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Office of Air and Radiation  
(6202J)  
EPA 430-K-05-004  
May 2005

Recycled/Recyclable - Printed with Vegetable Oil Based Inks on Recycled Paper (Minimum 50% Post-consumer Content)

## A Guide to Energy-Efficient Heating and Cooling



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# You can make a change for the better

The average home spends about \$1,500 annually on energy bills. Heating and cooling accounts for as much as half of a home's energy use. The EPA provides important recommendations for energy-efficient equipment, including proper sizing, quality installation and maintenance, and other home improvement considerations to help you get the most out of the heating and cooling products you purchase, save energy, and save as much as 20% annually on your total energy costs.

Whether you're replacing heating and cooling equipment in your home or planning the installation of equipment in a new home, choosing ENERGY STAR® qualified products can help keep your home comfortable year-round and contribute to a cleaner environment.

ENERGY STAR qualified products prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE).

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Get equipment that is the right size for your home and make sure your contractor follows proper installation procedures.

### *Use this guide to help you:*

1. Learn how to maintain your heating and cooling equipment and increase system performance to save energy and money while providing a more comfortable, healthy home for you and your family.
2. Decide when it's time to replace your old heating and cooling equipment with more energy-efficient equipment.

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## When is it Time for a Change?

As much as half of your household energy use goes to heating and cooling. With a few simple steps to properly seal and insulate your home, and energy-efficient heating and cooling equipment, you can stay comfortable and save on your energy bills at the same time. Review the checklist on the next page to decide whether you should consider sealing air leaks, adding insulation, replacing your old heating and cooling system, or improving the performance of your existing system. Once you've decided on what changes need to be made, visit page 12 "Working with a Heating and Cooling Contractor" for tips on selecting the right contractor to perform the services you need.

### You may want to consider making a change if:

- Some of your rooms are too hot or cold.** Duct problems, inadequate air sealing or insulation could be the cause. No matter how efficient your heating and cooling system is, if your home is not properly sealed and insulated against air leakage, you will not be as comfortable and your system will have to work harder. Learn more on page 8, "Improving your Home's Comfort with Home Sealing."
- Your home has humidity problems and/or excessive dust.** Poorly operating or improperly sized equipment could be to blame. Leaky ductwork can also cause these problems, so having it sealed may be a solution. Monthly maintenance of your heating and cooling equipment's filters may also help. See page 16, "Getting Properly Sized Equipment and a Quality Installation," page 10, "Sealing Your Ducts" or page 6, "Maintaining Your Equipment."
- Your cooling system is noisy.** Your duct system could be improperly sized or there may be a problem with the indoor coil of your cooling equipment. See page 10, "Sealing Your Ducts" or page 6, "Maintaining Your Equipment."
- Your equipment needs frequent repairs and your energy bills are going up.** In addition to the rise in energy costs, the age and condition of your heating and cooling equipment may have caused it to become less efficient. See page 6, "Maintaining Your Equipment" or page 14, "Choosing the Right Equipment."
- Your heat pump or air conditioner is more than 12 years old.** Consider replacing it with newer, more efficient equipment. And remember, high efficiency levels begin with ENERGY STAR. See page 14, "Choosing the Right Equipment."
- Your furnace or boiler is more than 15 years old.** Consider replacing with ENERGY STAR qualified equipment. ENERGY STAR has set high efficiency guidelines for both furnaces and boilers. See page 14, "Choosing the Right Equipment."
- You leave your thermostat set at one constant temperature.** You could be missing a great energy-saving opportunity. A programmable thermostat adjusts your home's temperature at times when you're regularly away or sleeping. See page 14, "Choosing the Right Equipment – Programmable Thermostats."
- Your score on the ENERGY STAR Home Energy Yardstick is below five.** That means you're using more energy at home than most Americans and probably paying more than you need to on energy bills. Get personalized recommendations to improve your home and/or heating and cooling system. Find the Home Energy Yardstick at [www.energystar.gov](http://www.energystar.gov). Click on Home Energy Analysis.



# Maintaining Your Equipment

Dirt and neglect are the #1 causes of heating and cooling system failure. One of the most important steps you can take to prevent future problems and unwanted costs is proper maintenance. Keep your heating and cooling systems at peak performance by 1. cleaning or replacing the air filter about once a month, and 2. having a contractor do annual pre-season check-ups. Contractors get busy during summer and winter months, so it's best to check the cooling system in the spring and the heating system in the fall. To remember, you might plan the check-ups around the time changes in the spring and fall. For tips on hiring the right contractor, see page 12, "Working with a Heating and Cooling Contractor."

## Overall System Maintenance Checklist

Your contractor should complete the following each spring and fall:

- Check thermostat settings** to ensure the heating and cooling system turns on and off at the programmed temperatures.
- Tighten all electrical connections and measure voltage and current on motors.** Faulty electrical connections can cause unsafe operation of your system and reduce the life of major components.
- Lubricate all moving parts.** Parts that lack lubrication cause friction in motors and increase the amount of electricity you use. It can also cause equipment to wear out more quickly, requiring more frequent repairs or replacements.
- Check and inspect the condensate drain in your central air conditioner, furnace and/or heat pump (when in cooling mode).** If plugged, the drain can cause water damage in the house, affect indoor humidity levels, and breed bacteria and mold.
- Check system controls to ensure proper and safe operation.** Check the starting cycle of the equipment to assure the system starts, operates, and shuts off properly.
- Inspect, clean, or change the air filter in your central air conditioner, furnace, and/or heat pump.** Your contractor can show you how to do this yourself. Depending on your system, your filter may be found in the duct system versus the heating and cooling equipment itself. A dirty filter causes energy costs to be greater than they should be and can damage your equipment, leading to early failures.

## System-Specific Maintenance

*The following checklists outline additional steps your contractor should follow when servicing either your heating or cooling system:*

### Heating-Specific Checklist:

- Check all gas (or oil) connections, gas pressure, burner combustion, and heat exchanger.** Improperly operating gas (or oil) connections are a fire hazard and can contribute to health problems. A dirty burner or cracked heat exchanger causes improper burner operation. Either can cause the equipment to operate less safely and efficiently.

### Cooling-Specific Checklist:

- Clean indoor and outdoor coils before warm weather starts.** A dirty coil reduces the system's ability to cool your home and causes the system to run longer, costing you more energy dollars and decreasing the life of the equipment.
- Check your central air conditioner's refrigerant charge and adjust it if necessary to make sure it meets manufacturer specifications.** Too much or too little refrigerant charge can damage the compressor, reducing the life of your equipment and increasing costs.
- Clean and adjust blower components to provide proper system airflow.** Proper airflow over the indoor coil is necessary for efficient equipment operation and reliability.

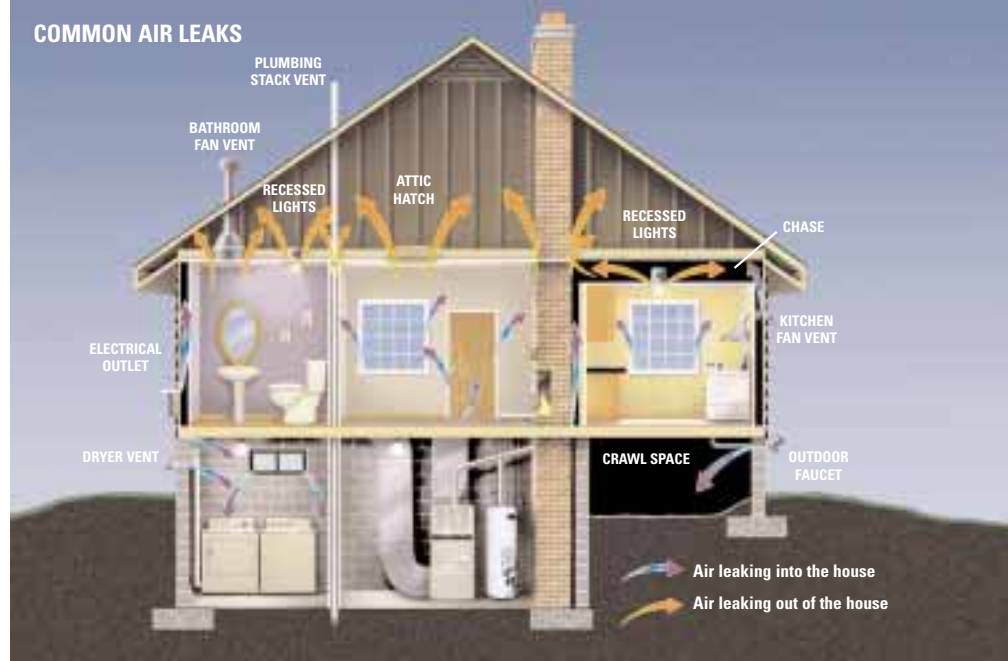


# Improving Your Home's Comfort with Home Sealing

The exterior of your home is called the “envelope” or “shell.” The envelope is made up of the outer walls, ceiling, windows, and floor. It is common to find both old and new homes that have poorly performing “envelopes” – that is, they have drafty air leaks and are poorly insulated. An envelope that performs poorly leads to an uncomfortable home and higher heating and cooling bills. This is especially true when the weather outside is very cold or hot. Sealing air leaks and adding insulation can increase your home’s overall comfort, as well as reduce heating and cooling bills.

*To improve your home’s envelope, the EPA recommends a process called ENERGY STAR Home Sealing:*

- Seal air leaks to reduce drafts and get the full performance out of insulation.**  
Always seal air leaks *before* adding insulation.
- Add insulation to keep your home comfortable and energy-efficient.**  
Usually, the easiest and most effective place to add insulation is in the attic. This can improve comfort throughout the home. The U.S. Department of Energy (DOE) recommends insulation levels for each part of the house, tailored for varying climates. Visit [www.energystar.gov](http://www.energystar.gov) and click on Home Sealing to see recommended levels of insulation.
- Choose ENERGY STAR qualified windows when replacing or adding windows to your home.** In addition to making you feel more comfortable, they reduce UV damage to interior fabrics and can help you save money on heating and cooling costs. Be sure the windows you choose are qualified for your climate zone.



## *Benefits of ENERGY STAR Home Sealing:*

- Improved comfort, especially during periods of hot or cold weather
- Lower energy use, which means lower energy bills
- A quieter home due to less noise entering from the outside
- Fewer holes where pollen, dust, pollution, and insects can enter your home
- Improved durability of the building structure through the reduced movement of moist air

Whether you do it yourself or have a contractor work on your home, it is important to have your local heating and cooling contractor perform a Combustion Safety Test after sealing air leaks to be sure all your gas or oil burning appliances are working properly. A good time to have it checked is during your annual heating system check-up. Of course, another way to help ensure good indoor air quality in your home is to test for radon.

Learn more about Home Sealing and your home’s envelope by visiting [www.energystar.gov](http://www.energystar.gov) and clicking on Home Sealing.

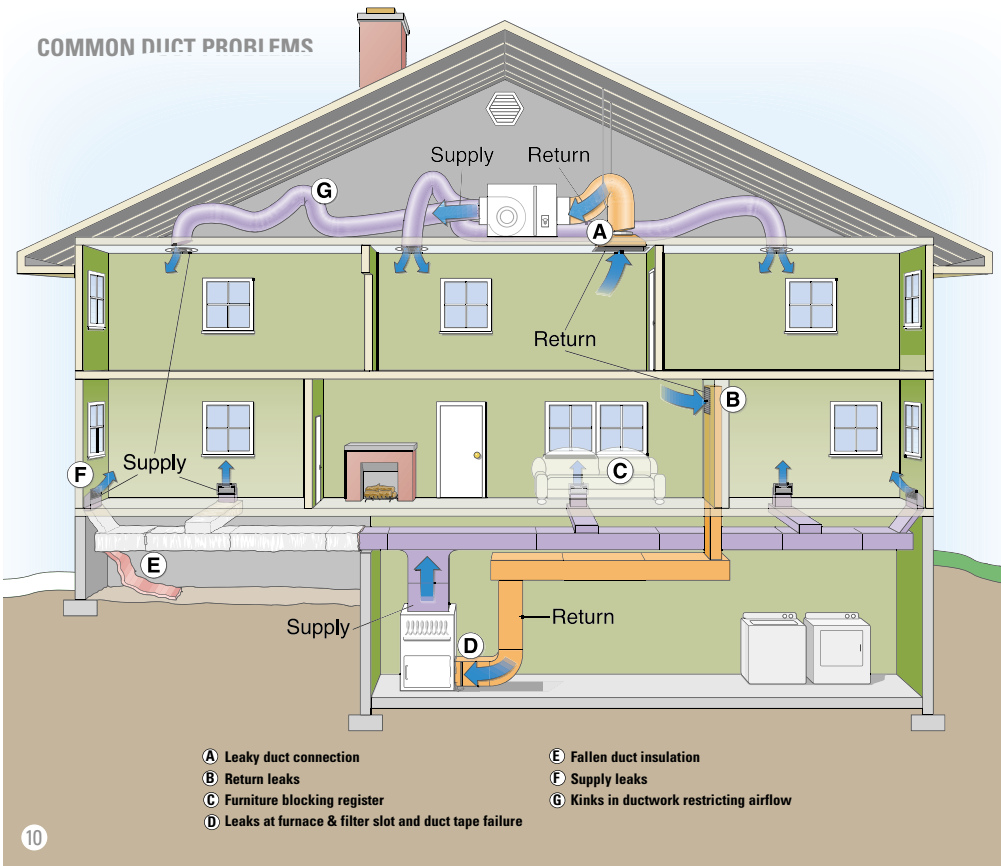
- For the “Do-it-Yourselfer” with an accessible attic, view “A DIY Guide to ENERGY STAR Home Sealing” for step-by-step instructions for sealing air leaks and adding insulation.
- If you prefer to hire a professional to seal your home, you can view recommendations for finding a contractor.

# Sealing Your Ducts

Ducts are an integral part of a forced-air system such as a furnace, heat pump, or central air conditioner, whose job is to circulate heated or cooled air evenly to every room in a house.

Poorly performing ducts can leak conditioned air and reduce your system's efficiency by as much as 20%, by causing it to work harder to keep your home at a comfortable temperature. Ducts are commonly concealed in walls, ceilings, attics, basements, or crawl spaces, which can make them difficult to access and repair. EPA recommends using a professional contractor for duct improvements. Many contractors who install heating and cooling systems also repair ductwork. For tips on selecting the right contractor, see p. 12, "Working with a Heating and Cooling Contractor."

**COMMON DUCT PROBLEMS**



- A** Leaky duct connection
- B** Return leaks
- C** Furniture blocking register
- D** Leaks at furnace & filter slot and duct tape failure
- E** Fallen duct insulation
- F** Supply leaks
- G** Kinks in ductwork restricting airflow

Improve your ducts by sealing leaks and insulating the ducts in attics and crawl spaces. This will improve your system's overall performance and your home's comfort and indoor air quality. You should have your duct system checked by a professional contractor to ensure it is operating efficiently to deliver the right amount of conditioned air.

## Duct Improvement Checklist

**When making improvements to your duct system, your contractor should:**

- Check, measure, and identify leaks with diagnostic equipment.
- Repair or replace damaged, disconnected, or undersized ducts. Straighten out flexible ducts that are tangled or crushed.
- Seal leaks and connections with mastic, metal tape, or an aerosol-based sealant. Duct tape should never be used because it will not last. Test airflow after sealing ducts.
- Seal all registers and grills tightly to the ducts.
- Insulate ducts in unconditioned areas, like attics and crawl spaces, with duct insulation that carries an R-value of 6 or higher.
- Include a new filter as part of any duct system improvements.
- Conduct a Combustion Safety Test after ducts are sealed to ensure there is no backdrafting of gas or oil-burning appliances.

For more information and a copy of ENERGY STAR's "Duct Sealing" brochure, visit [www.energystar.gov/ducts](http://www.energystar.gov/ducts).



# Working with a Heating and Cooling Contractor

Whether you want to schedule an annual equipment maintenance check-up or you've decided that you need to purchase and have new heating or cooling equipment installed, you will need to hire a contractor.

The following sections will help you find the right contractor, get quality and value from the contractor and your new equipment, and get a signed agreement on the work to be done. Many of the following recommendations also apply if you choose to work with a contractor to make other home improvements such as home sealing or duct work.

## How do you choose the right contractor?

### A reputable contractor should:

- Perform an on-site inspection of the job you want done and provide a detailed bid in a timely manner.
- Demonstrate to you that they are licensed and insured to repair or install heating and cooling equipment (many states require this).
- Be able to provide their certification for refrigerant handling, required since 1992.
- Have several years of experience as a business in your community.
- Provide examples of quality installation of energy-efficient heating and/or cooling equipment work, with names of customers that you can contact.
- Complete and submit the warranty information card on your behalf.
- Ideally, have service technicians who are certified by North American Technician Excellence (NATE) to professionally install and service heating and cooling systems. For a list of contractors that employ NATE-certified technicians in your state, visit [www.natex.org](http://www.natex.org).



## Get Quality and Value.

### Have the contractor:

- Show you a layout of where the equipment is going to be installed.
- Determine the size of your new equipment using ACCA/ANSI Manual J®, or an equivalent sizing calculation tool.
- Check refrigerant charge using pressure and temperature measurements.
- Explain the financial benefit of installing ENERGY STAR qualified equipment.
- Diagnose and repair your duct system, if needed.
- Provide financing for the purchase, if necessary.
- Explain the warranty on equipment, parts, and labor.
- Clearly explain the benefits of regular maintenance and help you set up a schedule to keep your system operating at its best.

## Sign an agreement before work begins.

### Both you and your contractor should sign a written proposal before work gets started. The agreement or proposal should:

- List in detail all the work that is being contracted.
- Specify all products by quantity, name, model number, and energy ratings.
- Provide manufacturer's warranty, equipment documentation, and contractor installation warranty information (if applicable).
- Give the payment schedule.
- State the scheduled start and completion date.
- Describe how disputes will be resolved.
- State the contractor's liability insurance and licenses if required.
- Outline paperwork and permits needed for the project.



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# Choosing the Right Equipment

When purchasing heating or cooling equipment, remember that high efficiency levels begin with ENERGY STAR. Whether you're searching for a new heat pump, furnace, or other heating and cooling equipment, ENERGY STAR has set energy efficiency specifications to help you save on energy bills and improve the comfort level in your home.



## Furnaces

Furnaces are the most commonly used residential heating system in the United States, running most often on gas, but sometimes on fuel oil or electricity, and deliver their heat through a duct system. One in four furnaces in U.S. homes today is more than 20 years old. ENERGY STAR qualified furnaces use advanced technology to deliver higher efficiency than standard new furnaces available today.



## Boilers

A boiler heats your home by burning gas or fuel oil to heat water or steam that circulates through radiators, baseboards, or radiant floor systems. Boilers do not use a duct system. Boilers that have earned the ENERGY STAR have higher AFUE ratings. AFUE, the Annual Fuel Utilization Efficiency, is a measure of heating equipment efficiency.

How much energy you save will vary based on your use and climate, with colder regions likely saving more. Features that improve boiler efficiency include electronic ignition, which eliminates the need to have the pilot light burning all the time, and technologies that extract more heat from the same amount of fuel.



## Central Air Conditioners

ENERGY STAR qualified central air conditioners have a higher SEER than today's standard models. SEER, the Seasonal Energy Efficiency Ratio, measures energy efficiency. The higher the SEER, the greater the level of efficiency. Since sizing and proper installation of a central air conditioning system are critical to energy efficiency and home comfort, it is important to hire a qualified technician.



## Heat Pumps

Electric Air-Source Heat Pumps (ASHPs): ASHPs, often used in moderate climates, use the difference between outdoor and indoor air temperatures to cool and heat your home. For example, they work in cold weather because the air is warmer than the refrigerant in the system and causes it to boil into a gas. This gas is then compressed which drives the temperature up to 120 degrees or more. This hot gas transfers heat to your home. High efficiency ASHPs use less energy than conventional models. They also come with higher HSPF ratings. HSPF, the Heating and Seasonal Performance Factor, measures the heating efficiency of heat pumps.

Geothermal Heat Pumps (GHPs): By using stable temperature conditions in the ground, GHPs cool and heat your home. In addition to providing much lower energy bills, high efficiency GHPs are quieter and include water-heating capabilities. Although initially expensive, they quickly pay back the homeowner with significant cost savings. GHPs are most often installed in new homes and require a duct system.



## Programmable Thermostats

A programmable thermostat is recommended for individuals and families who are away from home during set periods of time throughout the week, allowing them to use less energy without sacrificing comfort. Programmable thermostats that have earned the ENERGY STAR offer the most energy-saving potential for your home and, unlike older manual thermostats, contain no mercury. Through *proper use* of your ENERGY STAR qualified thermostat, you can save about \$100 every year in energy costs.

**In order to increase your energy savings, it's important that you:**

- Keep the thermostat set at energy-saving temperatures for long periods of time, such as during the day when no one is home and through the night. ENERGY STAR qualified thermostats come with four pre-programmed temperature settings for typical weekday and weekend routines.
- Resist the urge to override the pre-programmed settings. Every time you do, you use more energy and may end up paying more on your energy bill.
- Set the "hold" button at a constant energy-saving temperature when going away for the weekend or on vacation.
- Install your thermostat away from heating or cooling registers, appliances, lighting, doorways, skylights, and windows, and areas that receive direct sunlight or drafts. Interior walls are best.

If you have a heat pump, you may require a special programmable thermostat to maximize your energy savings year-round. Talk to your retailer or contractor for the details before selecting your thermostat.



# Getting Properly Sized Equipment and a Quality Installation

When purchasing heating and cooling equipment, choosing energy-efficient products is a step in the right direction. However, asking the right questions of your contractor and making sure your equipment is properly sized and installed are also important elements to ensure that your new system performs at optimal efficiency.

When it comes to heating and cooling equipment, bigger doesn't always mean better. Larger capacity systems are intended to meet the needs of a larger heating or cooling load. However, if the unit is too large for your home, you will experience less comfort and increased costs. Oversized equipment will operate in short run times or cycles, not allowing the unit to reach efficient operation. In addition, oversized equipment will not run long enough to remove humidity from the air. This can leave you feeling cool but not comfortable.

Don't assume that the size of your new system will be the same as your old equipment. Changes, such as additions or insulation improvements, may have been made to the house since the original equipment was installed; or, the equipment may have been too large from the start. Expect the contractor to gather information about your house such as the level of insulation, type and size of the windows, and floor area. Your contractor can determine the right size for your heating and cooling equipment by using ACCA/ANSI Manual J®, or an equivalent sizing calculation tool that takes these and other factors into consideration.



*When installing your new heating and cooling equipment, your contractor should do the following to ensure a quality installation:*

## Quality Heating Installation Checklist:

- Provide adequate room around the equipment for service and maintenance.
- Test and verify proper airflow (if a furnace or heat pump).
- Verify that your furnace or boiler has been tested for proper burner operation and proper venting of flue gases. The vent piping should be inspected for leaks or deterioration and repaired or replaced as necessary.

## Quality Cooling Installation Checklist:

- Provide adequate room around the equipment for service and maintenance.
- Replace the indoor coil of the equipment when replacing the outdoor unit. To get the expected level of efficiency, you should have a matched set. An old coil will not work efficiently with a new outdoor unit.
- Confirm that the level of refrigerant charge and the airflow across the indoor coil meets the manufacturer's recommendation. It's estimated that more than 60% of central air conditioners are incorrectly charged during installation.
- Place the condenser in an area that can be protected from rain, snow, or vegetation, as specified by the manufacturer. If you have a central air conditioning unit, cover your outside equipment during the winter to protect it from snow and ice. Heat pumps need to be left uncovered to properly operate during the winter.



## Protecting Our Environment Starts at Home.

The average household can be responsible for nearly twice the greenhouse gas emissions as the average car. The leading source of greenhouse gas emissions is energy production; whenever you operate any product in your home that runs on electricity, a power plant is most likely generating that electricity by burning fossil fuels (such as coal and oil), which produces greenhouse gases. Here are 5 ways you can help reduce the risks of global warming!

### *5 Steps You Can Take to Reduce Air Pollution:*

- Change five lights.** Change a light and you help change the world. Replace your five most frequently used lights, or the bulbs in them, with ones that have earned the ENERGY STAR, and you'll use less energy, which means less pollution from power plants. If every household did this, together we'd prevent more than one trillion pounds of greenhouse gases.
- Look for products that have earned the ENERGY STAR.** Ask for us by name. You'll get the features and performance you want AND help reduce air pollution. Look for ENERGY STAR qualified products in more than 40 product categories, including lighting, home electronics, heating and cooling equipment, and appliances. If you are building or buying a newly constructed home, ask about ENERGY STAR—we qualify those too.
- Heat and cool smartly.** Improve the performance of your heating and cooling system. Have it serviced annually by a licensed contractor, and remember to clean or replace air filters regularly. To avoid heating or cooling an empty house, use an ENERGY STAR qualified programmable thermostat. And when it's time to replace old equipment, choose an ENERGY STAR qualified model, and make sure it's sized and installed properly. If just one household in 10 did this, the change would prevent more than 17 billion pounds of greenhouse gases.

- Seal up your home.** Drafty windows and doors, cold walls or ceilings, and high energy bills are all symptoms of air leaks (usually in the attic and basement) and poor insulation. Seal air leaks, add insulation, and choose ENERGY STAR qualified windows when replacing old windows. That way you'll improve the comfort and durability of your home, save energy and help protect our environment.
- Tell family and friends.** Slip it into a conversation with a friend or family member. Talk about it at a neighbor's barbecue. Pass it on at a PTA meeting or at work. We're asking you to help spread the word that energy efficiency is good for your home and good for our environment. Tell five people and together we can help our homes help us all.

## ENERGY STAR It's a good sign.

The ENERGY STAR program is a voluntary partnership between consumers, their families, and many of the most respected brand names. All of us are working together to achieve a common goal: to protect our environment for future generations by changing to more energy-efficient practices today. Since the fossil fuel-based energy used in a typical home can cause twice as many greenhouse gas emissions as the average car, the U.S. Environmental Protection Agency encourages homeowners to make their homes more energy-efficient. The government awards the ENERGY STAR to those products, companies and organizations, homes, and services that meet specifications established by EPA and DOE. It's our future. Together, we can make a change for the better.