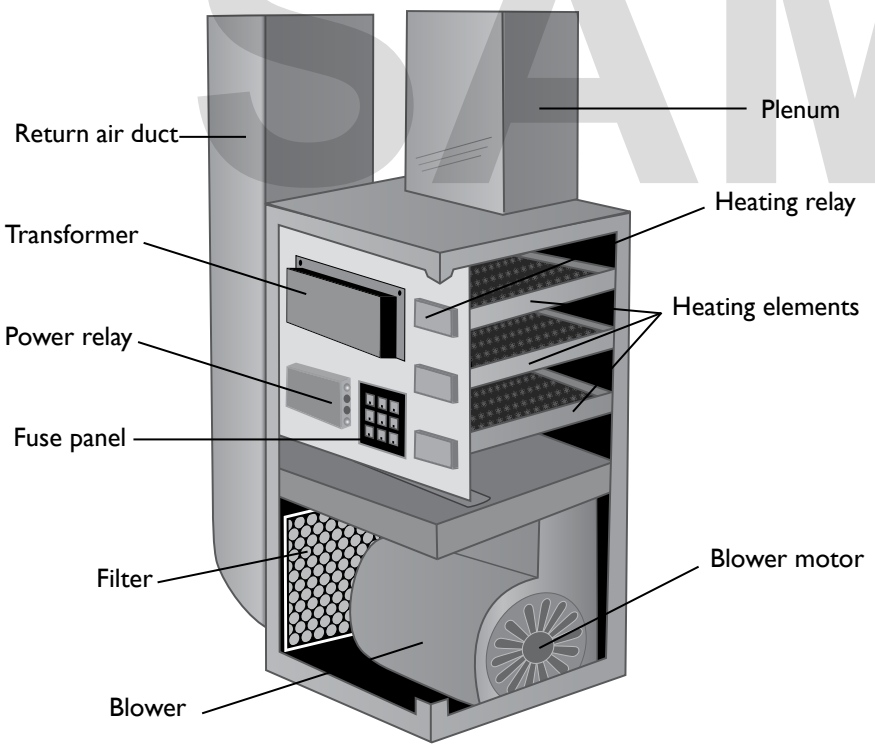
Heating Your Home

Your furnace is the engine that heats your home. It's one of the first things to look at when you're trying to cut your energy costs because your heating and cooling systems use a lot of energy.

Regular maintenance is key to preventing problems with your system—and to avoiding unnecessary costs. Dirt and neglect are the main causes of failure of heating and cooling systems. With the average heating bill alone topping $1,000, you have a lot to gain by making sure your system works properly.

Professionals can take a number of steps to tune up your heating system. But before calling them in, do a bit of maintenance yourself.

Forced-Air Furnace



Yearly Checkup

Each year before the weather gets chilly, check your furnace. Make sure nothing flammable or dangerous was stored against it during the summer months. Turn it on for a few minutes to make sure it's working. It's better to find out that your furnace is broken now rather than on the first cold day of fall, when everyone else is calling the repairman.

When you turn on the furnace for the first time in the fall, it may give off a very bad odor. This is usually because it's burning off all the dust that fell into it over the summer. The smell should go away quickly. If it doesn't, it could mean something serious. Contact a repairman.

Clean the Registers or Radiators

Make sure your registers (if you have a forced-air heating system) or your radiators (if you have a boiler-based system) are clean.

With registers, remove the cover and wipe the register with a damp cloth. Remove any objects that fell through the cover into the top of the duct. Use a vacuum to clean the area, and then replace the cover.

With radiators, wipe down the top and sides with a wet cloth.

With either system, survey your room to make sure rugs, carpets, drapes, and furniture aren't too close to the register or the radiator.

Check the Temperature

Set your temperature to 68 degrees in the winter and 78 degrees in the summer to save money on your heating and cooling bills. If you have a programmable thermostat, set it to reduce the temperature in the winter by about eight degrees at night or while you're at work during the day. You might not even notice the drop in temperature if your home is well insulated—but you will notice the savings on your bill.

If you have a heat pump, it's better to leave it on a consistent temperature to avoid triggering expensive backup heat.

Inspect the Furnace

Look for any soot or combustion residue around the furnace. Soot buildup means your furnace isn't combusting properly. If you see soot buildup, call a furnace technician.

Inspect the Flue

Birds or squirrels sometimes build nests in the tops of flues, so a quick visual inspection is a good idea. Also look for cracks in chimneys or flues. If you see anything unusual, call a professional.

Install a Carbon Monoxide Detector

There's always a chance carbon monoxide could leak from your furnace into your home. Normally, the carbon monoxide made by your furnace is vented out of your home. But if something goes wrong, this dangerous gas can build up inside your home. Carbon monoxide is a dangerous, toxic gas, but because it's colorless, odorless, and tasteless, it's almost impossible for people to detect. Carbon monoxide detectors should be installed in all homes and tested regularly. You can buy an easy-to-install carbon monoxide detector at many retailers, and some are included in newer alarm systems.

Change the Filters

Every house circulates small amounts of airborne debris; you'll see it as dust on tables and dust bunnies beneath the sofa. This debris also circulates through the ducts in your house when you use a forced-air heating system or a central air conditioning system. Your furnace's filter cleans the air, but it needs to be cleaned or changed regularly.

When to Call for Help

Most of us call the repairman when the heating system breaks—usually during the peak of heating season. Many of those calls could be avoided by cleaning and maintaining the system.

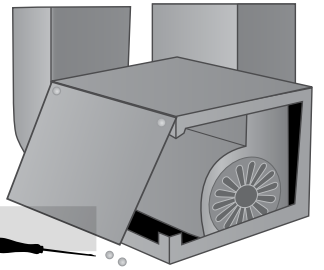
That's where a "clean and tune" comes in. A clean and tune is a regular checkup conducted by a professional. It saves you money in the long run by making your system efficient enough to cut up to 10 percent from your energy bill. The technician will test your system to see how efficient it is and then clean and adjust it to make it more efficient.

Oil-powered and kerosene heating systems should be serviced every year; gas-powered heating systems should be serviced every two years. Electric furnaces, heat pumps, and central air conditioning systems should also be serviced every two years. The best time to do this is in spring, when soot and residue are still soft and easy to clean. It's important to have this work done by a professional.

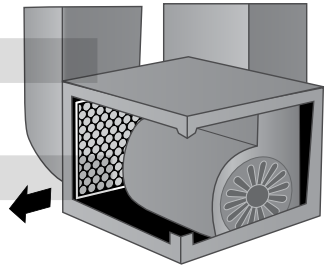
How to Clean Your Furnace's Filter

Cleaning or replacing the filter is simple. This is something you should do every month in the winter and, if you have central air, in the summer.

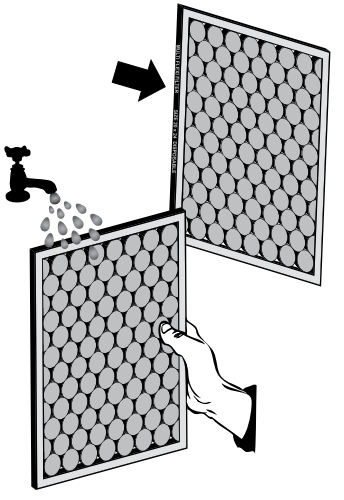
Step 1: Make sure the furnace is turned off. This prevents the furnace from operating with no filter while you're changing it, and it keeps the fan from making it difficult to insert the new filter.



Step 2: Find the filter. It's usually well marked, and most have a cover plate that's 18 to 24 inches long. Older furnaces sometimes don't have cover plates; their filters should be easy to see. The filter may also be inside the house at a return grille.



Step 3: Remove the cover plate and slide the filter out of the furnace along its tracks. This does not usually require any tools, but a few cover plates are fastened in place with small screws.



Step 4: Check to see whether the filter is disposable or intended to be cleaned and replaced. This should (but may not) be marked on the edge of the filter. Filters that are intended to be cleaned should have cleaning directions printed on them. If the filter is disposable, look for its size and make a note of it. Buy a replacement filter of the same size. Disposable filters are inexpensive and can be purchased at hardware or big box stores. It's a good idea to have one or two extra filters on hand.

Step 5: If your old filter is disposable, throw it away. If it's cleanable, follow the directions given to clean it. Make sure to let the filter dry if you have rinsed it. Install the new or cleaned filter and replace the cover plate.

Finding a Professional

To find a contractor, start by asking friends and neighbors if they've worked with a contractor they would recommend. Look for licensed, insured contractors and ask about their experience. Also ask for references—and check them. You can call the Better Business Bureau to find out if any complaints have been filed against the contractor.

Measuring Efficiency

The technician should test the efficiency of your heating system both before and after the clean and tune. The technician should show you the results of these tests, which will tell you two things: whether the efficiency of your heating system has been improved, and whether the system is running at an acceptable level. This is especially important if you're thinking about buying a new heating system.

Cleaning and Adjusting Your System

With all systems, the technician should:

- *Check the condition of your vent pipe and chimney to see if it has deteriorated over time.*
- *Inspect the heat exchanger. This is where your furnace or boiler heats up the air it sends into your house. In boilers, leaky heat exchangers leak water, making the problem easy to spot. In furnaces, cracked or broken heat exchangers mix dangerous combustion gases with the house air and potentially send carbon monoxide into the house—a big safety concern. This situation requires immediate repair, and it's why trained technicians should inspect your heating system every year or two, especially as it ages.*
- *Adjust controls to maximize efficiency for the water and air temperatures.*
- *Lubricate all moving parts to reduce the amount of friction.*

With forced-air systems, the technician should:

- *Check for cracks in the combustion chamber.*
- *Clean and oil the blower.*
- *Test for carbon monoxide and fix any problems related to it.*
- *Remove dirt, soot, and corrosion from the furnace.*
- *Adjust the blower control and supply-air temperature.*
- *Check fuel input and adjust if necessary.*
- *Seal the connections between the furnace and main ducts.*

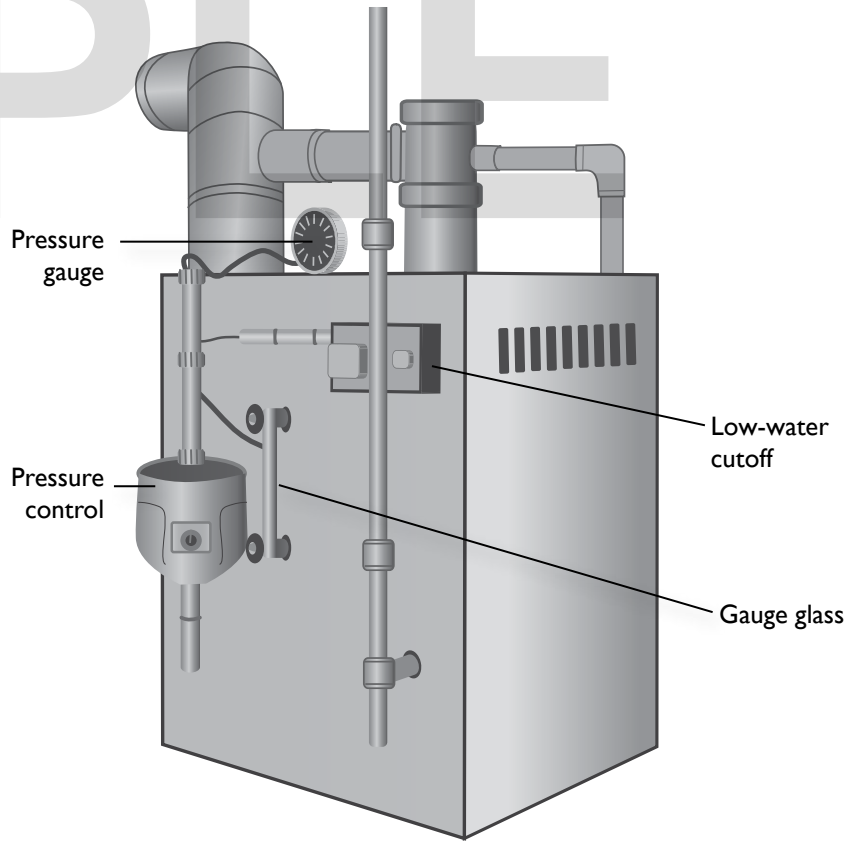
With hot water systems, the technician should:

- *Test the pressure relief valve, which maintains the boiler's water pressure.*
- *Test the high-limit control, a safety feature that turns off the boiler if the water temperature goes too high.*
- *Inspect the pressure tank, which should be filled with air, to ensure it's not filled with water.*
- *Clean the heat exchanger.*

With steam systems, the technician should:

- *Drain water from the boiler to remove sediments. This improves efficiency.*
- *Test the low-water cutoff and the high-limit control—two safety features that shut off the boiler if there's not enough water in the boiler or if the water temperature reaches unsafe levels.*
- *Drain the float chamber to remove sediments.*
- *Examine the water in the boiler and add chemicals if necessary to control deposits and corrosion.*
- *Clean the heat exchanger.*

Standard Boiler



Space Heaters

Small space heaters typically are used when the main heating system of a house isn't enough, but they should serve only as backups. Do not heat an entire house with space heaters alone; doing so is a safety hazard.

One of the main safety concerns with space heaters is ventilation. Most states have banned indoor use of unvented kerosene heaters, and at least five have banned unvented natural gas heaters in homes. Using these heaters can be a safety hazard for your family.

Electric space heaters are the only ones that are safe to use indoors. Though they don't harm the air quality of the house, electric space heaters can still cause fires and should be used with caution.

Space heaters should always be plugged directly into an electrical outlet and should never be used if the cord or plug is damaged.

Each year, space heaters cause more than 25,000 residential fires that result in more than 300 deaths. An estimated 6,000 people per year are treated at hospital emergency rooms for burns caused by touching the hot surfaces of room heaters.

Follow these guidelines for buying and using a small space heater:

- *Purchase only a newer model with all current safety features. Make sure it has the Underwriters Laboratories (UL) label attached.*
- *Select a heater of the proper size for the room you wish to heat. Most come with a general sizing table so you don't buy one that's too big.*
- *Place the heater on a level surface away from foot traffic. Take care to keep children and pets away from it.*

Space heaters usually have a capacity of 10,000 to 40,000 Btu per hour. Most rely on the air circulation of a room to heat the area, but some use infrared radiation to directly heat up objects and people nearby.

Heaters are classified as either vented or unvented. Vented heaters are designed to be permanently installed next to an outdoor wall so the gases the heater produces can be vented to the outside. Unvented combustion heaters (sometimes labeled "vent free") should not be used indoors because they can produce poisonous gases like carbon monoxide and can put a lot of moisture into the house.

Using Your Thermostat to Cut Heating and Cooling Bills

Control the Temperature of Your Home

One of the best ways to save on your home's heating bill is to control the temperature you set to heat your home. It's one of the simplest changes to make and leads to some of the biggest savings. The same is true of controlling the temperature you set to cool your home.

A programmable thermostat makes it easy to control the temperature in your home—and maximize your savings. Most people save enough money on their heating bill to pay for the thermostat within one year of installing it.

Those who benefit most are away from their home for long periods of time during the day. That's because programmable thermostats turn down the temperature when you leave home and turn it back up before you arrive home. The longer the temperature is set back, the more money you save.

Buy a Programmable Smart Thermostat

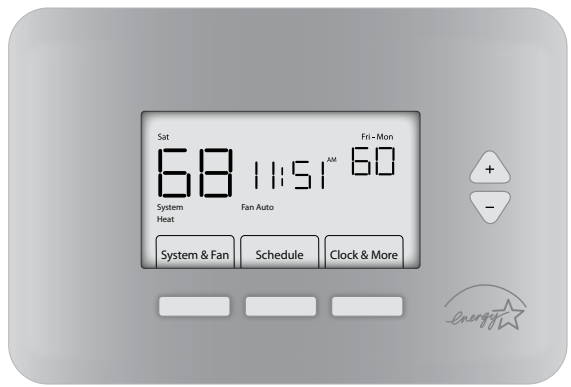
Look for a thermostat with the ENERGY STAR rating. Smart thermostats can connect to Wi-Fi and be controlled by a mobile device.

In the winter, save energy by setting the thermostat to 68 degrees while you're awake and then lower it while you're asleep or away from the house. In the summer, keep the house warmer than normal while you're away and set the thermostat to 78 degrees while you're home.

Programmable Thermostat

A programmable thermostat is the best way to control the temperature of your home, especially when you're away. When used properly, the money you save on heating or cooling your home will pay for the device in only one year.

This thermostat is set for 68 degrees in the winter when someone is in the home. Then when the occupants are away during the day, it goes down automatically to 60 degrees.



Programmable thermostats can be complicated to understand and set, so be sure to keep the instruction manual handy.

Program Your Thermostat

Think about your family's schedule. Reduce the temperature for times when no one will be home for four or more hours. Also think about the time you normally wake up and the time you go to sleep. Reduce the temperature an hour or two before you go to bed in the winter; you won't usually notice the house cooling off while you get ready for bed.

To use the thermostat properly, make sure it's set to save energy for long periods of time. Eight hours is a good minimum, both at night when you're sleeping and during the day when no one is home. If you need extra heating, use the manual override. It won't erase the preset schedule, but it will use more energy—and cost more—if you do this often.

Call a Heating, Ventilating, and Air Conditioning (HVAC) Professional to Install a New Thermostat

An HVAC technician can upgrade an old manual thermostat to a programmable one and find the right unit for heating systems that use heat pumps. Thermostats should be installed on interior walls away from vents, doorways, windows, and any other heating, cooling, or vent source. If it's in a place where the temperature changes frequently, the thermostat will sense that the room is hotter or colder than it actually is and cycle on and off more often than necessary.

You should also:

- *Consider installing multiple thermostats if you have multiple heating and cooling zones in your home.*
- *Change the batteries each year.*
- *Avoid using the "hold/permanent/vacation" feature for managing day-to-day settings; use it when going away for a weekend or longer.*
- *Avoid extreme settings. Setting your heater to 90 degrees will not heat the home any faster, nor will setting your air conditioner to 40 degrees cool it more quickly.*

Air Conditioning

Cooling your home is just as important as heating it, and in some areas it can be just as costly.

Reduce Your Cooling Needs

Before you consider buying a new air conditioning system, you can make smaller changes to reduce your need for air conditioning in the first place.

Make Sure Your Home Is Well Insulated

Insulation keeps you warm in the winter by keeping heat inside your home so outside air doesn't sneak indoors. And a well-insulated home will keep the heat outside your home in the summer. Make sure to check the insulation near your attic to reduce heat gain.

Look at Your Appliances

Inefficient appliances produce high levels of heat. Think about getting rid of any old or extra refrigerators you have, and unplug or use a smart power strip with your electronics when you're not using them so they don't produce extra heat.

Check Your Windows

Much of your home's heat enters through its windows. Locate the wall that gets the most summer sun and make sure any new windows you install there have low-E coatings to block unwanted heat gain. Consider planting trees for shade or creating an overhang to artificially shade the windows. Keep the window coverings closed on this side of your home during the summer to keep the heat out.

Use a Fan First

When your home does get warm, turn on a fan before turning on the air conditioner. Fans use less energy and can be very effective unless the indoor humidity is stifling. Fans cool people by circulating the existing air—not by reducing the room's temperature—so turn them off when you leave a room.

If you're purchasing a new fan for your home, invest in a ceiling fan, which is more efficient than other types. Choose an ENERGY STAR–rated fan, which is 50 percent more efficient than a conventional fan. Ceiling fans work best in rooms with a ceiling of at least 8 feet and are best installed with the blade 10 to 12 inches below the ceiling and 7 to 9 feet above the floor.

Ceiling fans are also a good addition to a home with air conditioning. Running a ceiling fan allows you to raise the thermostat on your air conditioning system by about four degrees with no noticeable change in comfort. In mildly hot weather, fans can keep you cool enough to avoid using the air conditioner altogether.

Window fans are another effective option. They are best used in windows facing away from the prevailing wind, where they can blow hot air out of the home rather than bring new air into the home. To cool your home, close the windows near your fan and open windows in the rooms far away from it, preferably on the windward side of the home, so the breeze will blow in through those windows, circulate through the house, and exhaust out through the window fan. Shaded windows are the best for this intake breeze.

Maintenance

The filters, coils, and other parts of your air conditioner need regular maintenance for it to be as efficient as possible.

Your primary maintenance task is **replacing or cleaning the filter on your air conditioner**. Dirty or clogged filters block airflow and reduce efficiency. Keeping the filter clean can lower your system's energy use by 5 to 15 percent. You should do this every month or two during the cooling season, but the filters can require more frequent maintenance if the machine is in constant use, you live in a dusty area, or you have pets that shed a lot.

Also make sure to have your air conditioning system checked well before cooling season begins each year. Once the weather becomes hot, technicians are in greater demand and are harder to schedule. An easy way to remember is to schedule preseason maintenance appointments for your heating and cooling systems near the daylight saving time transitions in spring and fall.

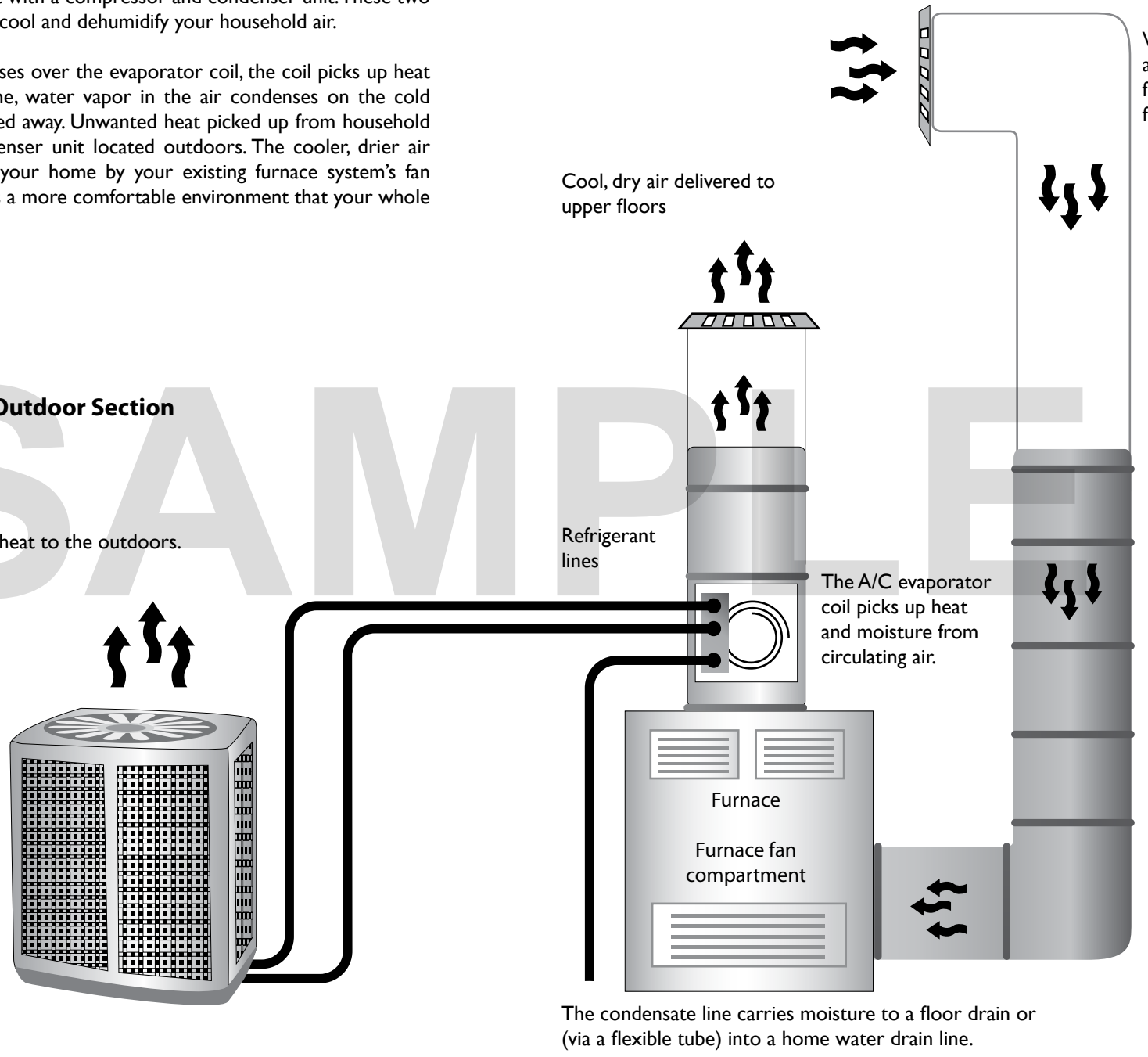
During the checkup, the technician should:

- *Clean the evaporator and condenser air conditioning coils. These coils collect dirt over time, which reduces airflow and insulates the coil, lessening its ability to absorb heat and cool your home.*
- *Check the coil fins. These aluminum fins are easily bent and can block airflow through the coil; the technician will use a "fin comb" to comb the fins into their proper position.*
- *Clean and adjust blower components to provide proper system airflow. Airflow problems can reduce a system's efficiency by up to 15 percent and reduce comfort.*
- *Check refrigerant levels in central air conditioning systems. Recharging the refrigerant can improve efficiency by 20 percent.*
- *Check the condensate drain in a central air conditioner, furnace, or heat pump installation. Condensate drains can become plugged from dust and slime that naturally accumulates inside the unit, causing water damage and affecting humidity levels indoors. For preventative maintenance, condensate drains should be cleaned once a year.*
- *Check the settings on your thermostat to ensure it's programmed both to keep you comfortable and to save energy.*
- *Measure airflow over the indoor coil. Correcting airflow problems can improve efficiency another 5 to 10 percent.*
- *Tighten all electrical connections and measure the voltage and current on motors.*
- *Lubricate all moving parts of the system.*
- *Ensure that the system starts, operates, and shuts off properly.*
- *Evaluate duct sealing: ducts carry cold air from the air conditioner to rooms in your home. Ensure that it isn't escaping en route.*

How a Central Air Conditioning System Works

Central air conditioners have two main units: an indoor unit with an evaporator or "A" coil and an outdoor unit with a compressor and condenser unit. These two components work together to cool and dehumidify your household air.

When warm household air passes over the evaporator coil, the coil picks up heat from the air. At the same time, water vapor in the air condenses on the cold surface of the coil and is drained away. Unwanted heat picked up from household air is transferred to the condenser unit located outdoors. The cooler, drier air is then circulated throughout your home by your existing furnace system's fan and ductwork. The end result is a more comfortable environment that your whole family will enjoy.



Operating Your System Efficiently

Instead of running your air conditioner constantly, use it only when fans and other forms of ventilation are not enough. Turn the thermostat up when you leave the house for several hours—or, better yet, install a programmable thermostat so this is done automatically. When you do run the air conditioner, keep your doors and windows closed to keep the cooled air inside your home. Run hot water appliances in the evening, and shower with the exhaust fan on to minimize indoor humidity.

If you have a room air conditioner, check the seal between the air conditioner and the window frame before each cooling season. The seal should make contact with the unit's metal case. Moisture can damage the seal and allow cooled air to escape from your home. Make sure to either cover your room air conditioner or remove and store it during the winter.

Take time to plan before installing a room air conditioner. It should be level when you install it so that the drainage system inside the machine operates efficiently. Put it in a shaded spot on your home's north or east side, if possible, because putting it in direct sunlight can decrease its efficiency by as much as 10 percent. You can also plant trees and shrubs to shade the unit if they don't block the airflow.

Check the interior location as well. Don't place electronics or televisions near the unit's thermostat, which can sense heat from those appliances and cause the unit to run longer than necessary.

Set the thermostat as high as comfort will allow in the summer. The smaller the difference between the indoor and outdoor temperatures, the lower your cooling bill will be. Set the fan on high except on very humid days, when a low setting will optimize comfort by removing more moisture from the air by cooling it more slowly. To maximize your comfort, try using an interior fan near your window air conditioner to spread the cooled air throughout your home with a minimal increase in your electricity use.

When to Replace

If you've minimized your cooling needs but your cooling system is still inadequate, it could be time to replace your air conditioning system.

If the air conditioner or heat pump is more than 10 years old, consider replacing it with an ENERGY STAR–rated model. The extra efficiency could save 20 percent on heating and cooling costs, according to ENERGY STAR.

If your cooling system needs frequent repairs, you have humidity problems, your energy bills are going up, the system is noisy, or some rooms in your home are too hot or too cold, it's likely time for a new system.

Selecting a New System

Your contractor will perform several calculations to find the right system for your home. Proper sizing and installation are key elements in air conditioner efficiency. Too large a unit won't adequately remove humidity. Too small a unit won't be able to produce a comfortable temperature on the hottest days. Improper unit location, lack of insulation, and improper duct installation can greatly diminish efficiency.

Central Air Conditioning

Central air conditioners are widely used in the United States and are the best way to keep comfortable in climates that have high levels of humidity. They circulate cool air through a system of ducts, which carry the cooled air from the air conditioner into the home. That air becomes warmer as it circulates through the home, and then it flows back to the air conditioner and is recooled.

Central air conditioners come in two types: a split system or a packaged unit. Split systems use an outdoor metal unit with a condenser and compressor and an indoor unit with an evaporator. Packaged systems come with just one unit, which is usually located on a roof or on a concrete slab next to your home's foundation.

These systems are rated according to their seasonal energy efficiency ratio (SEER), which measures the cooling output divided by the power input for an "average" climate in the United States. The higher the SEER, the more efficient the air conditioner will be. Your utility company may offer incentives for you to purchase this equipment, so check with them before buying. You can also look for an ENERGY STAR–rated air conditioner; they're about 14 percent more efficient than standard models.

Sizing

Finding the right size central air conditioner is one of the biggest factors in determining how efficient the system will be for your home. The contractor will make several calculations to determine what size unit you need—but you must know what questions to ask to ensure that the job is done properly.

The sizing calculations shouldn't be based solely on the square footage of your home or on the size of the equipment you currently use, because that system might not have been the right size in the first place. In older homes that were not well sealed, it was common to install heating and cooling equipment that was two to four times larger than needed. Today, that's a big waste of energy.

The contractor should base their estimate on the amount of heat your home gains during the summer. To do that, they need to factor in the following: the local climate, which direction your home faces, how well insulated your home is, how well air leaks are sealed, the sealing of your ductwork, and the size of

your windows and how much sun they receive. This calculation is usually done with software.

An improperly sized unit will cause many problems. If it's too large, it won't adequately remove humidity and it will turn on and off more often than a system that's properly sized, which will shorten the life of the equipment. One that's too small, though, will not be able to reach a comfortable, cool temperature on the hottest days. It will also reduce the efficiency of air distribution and speed up wear on the system.

Heat Pumps

Heat pumps are much more efficient than central air conditioners, and they can be used both to heat and cool some homes. During the cooling season, heat pumps use electricity to move heat from your cool house into the warm outdoors. Because they move heat instead of generate it, heat pumps can provide four times the amount of energy they use.

ENERGY STAR also rates heat pumps; they are 8 percent more efficient than newer conventional models and up to 20 percent more efficient than older ones.

Ductless Cooling Systems

Ductless cooling systems (also called mini-splits or multi-splits) deliver cool air to different rooms in your home without routing it through ducts first. A ductless air conditioner has two major components: a unit mounted on an inside wall that delivers cool air to the room and a unit mounted on the outside of the house. A pair of conduits with refrigerant lines run between the two, one delivering electricity, the other taking away condensate (water). Ductless systems are more expensive than window units but are much more energy efficient. Energy-saver models are available.

Room Air Conditioning Units

Room air conditioners usually cost less to buy than central air conditioning systems or ductless systems, even if you have to buy several for different parts of the home. They're less efficient than the other systems, but they can be less expensive to operate than whole-house systems if you use them to cool only the rooms you need to have cooled.

Choose one with a filter that slides out easily for cleaning and that has controls like a digital thermostat and a built-in timer that allow you to adjust the unit to use less energy. Also note the voltage. Units rated 230 volts may require a special circuit.

Getting the right size is very important. If your room air conditioner is too large, it will turn on and off too often, wasting energy. If it's too small, it won't cool well and it will overdry the air. You can use the chart from ENERGY STAR to help calculate what size unit you need. Keep in mind that square footage isn't the only factor. If your room has high ceilings, is directly under the attic, or has several windows that get the summer sun, consider a unit one or two classes higher than this chart suggests.

Energy Usage vs. Area

Area to Be Cooled (square feet)	Capacity Needed (Btu per hour)
100 *to* 150	5,000
150 *to* 250	6,000
250 *to* 300	7,000
300 *to* 350	8,000
350 *to* 400	9,000
400 *to* 450	10,000
450 *to* 550	12,000
550 *to* 700	14,000
700 *to* 1,000	18,000
1,000 *to* 1,200	21,000
1,200 *to* 1,400	23,000
1,400 *to* 1,500	24,000
1,500 *to* 2,000	30,000
2,000 *to* 2,500	34,000

Source: *ENERGY STAR.*

Chapter 6

Water Heating and Water Saving

Water is a key resource in your home. And you pay twice for most of the water you use. That's because you pay one bill for the water itself and another bill to heat it every time you wash your hands, take a shower, or run an appliance that uses hot water. For an average family, between 10 and 25 percent of the utility bill is for simply heating up water.

While most Americans worry about rising electricity, gas, and heating oil prices, water rates have also surged in the past dozen years. Reducing the amount of water you use will save your family money on two bills: the water bill and the energy bill.

Saving on Operating Costs

The first thing you can do to save money on heating water is turn down the temperature on your water heater. It takes only a minute and leads to big, big savings.

Most water heaters are automatically programmed to heat water to 140 degrees. But in most homes, 120 degrees is more than enough. The only exception is dishwashers, which need extra-hot water to clean dishes. Luckily, dishwashers have been made with their own internal heating systems since the 1990s. They boost the temperature to 140 degrees while your dishwasher works, so you can turn down the thermostat on your water heater. The change also prevents you from scalding yourself on extra-hot water and slows mineral buildup and corrosion in your pipes and water heater.

When you leave for vacation in summer, turn your water heater temperature down even more. Gas water heater temperature knobs often have a "vacation" setting that keeps the pilot light on but doesn't heat the water. Or you can turn the gas water heater completely off—just make sure you know how to safely relight the pilot light. Electric water heaters are wired to their own breaker, so an easy way to keep your electric water heater off while you're gone is to turn off the breaker—just be sure to leave yourself a reminder to turn the breaker back on when you return!

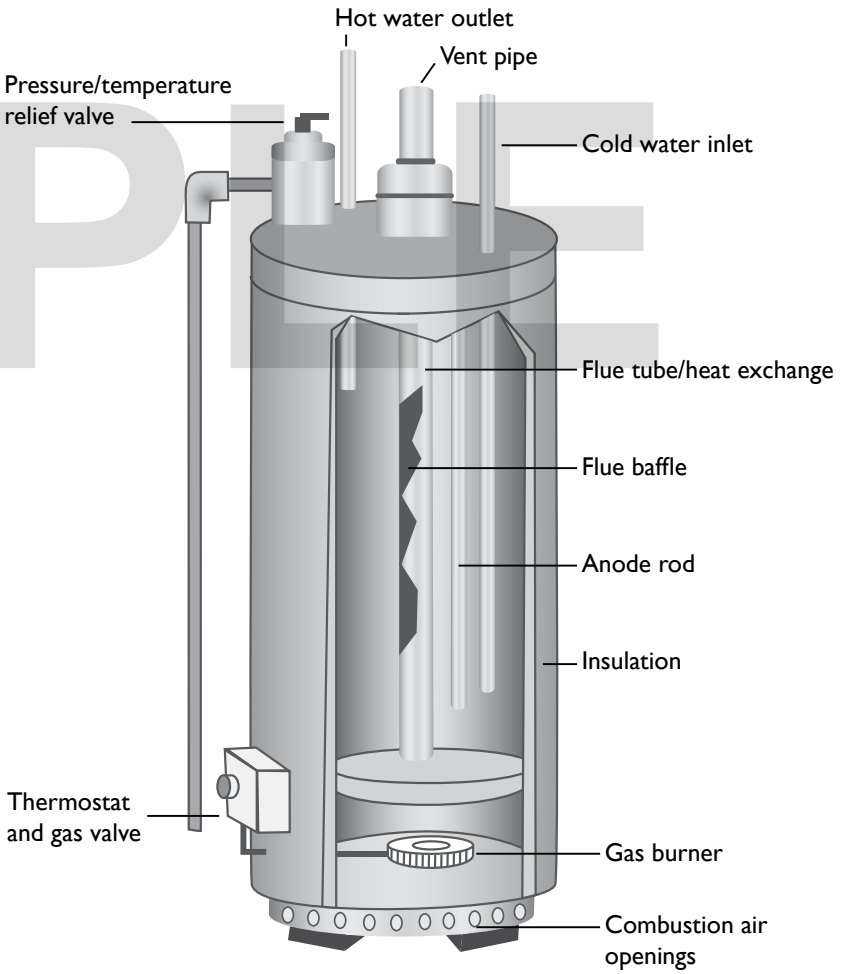
Insulating the Hot Water Tank

Insulation is very important to your water heater's efficiency. If your water heater has a tank, it will be rated with an R-value, just as regular insulation that goes into your walls is rated. The R-value should be at least R-10. If it isn't, your tank can benefit from additional insulation. Sometimes, insulation can reduce standby heat losses by 25 to 45 percent. If you don't know the R-value of your water heater's tank, just touch it. If it feels warm, it needs more insulation.

It's simple to add insulation to an electric storage water heater. You can find insulation jackets or blankets that are precut to fit your water heater's tank. An insulation blanket isn't necessary if you have a newer hot water heater that's factory insulated with R-16 or better. Sometimes adding a blanket to a new water heater voids the warranty, so read the label on your water heater.

Adding insulation to the tank of a gas- or oil-powered storage water heater is more difficult. It's best to have an HVAC contractor add insulation to these systems.

Storage Water Heater



Insulate Water Pipes

Pipes should be well insulated, especially at the point where they connect with the water heater. Insulated pipes can reduce heat loss and raise your water temperature between two and four degrees compared with uninsulated pipes. This means you can set the thermostat on your water heater two degrees lower but the water will be the same temperature when you turn on the faucet as it was before you adjusted the thermostat. Good insulation also helps pipes deliver hot water more quickly, so you don't have to wait as long for hot water when you turn on a faucet or shower. That conserves water—and saves you money on your water bill.

All hot water pipes that you can reach should be insulated, especially if they're within six feet of the water heater itself. Insulating cold-water pipes within six feet of the water heater is usually a good idea, too.

On gas water heaters, insulation should be kept at least six inches away from the flue for safety reasons. The safest choice with gas water heaters is to use fiberglass pipe wrap that's at least one inch thick and without a facing. Use either wire or aluminum foil tape to secure it to the pipe.

Repair Leaks Immediately

A leak of one drip per second can cost $1 per month, and repairing leaks in fixtures, faucets, and showerheads will reap instant rewards. If the leak is coming from your water heater's tank, though, it's likely you need a new water heater.

Make sure to check every leaky place in the house, including pipes, hoses, couplings, and even your toilet. A leaky toilet can waste more than 52,000 gallons of water a year.

Install Heat Traps

Heat traps save energy by preventing heat loss through the inlet and outlet pipes of a storage water heater tank. Installing heat traps requires soldering a pipe joint, so it's best done when you have the system installed or when you already have a technician out to work on your water heater. Many new water heaters come with a heat trap already installed.

Install a Timer

You can save an additional 5 to 12 percent on your energy bill by installing a timer that turns off the water heater at night or during your utility's peak demand times, when energy often costs more. It's possible to install one yourself.

Timers are most effective if you don't want to install a heat trap or insulate your hot water tank and pipes. Timers aren't as effective on gas water heater tanks because of their pilot lights.

Maintenance

Storage water heaters have an average life span of between 10 and 13 years, but they can last longer with the right maintenance.

The single most overlooked part of the water heater is the sacrificial anode, which is a metal rod inside the storage tank. Over time, it begins to decay because of a chemical reaction inside your water tank. If it has decayed completely and there is no metal left, the chemical reaction will attack the tank itself, causing it to rust. Replacing this anode every two to five years will make your water heater last longer.

Twice a year, you should also check for sediment in your tank and drain it. If you have not done this recently, the whole tank might need to be flushed. To do that, turn off the water heater circuit breaker (in an electric system) or shut off the gas valve (in a gas system) and drain the water from the tank. Allow a few gallons of cold water to refill in the tank. Drain again, and repeat until the water is clean. Check and replace the bottom and top thermostats of the tank, too, and if you have an electric system, check the heating elements regularly. For gas systems, ensure that the flame comes on whenever hot water is being used. If it doesn't, call to have the system serviced.

The temperature/pressure relief valve should also be checked every year. This valve prevents the buildup of dangerous pressures or very hot water in the tank. To check this, put a pan under the water outlet and lift the lever to check the flow. Be careful—the water is very hot. If water drips from the pipe after operating the valve, trip it several times to get a better seal. If it continues to drip, the valve might need to be replaced.

Tankless water heaters usually have a life expectancy of more than 20 years. They can also have parts replaced to extend their life for several more years. The maintenance on a tankless water heater varies based on the make and model of the unit, so check the owner's manual for specific maintenance recommendations.

Water Use at Home

Because you use water throughout your home—in your kitchen, bathroom, yard, and countless other areas—there are many ways you can cut down on both your water heating bills and your water bills.

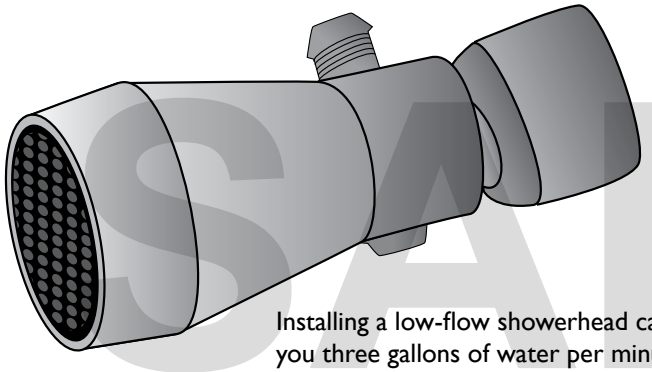
In the Bathroom

Install low-flow showerheads. Choose one that flows at a rate of less than 1.75 gallons per minute.

To see if yours should be replaced, conduct a quick test. You will need a bucket that's marked in gallon increments. Put the bucket under the showerhead and turn on the shower at the water pressure you normally use. Time how long it takes the water to reach the one-gallon mark. If it's less than 20 seconds, you can benefit from a low-flow showerhead.

With regular showerheads, a family of four can use 700 gallons of water per week if each person takes a daily five-minute shower. That's enough water to supply one person with drinking water for three years. Using low-flow showerheads and faucets can cut their hot water use in half—saving 14,000 gallons of water per year and saving all the energy required to heat it.

Low-Flow Showerhead



Installing a low-flow showerhead can save you three gallons of water per minute.

Know when to turn the water on–and when to keep it off. Your biggest savings will come from simply using less water. Take showers instead of baths, and take a shorter shower instead of a longer one. Turning off the water when you brush your teeth will save you four gallons per minute. Also turn off the water when you're shaving.

Install low-flow faucets. The maximum flow rate of a faucet is determined by the aerator, which is the screw-on tip on the faucet. New kitchen faucets typically come with aerators that limit their flow to 2.2 gallons per minute. New bathroom faucets have a lower flow of between half a gallon and 1.5 gallons per minute.

You can purchase a new aerator to lower the flow rate of your current faucets. To maximize efficiency, buy one with a flow rate of 1 gallon per minute or less. When you buy a new one, unscrew the current aerator from your faucet and bring it to the store with you to ensure that you purchase one that will fit your faucet.

Check the toilet. If your home was built before 1992 and you haven't replaced the toilets since then, you could benefit from installing high-efficiency models that use 1.6 gallons of water or less on each flush. This can save you up to five gallons of water per flush.

If you can't replace the toilet, consider putting a plastic bottle filled with water inside the toilet tank. This can save more than 11 gallons of water per day. Don't use bricks, as they can damage the tank.

Outside Your Home

Don't hose down the driveway. Use a broom or sweeper instead to clean your driveway, garage, or sidewalk.

Let grass grow. Taller grass reduces water lost to evaporation, and mowing too frequently will require more water to sustain your yard.

Pick plants carefully. Try to plant species native to your area, and focus on drought-resistant plants if you live in a warm climate. If maintained properly, native landscaping can use less than half of the water required by traditionally landscaped gardens.

Group plants that require the most water so you can water them properly without overwatering other species. Try to plant in the spring or fall when plants need less water.

Water carefully. Don't overwater your plants—it wastes water and harms your garden. If you have an automatic landscape irrigation system, adjust the controller at least once a month to account for changes in the weather. Install a rain shutoff device, soil moisture sensor, or humidity sensor to better control the irrigation system, too.

Water early or late in the day when temperatures are lower, and aim for the roots. This gets more water into the plant than watering just the leaves does.

Check your sprinkler. Don't water the sidewalk or your neighbor's yard. Where possible, use a drip hose instead of a sprinkler because sprinklers can lose water to evaporation. Don't leave sprinklers or hoses unattended. Outdoor faucets can flow at more than 264 gallons per hour. Install a timer to make sure your system shuts off properly.

Use a shutoff nozzle on your hose. This allows you to turn off the water while you wash your car or as you walk around your yard watering plants.

Mulch. Putting a layer of mulch around plants reduces water evaporation.

Forgo fountains. Unless the water is recycled, don't install ornamental water features like fountains and birdbaths.

Other Tips

Make sure you're saving energy with your appliances, including your dishwasher, clothes washer, and dryer. For tips on using these appliances efficiently, see chapter 9.

A New Water Heater?

If you're replacing a worn-out or old water heater, picking an efficient water heater is a surefire way to save on your energy bill. To choose the right water heater, you will have to decide what size system you need, what fuel source you'll use, and what type of water heater design is right for your home. ENERGY STAR–labeled water heaters assure the highest energy savings available for your replacement unit.

Storage Water Heaters

Storage water heaters are the most common type of water heater in American homes. They're named for the large tank they use to store hot water. The tank can range in size from 20 gallons for a small system to 80 gallons for a large one.

When you turn on a hot water tap in your home, the storage water heater begins to work. It releases hot water from the top of the tank and then replaces that water by drawing cold water into the bottom of the tank and heating it. This ensures that the tank is always full.

Even when the hot water in a home isn't running, heat gradually escapes from the tank and more energy must be used to reheat the water. This is called standby heat loss. You can minimize it by purchasing a heavily insulated tank, but you cannot avoid it entirely with a storage water heater.

Tankless Water Heaters

As their name suggests, tankless water heaters don't have a tank for storing hot water. Instead, they look like a small box.

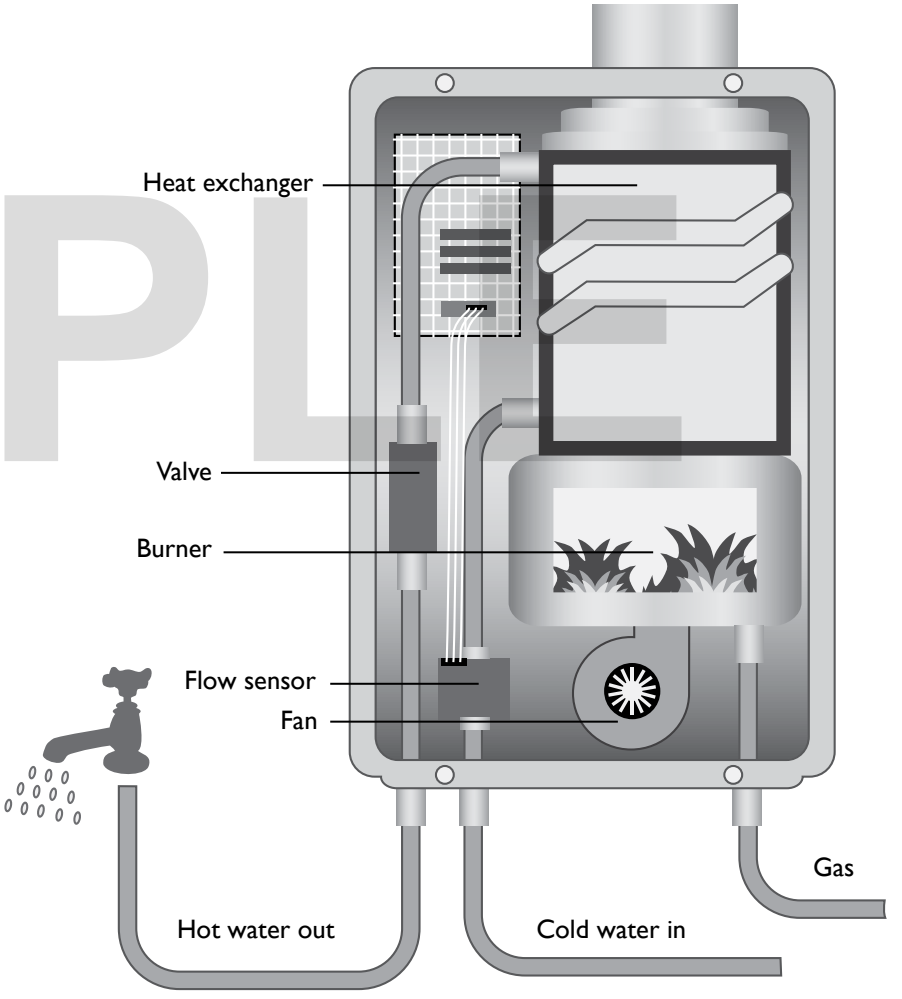
When you turn on a hot water tap, cold water flows through a pipe and into the box of the water heater. There, either a gas burner or an electric element heats up the water in a constant stream. Unlike with storage models, which can run out of hot water if you use a tankful of water, you won't run out of hot water with a tankless water heater because it continuously heats a steady stream of water. Most provide between two and five gallons of hot water per minute.

Because they don't have a tank, these models eliminate the standby energy losses that affect storage hot water heaters.

Some households need more than one tankless heater because in larger homes even the largest gas-powered tankless models can't supply enough hot water for all the appliances, showers, and taps at the same time. Tankless heaters work particularly well in homes that already use water efficiently with things like low-flow faucets and showerheads.

If you're purchasing a tankless water heater, look for a gas-fired model with the ENERGY STAR label. It should have an energy factor of 0.82. Some are eligible for federal, state, or local tax incentives.

Tankless Water Heater



Chapter 7

Air Leaks: What Are They?

It's easy to feel drafts around your doors in the winter, when chilly air can flow around the doorjambs if they haven't been properly sealed. Many people think windows and doors are the biggest cause of air leaks in their home because the drafts around them are so noticeable. But that's wrong.

The attic, basement, and crawl spaces are usually responsible for the biggest air leaks—and fixing them can bring down your energy bill a lot.

Air leaks happen when outdoor air enters your home through cracks and other openings. Temperature differences, wind, appliance use, and even living habits can create a different pressure inside your home than outside it, which helps air enter or escape your home.

Finding the air leaks in your home and then sealing them will cut your heating and cooling bill significantly. It will also improve the durability of your home, create a healthier environment, and make your rooms more comfortable.

How to Find Air Leaks

Look at the common air leak locations illustrated on the next page and find out if air is flowing through these spaces in your home. If the areas are already caulked or weather-stripped, check to make sure there are no gaps or cracks in the installation and that the material is still in good condition.

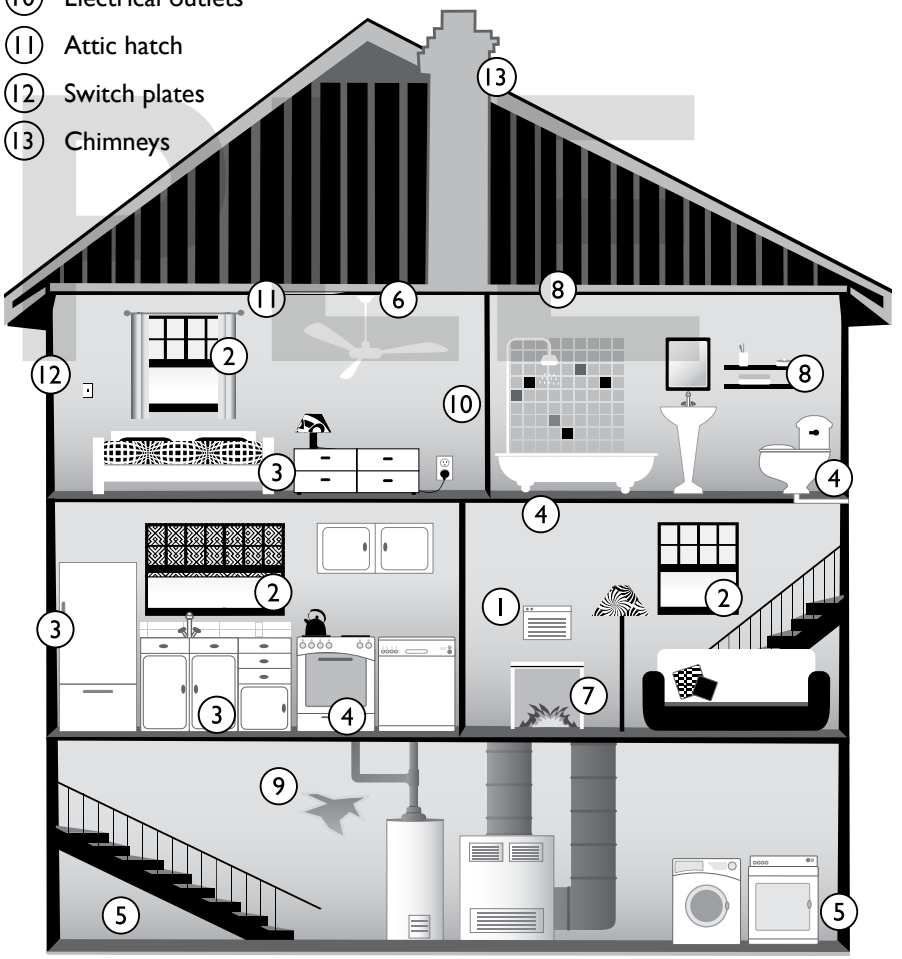
Windows and doors are a good place to start. Look for daylight around the frame—if you see it, it means the door or window is leaking air. Try to rattle the door or window; movement means there could be an air leak. Also check storm windows to see if they fit and that they're not broken.

Consider doing a basic building pressurization test to check for leaks:

- *Start by closing all exterior doors, windows, and fireplace flues.*
- *Turn off all combustion appliances, such as gas-burning fireplaces, furnaces, and water heaters.*
- *Then turn on all exhaust fans (usually located in the kitchen and bathroom) or use a large window fan to suck the air out of the rooms.*

Most Common Areas in Your Home for Leaks

1. Wall- or window-mounted air conditioners
2. Window, door, and baseboard moldings
3. Wiring that runs through insulated floors, ceilings, and walls
4. Plumbing that runs through insulated floors, ceilings, and walls
5. The basement where the foundation meets the wood framing
6. Recessed lighting and fans in insulated ceilings
7. Fireplace dampers
8. Dropped ceilings above bathtubs and cabinets
9. Missing plaster
10. Electrical outlets
11. Attic hatch
12. Switch plates
13. Chimneys



- *This increases the amount of air coming into your home through cracks and leaks and makes them easier to detect. You can light an incense stick and use it to locate leaks; the moving air will cause the incense smoke to waver. Or put water on your hand, making it more sensitive to any cool air.*

Check the exterior of your home where all the different building materials meet:

- *All exterior corners*
- *Where the siding meets the chimney*
- *Where the foundation and the exterior brick or siding meet*
- *Where the siding and window frames meet*

Calling a Pro: The Energy Audit

If you want a professional to evaluate the air leaks in your home, consider a professional energy audit. Check with your local utility to see if it provides a basic energy audit. Some utilities do this for free. If yours doesn't, find out if you can have an energy audit done when you have a technician tune up your heating and cooling system.

The auditor will use equipment like a diagnostic blower door or infrared camera to detect air leaks and areas with inadequate insulation.

There are several other ways to find an auditor. They might be called a home performance contractor, an energy rater, or even an energy doctor—all are good options. You can check with your state's energy office and the following organizations to find a qualified contractor.

- **ENERGY STAR**
  This federal program partners with local utilities and municipalities. Find local programs or search for home energy raters through its website.
  www.energystar.gov
- **Building Performance Institute (BPI)**
  This group has had certified contractors for more than 10 years but isn't available in every state.
  www.bpi.org
- **Weatherization Assistance Program (WAP)**
  Depending on your income, you may qualify for a free energy audit as well as energy-efficiency home improvements through this federal program.
  www.energy.gov/scep/wap/how-apply-weatherization-assistance
- **RESNET (Residential Energy Services Network)**
  This nonprofit industry group certifies energy raters; the raters conduct the same types of tests that an auditor would, but raters also assign your home a score between 1 and 100 that compares its efficiency to that of other homes.
  www.resnet.us

The auditor will use several devices to test the efficiency of your home:

- *Blower door. This is a fan with several speeds that the auditor mounts to an exterior door frame. The auditor uses the fan to pressurize and depressurize your house to detect air leaks.*
- *Duct blower. This fan attaches to your duct system to measure the amount of air it leaks.*
- *Manometer. This small instrument measures the pressure differences between two parts of your home.*
- *Flow hood. This device measures the amount of air flowing through a register.*
- *Infrared camera. The auditor can use either a still or video infrared camera to find heat variations that reveal heat or air leaks.*

How to Fix Air Leaks

Three main materials are used to seal air leaks: caulk, weather stripping, and single-part foam.

When to Caulk

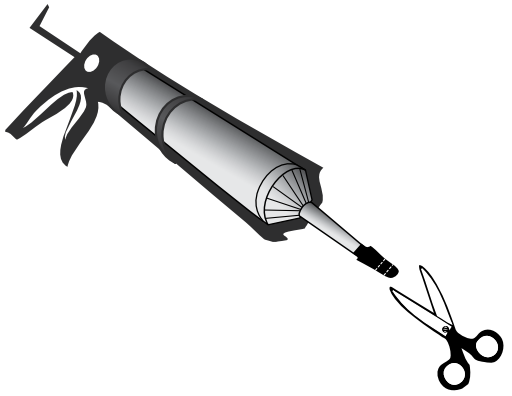
Caulk is flexible, and it's best used in cracks, gaps, or joints less than ¼-inch wide. You can use caulk throughout the home, including around windows and door frames. Besides sealing air leaks, caulk can also prevent water damage when applied around faucets, water pipes, bathtubs, and other plumbing fixtures.

Most caulk comes in disposable cartridges that fit into a half-barrel caulking gun—try to purchase one with an automatic release, if possible. Some caulking cartridges are already pressurized and don't require caulking guns. For smaller jobs, look for squeeze tubes and aerosol cans.

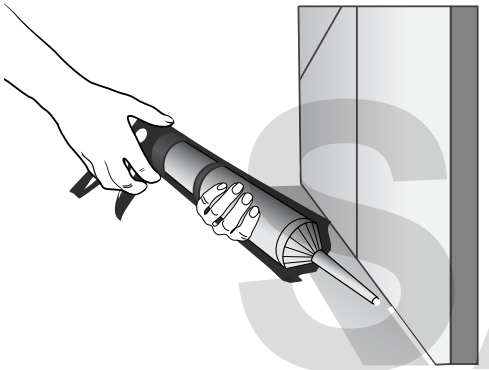
Before applying caulk, remove any old caulk or paint residue with a putty knife, stiff brush, or solvent. Try to apply new caulk during dry weather when the outdoor temperature is above 45 degrees.

The warm temperature helps the caulk set properly. If you apply caulk during a time of high humidity or rain, the cracks may be swollen with moisture, which will prevent the caulk from functioning properly.

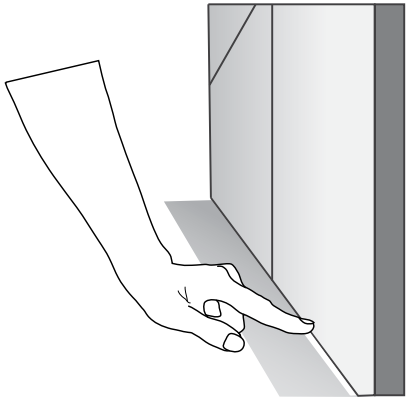
How to Use a Caulk Gun



Step 1: Cutting the nozzle. Embossed markings are located on each tapered caulk cartridge nozzle that correspond to the size of the bead that can be dispensed. By cutting the nozzle at different measurements, you can form a caulking bead to match your joint size. It's easy—just cut the nozzle at a 45-degree angle, and put the cartridge in a caulking gun.



Step 2: Applying a bead of caulk. As you apply the sealant, hold the caulking gun at a 45-degrees angle to the joint being filled. Orient the nozzle opening so that it forces sealant into the joint surfaces. As you finish applying each bead of sealant, relieve the pressure inside the tube by releasing the trigger and pulling back on the rod to stop the flow of caulk. (Releasing the trigger alone will not stop the caulk from flowing out of the nozzle.) Apply only about two to three feet of caulk bead at a time so that you'll have enough time to get it "tooled" before it begins to harden.



Step 3: Tooling. "Tooling" the bead ensures good adhesion and a good look. Tooling is the process of gliding over the entire length of the applied bead of caulk to smooth it out and further force the caulk into the area. Tooling can be done with a finger that's covered with a latex glove, moistened with some water or solvent, or just bare, depending on the caulk used.

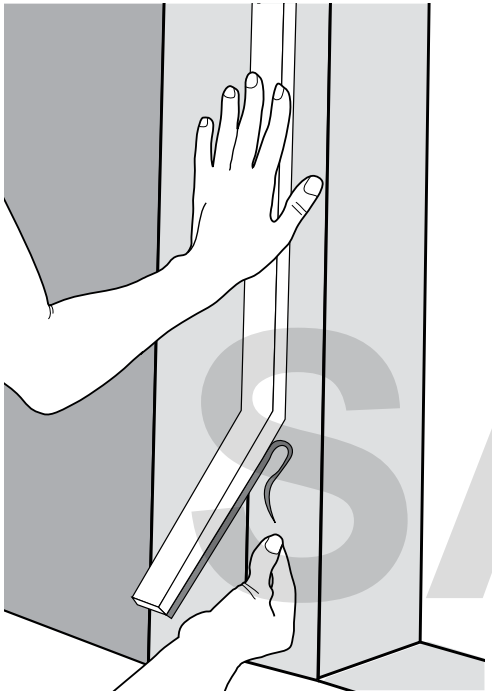
There are many types of caulk, with varying benefits

Type of Caulk	Recommended Use	Cleanup	Shrinkage	Adhesion
Silicone (household)	Seals joints between kitchen and bath fixtures and tile. Flexible. Can form adhesive for tiles and metal fixtures.	Use dry cloth immediately	Little or none	Good to excellent
Silicone (construction)	Seals dissimilar building materials to each other, including wood, stone, metal, and brick.	Use dry cloth immediately	Little or none	Good to excellent
Polyurethane, expandable spray foam	Expands when curing; good for larger cracks indoors or outdoors. Must be painted if used outdoors.	Use a solvent such as lacquer thinner	None; it expands to fill large, irregularly shaped gaps	Good to excellent
Water-based foam sealant (light)	Used around window and door frames in new construction; fills small cracks.	Use water	None; expands only 25%	Good to excellent
Butyl rubber	Seals dissimilar materials like glass, metal, plastic, wood, and concrete. Durable for 10 years or more.	Use mineral spirits	From 5% to 30%; may require two applications	Good
Latex	Seals joints around tub and shower. Fills cracks in tile, plaster, glass, and plastic. Seams can be smoothed with moist finger. Lasts 2 to 10 years.	Use water	From 5% to 10%	Good to excellent
Oil- or resin-based	Seals exterior seams and joints on building materials. Limited durability of 1–4 years. Should be painted.	Use mineral spirits	From 10% to 20%	Good

Source: *U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy.*

Weather stripping

Pressure-sensitive adhesive-backed foam is the easiest weather stripping to apply, and it's quite inexpensive. Available in both rubber and plastic, adhesive-backed foam comes in rolls of varying lengths and thicknesses. When compressed by a door or window, the foam seals out the air. As an added benefit, these strips also provide a cushioning effect that silences slamming. Though not permanent, this type of weather-stripping can last from one to three years.



Step 1: Use detergent and water to clean the surface where weather stripping is to be attached. If pressure-sensitive weather stripping was previously installed, use petroleum jelly to remove any old adhesive. Then let it dry completely.

Step 2: Use scissors to cut a strip to fit, but don't remove the backing paper yet.

Step 3: Starting at one end, slowly peel the paper backing as you push the sticky foam strips into place. If the backing proves stubborn to remove at the beginning, stretch the foam until the seal between the backing and the foam breaks.

When to Use Weather Stripping

Weather-stripping is ideal for sealing air leaks around movable things like windows and doors. It comes in many sizes, thicknesses, and styles.

Choose your weather stripping based on the specific place you want to install it. You can use more than one type of weather stripping to seal an irregularly shaped area, too. Just make sure your choice will withstand the friction, weather, temperature changes, and general wear and tear it will endure in the space where you plan to install it.

Weather stripping should be applied to clean, dry surfaces when the temperature is above 20˚F. Measure the area you want to weather-strip before cutting the material, and apply the weather stripping snugly against both surfaces. It should compress when the door or window is shut.

To weather-strip a door, apply one continuous strip along each side of the doorjamb. It should run the entire length of the doorjamb and meet tightly at the corners. The right thickness of weather stripping will press tightly between the door and the doorjamb when you close the door but won't make it difficult to shut.

To weather-strip a window, apply the weather stripping between the sash and the frame. The window should open and close normally.

When to Use Single-Part Foam

Single-part foam is a good choice for sealing small gaps and cracks where other materials like weather stripping or insulation may not be effective. It's particularly useful for filling small gaps that are too narrow or too irregularly shaped to be sealed with other materials.

Single-part foam comes in a can. It's made of a mixture of chemicals that expand when they come into contact with air. When you apply the foam to a crack or gap, it expands to fill the space, creating an airtight and watertight seal.

To use single-part foam, simply shake the can well and then apply the foam to the crack or gap using the nozzle provided. The foam will expand as it comes into contact with the air, so be sure to apply it slowly and carefully to avoid making a mess. Once the foam has fully expanded and cured, it can be trimmed or sanded to create a smooth finish.

Sealing Ducts

Forced-air heating and cooling systems use ducts to move the warmed or cooled air through the floors, ceilings, and walls of your home. These ducts are frequently made of sheet metal or fiberglass—but they're rarely airtight. In an average house, about 20 percent of the air that flows through the ducts is lost through leaks, holes, and poor connections. That means higher utility bills for you.

Studies indicate that duct leakage can account for as much as 25 percent of total house energy loss, and in many cases it has a greater impact on energy use than air infiltration through the building shell. Duct leakage can prevent heating and cooling systems from doing their job properly, resulting in hot or cold rooms and humidity problems. Worse yet, duct leaks can create air-quality problems by pulling pollutants and irritants directly into the house.

Indications that your ducts aren't properly sealed:

- *Your utility bills are high in summer and winter.*
- *Some rooms are difficult to heat and to cool.*
- *Some rooms are stuffy and never feel comfortable.*
- *Your ducts run through an attic, crawl space, or garage that isn't heated or cooled.*
- *You find tangled or kinked flexible ducts in your system.*

One of the biggest problems with ductwork is ducts running through unconditioned and unheated spaces, such as an attic, crawl space, or garage. The air you heat and cool is being piped through areas that are either too hot or too cold, affecting the temperature of the air in your ducts. Some minor duct repairs can be done yourself. To seal leaks in ducts, use mastic sealant. If your duct is in an unconditioned space, it should be sealed and insulated by an HVAC professional.

Keep in mind that insulating these ducts will have other effects. If you insulate ducts that run through a basement, the basement will become colder because it's no longer warmed by air that leaks from the ductwork. Protect water pipes and drains nearby from the reduced heat by insulating them with electrical heating tape.

Can the House Be Sealed Too Tightly?

Some people worry about sealing their home too tightly, but that's unlikely to happen in many older homes. Some amount of fresh air is needed for good indoor air quality, but relying on air leaks to provide ventilation is unwise because they're unpredictable and inefficient.

Ventilation

Bringing fresh air into your home reduces the amount of indoor air pollutants, lowers the moisture level, and helps to get rid of odors. In poorly ventilated homes, pollutants can build up and cause health problems. Poor ventilation can also cause extra moisture to build up and lead to mold growth and structural damage.

To maintain the proper amount of ventilation, the American Society of Heating, Refrigerating and Air Conditioning Engineers suggests that a home's living area be ventilated at a rate of 0.35 air changes per hour, or 15 cubic feet of air per minute per person, whichever is greater.

There are three basic ways to ventilate your home.

Natural ventilation. This term refers to the uncontrolled movement of air through cracks and small holes in a home—the same ones you want to seal to make your home more energy efficient. Natural ventilation used to be the most common way of getting fresh air into a home, but it's no longer the best strategy. It's unpredictable and uncontrollable, and it's unlikely to be uniform across all parts of a home.

Whole-house ventilation. With one or more fans and duct systems piping fresh air into the house and pushing stale air away from it, whole-house ventilation systems make the air flow through your home at a uniform rate. There are four basic types of whole-house systems: exhaust ventilation systems, supply ventilation systems, balanced ventilation systems, and energy-recovery ventilation systems. Unfortunately, installing a whole-house ventilation system in an existing home is rarely feasible.

Spot ventilation. Using small exhaust fans, like the one above your oven or the one in your bathroom ceiling, is called spot ventilation. It increases the effectiveness of other ventilation methods, including natural and whole-house systems.

To improve the ventilation in your home:

- *Open windows.*
- *Use portable house fans.*
- *Install supply-only ventilation systems, which draw clean air from the outdoors into your home.*
- *Use exhaust ventilation, which operates a fan to push stale air out.*
- *Use a stand-alone dehumidifier. On a humid day in a hot climate, an air conditioner alone won't be enough to remove moisture from the air.*

Chapter 8

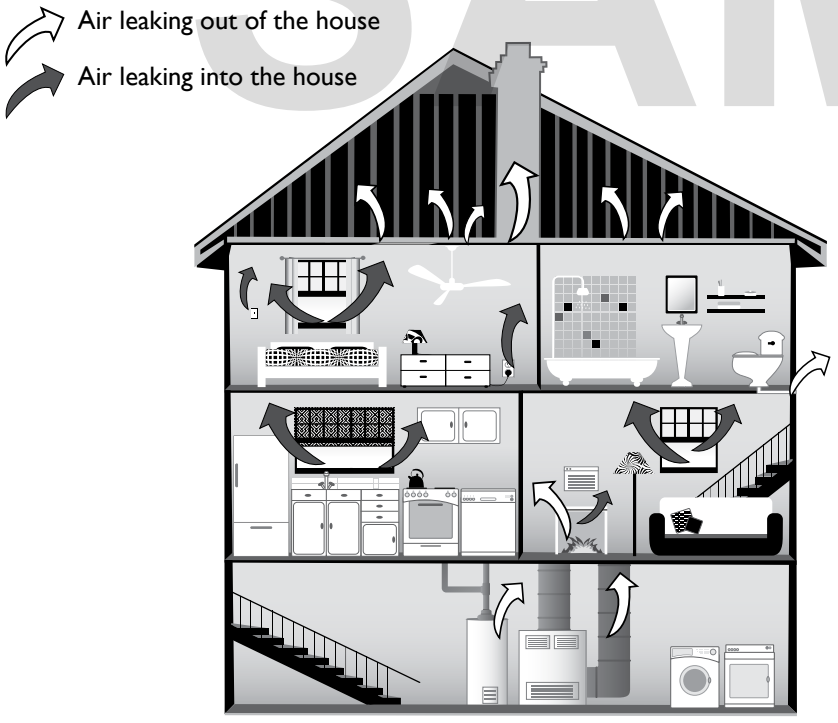
Insulation

Heating is one of the most expensive items on your home's energy bill. More than one-third of the money you spend on energy goes to heat up your home. That's a big investment, and there are several changes you can make to maximize it.

Adding insulation is one of the best ways to save on energy costs. In the winter, you pay to heat the air inside your home. In the summer, you pay to cool the air. But without a well-sealed home and the right amount of insulation, air can escape to the outdoors. That wastes your energy and your money.

In fact, poor insulation and air leaks are the biggest causes of wasted energy in most homes. To change this, you first have to find the air leaks in your home and fix them, as we discussed in chapter 7. After you do that, adding insulation will help stop this waste of energy—and save money.

Airflow through a Home



How Insulation Works

There are many different shapes and styles of insulation. They all have the same basic goal: to resist heat flow. The more resistance your insulation provides, the lower your heating and cooling costs will be.

Heat naturally flows from warm spaces to cool ones. Inside your home, the warm air flows through heated living spaces into unheated attics, garages, basements, and even the outdoors—unless there's enough insulation to resist this natural heat flow. The same thing happens in your ceilings, walls, and floors. Warm air can move through these parts of your home unless it meets resistance, such as insulation. The problem also happens in summer, when you want to keep your home cool. In the summer, warm air from the outdoors tries to flow into the cool space inside your air-conditioned home.

When outdoor air gets inside your home, or when inside air leaks out, your heating and cooling systems have to work extra hard to correct the problem. This means they use more energy to do their job, and that costs you money.

Insulating your home correctly increases its ability to resist heat flow, which keeps the air you pay to heat or cool inside your home, where you want it. Good insulation also keeps outdoor air outdoors. This is what decreases your energy bill.

Insulation has other benefits, too. It helps make your home more comfortable by keeping the temperature even throughout your house. In the winter, insulation keeps the walls, ceilings, and floors in your home warmer. In the summer, it keeps them cooler.

Together, proper sealing and insulation can save up to 20 percent on your heating and cooling bills, according to ENERGY STAR.

How Much Is Enough?

Insulation's resistance to heat flow is measured in terms of its thermal resistance, which is written as an R-value. The higher the R-value, the more effective the insulation is.

The R-value your home needs depends on several things, including the cost of heating and cooling in your area and the local climate. Different R-values also are recommended for different areas of the home, such as the walls, attic, basement, and crawl space. Check to see if the insulation in your home meets the recommendation for your area. Some state and local codes have lower R-value requirements than the U.S. Department of Energy recommends.

How Much Does Your House Have?

It's easy to check the R-value of insulation if you're buying it or having it installed. The Federal Trade Commission requires that all residential insulation products have

a label showing their R-value. The rule applies to products purchased at a supply store and to those installed by professionals. Read the labels before installation or insist that your contractor provide the information to you from each package of insulation. This will help ensure that you end up with the right amount of insulation.

It's harder to determine the amount of insulation already in your home. One key indicator is the recommendations in place at the time your home was built. It's likely the builder followed the recommendations and local building codes in effect then. Many of these old standards are now considered inadequate, given rising energy prices.

Start in the Attic

How much insulation does your home have already? Looking at the floor of an unfinished attic is an easy way to begin because it should be insulated, and it's easy to see.

Identifying different types of insulation:

- *Loose fibers that are lightweight and pink, yellow, or white are probably loose fiberglass insulation.*
- *Batts that are lightweight and pink, yellow, or white are probably fiberglass batts.*
- *Loose fibers that are dense gray or nearly white are rock wool insulation.*
- *Loose fibers that are small, gray, and seem to be from newsprint are cellulose.*
- *Lightweight granules are probably vermiculite or perlite. This type of insulation can contain asbestos, and you should contact a licensed contractor to do any repairs.*
- *If the insulation is dirty or degraded, then warm, dusty air is escaping from the house and being filtered through the insulation—an indication that air sealing is needed under the existing insulation.*

Look underneath your floors. Look at the underside of any floor over a garage, basement, crawl space, or other unheated area. Measure the thickness of any insulation there. It's most likely fiberglass batt, and you can multiply the thickness in inches by 3.2 to find its R-value.

Look at your ductwork. If the ducts of your heating and air conditioning system run through unheated or uncooled spaces like attics or crawl spaces, the ducts should be insulated. Return air ducts, which are located inside the heated portion of the house, don't need to be insulated, but they should be properly sealed. Seal all the seams and joints with mastic duct sealant, available at hardware stores, and then cover these ducts with duct insulation if necessary.

Look at your pipes. They should be insulated if they run through unheated or uncooled spaces like the attic or crawl spaces.

Walls are harder to check. To determine whether your exterior walls are insulated, you can turn off power to an electrical outlet and then remove the cover plate from around the outlet. Shine a flashlight into the crack around the outlet box—you should be able to see whether the wall has insulation inside it. Do this on all levels of the house and in new and old parts of the house. If you don't want to remove an outlet cover, one alternative is to remove and replace a small section of exterior siding.

You might need more insulation if:

- *Your home is older and hasn't had any insulation added. Only 20 percent of homes built before 1980 are well insulated, according to the U.S. Department of Energy.*
- *Your home is too cold in the winter or too hot in the summer. Adding insulation will even out the temperature and increase your comfort.*
- *You build a new home or an addition or install new siding or roofing.*
- *Your energy bill is high.*
- *You hear excessive noise from outside. Insulation can muffle sounds.*
- *The tops of walls show signs of condensation or discoloration.*

Location, Location, Location

There are several areas you should focus on insulating: the attic, basement, crawl space, and walls. These tend to be areas where the biggest air leaks in your home occur—and you save more money by fixing the biggest leaks first.

Attics

Attics are the easiest place in a house to insulate, especially if you're adding insulation to an older home. Before deciding whether to do an insulating project yourself, keep safety in mind. If your home has vermiculite insulation, which contains asbestos, do not disturb it. Only qualified contractors certified to handle asbestos should do this work.

Keep in mind that stacking new insulation on top of the old affects the R-value of your existing insulation. Because of the compression, the R-value of the existing insulation will decrease slightly. You can compensate for this by adding about one extra inch of insulation if the old insulation is fiberglass or an extra half inch if the existing insulation is rock wool or cellulose.

You can install batts and rolls yourself or hire a contractor to do this work. Make sure it's done right, though, because installation is extremely important with this insulation. When you add insulation to the insulation already in your home, use unfaced batts instead of batts with a metal or paper facing on one side. Before you add any insulation, look underneath the insulation for any obvious ceiling penetrations or cracks that might need to be sealed.

Check the insulation on your attic door, too. It should be insulated to the same level as the rest of the attic. The door or hatch should be weather-stripped as well. If it's not,

air will flow right through it. The door might seem small, but insulating and sealing it properly will lead to big savings.

Basements

Basements are notorious for water problems, mold, cold temperatures, and other uncomfortable conditions. Insulating the basement can help reduce energy costs, but the best way to do is controversial.

There are two general ways to insulate your basement. One is to insulate the ceiling, which prevents heated or cooled air from the rest of your home from entering the basement, essentially keeping it at the same temperature as the outdoors. The second way is to insulate the walls of the basement but not its ceiling, which keeps it at the same temperature as the rest of your house.

Advantages of insulating the walls but not the ceiling:

- *It requires less insulation in many cases.*
- *It's easier to properly seal the walls than the ceiling because the basement ceiling typically includes electrical wiring, plumbing, and ductwork, and air can leak around these wires and pipes easily.*

Disadvantages:

- *Installation can be expensive for an existing building.*
- *Many types of exterior insulation are susceptible to insect infestation.*
- *If the surrounding soil contains radon gas, the house will require a mitigation system beneath the basement floor. For more information on radon, visit the U.S. Environmental Protection Agency website (www.epa.gov/radon).*

Any insulation that could be damaged by moisture, including fiberglass batts and cellulose, should never be used to insulate a basement. If you want the basement to be finished for use as a living space, find an experienced professional to help you select the right materials.

Crawl Spaces

The best way to insulate your crawl space depends on whether it's ventilated or unventilated.

Crawl spaces were traditionally vented to prevent problems with moisture, and many building codes still require this. However, many builders now believe that an unventilated crawl space is the best option. There are two reasons for this. First, in the winter, vents make it difficult to keep crawl spaces warm. Second, in the summer, warm, moist outdoor air can come into the crawl space through the vents and increase moisture.

Insulating a ventilated crawl space:

- *Seal any and all holes in the floor above the crawl space.*
- *Insulate between the floor joists with rolled fiberglass. Install it tightly against the subfloor and seal all seams carefully. Make sure to support the insulation with mechanical fasteners so it won't come loose.*
- *Cover the insulation with a house wrap or face it with a vapor barrier. The orientation depends on the home's location or climate; in most of the United States a vapor barrier should face upward. But in the Gulf states and other regions with mild winters and hot summers, it should face downward.*
- *Install a polyethylene vapor retarder or an equivalent product over the dirt floor. Tape and seal all the seams carefully.*

Insulating an unventilated crawl space:

If your crawl space is unventilated, the best approach is to seal and insulate the walls of the space rather than the subfloor. In this case, the access door to the crawl space should be located inside the home—not in a wall on the outside of your house.

- *Review plans for this type of insulation with pest control and local building officials to ensure that your plans comply with existing codes.*
- *Make sure any combustion furnaces or water heaters located in the space are sealed-combustion units with a powered-combustion system.*
- *Seal all air leaks through the exterior wall.*
- *Install rigid foam board or batt insulation to achieve complete insulation coverage. Insulate the band joist with batt insulation.*
- *Install a continuous termite shield between the band joist and masonry foundation wall.*
- *Install a supply outlet in the crawl space, and rely on the leakiness of the crawl space's floor to provide the return air path.*

Walls

When adding insulation to existing finished walls, loose-fill insulation (either cellulose or fiberglass) is the best choice. It can be added with minimal disturbance to the finished areas of your home.

In new construction, the options are more abundant. Wet spray insulation can be used in wall cavities before the wall is finished. In homes built with insulating concrete forms, however, structural insulated panels and concrete block insulation literally have the insulation built into their walls.

Types of Insulation

Insulation can be made from many materials and in several styles.

Rolls and batts (or blankets) are flexible and made from mineral fibers like fiberglass and rock wool. Batts made from mineral wool, plastic fibers, and natural fibers such as cotton and wool are also available.

This is the most common and widely available type of insulation, and it usually costs less than other types. It comes in widths suited to the standard spacing of house studs or in continuous rolls that can be trimmed to fit a specific space.

Facing is an important factor in batts and rolls. The facing can act as an air or vapor barrier and be made from craft paper, foil, or vinyl. Flame-resistant facing is also available for batts intended to be installed in basements where the insulation will be left exposed. But if you're installing new batts or rolls on top of existing insulation, use unfaced batts.

If you want a contractor to install it, obtain written cost estimates from several contractors for the R-value you need and ask about air-sealing services. If you install the batts yourself, follow the instructions from the manufacturer and check local building and fire codes.

Loose-fill insulation is made up of small bits of fiber, foam, or another material. The material is typically blown into a space using special equipment, such as a blowing hose, and the bits are small enough to conform to any cavity without disturbing the structure or finish. It's a good choice for both enclosed spaces like walls and open spaces like attics.

Loose-fill insulation settles over time. This is a particular problem in an attic. Because the insulation settles, it loses its R-value over time. Some materials are more prone to this problem than others. Cellulose settles more than rock wool or fiberglass. So if you use cellulose, install 20 percent more of it in an attic to make sure you have the right amount of insulation after it settles.

To make sure the walls are tightly filled with insulation—which will prevent settling—use roughly one 30-pound bag of cellulose or 15 pounds of fiberglass or rock wool for every three cavities you fill. (This recommendation is based on an eight-foot wall with 16-inch on-wall center cavities and 2x4-inch framing studs.)

Be wary of voids, gaps, and fluffing. Voids and gaps happen if the insulation isn't tightly packed or the space isn't completely filled. Fluffing happens when insulation is installed to meet minimum thickness requirements but not minimum weight requirements, which means the insulation is installed more loosely than it should be. This lets air pass more easily through the insulation and into the outdoors. Fluffing is more of a problem with fiberglass than with cellulose or rock wool.

Make sure you're safe whenever you handle insulation. Protect yourself when installing insulation by wearing a quality respirator, protective eyewear, and clothing with long sleeves and long pants to minimize contact with the insulation. Be sure ducts are properly sealed before you install the insulation so the ducts don't carry loose bits of insulation into your living space, where it could be harmful.

Liquid foam insulation can be sprayed, injected, poured, or foamed into an existing or new wall. Because it can fill even the smallest spaces, the R-value of sprayed foam insulation is about twice as high as traditional batt insulation. As a result, this type of insulation costs more than traditional batt insulation, but because the foam forms a seal that acts as an air barrier, you won't need to buy as much caulk or weather stripping to provide additional insulation.

Here are some types of liquid foam insulation:

- *Cementitious*
- *Phenolic*
- *Polyisocyanurate*
- *Polyurethane*

To install liquid foam insulation, a contractor combines it with a foaming agent and then sprays it into the hole you want to insulate. The foam hardens over time and conforms to the shape of the space, sealing it tightly. In existing buildings, a foam that expands slowly is sometimes used because it's designed to flow over any obstacles, such as pipes, before it expands and dries in place. These are called slow-curing foams.

Installing most types of liquid foam requires special equipment and certification, so find a certified contractor to do the work. After installation, the wall must be covered with a barrier, such as drywall.

Rigid insulation or foam-board insulation is produced in a board-like shape that can insulate almost any part of your home, from the roof to the foundation. It's often used to insulate foundations and as an insulating wall sheathing. It's typically more expensive than fiber insulation.

Foam-board insulation can add structural strength to your home and reduce heat flow through structural elements like wood and steel studs. Because there are so few paths for heat loss, it's often able to provide a high R-value in a limited space. The types of materials most commonly used in making foam board include polystyrene, polyisocyanurate (or polyiso), and polyurethane.

The foam board can be damaged by sunlight, so the foam is usually covered with a rubber or plastic membrane or, if it's used on a roof, a layer of asphalt and roofing felt.

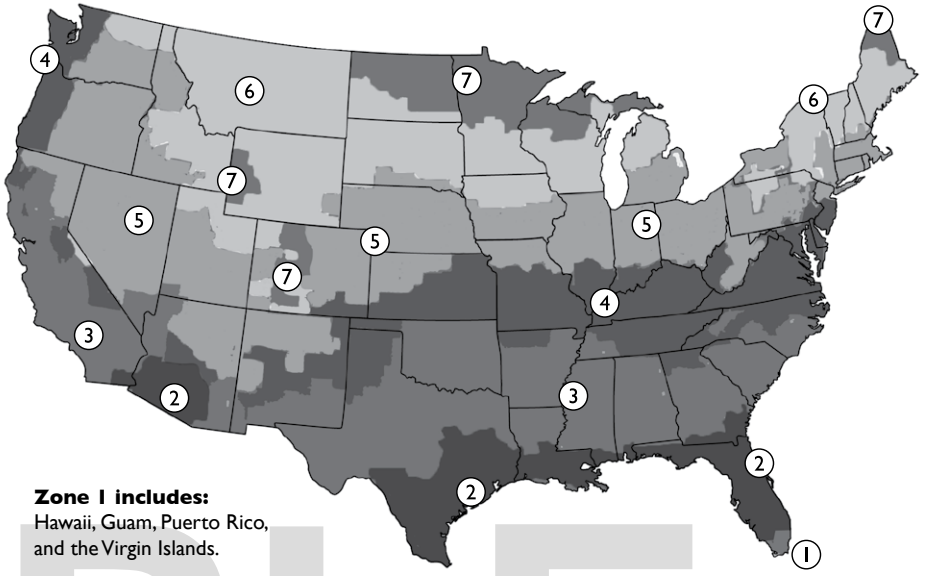
Insects can also cause damage, because they can easily tunnel through the foam board. Their burrows reduce the R-value and the structural integrity of insulation. To prevent infestation, some makers treat the foam board with an insecticide. Another solution is to install the foam board over the interior of basement walls rather than on the exterior, which is more common.

Recommended R-Value for Insulation in the U.S.

The amount of insulation or R-value you'll need depends on your climate, type of heating and cooling system, and the part of the house you plan to insulate. Also, remember that air sealing and moisture control are important to home energy efficiency, health, and comfort.

Use this map to determine your climate zone and the table to estimate the required R-values.

Installing more insulation in your home increases the R-value and the resistance to heat flow. In general, increased insulation thickness will proportionally increase the R-value. However, as the installed thickness increases for loose-fill insulation, the settled density of the product increases due to compression of the insulation under its own weight. Because of this compression, loose-fill insulation R-value does not change proportionately with thickness. To determine how much insulation you need for your climate, consult a local insulation contractor.



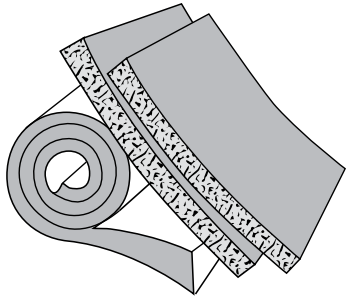
Zone 1 includes:
Hawaii, Guam, Puerto Rico, and the Virgin Islands.

Source: *U.S. Department of Energy (https://www.energy.gov/energysaver/insulation)*

CLIMATE ZONE	UNINSULATED ATTIC	3–4 INCHES OF EXISTING ATTIC INSULATION	UNINSULATED FLOOR	UNINSULATED WOOD-FRAME WALL	INSULATED WOOD-FRAME WALL
1	R30–R49	R19–R38	R13	R13 or R0 + R10 CI*	N/A
2	R49–R60	R38–R49	R13	R13 or R0 + R10 CI	N/A
3	R49–R60	R38–R49	R19	R20 or R13 + R5 CI or R0 + R15 CI	Add R5 CI
4 EXCEPT MARINE	R60	R49	R19	R20 + R5 CI or R13 + R10 CI or R0 + R15 CI	Add R10 CI
4 MARINE AND 5	R60	R49	R30	R20 + R5 CI or R13 + R10 CI or R0 + R15 CI	Add R10 CI
6	R60	R49	R30	R20 + R5 CI or R13 + R10 CI or R0 + R20 CI	Add R10 CI
7	R60	R49	R38	R20 + R5 CI or R13 + R10 CI or R0 + R20 CI	Add R10 CI

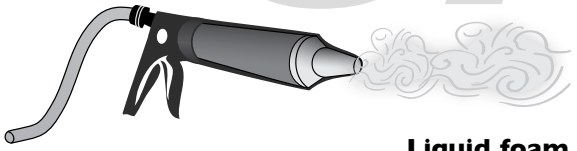
*Note: In the table above, CI stands for "continuous insulation" that's applied to the exterior of the wall assembly just inside the cladding.

Types of Insulation

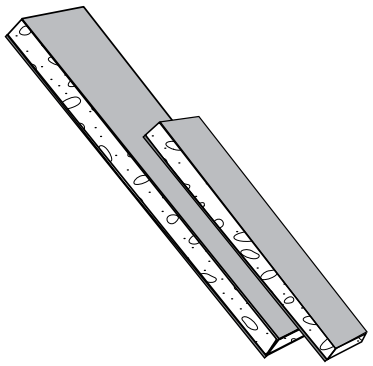


Rolls and batts or blankets are flexible and made from mineral fibers like fiberglass and rock wool. This is the most common and widely available type of insulation, and it usually costs less than other types.

Loose-fill insulation is made up of small bits of fiber, foam, or another material. The material is typically blown into a space.



Liquid foam insulation can be sprayed, injected, poured, or foamed into an existing or new wall. This material must be installed by a certified contractor.



Rigid insulation or foam-board insulation is produced in a board-like shape that can insulate almost any part of your home.

Appliances

The average home uses $1,900 worth of energy every year—and more than 20 percent of that goes right into your appliances, including your refrigerator, dishwasher, freezer, clothes washer, and dryer.

People shopping for a new appliance usually think the best buy is the one with the lowest sticker price. But that's not necessarily true.

Every appliance has two price tags: the sticker price you pay at the store and the price you pay in utility bills to operate it. If you buy an appliance with a low sticker price, you can end up paying higher utility bills if it isn't energy efficient, and that's going to cost you more money in the long run.

Operating Cost

How much you pay to operate an appliance depends on a few things. The first—and the most important—is how energy efficient the appliance is. Standards for efficiency have risen dramatically in recent years. In some cases, a new appliance will use just half the energy that a five-year-old model does.

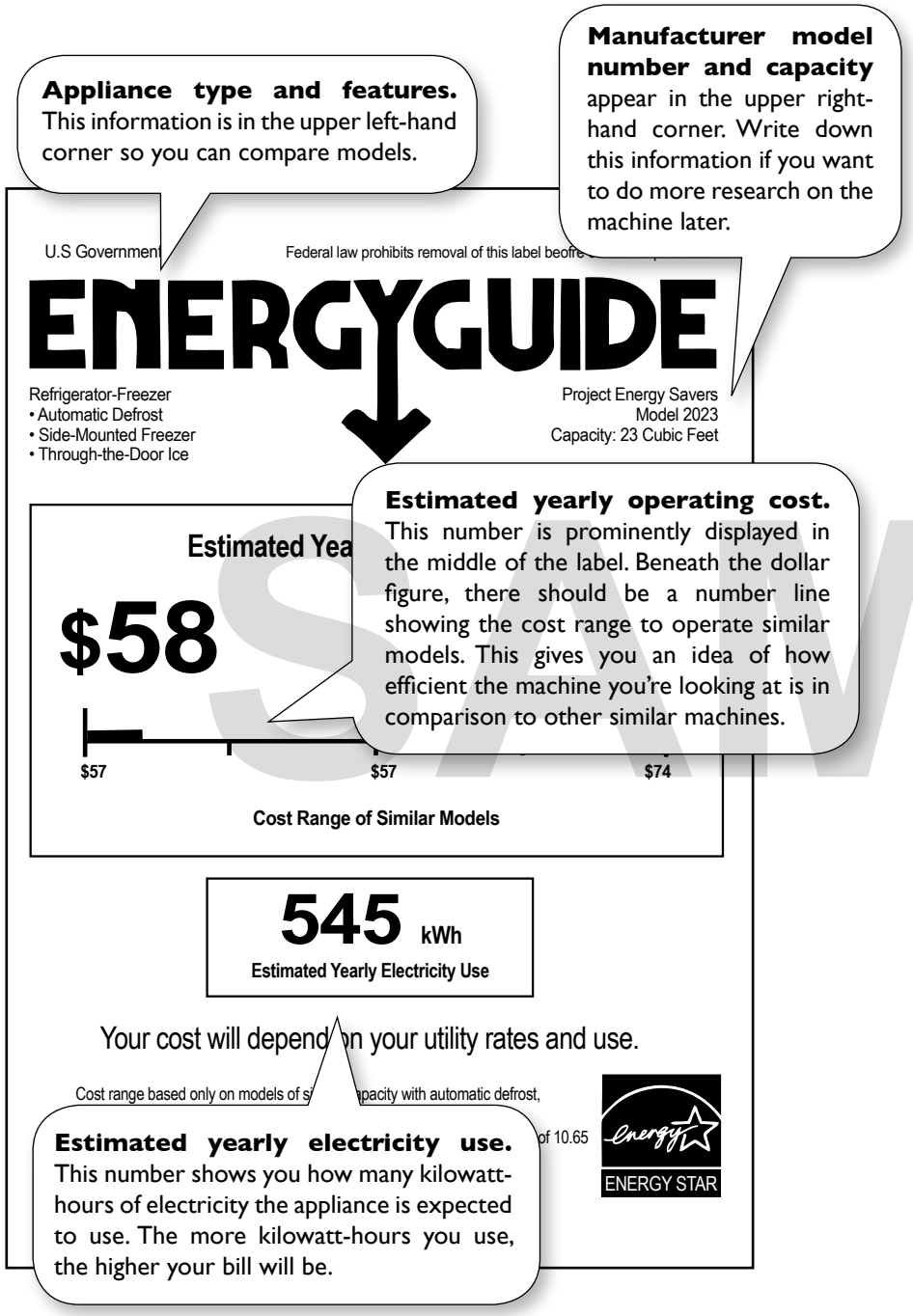
You also need to think of these costs over the long term. When you buy an appliance, you expect to use it for many years, often for more than a decade. The cost of operating it will add up over time. How frequently you use the appliance also affects your utility bill. The more frequently you switch it on, the greater the cost to operate it.

Some appliances, such as clothes washers and dishwashers, use two types of energy. They need electricity to power their motors and run the machine. But they also use hot water to do their job. The hot water costs more than the electricity does, and choosing a high-efficiency model will save you money on both bills.

When to Replace Your Appliances

Knowing when to replace your current appliances with high-efficiency ones can be tricky. Utility bills don't come with a receipt listing how much energy your fridge or your dishwasher uses. Some appliances, such as a refrigerator that's more than 15 years old, are good bets for replacement, though. Others should simply be replaced with an energy-efficient model whenever they wear out.

How to Read an EnergyGuide Label



Know What to Look For

It's hard to tell from the outside how efficient an appliance is. The things that make it more energy efficient are on the inside—in the motors, compressors, pumps, valves, gaskets, seals, or electronic sensors. Two appliances can look exactly the same on the outside but be very different on the inside.

You should look for two things when you're shopping for a new appliance: the EnergyGuide label that tells you how much energy the machine will use and the ENERGY STAR symbol that tells you it's highly efficient.

Always choose appliances rated by ENERGY STAR. These meet energy-efficiency standards far more strict than the minimums required by law. That increased efficiency is what leads to increased savings.

Before you go to the store, find out if ENERGY STAR certifies the type of appliance you need. ENERGY STAR rates many appliances, including clothes washers, dishwashers, refrigerators, freezers, room air conditioners, and dehumidifiers. But it doesn't certify clothes dryers or water heaters.

You can still tell how much energy the appliance will use, though, by looking for the yellow EnergyGuide label. All appliances except stove ranges and ovens must have this label. It will show you an estimate of how much energy the appliance uses, how much it will cost to operate, and how efficient it is compared with similar appliances.

Shopping Strategy

Before you go to the store, think about what features you need from the new appliance.

Measure the space where it will go to ensure that you buy one that will fit. Check that you'll have room to open the door of a dishwasher, for example, or the lid of a clothes washer.

When you get to the store, look at more than one appliance. Examine brands from different manufacturers and compare different models of the same brand. The efficiency of an appliance is the single factor that reduces your utility bills most—especially when you consider the 10 years or more you'll be using it.

Refrigerators

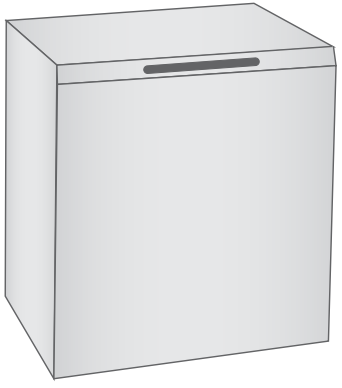
An average household spends 7 percent of its entire energy bill just powering the refrigerator, according to the U.S. Department of Energy.

New refrigerators and freezers are significantly more efficient than old models, even old models in perfect operating condition.

Some Combinations of Fridge and Freezer

The least efficient models have the freezer on the bottom

The most efficient models have the freezer on the top



Not the most efficient freezer

ENERGY STAR refrigerators also:

- *Use high-efficiency compressors, improved insulation, and precise temperature and defrost mechanisms to improve energy efficiency.*
- *Use 15 percent less energy than required by current federal standards.*
- *Use 40 percent less energy than conventional refrigerators sold in 2001.*

What to Look for When You Buy

Shape. Models with the freezer on top are more efficient than those with a side or bottom freezer. While ENERGY STAR certifies each of these configurations, it holds them to different standards. To be certified by the program, side-by-side models are allowed to use 10 to 30 percent more energy than models with the freezer on top. Features like through-the-door ice and automatic icemakers also add 10 to 25 percent to the operating cost.

Size. For most homes, a fridge under 25 cubic feet will meet all your needs. Those larger than 25 cubic feet use significantly more energy—and raise your utility bill. In the unlikely event you need more refrigeration than a 25-cubic-foot fridge can provide, it's usually best to buy one large fridge instead of moving your old one to your garage and using it as a backup. Or you can look for a compact fridge—ENERGY STAR certifies these, too.

Keeping Operating Costs Down

Thermostats should be set between 36˚F and 38˚F for the refrigerator. Freezers should be kept at 0˚F.

Keep the fridge in a cool spot. If it's in sunlight or near the stove or dishwasher, which produce heat, it must work harder to keep cool.

Check your power-saver switch. Many refrigerators have small heaters to prevent moisture from condensing on the outer surfaces of items in the fridge. Look for an energy-saver switch or a power-saver switch to turn off this feature, which usually isn't needed.

Defrost regularly if you have a manual defrost or partial-automatic defrost model. Ice buildup on the coils makes the compressor work harder to keep the temperature cold. If you live in a hot, humid climate and don't use air conditioning, you may need to defrost your fridge often.

Check door seals and gaskets. They should be airtight. To test this, you can put a slip of paper on the door seal strip and close it. If you can't pull the paper out easily, the seal is good.

Leave room behind the fridge. Don't push your fridge too close to the wall behind it. It needs a few inches of air to circulate around the condenser coils.

Minimize the amount of time the door is open. Grab several things at once, and make sure to close the door tightly behind you. Some refrigerators have an alarm that will sound if the door isn't closed tightly.

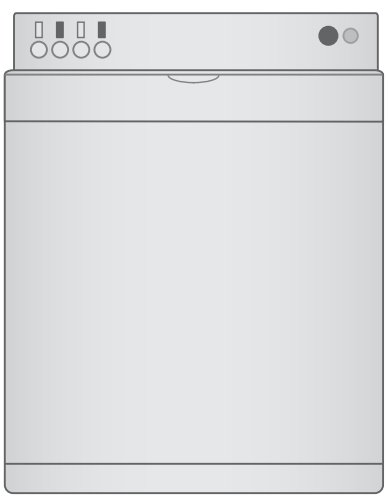
Don't put a second fridge in your garage. If your garage reaches 90 degrees in the summer, a fridge will use 45 to 50 percent more energy to operate there than it would in a 70-degree room. That's a big increase in your bill.

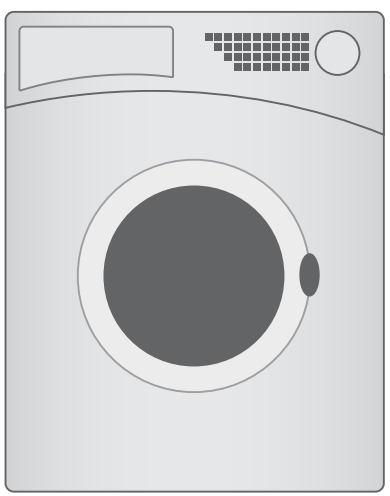
Clean the condenser coils. If your refrigerator has visible condenser coils, either under the refrigerator or on the back, periodically clean them to remove lint, pet hair, and dust balls, which can reduce efficiency. Special coil-cleaning brushes are available to make the job easier.

Clothes Washers

Using a high-efficiency clothes washer can make a big dent in your utility bills. ENERGY STAR clothes washers cut utility bills by an average of $50 per year, and a typical clothes washer will last at least 11 years. This means you can save more than $550 during the life of the average washer just by choosing an ENERGY STAR model. That's enough savings to buy a new clothes dryer or dishwasher—and have some money left over.

New ENERGY STAR Washing Machines





ENERGY STAR clothes washers also save an average of 7,000 gallons of water a year. That's enough water to fill up three backyard swimming pools over its 11-year life span.

When You Buy

Ask for an ENERGY STAR model and check the yellow EnergyGuide label. It will give you an estimate of how much the washer costs to operate per year with both natural gas water heaters and electric water heaters. The more energy it uses, the more it will cost to operate. ENERGY STAR washers come in two designs: front-loading machines and redesigned top-loading models.

New ENERGY STAR washers don't have a central agitator. Front-loading machines tumble clothes through a small amount of water, rather than rubbing them against an agitator in a tub full of water. Redesigned top-loading machines flip or spin clothes, through a reduced stream of water. Both designs reduce the amount of hot water needed for the wash cycle, which reduces the amount of energy the machine uses. These models also have a faster spin speed than other machines. This gets more water out of the clothes so they won't need as much time in the dryer.

These changes have other benefits, too. With no agitator, there is room for more clothes and it's easier to wash big items like comforters. Machines without agitators are also gentler on your laundry, which helps your clothes last longer.

Conventional clothes washers use about 40 gallons of water in each wash cycle. Energy-efficient models with a large capacity use less than 25 gallons per cycle. Small and medium-sized machines can use less than 10 gallons. Many machines are now able to detect how much laundry you're doing and adjust the water level accordingly. If the machine you choose doesn't do this, make sure you can select lower water levels manually.

Save on Operating Costs

The energy a washing machine uses is almost directly proportional to the amount of hot water it uses—so the more hot water you can save, the more money you can save.

Wash with either warm or cold water, but remember that washing with cold water will reduce your energy costs. About 90 percent of the energy used to wash clothes is used to heat the water. Switching from hot to warm water can cut the energy use in half for a load of laundry. Cold water reduces that even more.

Wash only full loads. Wait until you have enough clothes or other items needing the same wash cycle to fill up the washer.

Don't use the sanitary cycle. This is an extra-hot setting available on some models that increases energy use significantly.

Select the right water level. Reduce the water level when you're doing a small or medium load of laundry.

Use the high-speed spin. If your clothes washer has this option, use it. Or choose the extended spin. This feature reduces the amount of moisture in your clothes after they're washed, decreasing the time and energy needed to dry them.

Leave the door to a front-loading machine open after use. Front-loading washers have airtight seals to make sure no water leaks out while it's running. But when it's not in use, the seal traps moisture inside. Leave the door open for an hour or two to let the moisture evaporate. But be safe—keep children away from the machine so they don't climb in while the door is open.

Use high-efficiency detergent in a high-efficiency washer. Front-loading clothes washers are designed to be used with high-efficiency detergent. Regular detergent in these machines produces excessive soapsuds, leading to bad performance and, over time, mechanical problems.

Clothes Dryers

There are several factors to consider when shopping for an energy-efficient clothes dryer:

ENERGY STAR rating: Look for a dryer that has an ENERGY STAR rating, which means it meets strict energy-efficiency guidelines set by the U.S. Environmental Protection Agency.

Dryer size: Choose a dryer whose size is appropriate for your household. A larger dryer will use more energy than a smaller one.

Features: Look for energy-saving features such as a moisture sensor, which shuts off the dryer when clothes are dry, and a high-efficiency motor, which uses less energy to operate.

Price: Don't focus just on the upfront cost of the dryer. Consider the long-term cost of ownership, including the cost of energy to operate the dryer and potential repair costs.

The real key to saving energy on your clothes dryer usage, though, is in how you operate it—and in knowing when not to operate it.

Save on Operating Costs

Clean the lint filter. Removing lint after every load improves air circulation, which increases the efficiency of your dryer.

Make sure your vent hose isn't clogged. Also make sure your outside dryer vent damper is closing completely and lint isn't blocking the damper from closing. Check and clean it regularly.

Use a drying rack or hang your clothes outside to dry. Air drying helps your clothes last longer and doesn't use any energy.

Don't overload the dryer. One washer load is one dryer load. The clothes should tumble freely. But take care not to underload the dryer, which wastes energy.

Sort clothes by drying time. Wash and dry similar fabrics together so you run the dryer only as long as you need to.

Dishwashers

ENERGY STAR dishwashers use 41 percent less energy than the minimum federal standards and use less water than conventional models.

ENERGY STAR rates only the energy efficiency of an appliance—not its efficiency with water. Water use is a big factor in choosing a dishwasher, though. It doesn't appear on the EnergyGuide label, so ask the salesperson for the manufacturer's information on water use. Models rated by ENERGY STAR meet minimum water-efficiency standards.

Dishwashers rated by ENERGY STAR use an average of four gallons of water per cycle, while a regular dishwasher uses six gallons, according to the program. That's one-third less water.

When You Buy

Choosing a dishwasher with high energy efficiency and low water use will decrease the amount you pay to operate the machine.

Start with the EnergyGuide label, which tells you how many kilowatt-hours a year the machine is expected to use. This estimate is based on washing 215 loads per year (of course, your family's usage will likely be different). Choose a machine with an estimated use of less than 340 kilowatt-hours per year, which is 40 percent better than the minimum federal standard.

The EnergyGuide label also shows you how much water the machine uses. Some ENERGY STAR models use half as much water as others, which can save you hundreds of gallons of water each year. Also see if your local utility offers rebates for the purchase of a high-efficiency model.

Look for features like light-wash or energy-saving cycles, which can be used for dishes that are only slightly dirty. Some dishwashers are able to sense this. If the machine is marked "soil sensing," that means it can detect how dirty the dishes are and automatically adjust its water use. Not all high-efficiency models have this feature.

The machine should also have several options for drying. Choose one with an air-dry or no-heat drying option. Most dishwashers use an electric heating element to dry dishes, which accounts for 7 percent of the machine's energy use. You can eliminate that by using a no-heat setting. After the last rinse, a machine on this setting will use fans to blow room air through the dishwasher to dry the dishes, instead of baking them dry with the electric heating element.

Keep Operating Costs Down and Save Water

Scrape dishes instead of prerinsing them. You can use up to 20 gallons of water prerinsing dishes, according to ENERGY STAR. Instead, just scrape off your dishes and put them in the dishwasher. Machines made in the past 10 years are built to handle this.

Wash only full loads. The dishwasher uses the same amount of water whether it's empty or full, so you save energy simply by waiting to run it when it's full. If it takes a day or two to fill the dishwasher, use the rinse-and-hold feature on newer models to prevent food from drying onto your dishes. It uses just one to two gallons of water—a fraction of the amount hand washing does.

Remember that washing dishes by hand uses more water than a dishwasher does. You can save 5,000 gallons of water per year and $40 in utility costs (not to mention 230 hours of time) by using a dishwasher instead of hand washing, according to ENERGY STAR.

Use the energy-saving options on wash and dry cycles. Use the no-heat or air-dry feature. Use a light wash when dishes aren't very dirty.

Turn down the temperature of your water heater. Most dishwashers sold in the United States since the 1990s include built-in heaters to increase water temperature to 140 degrees. This extra booster means you can turn down your water heater to 120 degrees and save on the energy bill.

Stoves and Ovens

As of the writing of this book, your kitchen oven won't come in an ENERGY STAR–rated model. But you can still make a few small changes to reduce the amount of energy you use while operating your oven cooktop—and make sure you're using these appliances efficiently.

Purchasing a new oven is a big decision and one that will probably stay with your kitchen for decades. There are many factors to consider when purchasing a new oven, including energy use.

The three most typical types of ovens are gas, electric, and induction. Induction ovens are the most energy efficient. Using an electromagnetic field, it transfers energy to the cookware more quickly and cooks food faster. Electric models heat up coils or a glass surface under your cookware, and gas ranges use natural gas to produce flames that heat your cookware. If you're buying a new gas stove, choose one that doesn't have a standing pilot light. Standing pilot lights can double the amount of energy a cooktop or range uses.

Check the energy usage of each type and ensure you're purchasing the right type for your cooking needs.

Self-cleaning models are more energy efficient because they have more insulation. Using the self-cleaning feature more than once a month ends up using more energy than you save, though, because of the high temperatures the cycle uses. If your oven has a self-cleaning option, use it only after you finish baking and the oven is still warm. That takes advantage of the heat to jump-start the cycle.

A microwave is a good option for saving energy while cooking. Although it can use a large amount of energy, it drastically reduces cooking time for many meals, which can save you up to two-thirds of the energy you'd use to prepare the same meal in a conventional oven. It also generates less heat in the kitchen than a regular oven, decreasing your air conditioning costs in the summer.

Save on Operating Costs

Choose the right pot or pan. Size is important. If you use an electric cooktop with eight-inch burners, using a six-inch pot wastes more than 40 percent of the heat the burner produces. Pans should also have a flat bottom (not warped) to keep good contact with an electric burner.

Don't overcook. If you can heat up a small amount of food with a toaster oven or microwave, it will save energy. Don't heat up the entire oven unless you need to.

Use the right material. Pots and pans should be made of a highly conductive material that heats your food more quickly and results in a more evenly cooked meal. Copper-bottom pans heat more quickly than regular ones. For the oven, ceramic or glass pans are more efficient than metal—you can turn the temperature down by 25 degrees and the food will cook just as quickly. This is why some recipes call for one baking temperature for glass pans and a different temperature for metal ones.

Put a lid on it. Covered pots and pans heat up faster and hold heat better than uncovered ones.

Keep it clean. When your burner pans become blackened from heavy use, they can absorb a lot of heat and reduce the efficiency of the burner. They should stay shiny so the metal reflects heat up to the cookware.

Reduce cook times. Defrost frozen foods in the refrigerator instead of the microwave. Keep the oven closed while you cook and avoid peeking, which lets heat escape. If you're using an electric burner, turn off the heat just before the food is cooked—the heat will continue to cook the food. You can do the same with a conventional oven.

Plan ahead. Cook double portions of your meals for your own convenience and to reduce your energy bills. If you use the self-clean feature on your oven, plan to do so only after you're finished baking something to take advantage of the warm oven.

Stay safe. If you have a gas stove, always use the ventilation fan. Start it before cooking and let it run 10 to 20 minutes after you're done to reduce humidity in your house and vent to the outdoors. Never—under any circumstances—use your oven as a way to heat a room. They're not designed for that purpose. Operating an oven with the door open is a safety hazard and can release carbon monoxide into your home.

What to Do with Your Old Appliances

Once you've purchased a new energy-efficient appliance, you have to decide what to do with the old one. The best option is to recycle it. Check with your state or local utility company, as they often run recycling and donation programs for old refrigerators and other appliances. Also check with your local solid waste and trash haulers, many of which will pick up old appliances from their customers with notice.

It's important to make sure appliances are removed properly. Cooling equipment such as refrigerators and freezers use refrigerants, and older models can contain PCBs or mercury. If an old refrigerator or freezer can't be recycled, most municipalities will pick it up with their bulk trash pickup as long as you call to arrange it. By law, they must dispose of refrigerants, PCBs, and mercury properly.

Home Electronics

We use electronics in our homes every day. We watch TV, turn on the computer, and pick up the phone. The cost of operating these home electronics adds up quickly. The main reason these electronics use so much energy isn't that they're physically large. It's that we own so many of them, and we use them so often. Many of our electronics continue to use electricity even when we think they're off, which adds an extra cost to the energy bill. There are a few steps you can take to reduce the energy used by home electronics.

Levels of Power

To understand how these costs add up, it's useful to know how these devices use electricity. In many cases, it's not as simple as being either on or off. Electronics come with as many as four different power levels that vary the amount of energy the machines use.

Most Common Energy Levels

Active mode. The appliance is on. For example, the TV is displaying pictures and sounds, or the printer is printing.

Active standby. The appliance is ready for use but not actually in use. For example, the DVR player is powered on but not playing or a printer is on but not printing.

Passive standby. The appliance is off or on standby. If it appears to be off but can be activated by a remote control, the machine is actually in passive standby mode. For example, the television is off but can be turned on using a remote.

Off. The appliance is off. No function is being performed, and it can't be turned on with a remote.

Purchasing Home Electronics

To purchase energy-efficient home electronics, you should:

- Look for the ENERGY STAR label: ENERGY STAR is a program run by the U.S. Environmental Protection Agency (EPA) that helps consumers identify products that are energy efficient. Electronics with the ENERGY STAR label use less energy and can save you money on your energy bills.

- Compare the energy usage of different models: look for the energy usage or power consumption ratings on the product packaging or in the product specifications. This will allow you to compare the energy usage of different models and choose the most energy-efficient option.
- Consider the size and features of the product: larger electronics and those with more features tend to use more energy. Find the right appliance for your needs.

Smart Power Strips

It can be cumbersome to always remember to turn off electronics. And in the case of a TV or computer, there might be multiple devices as part of the system. A TV might have the television itself, a cable box/DVR, a game system, speakers or any number of connected gadgets. Unplugging the TV will save energy, but unplugging the DVR might cause you to miss your favorite show.

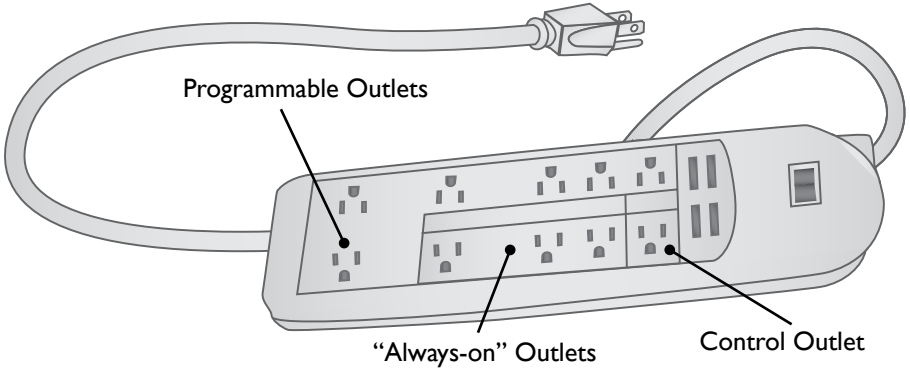
That is where smart or advanced power strips can save you energy and hassle. They're designed to cut power to the devices you want while leaving the DVR to record your favorite show. And they do so by sensing when you don't need the devices to receive power.

Advanced power strips will cut off power to other devices when one of the devices (a TV in the example above) is turned off. And provide power to all of them when you need them.

Smart power strips are Wi-Fi connected devices that do the same, but you can control them from your phone or computer.

To use a smart power strip, you will first need to connect it to a power source and then plug your electronics in to it. You will then need to connect the power strip to your home's Wi-Fi network and pair it with a smart home hub.

Smart power strips also often have additional features, such as surge protection and energy monitoring. These features can help protect your electronics from power surges and allow you to track the energy usage of your devices.



Health and Safety

A comfortable home is an energy-efficient home. But comfort and savings aren't the only outcomes of energy upgrades. Your health and the health of your family is connected to your home's energy efficiency. That's because many of the measures discussed in this book can also improve your home's indoor environment. A thorough energy upgrade will tackle moisture problems, indoor pollution, toxic chemicals, and more.

What's Healthy?

There are a few fundamental components of all healthy homes. You'll know you're on the way to a safe and healthy home if it meets the following conditions.

Your indoor environment should be:

- *Dry*
- *Clean*
- *Well ventilated*
- *Free of combustion by-products*

Your home should be free of:

- *Pests*
- *Toxic chemicals*
- *Lead hazards*

The 7 Keys to a Healthy Home Checklist

Following these seven keys to a healthy home will help you address some common household concerns before they become serious problems—for your health and for your home.

Key #1: Keep Your Home Clean

A clean home reduces dust and other irritants that can trigger allergies and asthma attacks. Common house dust may contain asthma triggers, including dust mites (microscopic bugs that feed on human skin flakes). Dust mites are in every home and can trigger asthma in people who are allergic to them.

Dust and vacuum your home every week. Invest in a vacuum with a HEPA filter, which traps small particles that can trigger allergies or other respiratory problems. Wear a dust mask while cleaning if you have allergies or you're sensitive to dust.

Key #2: Keep Your Home Free of Contaminants

Contaminants are potentially harmful substances such as lead, asbestos, and carbon monoxide that can enter your home through the water supply or the air—or even be inside your walls. Contact with contaminants can lead to serious health problems, such as kidney and liver disease, respiratory illness, and even cancer.

In the Air

Radon occurs naturally in the earth and can drift into your home through the basement. Buy a radon detection kit from your local hardware store or online. If you have radon, hire a professional who can install basement vents to remove radon from your house.

Carbon monoxide (CO) is a by-product of burning fuel in a furnace or other heating system. It should be vented to the outside, but if ducts are blocked or damaged, it can build up in your home. Purchase CO detectors and place them within 15 feet of every sleeping area. If a detector goes off, leave the house immediately and call 911.

Asbestos was commonly used as insulation—especially around pipes—until the 1970s. It can cause lung cancer and respiratory illness. If you find asbestos, don't disturb it, and call an asbestos removal expert.

In the Water

Most people get their water from a public utility that purifies it before it reaches your home. Still, it can become contaminated with bacteria, viruses, chemicals, heavy metals, pesticides, and other pollutants. If you're concerned about your water's content, request a report from your utility. If you have a private water supply, such as a well, don't use pesticides, and get your water tested by a professional every year.

Lead

If your home was built before 1978, it may contain lead paint and/or pipes. Lead exposure can cause learning and behavior problems in children and neurological and reproductive problems in adults. You can buy a lead test kit at the hardware store, but it's always safest to hire a professional to test for lead.

To minimize your lead exposure:

- *Gently wipe door frames, banisters, stairs, railings, porches, fences, windowsills, and walls with a damp paper towel. Throw out the towel.*
- *If you're renovating, make sure the contractor is certified in lead-safe practices.*
- *Run the cold water for three minutes straight to flush out potential lead buildup.*
- *Don't scrape, sand, or burn any substance you think may contain lead.*

Key #3: Keep Your Home Dry

Water comes into your house through cracks in door and window frames or through leaks in walls, roofs, showerheads, clothes washers, and faucets. Too much water in the home causes mold and structural damage and provides optimal conditions for some pests, especially termites.

Mold

Mold is a fungus that can irritate your lungs. If you have a sore throat, skin rash, difficulty breathing, or bloody nose, you may be affected by mold.

To reduce moisture and prevent mold:

- *Clean the bathroom regularly by scrubbing the toilet, tub, sink, and fixtures.*
- *Make sure sinks and tubs are draining and water isn't pooling anywhere.*
- *Run an exhaust fan while showering and cooking; make sure fans vent to the outside.*
- *Clean up spills and puddles immediately.*
- *Get rid of anything damaged by water or flooding, including drywall and insulation.*

Key #4: Keep Your Home Well Maintained

Regular maintenance of your home's systems (heating and cooling, ventilation, plumbing, waste management) is vital for maintaining a healthy home. Malfunctioning equipment could lead to moisture problems, excessive dust, and contamination. In the case of excessive carbon monoxide, the situation could be deadly.

Your systems don't require constant, daily supervision, but they do need to be checked periodically. Check the flues and vents of your heating system to ensure they're connected correctly—otherwise carbon monoxide could build up inside your home. Once a year, have a professional examine your heating and central air conditioning system. Minor repairs now could save you lots of money later.

Key #5: Keep Your Home Pest Free

Pests such as insects and rodents can trigger allergies and asthma, spread disease, bite people, and contaminate food.

Rodents

Mice and rats can carry rat bite fever—a bacterial infection caused by bites—and hantavirus, which is spread through mouse and rat waste and can be inhaled by humans. Signs of rodents in your house include gnawed wood or electrical cords, droppings, nests, and scampering sounds.

To keep rodents out of your house, eliminate all water and food sources, including bird feeders and pet dishes. Rodents seek out hiding places, so remove clutter. Keep all food (pet and human) in airtight plastic, glass, or steel containers. Seal exterior gaps with mortar, and install weather stripping at the bottom of basement and garage doors.

Insects

The most common insects you'll encounter in your home are cockroaches and fleas and ticks. When faced with an infestation, many people turn to pesticides, but these chemicals pose many health risks. They can cause eye, nose, and throat irritation; skin rashes; stomach cramps and nausea; and damage to the kidneys and central nervous system. Children are especially at risk because they may not know the dangers. Always follow the directions on pesticide labels.

To keep insects away, eliminate their food source by cleaning up food spills immediately and putting away all food. To control fleas, give pets a shampoo, and wash your bedding and vacuum your floors often. If you must use pesticides, keep them out of reach of children, and don't put traps or poisons where kids might find them. If you can't handle an infestation on your own, call an exterminator.

Key #6: Keep Your Home Safe

The home can be a perilous environment for two age groups: children and older adults. Children aren't always aware of household dangers, and older adults aren't as steady on their feet. For both of them, falls are the most frequent cause of injury. To prevent falls, keep your home well lit; install handrails and grab bars; repair broken steps; use nonskid mats under your rugs; and remove tripping hazards.

Key #7: Keep Your Home Well Ventilated

Proper ventilation in your home expels dust and harmful odors, such as those from household chemicals and pesticides. Many products also release volatile organic compounds, or VOCs, that can cause respiratory problems. VOCs can be found in carpets, paints, cleaning products, and furnishings. The best way to reduce your exposure is to open the windows and let in some fresh air. If you're installing new carpeting or furniture, air out the rooms with fans before moving back in.

KEY SOURCES AND MORE INFORMATION

For more information about saving energy in your home, check out the following sources:

The American Council for an Energy-Efficient Economy
www.aceee.org

United States Consumer Product Safety Commission
www.cpsc.gov

The United States Department of Energy Tips
www.energy.gov/energysaver

ENERGY STAR
www.energystar.gov

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