
# Conserve Energy and Save Money

Are your energy bills too high? Is your home not as comfortable as you want it to be? Do you want to do more to protect the environment? Do you have teenagers at home giving your hot water bill a beating? Whatever your situation, this information will help you to find a solution that's right for you. This guide is primarily aimed at homeowners who are thinking of upgrading or replacing their home's existing heating or cooling systems. It also contains useful information for people who are having a home built for them, and for those who want to reduce their energy consumption in general.

While builders generally offer a standard heating or heating/cooling package, upgrades to more efficient equipment might be available. Familiarity with the different systems, fuel options, their comparative prices, and their operating costs will help you to review upgrade options with your builder. Remember to also ask about other energy-efficiency upgrades, which can range from extra insulation to a complete R-2000-certified home. Before being R-2000-certified, each home is evaluated and tested to ensure that a high level of energy efficiency has been designed and built into it. There are both financial and environmental benefits to conserving energy and using it wisely. To help you conserve even more, these tips will also direct you to resources that can help you reduce energy consumed for purposes beyond heating and cooling your home.

## A Wise Choice:

The options presented will help you to select heating and cooling systems that meet the needs of both your lifestyle and your checkbook. Besides the obvious savings for you that occur by lowering your consumption, by reducing demand for energy through conservation, or, in the case of electricity, from shifting consumption to times of lower demand, together we can lower the market price for the energy that is consumed. The advantages of investing in energy efficiency aren't only felt within your family budget – they are realized in the cleaner environment that goes hand in hand with more efficient systems and the wise use of energy.

## Before You Start:

Putting an energy-efficient heating system into a drafty, poorly insulated house will reduce your energy bills. But you'll notice a more dramatic savings and even make yourself more comfortable if you also make your entire house more energy-efficient.

1. How? Here are some ideas:
   Weatherstrip and caulk to seal air leaks. You may have to replace uncontrolled sources of air with designed sources to ensure proper ventilation.
2. Increase insulation levels where appropriate (such as in the attic and walls) to reduce heat loss in winter and heat gain in summer.
3. Open drapes on south-facing windows on sunny winter days so that the sun's energy can help heat your home, and close them in summer to help keep your home cool.
4. Choose energy-efficient products when replacing windows and doors.

By making your house more energy-efficient, your heating and cooling systems will work less, and you may reduce the capacity needed when you replace your systems, which means more savings for you.

## Why Energy Efficiency Matters:

It's good for your budget, your comfort and our environment. Each year, you spend hundreds of dollars to heat and cool your home and to heat your hot water. By installing energy-efficient equipment, which gives you the same comfort for less energy, you can lower these costs. Furthermore, the lower you can make your energy costs now, the better off you will be should energy prices go up – and conservation reduces upward pressure on energy prices.

Whenever fuels are burned – in your home, in a generating station to produce electricity, in vehicles, and elsewhere – carbon dioxide, nitrogen oxide and sulphur dioxide are released. These emissions contribute to environmental problems, including smog, acid rain and climate change. Reducing energy use lowers the amount of these emissions and their impact on the environment. You can help by practicing energy efficiency and conservation not only in heating and cooling your home, but everywhere at home, in the workplace, and in your transportation choices. Many factors can affect your annual energy bill, such as size and location of your home, yearly variations in weather, efficiency of your furnace and other appliances, thermostat settings, number of occupants, and the local cost of energy.

## Are you serious about how to go about cutting your heating and cooling costs?

Follow these steps:

1. Where appropriate, improve the insulation and air sealing in your home.
2. Use this guide to help you decide what kinds of changes to your heating and cooling systems will be right for you.
3. Consult with a registered heating/cooling contractor and your fuel supplier before making a final decision.

## There are four common types of heating units:

1. A furnace provides heat through a forced-air distribution system.
2. A boiler provides heat through a hydronic distribution system. (Hydronic systems are also referred to as hot water systems.).
3. A space heater supplies heat directly to the room where it is located.
4. A heat pump extracts heat from the air, ground and water outside the house and usually delivers it through a forced-air distribution system.

Most heating systems need air for combustion. Furnaces, boilers and space heaters that burn fuels need a supply of air to be able to burn properly, and a vent to the outdoors so that combustion gases can escape from the house. Electric heaters do not need to be vented. Combustion is a two-step process: air in, and gases out.

## Air In:

In the past, there was usually plenty of air leaking into a house to keep the furnace, boiler or stove burning well. Modern homes, however, are better sealed and use controlled ventilation, rather than uncontrolled leakage, to provide greater comfort and energy efficiency. Vents that supply air for heating units should never be blocked. It is important to ensure that there is an adequate supply of combustion air available, even when other air exhausting equipment is in use.

## Gases Out:

Venting used to be done through a chimney. Today, however, many models of natural gas, oil and propane equipment can be vented by pipe directly through the wall, which greatly simplifies installation. Remember that combustion gases cannot escape from your home unless you provide air to replace them. That's why venting problems can often be traced to air supply problems.

## Controls:

The indoor temperature is automatically controlled by a thermostat. Two important considerations are type and location. Central systems are normally controlled by a single thermostat. To achieve proper temperature control, the thermostat must be located in an area where it will sense the average indoor temperature. Locations exposed to localized temperature extremes (outside walls, drafts, sunlight, hot ducts or pipes, etc.) should be avoided.

Different types of thermostats are available. Basic types maintain a fixed indoor temperature. However, you can reduce your heating costs by installing a setback thermostat, which can be programmed to automatically lower the temperature when no one is home or everyone is in bed, and then warm up the house before you get home or wake up. Savings will vary, but a setback of 3º for eight hours daily could reduce your heating costs by about 5%.

Where space heaters are used, each unit will likely be individually controlled by its own thermostat – which is usually the basic type. This allows you to keep unused areas at a lower temperature than those areas you do use.

## Distribution Systems:

There are three types of distribution systems:

1. A forced-air system circulates warmed or cooled air around the house through a network of ducts. It also provides a means of distributing ventilation air.
2. A hot water (hydronic) system distributes heat through hot water pipes and radiators.
3. Space heaters, though not technically a distribution system, provide direct heat to the room in which they are located.

It is important that a distribution system is properly designed, installed and operated to ensure maximum energy efficiency and comfort levels. Try to avoid placing any part of your distribution system outside of your home's insulation. This is sometimes done as a simple remedy to a routing problem, but there is always some heat loss through the wall of any distribution system.

## Forced Air:

Registers in each room can be adjusted to control the air flow. Return registers draw air from the rooms through separate ducts back to the furnace to complete the cycle of air flow through the house. Leaks in forced-air distribution systems are often ignored because they normally do not cause any obvious damage, but it is important to avoid or eliminate such leaks. Leaks will affect a distribution system's ability to provide comfort in all areas of the house, and leaks in some parts of the system can result in significant energy loss and/or condensation-related damage, which may be hidden from sight.

## Hot Water (Hydronic) Heating:

These systems distribute hot water from a boiler to radiators, convectors or under-floor heating systems in each room. In older homes, large, cast-iron radiators are common. Modern systems feature smaller boilers, narrow piping and compact radiators that can be regulated to provide temperature control in each room. Under-the-floor heating systems can be built into the floors of new and existing homes.

## Space Heaters:

These have no central heating unit or distribution system. Instead, individual space heaters – such as a wood stove, electric baseboards, radiant heaters and heaters fueled with oil, natural gas or propane – supply heat directly to the room. For safety, all space heaters except electric ones need to be vented to the outside. An appropriately sized space heater can supply some heat to all parts of a home if the design of the home allows for natural distribution of heat from the heater location. In most cases, more than one unit is required to comply with building code requirements, but multiple units allow you to vary the temperature around the house.

## Energy Sources and Equipment Options:

### Natural Gas:
Furnaces in forced-air heating systems, boilers in hot water systems, fireplaces and space heaters can be fueled by natural gas. It is delivered to your house through an underground pipeline. (It is not available in some areas.)

### Propane:
Most equipment fueled by propane is similar to that fueled by natural gas. In many cases, the only differences are one or two small components that can often be changed by a registered contractor to convert a unit from one fuel to the other. Propane is delivered by truck and stored in a tank on your property.

### Gas Equipment:
Because of their similarities, natural gas and propane heating equipment are discussed together. The term "gas" refers to both natural gas and propane. The cost of the two fuels differs, so remember to check for cost comparisons.

### There are three main types of gas furnaces:
Conventional (with a seasonal efficiency range of 55% to 68%);
Mid-efficiency (78% to 82%); and
High-efficiency (90% to 98%).
Gas boilers have similar ranges of seasonal efficiency.

### Older Conventional Gas Furnaces and Boilers:
Some older furnaces and boilers, which are no longer produced but are still in use, require a continuous liner in a masonry chimney or a metal "B"-vent chimney. The liner is needed because the combustion gases contain water vapor, which condenses on masonry and causes deterioration over time. About 35% of the heat from the fuel goes up the chimney with these models.

### Mid-Efficiency Gas Furnaces and Boilers:
These models remove more heat from combustion gases so that less heat escapes when the gases are exhausted, and efficiency is improved. Depending on the circumstances, they might be vented through a wall or through a chimney.

### High-Efficiency (Condensing) Gas Furnaces and Boilers:
These models extract so much heat from combustion gases in order to achieve their efficiency that they can be safely vented through a narrow plastic pipe that runs through the wall.
Gas-Fueled Fireplaces
Gas fireplaces are sometimes used to provide space heating, though they are often chosen for aesthetic reasons. There can be significant differences in energy efficiency from one model to another, and the effective efficiency of some types can be significantly affected by how they are used.

## Electricity:

Electric-resistance systems can consist of a central furnace or boiler connected to an air or hot water distribution system, radiant panels embedded in the floor or ceiling, or a baseboard space heating system. Electricity also powers heat pumps. When electric resistance heating is used in a new home, including as a back-up for an air-source heat pump, the building code requires the house to be built with higher minimum levels of insulation.

## Heat Pumps:

A heat pump is usually an electrically powered system that can either heat or cool by transferring heat from one place to another. During the heating season, a heat pump extracts heat from either the air, ground or water outside the house, and transfers it indoors. In the summer, the direction of the heat flow is reversed, extracting heat from indoors and transferring it outdoors, to provide air conditioning. Because they satisfy a substantial part of your heating needs by utilizing heat that's already available, rather than consuming electricity to generate all of the heat you need, heat pumps are significantly more efficient than electric-resistance heating.

## There are three main types of heat pumps:

Air-source heat pumps;
Earth-energy systems; and
Bivalent heat pumps.
Air-Source Heat Pumps

These most commonly-used heat pumps can provide all the cooling requirements of a home and most of the heating needs, but they require an auxiliary heating source during very cold weather. This can be either an electric-resistance or a fossil-fuel unit.

## Earth-Energy Systems:

Also known as ground-source heat pumps, these systems transfer heat from the ground, ground water or surface water and use it to provide home heating. For summer cooling, the process is reversed. If desired, earth-energy systems can be equipped to provide domestic hot water year 'round. Electric-resistance heaters may be installed to provide supplementary heating for the coldest days. They normally utilize much less electric-resistance heat and offer significantly higher efficiency than air-source heat pumps.

## Wood:

Some households use wood as their main fuel, but even more use it as a supplementary source of heat. Most of these households are outside large urban areas where firewood is usually less expensive than other fuels. The most common approach to wood heating today is a wood stove or high-efficiency fireplace installed in the main living area of the house. If the house is medium-sized and relatively new, this kind of equipment can provide almost all the heat needed.

If you have an existing masonry fireplace, a high-efficiency fireplace insert could be a good option. And many models offer the pleasure of a visible wood fire.

Older or larger houses may need the additional heating power offered by a wood-burning furnace. If your present heating system is a forced-air furnace that uses a more costly fuel, you might want to consider an add-on wood furnace. It is installed beside the existing furnace, and the duct work is modified so that it can be shared by both furnaces.

Combination wood-oil or wood-electric furnaces are options for new or replacement systems. Stoves that burn pellets made from wood or agricultural crops, such as corn kernels, are also available. Pellets are automatically fed into the burner and the householder simply dials in the required temperature on the thermostat.

When shopping for wood-burning equipment, visit several wood heat retail stores and discuss appliance selection, location and installation with a knowledgeable salesperson. Always buy wood-burning equipment that is certified for safety. It is also preferable to buy equipment that has been certified as meeting the U.S. Environmental Protection Agency (EPA) or Canadian CSA-B415 emission standards. These certified wood-burning appliances produce one-tenth of the chimney emissions, and one-third higher efficiency than earlier-built units.

## Outdoor Furnace:

"Outdoor" wood furnaces or boilers are also on the market. They may appear attractive because they will burn low-cost material you would not think of putting in an indoor appliance, and they can burn for long periods between refueling. However, they can be low on efficiency and high on emissions.

## Solar Energy:

Like wood, solar energy is a renewable resource. Solar heating does not involve the combustion of fuels, so it does not produce harmful emissions. It can be as simple as south-facing windows serving as passive solar collectors. Passive solar heating is free and should be an important consideration in the design of homes. Homes built to high levels of energy efficiency and designed to make the most use of free solar heating can save hundreds of dollars a year on energy bills.

## Other Energy Sources:

Residential systems are available to generate electricity from sunlight and wind. In certain situations, such as remote locations, one of these may be the most practical option. In addition, the government is establishing standardized processes and technical requirements which will require electricity distributors to allow customers with qualifying generation equipment to supplement their utility/electricity needs with power they generate themselves.

## Cooling Systems (Air Conditioning):

Two types of units cool an entire house: a central air conditioner and a heat pump. If you need to cool a specific area, a window air-conditioning unit could be your most energy-conserving choice. Regardless of what type you are considering, remember that models vary in efficiency ratings, and efficiency has a direct impact on operating costs, so optimizing efficiency should be a priority. Consider buying an ENERGY STAR®-qualified model.

## Central Cooling:

If you decide you want to cool your entire house, you should consider which system to install – central air conditioning or a heat pump – when reviewing your home's heating needs. An air conditioner is actually a heat pump that can only cool. Remember: Your heating decisions can affect your cooling options.

## Duct Work for Central Air:

Duct work is generally needed to carry cool air throughout the house in a central air-conditioning system. If you have a forced-air heating system, you can usually use the same ducts for cooling. If you do not have duct work, you can look into installing it, or consider air-conditioning technologies that have been developed for homes without ducts. These alternatives are more costly, so if you are considering them, investigate your options with your heating/cooling contractor.

## Mini-Splits:

Mini-splits are systems suited to homes without a central air-distribution system. No duct work is required. The system consists of two components: an outdoor condensing unit, and an indoor evaporator and fan. The indoor section can usually be mounted on any interior or exterior wall, and is much quieter than a window unit.

## Window Units:

Window air conditioners are effective if you need to cool a specific area of your home. They will cost less to install than a central air-conditioning system. If you don't have duct work, they might be your most practical choice. It is important to match the capacity of the window air conditioner with the size of the area to be cooled. Window units should either be covered in winter or, better still, removed to minimize heat loss.

## Other Ways to Cool Your House:

1. The following measures will help keep your home more comfortable:
   Install ceiling fans to circulate air.
2. If you're planning for the long term, plant trees that lose their leaves in the fall on the east, south and west sides of your house.
3. Close the blinds and drapes on south- and west-facing windows during sunny summer days to reduce heat gains.
4. Turn off lights and appliances when they are not in use.
5. Install awnings for patio doors and windows that face the sun.
6. Open windows in the evening and at night during the summer months.

## Hot Water and How to Heat It:

There are several water-heating options available to you. While you are taking steps to save on home heating, don't forget to see what you can do to lower your water heating costs. Check with your fuel supplier for more information, and consider alternatives to your current method.

## Storage-Type Water Heaters:

Most homes have storage-type water heaters in which water in a tank is heated by a gas or oil burner, or by electric elements. Traditional storage heaters have been improved with such features as through-the-wall venting for combustion units, and better insulation, making them less expensive to operate. Units designed to give even greater efficiency are now available.

## Instantaneous Water Heaters:

Instantaneous water heaters, which heat water as needed and have no storage tank, are available, but not widely. They require little space, but they usually cost more than storage-type water heaters, and more than one unit might be required to meet your needs. For electric instantaneous water heaters, upgraded wiring is often necessary.

## Integrated (Combination) Hot Water Systems:

Systems that combine space heating and water heating are becoming more popular. Water can be heated with a boiler or a storage-tank water heater. The hot water can be used for space heating as well as domestic hot water needs. Space heating methods include baseboard radiators, in-floor radiant heating, and forced-air heating when piped to an air handler. Some of these systems can also be used for pool and spa heating, as well as snow-melting applications. Combo systems vary widely in efficiency and must be carefully designed to give satisfactory service.

## Solar Water Heaters:

With solar water heaters, energy from the sun is collected by solar panels and transferred by circulating fluids to a storage tank. These heaters are typically used with an electric water heater, or one fueled by oil, natural gas or propane, which acts as a back-up for overcast days. Solar collector panels can be mounted on any unobstructed roof, wall or ground frame that faces between southeast and southwest. Solar water heaters are designed to provide between 35% and 75% of your hot water needs, with the back-up providing the balance.

## Replacing Your System:

Review your options, consider the pros and cons of different equipment and fuels, and compare installation and operating costs. Now, it's time to select a contractor. Here are some tips:

## Look for a Registered Contractor:

Your contractor will supply and install your equipment. Proper installation is essential for the safe, efficient and economical operation of your system. Electric equipment must be installed by a licensed electrician, and all electrical work should be inspected by an InterNACHI inspector.

## Get Estimates from Several Contractors:

Prices can vary significantly among contractors. Ask each firm for a written estimate covering the following items:

- The total cost, and a listing of all necessary work, including improvements to the existing system, and the provision of combustion air, if applicable;
- A heat loss/gain analysis;
- The size and seasonal efficiency of the unit, and sound ratings, if applicable;

The responsibility of the contractor or homeowner for:

- Obtaining permits and paying related fees;
- Removing and disposing of old equipment;
- Arranging for such work as installation of gas supply;
- Arranging for necessary inspections.
- A work schedule and completion date.
- Guarantees, warranties and service contracts;
- Terms of payment; and
- Evidence of an proper license, as appropriate.

Use costs (both installed and operating), work schedule, warranties and service as the basis for your decision. Ask the contractors you are considering for references, and follow up by contacting previous customers. Ask what they think about the contractor, fuel supplier, and the system options you are considering.

## Choose the Right Equipment:

In order to correctly size new heating and cooling equipment, your contractor must analyze how much heat is lost from your home in winter and gained in summer. Ask for this heat loss/gain analysis in writing, including the method used to perform the calculation. This calculation should take into consideration such factors as the size of the house, its level of insulation, and the condition of windows and doors. If the heat loss and gain is significant, and you haven't already taken steps to increase the energy efficiency of the house, now is the time to do it.

Avoid the temptation to simply choose the same size equipment that already exists in your house without doing a heat loss/gain analysis. Your home has likely been altered over the years, and the system might even have been the wrong size at the start. An oversized unit will usually operate below peak efficiency, and both oversized and undersized units can adversely affect the comfort of your home. Any installation involving combustion equipment should include steps to ensure that there will be an adequate supply of air for combustion and venting, and that other air-exhausting equipment will not cause problems.

## Changing Your Water Heater:

Size is an important consideration when selecting new hot water equipment. A larger family is likely to use more hot water. A "downsized" household – for example, an older couple whose children have grown up and moved into their own homes – will no longer need a water heater meant to supply the needs of four or more people. By practicing water conservation – for example, by installing energy-efficient showerheads and aerators on taps, and using cold water in your washing machine – you can substantially reduce your hot water usage.

## Steps to Installing a Hot Water Tank:

Contact your local fuel supplier or contractor and ask for the efficiency ratings of the models you are considering. When you have selected a unit just big enough to meet your household needs, your fuel supplier or contractor can arrange for a qualified serviceperson to install the water heater. If you have an electric hot water tank, wrap it in an insulating blanket. Make sure the blanket is certified for use on your heater and is properly installed. Insulate both the hot and cold water lines of the tank, and consider installing a heat trap. Be careful not to insulate the pipes too closely to the flue of a fossil-fueled tank. Ask your fuel supplier about any water heating cost-saving programs they offer. Some suppliers do some of the work at little or no cost to you.

## Glossary of Terms:

Here is a quick overview of terms used in this guide that you'll need to know as you gather information about your home heating and cooling options.

- air-source heat pump: aheating-cooling unit that transfers heat in either direction between the air outside a home and the indoors.
- air supply for combustion: the air that a furnace, boiler or space heater requires to burn fuel.
- aquastat: a thermostat that controls the water temperature in a boiler.
- boiler: the heating unit used with a hot water (hydronic) distribution system.
- central air conditioner: a unit that cools an entire house by removing heat from the inside air and releasing it outside.
- controls: devices, such as a thermostat, that regulate a heating or cooling system.
- conventional gas furnace or boiler: a gas-heating unit with an annual fuel utilization efficiency (AFUE) less than 70%. It exhausts through a masonry chimney (which should be lined), or metal "B"-vent.
- cost-effective heating/cooling system: one that produces good value for money after all costs (purchase, installation, financing and energy charges) are considered.
- distribution system: the components of a heating or cooling system that deliver warmed or cooled air, or warmed water, to the living space.
- domestic hot water: hot water used for household purposes.
- earth-energy system (ground source heat pump): a heat pump that transfers heat from the earth or groundwater in cold weather and transfers it to the house through an underground piping system for space heating, cooling or water heating. The process reverses in warm weather, and heat is discharged to the ground or water.
- electrical resistance heating: heat produced by passing electricity through a resistor.
- flame-retention head burner: a higher-efficiency burner in an oil furnace. It produces a hotter flame and operates with a lower air flow, thus reducing heat loss up the chimney.
- fluorocarbon refrigerants: the fluids commonly used in refrigerating and air-conditioning equipment to create the cooling effect. These fluids can damage the environment.
- forced air: a distribution system in which a fan circulates air from the heating or cooling unit to the rooms through a network of ducts.
- fossil fuel: a naturally occurring carbon or hydrocarbon fuel, such as natural gas, propane and oil, formed by the decomposition of prehistoric organisms.
- furnace: a heating unit that uses a forced-air distribution system.
- ground-source heat pump: another term for an earth-energy system.
- heat exchanger: a structure that transfers heat from one gas or liquid to another gas or liquid — for example, the hot combustion gases in a furnace to the circulating household air or, in a boiler, to the circulating hot water.
- heat-recovery ventilator (HRV): a device used in central ventilation systems to reduce the amount of heat that is lost as household air is replaced with outside air. As fresh air enters the house, it passes through a heat exchanger, heated by the warm outgoing air stream, and is pre-heated.
- high-efficiency (condensing) furnace or boiler: a heating unit with an annual fuel utilization efficiency (AFUE) of 90% or more. It has a second stainless steel heat exchanger that removes additional heat from exhaust gases. Water vapor condenses as the exhaust cools. The unit vents through a narrow plastic wall pipe instead of a chimney.
- hydronic system: a distribution system in which hot water is circulated through a network of pipes to radiators, wall panels or an under-floor heating system.
- installed cost: the total of the purchase price and the installation costs of equipment.

- instantaneous water heater: a device that heats water as required, but does not store it. The unit is usually located near the point of use.
- integrated (combo) hot water system: a system that provides both space and water heating from a single heat source.
- kilowatt: a unit of electrical power used to measure the heating capacity of electric equipment. One kilowatt (kW) equals 1,000 watts (W).
- mid-efficiency natural gas or propane furnace or boiler: a gas-heating unit with an annual fuel-utilization efficiency (AFUE) of 78% to 82%. Some models exhaust through the basement wall.
- new oil furnace: efficiencies (AFUE) range from 78% to 86%; has flue gases that may be exhausted through a chimney or a side wall vent.
- R-2000: a performance standard for new homes under a voluntary government/industry program. Builders meet the standard by offering an integrated package of features designed to meet the R-2000 requirements. The package includes high insulation levels, air-tightness, heat recovery ventilation, and efficient heating/cooling systems.
- retrofit: replacement of one or more components of an existing system.
- seasonal efficiency: a performance rating that considers the heat (or cool) actually delivered to the living space, the total energy available in the fuel consumed, and the impact the equipment itself has on the total heating or cooling load through an entire heating or cooling season. HSPF, AFUE, SEER and EF are seasonal efficiency ratings.
- SEER: seasonal energy-efficiency ratio
- setback thermostat: a programmable thermostat with a built-in timer. You can adjust it to vary household temperature automatically.
- space heater: a heating unit that supplies heat directly to the room where it is located, and is not connected to a distribution system.
- storage-type water heater: a tank that heats and stores hot water.
- ton: a measure of the cooling capacity for central air conditioners and heat pumps.

## Efficiency Ratings: AFUE, COP, HSPF, SEER & EER

Take a few moments to familiarize yourself with the efficiency ratings you'll find on various pieces of equipment.

## Boilers and Furnaces:

Rating to look for: AFUE

The annual fuel-utilization efficiency (AFUE) of furnaces and boilers measures their performance over a typical heating season. It takes into account things such as on-and-off cycles and heat loss through the chimney or vent, and is the most useful furnace and boiler rating available. The higher the rating, the more efficient the unit.

There is a second efficiency rating for furnaces and boilers, and it is known as steady-state efficiency. It is higher than an AFUE rating, but it's not as helpful. It measures the equipment's performance after it has been running a short while, and after all components have reached their normal operating temperature. The steady-state efficiency of furnaces and boilers is determined by comparing the amount of heat that's available in the fuel to the amount that is converted into usable heat, but it does not include off-cycle losses.

## Wood-Burning Appliances:

Advanced equipment which is certified as meeting the EPA or CSA-B415 emissions standards normally exceeds 60% and averages 70% efficiency. Conventional wood-burning appliances, which are not certified as low-emission, average 50% efficiency, with a range of 35% to 70%. Although some wood-burning equipment is specifically certified for efficiency, most is not. Also, most wood-burning appliances are manually operated, not automatic, so the practices of the operator will affect the efficiency actually achieved.

## Heat Pumps:

Ratings to look for: COP, HSPF

Earth-energy systems are rated for heating efficiency by comparing them to electric-resistance heat. The measurement used is its coefficient of performance, or COP, and is determined by dividing the heat output by the energy input. Since the COP of an electric-resistance heater is 1.0 – which means that the same amount of energy that goes into it as electricity comes out as heat – any rating higher than 1.0 means that, for the same amount of electricity going in, more heat comes out. Look for a COP of 3.1 or more.

The heating-efficiency rating for an air-source heat pump is called known as its heating seasonal-performance factor (HSPF). This is determined by dividing the total heat provided during the season (in BTU) by the total energy consumed by the system (in watt-hours). The higher the rating, the more efficient the heat pump is over the entire heating season. Look for an HSPF of more than 5.9.

## Air Conditioners and Air-Source Heat Pumps:

Ratings to look for: SEER

A SEER rating, which stands for seasonal energy-efficiency ratio, tells you the cooling energy efficiency of air conditioners and air-source heat pumps. The rating is determined by dividing the total cooling provided during the season (in BTU) by the total energy consumed by the system (in watt-hours). The higher the rating, the more energy-efficient the unit. SEERs for new central air conditioners and air-source heat pumps currently range from 10 to 17. For room air conditioners, the range is 8 to 12.

## Earth-Energy Systems:

Ratings to look for: EER

If you want to know how efficiently an earth-energy system can cool, look for the letters EER, which stand for energy-efficiency ratio. EER ratings are determined by dividing the cooling output of the ground or water-source heat pump (in BTUs per hour) by the power input (in watts). Look for an EER of at least 10.5.

## Hot Water Equipment:

Storage-Type Hot Water Heaters

An energy factor (EF) is used to rate the energy efficiency of storage-type hot water heaters. Both on-cycle efficiency and off-cycle losses are taken into account, which makes it a seasonal rating. The higher the EF, the more efficient the unit. You can expect to find the following energy factor ranges for new storage-type water heaters:

- gas: 0.56 to 0.86;
- electric: 0.87 to 0.98; and

A storage-type water heater added to an earth-energy system will normally have an energy factor of 2.7 to 3.1.