Heating and Cooling Your Home

A Conservation Guide

Ontario

Conserve Energy and Save Money

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Cette publication est également disponible en français.

Ontario

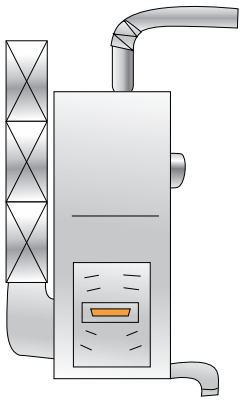
Conserve Energy and Save Money

CHAPTER 1

How this guide can help you

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 guide 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 (pages 8 –12), their comparative prices and operating costs (pages 13-16) will help you to review upgrade options with your builder.

Remember to also ask your builder 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 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, this guide will also direct you to resources that can help you reduce energy consumed for purposes beyond heating and cooling your home.

Dollars and sense

Once you are familiar with all your equipment and fuel options, and have compared their advantages and disadvantages in the Comparison Shopping section, you'll want to look at the charts in the Comparing Energy Costs Section. They show at a glance how the operating cost of your current heating and cooling system compares with other technologies. They also compare approximate equipment installation costs so that you can decide which option is best for you.

A wise choice

The options presented in this guide will help you to select heating and cooling systems that meet the needs of both your lifestyle and your cheque book. 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, even 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.

For more information on energy conservation, please turn to the Advice and information chapter (page 23).

Are you already a homeowner?
If you want to make your home more energy-efficient, this guide:

- *explores how different heating systems produce heat and distribute it throughout a home;*
- *investigates central air conditioning and suggests options to cool your home;*
- *explores the efficiencies of different units;*
- *helps you make a fuel choice;*
- *looks at options for providing hot water;*
- *compares the purchasing and energy costs of different pieces of equipment;*
- *explains how to go about replacing a system;*
- *helps you select a contractor; and*
- *tells you how to get more information on heating, cooling and general energy conservation.*

NOTE: Any energy efficiencies, costs or potential savings referenced in this Guide in terms of either percentage or dollar figures are based on estimates and are not guaranteed, but are dependent on factors that can be highly variable and specific to a particular household including, but not limited to, actual individual preferences and consumption patterns, energy costs, degree and type of insulation, weather, location, and product performance.

CHAPTER 2

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 saving, and even make yourself more comfortable, if you also make your entire house more energy-efficient. 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.*
- *Increase insulation levels where appropriate (such as in the attic or walls) to reduce heat loss in winter and heat gain in summer.*
- *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.*
- *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 or elsewhere – carbon dioxide, nitrogen oxide and sulphur dioxide are released. These emissions contribute to environmental concerns including smog, acid rain and climate change.

Reducing energy use lowers the amounts of these emissions and their impact on the environment. You can help by practising energy efficiency and conservation not only in heating and cooling your home, but everywhere at home, in the workplace and in your transportation choices. For more information on energy conservation, please turn to the Advice and information chapter (page 23).

How energy is used in Ontario homes*		For an annual energy bill of $2,000**
Space heating	57 - 62%	$1,140 - $1,240
Water heating	20 - 21%	$400 - $420
Appliances	12 - 13%	$240 - $260
Lighting	4 - 5%	$80 - $100
Cooling	0 - 7%	$0 - $200

*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.

**Source: Data for Ontario, 2000 — Office of Energy Efficiency, Natural Resources Canada and Statistics Canada.

The *Energy Efficiency Act* of Ontario

Ontario's *Energy Efficiency Act* establishes minimum efficiency levels for a wide range of energy-using products. Look for an energy performance label similar to the one shown here.

You'll find these labels on such products as:

- *electric, gas and oil water heaters*
- *gas and propane furnaces*
- *oil furnaces and boilers*
- *ground source and air source heat pumps*
- *room and central air conditioners.*

For more information about the *Energy Efficiency Act*, you can also visit the Ministry of Energy website at www.energy.gov.on.ca, or e-mail questions to write2us@energy.gov.on.ca. Or you can telephone the Ministry of Energy at 1-888-668-4636 toll-free.

The EnerGuide Program

The EnerGuide Program is a rating and labelling system that started by providing consumers with a standardized method of comparing the energy efficiency of large household appliances. This program has been expanded to rate an entire house as well as heating, ventilating and air conditioning (HVAC) products.

The EnerGuide rating is printed on the back of manufacturers' literature for all furnaces, central air conditioners and heat pumps. The program for HVAC products was developed by Natural Resources Canada and the Heating, Refrigeration and Air Conditioning Institute of Canada.

Buying a higher-efficiency furnace or air conditioner may cost more, but can provide environmental and economic benefits. Higher-efficiency equipment uses less fuel and has the following advantages:

- ***savings from lower energy use will accumulate over the lifetime of the equipment. The actual amount of savings will depend on location (the climate), the cost of fuel or electricity, the efficiency of the equipment chosen, the house itself and the habits and temperature selections of the occupants.***
- ***using less fuel will help conserve our non-renewable natural resources and will reduce emissions that contribute to smog, climate change and acid rain.***
- ***newer energy-efficient air conditioners tend to be quieter.***

As mentioned earlier, there is now an "EnerGuide For Houses" program, which can provide an energy efficiency rating for your house and customized advice on how to improve that rating. This program was developed by the Office of Energy Efficiency, which is part of Natural Resources Canada.

An evaluator comes to your home to analyze your home's comfort and energy performance, and gives you impartial advice on how to achieve energy savings through such steps as increasing insulation and upgrading your heating or air conditioning equipment.

You can obtain more information about the EnerGuide For Houses program from Natural Resources Canada, (contact information – page 23).

The ENERGY STAR® program

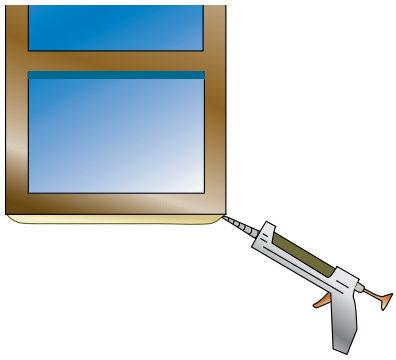
ENERGY STAR is now an international program. It was introduced by the U.S. Environmental Protection Agency (EPA) as a voluntary labelling program designed to identify and promote more energy-efficient products, in order to reduce carbon dioxide emissions. EPA partnered with the US Department of Energy to promote the ENERGY STAR label. In Canada, ENERGY STAR is administered and promoted by Natural Resouces Canada in conjunction with EnerGuide. Products that show the international ENERGY STAR mark are certified as offering a premium level of energy-efficiency. While the EnerGuide label helps you to compare how much energy a product uses, the ENERGY STAR mark helps you to identify which ones are more energy-efficient.

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

Please follow these steps:

First: Where appropriate, improve the insulation and air sealing in your home.

Next: Use this guide to help you decide what kinds of changes to your heating and cooling systems will be right for you. Remember to review your hot water options at the same time so that your overall system will have optimal energy-efficiency.

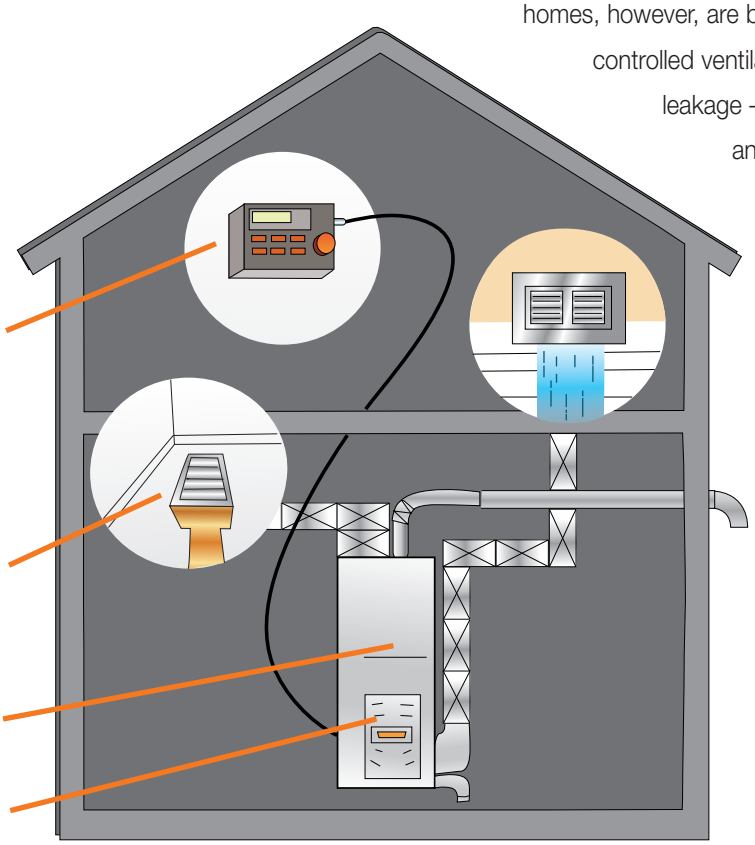


Then: Consult with a registered heating/cooling contractor and your fuel supplier before making a final decision. Once you have taken care of your heating and cooling systems (or while you are doing it), be sure to also use the resources in this guide to help you reduce the energy you consume for all other purposes.

CHAPTER 3

Heating units and controls

A heating system often has four main components:



Heating units

There are four common types of heating units:

- ***A furnace** provides heat through a forced air distribution system.*
- ***A boiler** provides heat through a hydronic distribution system. (Hydronic systems are also referred to as hot water systems.)*
- ***A space heater** supplies heat directly to the room where it is located.*
- ***A heat pump** extracts heat from the air, ground or 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

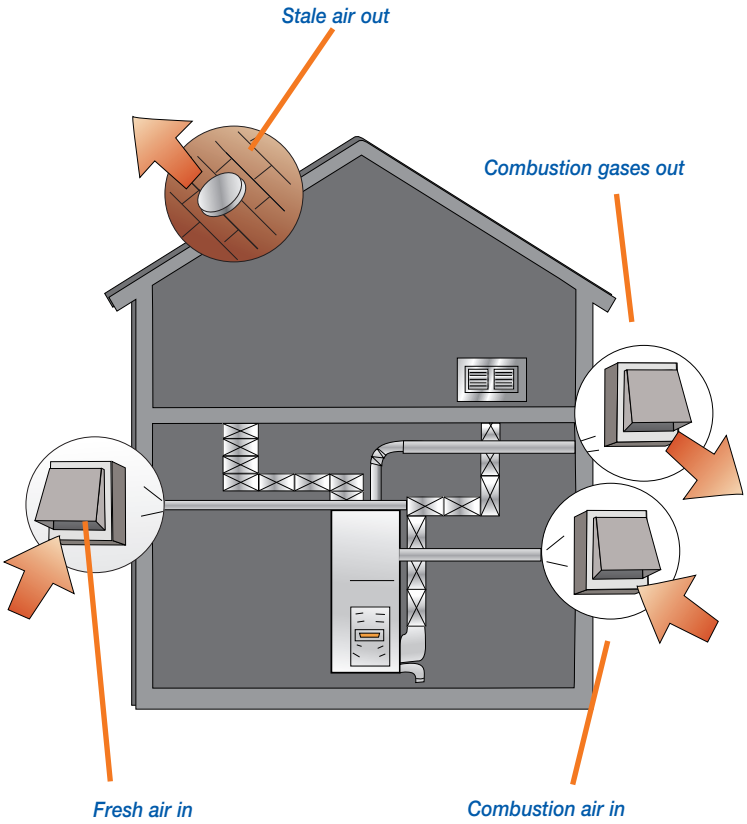
In the past, there was usually plenty of air leaking into a house to keep the furnace, boiler or stove burning well. Modern homes, however, are better sealed and use controlled ventilation – rather than uncontrolled leakage – to provide greater comfort and energy efficiency. Vents that supply air for 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 location and type. 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 set-back 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 set-back of 3°C for eight hours daily could reduce your heating costs by about five per cent.

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.

A word about… air quality

Air pollution can sometimes be worse inside your home than it is outside. As you increase the air-tightness of your home, you must also keep air quality in mind.

Recognize sources of pollution in your home

Air-borne pollutants are either biological (mould, dust mites, pollen, animal dander) or originate from other sources (gases or chemical particles released by furnishings, carpets, construction materials, unvented appliances, renovation activities including dust from lead paint, poorly maintained heating systems, humidifiers and dehumidifiers).

Your heating system

All heating systems and other equipment that burn fuel give off combustion gases. Occasionally, a portion of these gases might "spill" into the home instead of exhausting to the outdoors. If you suspect a problem, ask your fuel or equipment supplier to check for combustion spillage and make any recommendations necessary, such as installing a combustion air supply or upgrading or replacing equipment. You should have a working carbon monoxide detector. They are now mandatory in many situations.

Wet firewood brought into the home to dry can both introduce and support mould growth. Wood should be stored outside until needed.

Is your home well ventilated?

If you are planning to make your home more air-tight, be sure to check into the need for improved ventilation. A mechanical ventilation system is a must for any well-sealed home. A heat recovery ventilator goes a step further and provides more energy-efficient ventilation by reducing heat loss as outdoor air replaces indoor air.

See the Home Air Quality listing on page 24 for places to obtain more information.

CHAPTER 4

Distribution systems

There are three types of distribution systems.

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.

A hot water (hydronic) system distributes heat through hot water pipes and radiators.

Space heaters, though not technically a distribution system, provide direct heat to the room in which they are located.

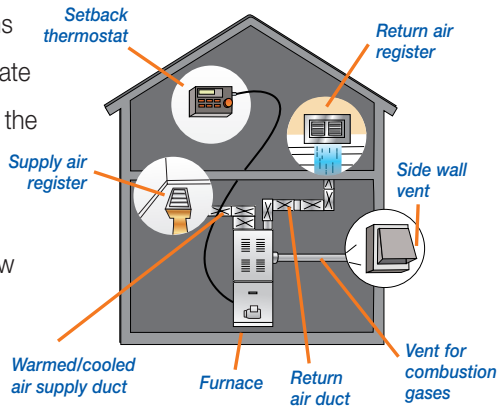
It is important that a distribution system is properly designed, installed and operated to ensure maximum energy efficiency and comfort levels.

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. It is better that any losses heat (or cool) you rather than your attic.

Forced Air

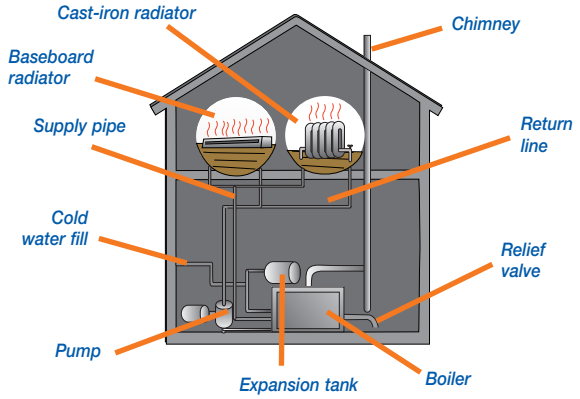
The majority of Ontario's homes have forced air distribution. Registers in each room can be adjusted to control the air flow. Return registers draw air from the rooms through separate ducts back to the furnace to complete the cycle of air flow through the house.

Forced Air Heating System



Leaks in forced air distribution systems are often ignored because they normally do not cause any obvious damage, but it is important to avoid/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 System



Hot water (hydronic) heating

A hot water heating system distributes 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 or 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.

CHAPTER 5

Energy sources and equipment options

Natural gas

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

Propane

Most equipment fuelled by propane is similar to that fuelled 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 the charts (pages 14,15) for cost comparisons.

There are three main types of gas furnaces:

- *conventional (with a seasonal efficiency range of 55 to 68 per cent);*
- *mid-efficiency (78 to 82 per cent); and*
- *high-efficiency (90 to 98 per cent).*

Gas boilers have similar ranges of seasonal efficiency.

For an explanation of efficiency ratings for furnaces, boilers, heat pumps, air conditioners and hot water heaters, see Chapter 12, Efficiency Ratings.

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 vapour which condenses on masonry and causes deterioration over time. About 35 per cent of the heat from the fuel goes up the chimney with these models.

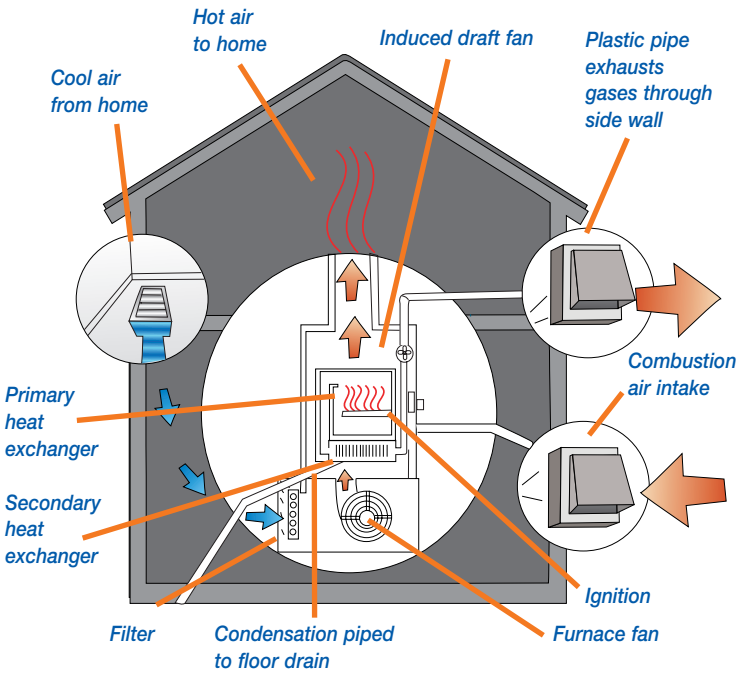
Mid-efficiency gas furnaces and boilers

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.

High-Efficiency Gas Furnace



A word about…conversions

Natural gas and propane equipment are often identical except for a few components. However, conversion of such equipment may only be performed by fitters licensed to work on the equipment involved, and such conversions are normally only permitted on equipment for which the manufacturer supplies a certified conversion kit. It is possible to convert equipment without a certified conversion kit. However, such conversions must be individually inspected by the Technical Standards and Safety Authority which, for residential applications, is a relatively costly procedure.

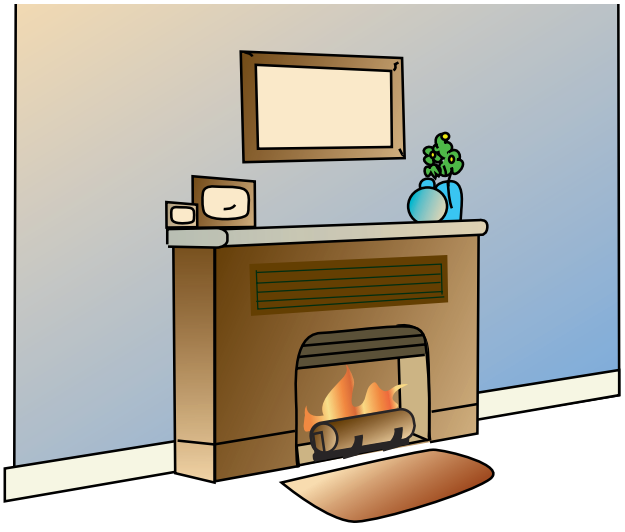
If conversion capability is important to you, confirm the possibility of legal conversion of the equipment involved before you buy.

A word about…efficiency

Under *Energy Efficiency Act* regulations, gas furnaces manufactured after January 1, 1992, and oil furnaces manufactured after September 1, 1994, must have an annual fuel utilization efficiency rating (AFUE) of at least 78 per cent to be legally sold in Ontario. Older, lower-efficiency (conventional) furnaces can be and are still used – for example, they may be the heating system in an older home that has not been updated – but such models are no longer produced.

Gas-fuelled 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. The considerations in selecting a gas fireplace are numerous and beyond the scope of this guide, but if you are considering one, "All About Gas Fireplaces", available from Natural Resources Canada (contact information – page 23), can assist you in your choice. It has information not only on efficiency ratings, but several other factors you should consider, both before selecting one, and in installing and using one.



Oil

Oil furnaces and boilers have a burner, a heat exchanger and a blower or pump. New oil furnaces made in Ontario are efficient. Oil is delivered by truck and stored in a tank, which is usually located in the basement.

Older conventional oil furnaces and boilers

Older, conventional oil furnaces and boilers with a standard burner have a seasonal efficiency generally ranging from 60 to 70 per cent. Like older, conventional gas furnaces and boilers, they are no longer produced. However, in an existing model that is working well, the seasonal efficiency can be improved by replacing the burner with a flame retention unit – usually a more cost-effective step than replacing the entire furnace.

New oil furnaces and boilers

A typical new oil furnace or boiler has a seasonal efficiency rating generally ranging from 78 to 86 per cent. Many of these units can be vented through the wall.

Oil stoves

There are free-standing oil space heaters with a visible flame now available. There are no efficiency standards for these products.

A word about…upgrading

An older oil furnace or boiler can often be upgraded to more than 80 per cent efficiency. The first step in making a decision about a possible upgrade or replacement of your oil furnace or boiler is to have a qualified service technician measure its steady-state efficiency. The technician can explain what could be done to increase efficiency and maintain safe operation. The technician can also estimate the remaining life expectancy of the existing equipment, the costs of an upgrade and the cost of replacement with all-new equipment.

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

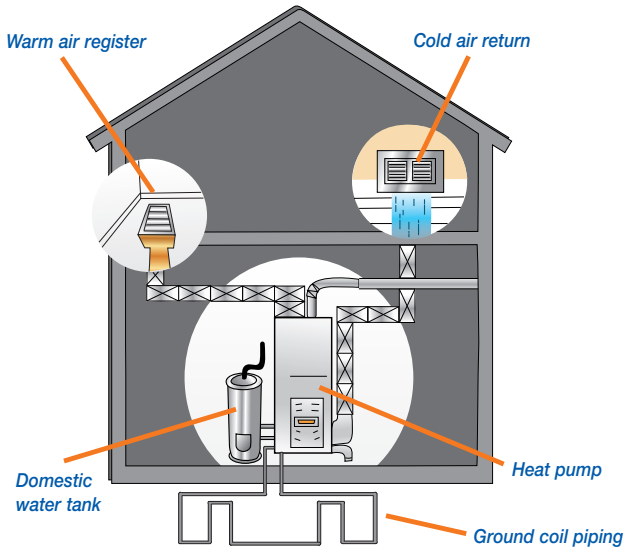
A heat pump is usually an electrically-powered system that can either heat or cool by transferring heat from one place to another. During the heating season, a heat pump extracts heat from either the air, ground or water outside the house, and transfers it indoors. In the summer the direction of the 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 already available heat, rather than consuming electricity to generate all of the heat you need, heat pumps are significantly more efficient than electric resistance heating. Heat pumps are sized in tons – one ton equals 12,000 British Thermal Units per hour (BTU/h) – and most home models range from 1.5 tons to 5 tons. 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 Ontario 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. Before considering converting to wood heat for economic reasons, however, you should also take into account the need for storage space and the time and effort required to handle the wood and tend the fire. (For information on sources of firewood, see page 24.)

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. (See Space Heaters on page 7.)

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. Certification under the Wood Energy Technical Training program (WETT) indicates that the salesperson and installer have been trained in the proper, safe installation and operation of wood-burning equipment. Always buy wood-burning equipment that is certified for safety. Look for equipment labels bearing the names Warnock Hersey, Underwriters Laboratories of Canada (ULC) or Canadian Standards Association (CSA). 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 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 can burn for long periods between refueling. However, they can be low on efficiency and high on emissions. If you still want to consider one, it's advisable to check with your local municipal building officials and your local Ontario Ministry of the Environment office (see Blue Pages of your phone book or Chapter 10) regarding acceptability for the location you have in mind.

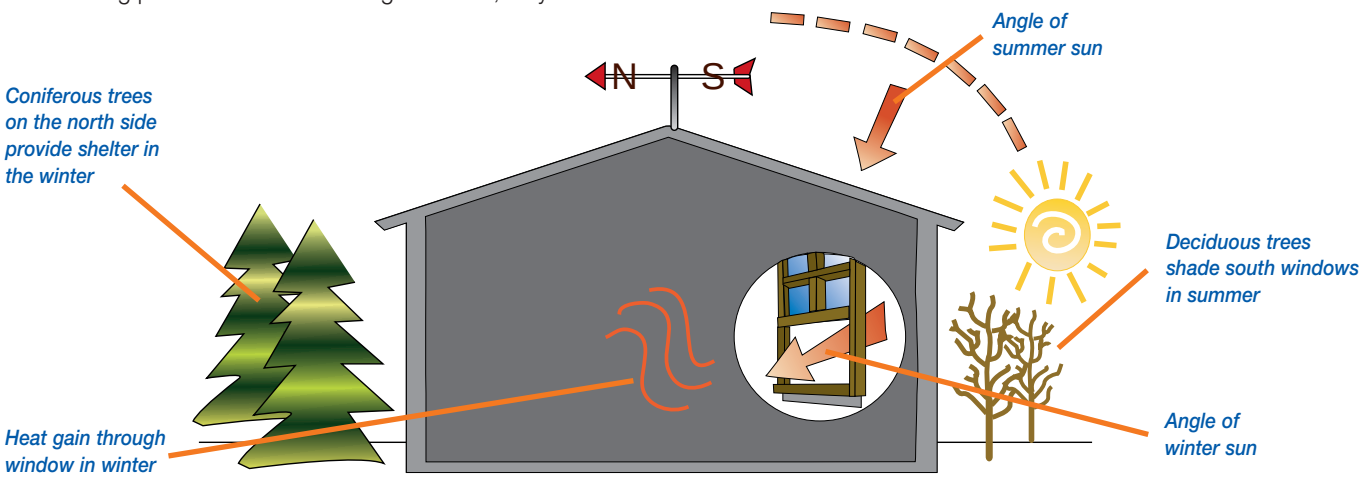
Solar energy

Like wood, solar energy is a renewable resource. Solar heating does not involve the combustion of fuels, so it does not produce environmentally-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.

BONUS: The Ontario government is offering residential consumers a sales tax rebate on the purchase of solar energy systems and components up to November 25, 2007. For details, check out www.trd.fin.gov.on.ca, or call 1-888-668-4636.

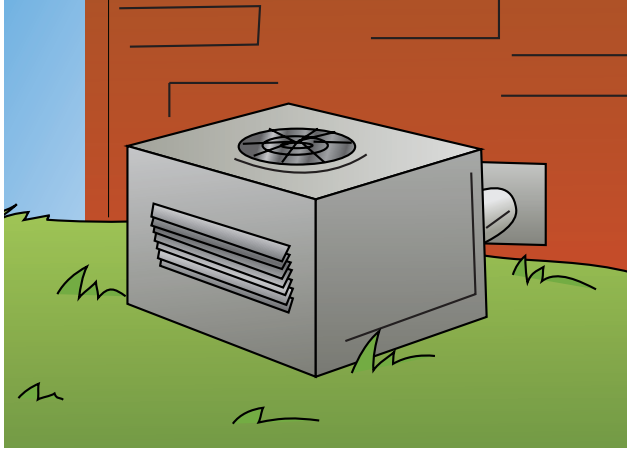
Other energy sources

Residential systems are available to generate electricity from sunlight or 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. Check the listings on page 24 for information on alternative energy choices.



CHAPTER 6

Cooling systems (air conditioning)

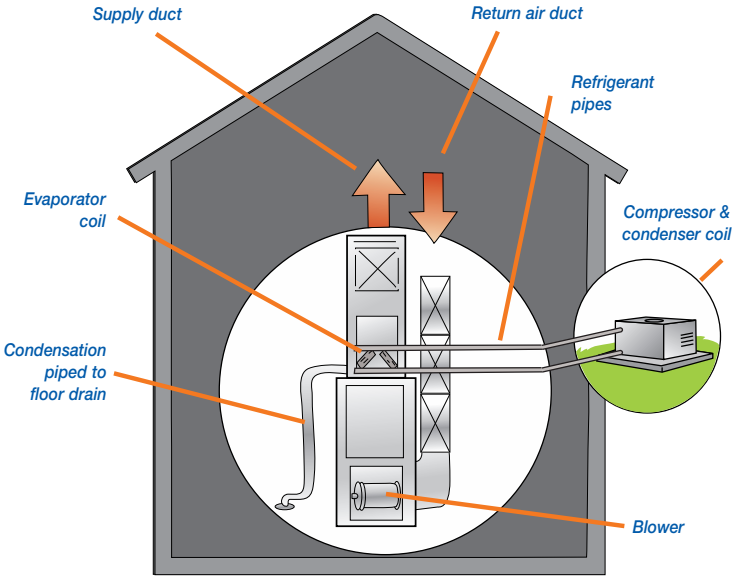


Two types of units cool an entire house: a central air conditioner or a heat pump. If you only need to cool a specific area, a window air conditioning unit could be your most energy-conserving choice. Regardless of what type you are considering, remember that models will vary in efficiency ratings and 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. Page 10 describes how a heat pump both heats and cools. An air conditioner is actually a heat pump that can only cool. Remember: your heating decisions can affect your cooling options.

Central Air Conditioner on a Forced Air System



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, as shown, 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. Also, remember the comments regarding distribution system placement and losses in Chapter 4.

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 frequently 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 only need to cool a specific area of your home – say, a bedroom or a kitchen. And 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.

Chapter 6 continues on page 17.

PULLOUT SECTION

Comparing energy costs

An important note about energy prices

Energy prices vary around the province and can change so you should always **determine your current local rates** to see if you should adjust the costs in the charts for your circumstances.

The energy costs listed in the charts here are based on the following prices, which except as noted for electricity, were valid as of January, 2004 and include GST.

Natural Gas	*44 cents/cubic metre**
Electricity	*10.1 cents/kilowatt-hour**
Oil	*60 cents/litre*
Propane	*63 cents/litre*
Wood	*$200/cord (one full cord = 4' x 4' x 8')†*

** The natural gas price is composed of an estimated 23 cents for the gas itself (which you can purchase from the utility or any licensed marketer) and an estimated 18 cents for the delivery services provided by the utility – rates which are regulated by the Ontario Energy Board + GST.*

The electricity price of 10.1 cents/kWh includes an electricity commodity cost of 5.5 cents/kWh and estimated regulated costs of 4.0 cents/kWh. + GST. This reflects announced charges effective April 1, 2004.

Both electricity and natural gas distributors have fixed monthly customer charges. The electricity price used for the charts does not incorporate this charge because you are most likely to be using electricity (and paying this charge) irrespective of what fuel you choose for heating and cooling. The natural gas price does incorporate this charge because you would likely not be a natural gas customer (and not incur this charge) if you do not use natural gas heating.

† For wood, the chart calculations are based on burning hardwood. Softwood is just as suitable for use as a fuel, but keep in mind that it takes about one and two-thirds cords of softwood to equal the energy content of one cord of hardwood.

TO USE THE CHARTS

Before you start

Remember to first consider making improvements to the shell of your house (caulking, weatherstripping, insulation, etc.). These measures can make your home more comfortable while reducing your energy costs, and you can do many of these tasks yourself.

Energy costs and savings are highly variable because of the range of conditions, extent of improvements and the costs of the fuel used. For example, the summer of 2002 was twice as hot, in terms of air conditioning load, as a "normal" or average summer. This would cause 2002 air conditioning energy consumption to be double the average on which the tables are based.

If you are building a new home, remember that an R-2000 certified house assures energy-efficient design and construction with built-in comfort. Every R-2000-certified house undergoes specific R-2000 Program-prescribed tests of certain efficiency and comfort-related components (after the components are installed).

Many of the options you may consider will involve weighing higher initial costs against lower energy consumption and cost, regardless of the specific energy source involved. If the choice is not clear for your circumstances, remember that energy costs are likely to rise over time, just like other costs, so the annual energy cost savings provided by the more efficient option are also likely to rise.

An important note about installed costs

While this booklet attempts to give some indication of the installed cost of the various options, each situation is unique and installation costs can vary considerably. Your decisions should be based on several quotes for the work you are considering.

Ontario

Also, the costs in the charts include an allowance for any typically required fuel lines or tanks and connections to an existing distribution system, but do NOT include the cost of the actual distribution system, as these too can vary widely depending on the size of the house and the amount of work required. You should obtain several quotations from different suppliers or contractors for each option you are considering; be sure the quotes include pricing for installation. The quoted wood costs in the charts are for a decorative stove and a factory-built chimney. Efficient fireplace costs are higher.

Maintenance costs

Maintenance needs and costs can vary significantly amongst the options you are considering and also can vary from one equipment supplier or fuel supplier to the next. When you get your quotes, also ask for quotes on standard maintenance packages and any extended warranty plans that are available. Consider these costs in arriving at a total annual operating cost.

Efficiency ratings used for calculating the charts

In most cases, the efficiency level used in calculating the charts is representative of the published ratings that are described in Chapter 12, Efficiency Ratings.

The published ratings cannot be used so directly in the case of earth energy systems because the field conditions for those systems operating in Ontario usually differ significantly from the fixed conditions used to establish the ratings. This, in turn, causes the average field operating efficiency for that equipment to differ significantly from the published ratings. The 2.8 COP (Coefficient of Performance) used for earth energy systems in the charts is based on estimates of average seasonal operating efficiencies for these systems in Ontario homes.

Fan energy

The methods used to determine the AFUE (Annual Fuel Utilization Efficiency) of fossil-fuelled equipment do not consider the electricity used by that equipment. This component is quite significant, so in the charts it is assumed that 900 kWh of electricity per year is used by that equipment. Models with much more efficient direct current variable speed motors – which use much less electricity – are available.

Step 1: Start here

You can use the charts in two ways to help you make the most cost-effective decisions possible when you upgrade or replace equipment or switch to another fuel:

1. You can find approximate costs by looking in the row of figures that relates to your house type. See **Method 1: Approximate Costs** as follows.
2. If you are able to determine your annual heating cost, you can use the charts to find a more accurate, comparative cost. Locate the figure that most closely matches your cost for your type of equipment, and then use that row to view an energy cost comparison. See **Method 2** as follows.

METHOD 1: APPROXIMATE COSTS

Choose the option which most closely resembles your property. (Square footage does not include the basement.)

Smaller house: Town or row house, inside unit, 1,000 square feet

Average house: Semi-detached or detached, 1,200 square feet

Larger house: Detached/older house, 1,500 - 2,000 square feet

A word about … calculations

Even though the costs you determine using Method 2 are more accurate than the costs you can find through Method 1, they are estimates only. That's because the charts are based on typical equipment efficiencies and approximate fuel rates at the time of printing. For greater accuracy, you should always confirm the efficiency of the equipment you are considering and the fuel rates charged by your supplier. Then you can fine-tune the annual energy costs in the charts to your own circumstances.

To use the charts with Method 1:

Using the row of figures for your house type, you can compare typical annual energy costs for a number of equipment options with the typical energy cost for your present equipment.

You can see, though, that this method can only give you approximate costs. Your annual heating bill might be higher or lower than the average given, and this will affect the amount of savings you can expect from new equipment. The level of insulation, caulking and weatherstripping in your home, as well as your lifestyle, all affect the bottom line.

Before you make any decisions, you need to determine the answers to the questions listed below in Step 2.

An example for Method 1 is on Page 16.

METHOD 2: MORE ACCURATE COSTS

For this method you must estimate your current annual heating costs. If you haven't kept your bills, call your fuel supplier for the information. Your bill most likely combines both space heating and hot water costs; to discover your true heating bill for the year, you must deduct your hot water costs.

If you have a gas or an oil furnace and water heater, use Chart 4 to find approximately how much money your family spends in a year on hot water, then deduct this from your total annual gas or oil bill to find your home heating energy cost.

If you have electric heat, your bill also includes lighting and appliance costs. Assume that 60 per cent of your annual electricity bill is for home heating.

To use the charts with Method 2:

Using the column for your current heating system in Chart 1 or 2, find the figure that comes closest to your annual heating cost. It might be in a row that relates to a different House Type than your home, but this row will be the most accurate for your house and lifestyle and this will be the row you use.

Now, using Chart 2 and remaining in the appropriate row, look across that row to see the operating costs of new equipment, which you will adjust as described in Step 3.

Don't forget to review the questions in Step 2: Ask Yourself… before you make any decisions.

An example for Method 2 is on page 16.

Step 2: Ask yourself...

- ❒ Am I interested in heating only, or do I want to check out heating and cooling options?
- ❒ What fuels are available in my area? (There's no point in checking out, for example, natural gas costs if your property is located in a remote area where natural gas is not available.)
- ❒ I'm renovating. What limits does my present heating system place on my choices? (For example, if there is no ductwork you would need to decide if it is practical or worthwhile to put in ductwork for forced-air heating.)
- ❒ I'm having a home built. Am I aware of all the options my builder can offer? Are there options I am interested in, such as heat pumps, that I should explore?
- ❒ How will I finance new equipment and installation?

Once you have considered these questions, you're ready to move on to Step 3: Determine Your Options (next page).

1 Annual heating costs for older systems (in $)

House Type	Electric Resistance 100% Efficiency	Natural Gas Furnace/Boiler 63% AFUE	Oil Furnace/Boiler 63% AFUE
Smaller	$1,030	$740	$930
Average	$2,060	$1,390	$1,770
Larger	$3,090	$2,030	$2,600

For an explanation of Efficiency and AFUE, see Chart 2, and read Chapter 12: Efficiency Ratin

2 Annual heating costs for newer systems (in $)

House Type	Electric Resistance 100% Efficiency	All Electric Heat Pump 6.0 HSPF	Earth Energy System 2.8 COP
Smaller	$1,030	$590	$370
Average	$2,060	$1,180	$740
Larger	$3,090	$1,770	$1,100
Installed Cost (Range in $)	$2,200-$2,700	$4,500-$6,000	$6,000-$12,000

COP: Coefficient Of Performance **AFUE:** Annual Fuel Utilization Efficiency **HSPF:** Heatin

3 Cooling costs for newer systems (in $)

House Type	Central Air Conditioner 10 SEER	All-Electric Heat Pump 10 SEER	Earth Energy System 11.5 EER
Smaller	$50	$50	$40
Average	$100	$100	$90
Larger	$150	$150	$130
Installed Cost (Range in $)	$1,600-$3,000	$4,000-$6,000	$6,000-$12,000

This chart shows an average cost during an average season (excluding atypical, i.e., extremely hot or humid conditions).

SEER: Seasonal Energy Efficiency Ratio. **EER:** Energy Efficiency Ratio. For an explanation of SEER and EER, please see the Cooling Equipment section of Chapter 12.

Propane Furnace/Boiler 63% AFUE
$1,470
$2,840
$4,210

gs, in the guide.

A word about…saving money

What if your heating bill is higher than you think it should be?

Perhaps you're spending more money on energy because your home isn't as energy-efficient as you can make it, or you're not practicing energy efficiency in your lifestyle.

Without changes in those areas, your energy bill will always be higher than it needs to be even if you install new, more efficient heating equipment. Perhaps it's time to start thinking the energy-wise way!

Natural Gas Furnace/Boiler 80% AFUE	Natural Gas Furnace/Boiler 93% AFUE	Oil Furnace/Boiler 83% AFUE	Propane Furnace/Boiler 80% AFUE	Propane Furnace/Boiler 93% AFUE	Wood Stove (conventional) 50% Efficiency	Wood Stove (advanced) 70% Efficiency
$600	$530	$750	$1,180	$1,030	$550	$420
$1,110	$970	$1,400	$2,260	$1,960	$1,010	$750
$1,620	$1,410	$2,060	$3,340	$2,880	$1,470	$1,080
$1,600-$2,700 (Furnace)	$2,700-$3,600 (Furnace)	$1,600-$2,500 (Furnace)	$3,000-$3,700 (Furnace)	$3,700-$4,600 (Furnace)	$2,400-$2,800	$2,600-$3,000
$3,500-$4,500 (Boiler)	$4,500-$5,500 (Boiler)	$3,500-$4,500 (Boiler)	$4,500-$5,500 (Boiler)	$5,500-$6,500 (Boiler)		

g Season Performance Factor For a more detailed explanation of these terms, please see Chapter 12: Efficiency Ratings in the guide.

4 Annual water heating costs (in $)

# People in Household	Earth Energy System 2.8 COP	Electric 0.89 Energy Factor	Natural Gas 0.57 Energy Factor	Oil 0.57 Energy Factor	Propane 0.57 Energy Factor	Solar with Electric Back-up
One	$90	$300	$180	$240	$390	$120
Two	$130	$400	$240	$330	$520	$160
Three	$170	$530	$330	$440	$690	$210
Four	$200	$630	$390	$520	$820	$250
Six	$260	$830	$510	$680	$1,080	$330
Installed Cost (Range in $)	$300-$500 (add-on to EES)	$300-$400	$400-$600	$600-$900	$500-$700 (not incl. fuel tank)	$2,500-$3,200
Monthly Rental	*not available	$4-$14	$8-$20	$9-$15	$4-$15	*not available

* "not available" means the equipment is not commercially available as a rental. **EF:** Energy Factor. **COP:** Coefficient of Performance.
For a fuller explanation of these terms, please see the Hot Water Equipment section of Chapter 12.

Step 3: Determine your options

Following are two examples that use the charts to calculate costs and identify options. All calculations are rounded to nearest $10.

METHOD 1: APPROXIMATE COSTS: HOUSEHOLD X

This two-person household lives in a 1,700-square-foot detached home that was built in the 1950s. It has a natural gas furnace and water heater. The furnace is old and needs to be replaced.

The householders have determined that they have a number of alternatives for replacing the furnace. They have decided that they will not install central air conditioning.

Using **Method 1**, the householders determine that their home fits the category listed as "Larger house."

They decide to use Chart 1, Annual Heating Costs for Older Systems, to find out what the annual heating energy bill should be for their type of home when it's heated by an older natural gas furnace. Looking down the column for Natural Gas Furnace or Boiler, 63% AFUE, the cost is estimated at $2,030 per year.

Next, they look at Chart 2, Annual Heating Costs for Newer Systems, to compare annual costs of several new heating options. Looking across the row of figures for the same category (Larger House) they see that the column for Natural Gas Furnace or Boiler with 93% AFUE will cost about $1,410 per year to operate, while a Natural Gas Furnace or Boiler with 80% AFUE will cost a little more at $1,620.

A Wood Stove, Advanced, with 70% Efficiency, would be cheaper, at $1,070. But, they have no space for wood storage. An Earth Energy System with 2.8 COP seems even cheaper at $1100, according to the chart, but they check the bottom row for "Installed Cost" and are aware that installation cost is high.

So Household X decides not to switch to another fuel. They decide to go with replacing the existing gas furnace with another, and with no changes to the gas piping.

They decide to get quotes for mid-efficiency and high-efficiency gas furnaces, plus the cost of installation, to see how the two actual installed costs compare.

NOTE: **Chart 1 shows examples of installation costs, but these vary widely. The examples on the chart are approximations only and are included to give you an idea of the differences in installation costs for the range of heating options. ALWAYS get quotes from at least three contractors/suppliers so you can compare price, service and warranties.**

METHOD 2: MORE ACCURATE COSTS: HOUSEHOLD Y

Household Y is a family of two adults and two children. They have a 2,500-square-foot, two-storey detached house built in 1980. It has electric baseboard heat and an electric water heater. The householders want to see if energy costs can be reduced by using a different heating system.

After reading this guide, the householders realize that switching to another fuel would require the installation of a distribution system (such as ductwork or radiators). And, they know that natural gas is not an option because it's not available in the area.

Their neighbours heat their home with wood at no cost for the wood because they own a woodlot, but Household Y decides that wood heating is not practical for their lifestyle. They also decide they won't install central air conditioning.

They decide to investigate two of the remaining options – propane and oil – as fuels, and forced air (ductwork) and hot water (radiators) as possible distribution systems.

They decide to use **Method 2** for their calculations. For Method 2: they look up their electricity bill for the past year, which totaled $4,800. Figure that 60 per cent of that cost is to provide heat, so the cost to heat their home is $2,880 ($4,800 x 60%).

Using the cost of $2,880 as the reference point, they look for that number in Chart 1, Annual Heating Costs for Older Systems. They find that their cost to heat with electricity is 7 per cent below the price listed in the chart for a Larger house ($3,090).

Next, they review Chart 2, Annual Heating Costs for Newer Systems, and look in the columns for the cost of four types of heating: Oil Furnace or Boiler 83% AFUE, Propane Furnace or Boiler 80% AFUE, Propane Furnace or Boiler 93% AFUE and Earth Energy System 2.8 COP. They check across the row for Larger house, and adjust appropriately.

Here's how the numbers work out for Household Y:

Heating System	Average Cost
Oil Furnace/Boiler, 83% AFUE:	*$2,060 - 7% = $1,920*
Propane Furnace/Boiler, 80% AFUE (mid efficiency):	*$3,340 - 7% = $3,110*
Propane Furnace/Boiler, 93% AFUE (high efficiency):	*$2,880 - 7% = $2,680*
Earth Energy System 2.8 COP:	*$1,100 - 7% = $1,020*

From this it appears that an earth energy system is the least expensive. But, what about installation costs? The householders find that this heating option, in their circumstances and among the four options they are exploring, is the most costly to install.

Because the installation of a distribution system can be highly variable, the householders decide to get firm quotations – including installation – for these possibilities:

- *an oil furnace with duct work*
- *an oil boiler with water pipes and radiators*
- *an earth energy system with duct work.*

They're careful to specify that they want the interior completely refinished where required after installation of the distribution system. They also specify that in the case of the earth energy system, the installation must comply with the CSA installation standard, and landscape repairs must be included in the cost.

The people in Household Y notice in Chart 4 that they could save money on water heating costs either by adding a solar system to their electric tank, switching to oil, or heating their water with an earth energy system. They decide to get prices for these options too.

With actual installed costs to weigh against the annual energy costs of the various options, the householders can then make a final choice for this important purchase.

A word about…fluorocarbon Refrigerants

Air conditioners (home and auto), heat pumps and most freezers and refrigerators rely on the compression and expansion of fluorocarbon refrigerants to produce their cooling effect. Remember, heat pumps are reversible air conditioners, so they use the same fluids.

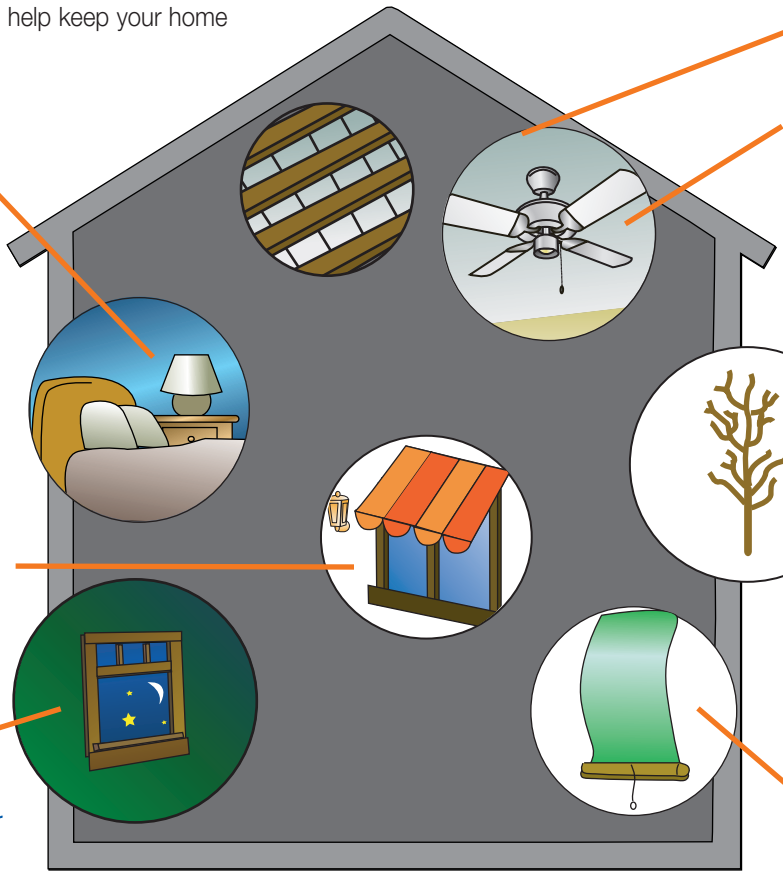
The refrigerants include CFCs (chlorofluorocarbons), HCFCs (hydrochlorofluorocarbons) and HFCs (hydrofluorocarbons). These substances can damage the environment if they leak or escape from air conditioners.

CFCs are a major contributor to the thinning of the ozone layer and are no longer produced in North America. HCFCs, while their effect is less drastic than those of CFCs, still contribute to the thinning of the ozone layer, and are being phased out. HFCs are not known to damage the ozone layer but are greenhouse gases which cause global warming.

It is illegal in Ontario to allow these chemicals to escape and damage the environment. By law, in Ontario only technicians holding a valid Ozone Depletion Prevention (ODP) card issued by the Ministry of the Environment may work with these refrigerants, including when refrigerant is added to or removed from any equipment. When any appliance or equipment containing such refrigerants is retired from service, the refrigerant must be properly removed by an ODP-card-holding technician.

Other Ways to Cool Your House

The following measures will help keep your home more comfortable:



Increase your home's insulation. It keeps out both heat and cold.

Install ceiling fans to circulate air.

Turn off lights and appliances when they are not in use.

If you're planning for the long term, plant trees that lose their leaves in the fall on the east, south and west side of your house.

Install awnings for patio doors and windows that face the sun.

Open windows in the evening and at night during the summer months.

Close the drapes or blinds on south and west-facing windows during sunny summer days to reduce heat gains.

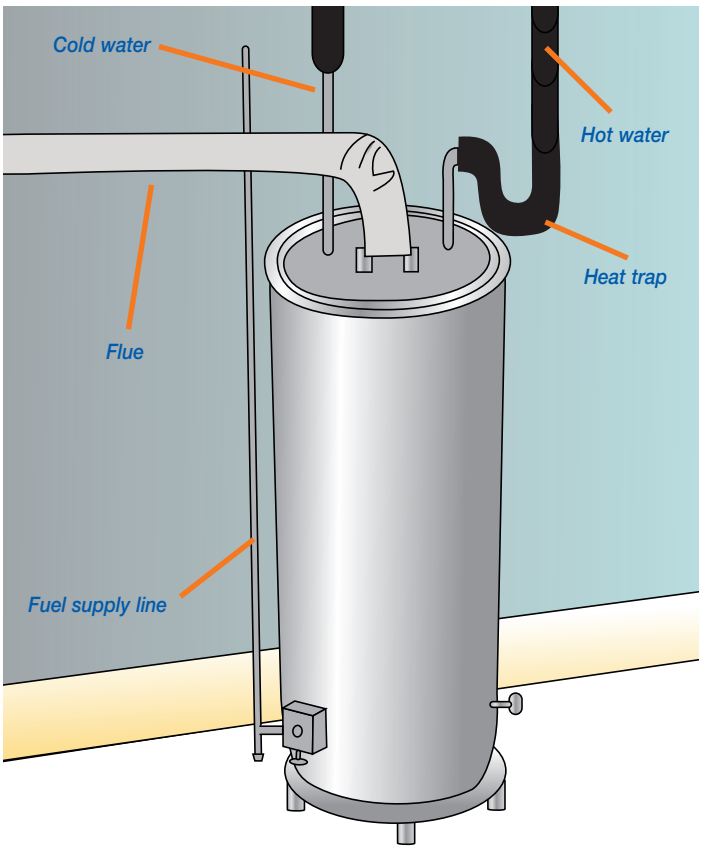
CHAPTER 7

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 and snow-melting applications. Combo systems vary widely in efficiency and must be carefully designed to give satisfactory service.

Solar water heaters

In 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 per cent of your hot water needs, with the back-up providing the balance.

BONUS: The Ontario government is offering residential consumers a sales tax rebate on the purchase of solar energy systems and components up to November 25, 2007. For details, check out www.trd.fin.gov.on.ca, or call 1-888-668-4636.

CHAPTER 8

Comparison shopping

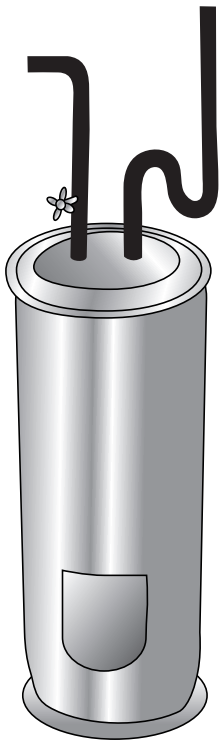
In this chapter, you'll see at-a-glance tables that summarize the advantages and disadvantages of the different kinds of widely available energy sources and distribution systems for heating (not including fuel costs, which are dealt with in the charts in the pull-out section on pages 13-15). There is also a table comparing the different cooling systems and another for hot water heaters.

HEATING SYSTEMS COMPARISON

POSSIBLE ADVANTAGES	POSSIBLE DISADVANTAGES
FORCED AIR	
• Rapid heat delivery • Compatible with central cooling, air cleaning, ventilation and humidity control • Circulates air to each room	o Duct work expensive as a retrofit o Space required for duct work
HYDRONIC (Hot Water)	
• Boiler more compact than forced air furnace • Temperature can be regulated from room to room • Can provide hot water	o May have higher installed costs o No duct work for central air cooling
SPACE HEATERS	
• Available in a range of models and sizes and choice of fuels • Convenient for homes with no basement or for heating home additions • Moderate installed cost • Can provide room to room (zoned) temperature control	o Will likely require more than one unit to heat house o Space heaters not currently regulated for efficiency o No duct work for central cooling

ENERGY SOURCE COMPARISON

POSSIBLE ADVANTAGES	POSSIBLE DISADVANTAGES
NATURAL GAS	
• No fuel storage facilities needed	o Not available in all areas o Venting required
PROPANE	
• Wide range of products available	o Storage facilities needed for fuel o Venting required
OIL	
• Some older units can be upgraded by replacing the burner	o Space needed for a fuel storage tank o Venting required
WOOD	
• Renewable resource • Can be cost-effective where low-cost wood is available • Aesthetically pleasing • Back-up heating	o Storage area needed for fuel o Supplementary heating may be required o Requires effort and knowledge o Venting required
ELECTRICITY	
• No venting needed since there is no combustion • Compact heating units • No fuel storage facilities needed	o Likely requires 200-amp electrical service
AIR SOURCE HEAT PUMPS	
• Lower operating cost than electric resistance heat • Also provides cooling	o Requires auxiliary heating source during coldest weather o More expensive to purchase than central cooling o Noise may disturb neighbours, depending on model and location
EARTH ENERGY SYSTEMS (Ground Source Heat Pumps)	
• Most efficient system • Low operating costs • Can provide hot water • Also provides cooling	o Typically, highest installed costs o Supplementary heating usually needed for extreme temperatures o Requires a suitable site for ground or water loop

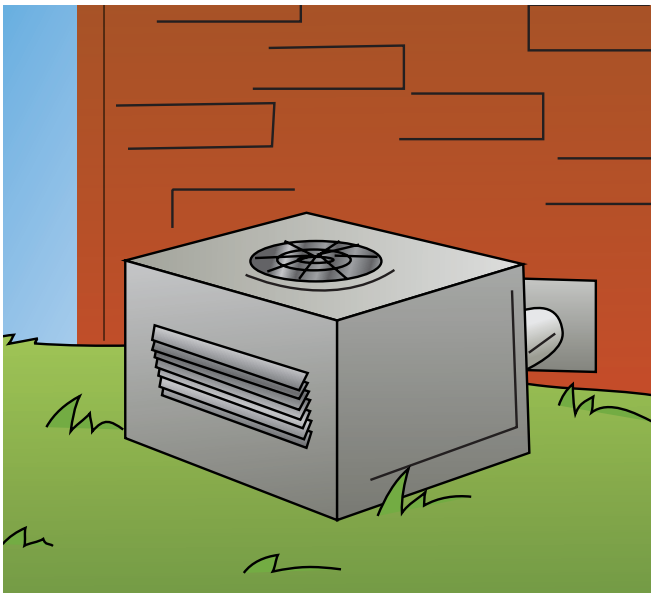


HOT WATER HEATERS COMPARISON

POSSIBLE ADVANTAGES	POSSIBLE DISADVANTAGES
ELECTRIC	
• No venting needed because there is no combustion • Tank can be located almost anywhere	o Slower recovery time
EARTH ENERGY SYSTEM	
• Low operating cost	o Only practical where earth energy system is used for heating
NATURAL GAS	
• Faster recovery time than electric	o Natural gas not available in all areas o Venting required
PROPANE	
• Faster recovery time than electric • Equipment may be convertible to natural gas	o Venting required
OIL	
• Fastest recovery time • Smaller tank	o Higher equipment costs o Venting required
SOLAR	
• Renewable energy source • No-cost fuel	o Requires back-up with conventional fuel o High equipment costs
INTEGRATED HOT WATER SYSTEMS	
• Only one system to purchase and maintain for both home and water heating • May provide higher water heating efficiency	o A breakdown may disable both home and water heating

COOLING SYSTEMS COMPARISON

POSSIBLE ADVANTAGES	POSSIBLE DISADVANTAGES
ROOM AIR CONDITIONING	
• Duct work not required • Can target the area to be cooled • Low installed cost • Portable	o Limited cooling o Obstructs window o Will likely increase interior noise level (will vary with model) o Must be removed or covered in winter to minimize heat loss
CENTRAL AIR CONDITIONING	
• Easily added to forced air system to cool and de-humidify whole house	o Duct work expensive as a retrofit o Noise might disturb neighbours, depending on model and location o More expensive than room air conditioners
HEAT PUMP	
• Also provides heating	o Higher installed costs than central air conditioning o Noise might disturb neighbours, depending on model and location
CEILING FAN	
• Low operating costs • Low installed cost	o No dehumidification o No air cooling (occupants cooled by contact with moving air)



CHAPTER 9

Replacing your system

You've looked at all your options, considered the pros and cons of different equipment and fuels, and compared installation and operating costs in the energy charts and tables provided elsewhere in this guide. Now you're ready to improve on your existing system, and it's time to select a contractor. Here are some tips:

1. Look for a registered contractor

Your contractor will supply and install your equipment. Installation of fossil-fuelled appliances must be performed by a contractor who is registered with the Technical Standards and Safety Authority (previously the Fuels Safety Branch of the Ontario Ministry of Consumer and Business Services). 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 must be inspected by the Electrical Safety Authority. For earth energy systems, insist on compliance with the Canadian Standards Association C448 design and installation standard and with all environmental regulations.

In the case of wood heating systems, look for registration with the Association of Wood Energy Technicians of Ontario.

2. 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*
- ✔ *Heat loss/gain analysis (see "Choose the right size equipment" on the next page)*
- ✔ *The size and seasonal efficiency of the unit, and sound ratings if applicable*
- ✔ *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 necessary inspections*
- ✔ *A work schedule and completion date*
- ✔ *Guarantees, warranties and service contracts*
- ✔ *Terms of payment*
- ✔ *Evidence of registration with the Technical Standards and Safety Authority, the Association of Wood Energy Technicians of Ontario (the ODP card) and/or an electrician's licence as appropriate*

3. Make your selection

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 options you are considering.

4. 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. (See Chapter 2, Before you start, page 3.)

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.

If you are installing an air source heat pump, keep in mind that Ontario homes have heavier heating than cooling demands. The rule is to size the heat pump based on cooling rather than heating needs so that it isn't oversized for the cooling job it has to do.

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 "down-sized" 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 practising 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.

Chart 4 on page 15, annual water heating costs, shows typical costs for water heating using the various categories of equipment that are commonly available.

Steps to installing a hot water tank

1. Contact your local fuel supplier or contractor

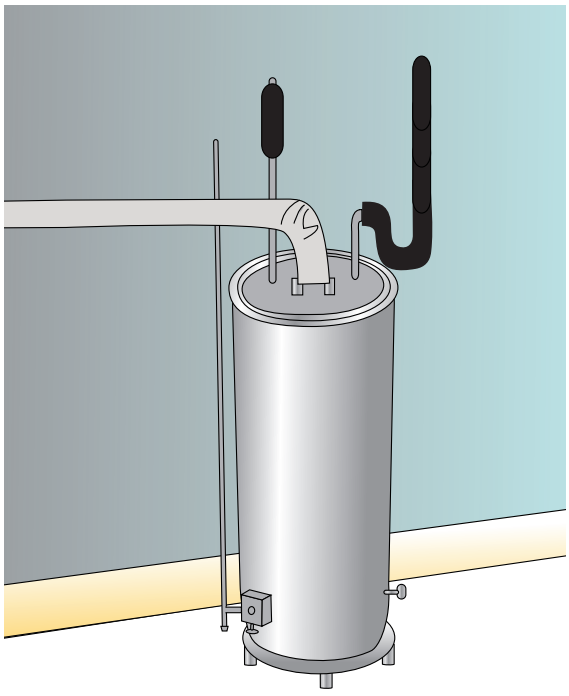
Ask for the efficiency ratings of the models you are considering (see Chapter 12, Efficiency Ratings, page 28). When you have selected a unit just big enough to meet your household needs, your fuel supplier or contractor can arrange for a qualified serviceperson to install the water heater.

2. Save on your hot water bill

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 within two metres of the tank and consider installing a heat trap (see diagram on page 18). Be careful not to insulate the pipes within 15 cm of the flue of a fossil-fuelled 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.



CHAPTER 10

Advice and information

Often the most difficult part of any project is getting started – knowing where to get advice and information. Here are a few suggestions for sources. Don't forget your local public library, the Internet and home improvement centres as information sources.

Energy conservation and efficiency

For information about Ontario's *Energy Efficiency Act* or to receive a copy of 'Conserve Energy and Save Money', contact:

Ontario Ministry of Energy

Call toll-free: 1-888-668-4636

Internet: www.energy.gov.on.ca

Natural Resources Canada is a federal government department that offers a variety of free publications on home energy conservation and efficiency. Contact:

Energy Publications
Office of Energy Efficiency
c/o DLS
Ottawa ON K1A 0S7

Telephone in Ottawa: 613-995-2943
Toll-free: 1-800-387-2000
Fax: 819-794-1498
Internet: www.oee.nrcan.gc.ca

Information about EnerGuide and ENERGY STAR® is also available through the above address, web address or phone numbers.

The 20/20 Planner with many practical, and in many cases low or no cost, suggestions on how you can reduce energy consumption (and the related emissions) both at home and on the road, is available from Toronto Public Health by visiting **http://www.toronto.ca/health/2020/**

Those in the Greater Toronto Area can obtain a printed copy by calling 416-392-2020 or 1-866-583-2020.
If you have Internet access, a search of "energy saving tips" will produce many different sources of information.

Energy sources and fuels

For information on energy/fuel options, you can check out the following sources.

For ELECTRICITY:

Contact your local electricity distributor. For information about electricity distributors, call or visit the website of the

Ontario Energy Board

Telephone: 1-877-632-2727
Internet: www.oeb.gov.on.ca

For ENVIRONMENTAL ISSUES:

For information about protection of the environment and environmentally sustainable use of our water, land and energy, contact:

Ontario Ministry of the Environment (MOE)

Telephone: 1-800-565-4923
Or
the Public Information Centre, MOE
135 St. Clair Avenue West, 1st floor
Toronto ON M4V 1P5
Or
check the Blue Pages for a local office listing
Internet: www.ene.gov.on.ca

For EARTH ENERGY SYSTEMS:

Contact:

Earth Energy Society of Canada

Suite 504, 124 O'Connor,
Ottawa ON K1P 5M9
Telephone: (613) 371-3372
Fax: (613) 822-4987
E-mail: eggertson@earthenergy.ca

For NATURAL GAS:

Contact your local natural gas distributor. A list of licensed natural gas marketers is available from the

Ontario Energy Board

Telephone: 1-877-632-2727
Internet: www.oeb.gov.on.ca

For PROPANE:

Contact your local propane dealer or:

Ontario Propane Association

1155 North Service Road West, Unit 11
Oakville ON L6M 3E3
Telephone: 905-469-1941
Fax: 905-469-1942
Internet: www.propane.ca
E-Mail: opa@propane.ca

For OIL:

Contact your local heating oil supplier or:

Canadian Oil Heat Association

115 Apple Creek Blvd. Suite 202
Markham ON L3R 6C9
Telephone: 905-946-0264

For RENEWABLE ENERGY AND SUSTAINABLE ENERGY, including SOLAR, WIND, SMALL HYDRO, BIOMASS and more, visit:

The Independant Power Producers' Society of Ontario
Internet: www.newenergy.org

Natural Resources Canada
Energy Resources Branch

580 Booth Street, 17th Floor
Ottawa ON K1A 0E4
Fax: (613) 995-0087
Internet: http://www2.nrcan.gc.ca/es/erb

Solar Energy Society of Canada Inc.

P.O. Box 33047
Cathedral P.O.
Regina SK, S4T 7X2
Internet: www.solarenergysociety.ca
E-mail: info@solarenergysociety.ca

Canadian Wind Energy Association

3553 31 Street NW Suite 100
Calgary AB T2L 2K7
Telephone: 1-800-9-CANWEA (1-800-922-6932)
Fax: 403-282-1238
Internet: www.canwea.ca
E-mail: canwea@canwea.ca

For WOOD:

Check the Yellow Pages under Firewood. For information on cutting your own firewood, contact your local Ontario Ministry of Natural Resources office, as listed in the Blue Pages of your telephone book. For information about heating with wood, contact Natural Resources Canada's Energy Publications, listed under Publications (see above addresses), and/or visit **www.woodheat.org**

Home air quality

For information on air contaminants in the home contact:

Canadian Housing Information Centre

700 Montreal Road
Ottawa ON K1A 0P7
Telephone: 1-613-748-2367
Fax: 613-748-4069
Internet: www.cmhc-schl.gc.ca
Email: chic@cmhc-schl.gc.ca

Home heating safety

For information on the use of natural gas, oil or propane, contact your local fuel supplier or:

Technical Standards and Safety Authority

3300 Bloor Street West
Clarica Centre West Tower 4th floor
Etobicoke ON M8X 2X4
Telephone: 416-325-2000

For electrical safety and inspection information, contact your electricity distributor or call your local Electrical Safety Authority office. The Electrical Safety Authority website at **www.esainspection.net** has local office phone numbers and further information.

For information on wood safety, contact your municipal building or fire department, or a WETT certified retailer, installer or chimney sweep. For further information, contact:

Wood Energy Technology Transfer (WETT) Inc.

365 Bloor Street East, Suite 1807
Toronto ON M4W 3L4
Telephone: 416-968-7718 (1-888-358-9388)
Fax: 416-968-6818
Internet: www.wettinc.ca
Email: info@wettinc.ca

CHAPTER 11

Glossary of terms

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

A

AIR SOURCE HEAT PUMP

A heating-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.

AFUE (annual fuel utilization efficiency)

See Chapter 12, Efficiency ratings, for more information.

AQUASTAT

A thermostat that controls the water temperature in a boiler.

BOILER

The heating unit used with a hot water (hydronic) distribution system.

BTU/h (British Thermal Units per hour)

A unit used to measure the heating capacity of heating equipment.

CENTRAL AIR CONDITIONER

A unit that cools an entire house by removing heat from the inside air and releasing it outside.

COP (coefficiency of performance)

See Chapter 12, Efficiency ratings, for more information.

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 per cent. 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.

COMBINATION HEATING SYSTEM

See Integrated (Combo) Systems.

HOT WATER DISTRIBUTION SYSTEM

See Hydronic System.

DISTRIBUTION SYSTEM

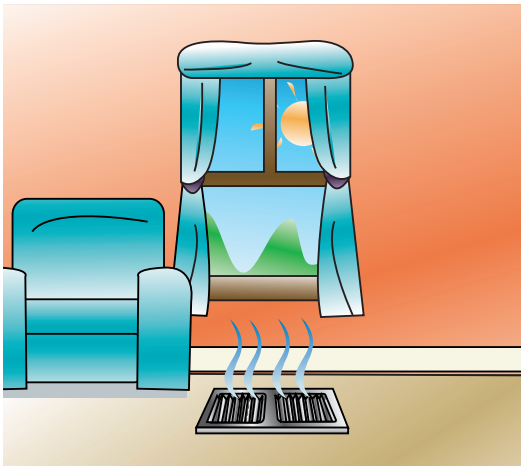
The components of a heating or cooling system that deliver warmed or cooled air, or warmed water, to the living space.

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 ground water 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.

EER (energy efficiency ratio)

See Chapter 12, Efficiency ratings, for more information.

EF (energy factor)

See Chapter 12, Efficiency ratings, for more information.

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 preheated.

HSPF (heating seasonal performance factor)

See Chapter 12, Efficiency ratings, for more information.

HIGH-EFFICIENCY (condensing) FURNACE OR BOILER

A heating unit with an annual fuel utilization efficiency (AFUE) of 90 per cent or more. It has a second stainless steel heat exchanger that removes additional heat from exhaust gases. Water vapour condenses as the exhaust cools. The unit vents through a narrow plastic wall pipe instead of a chimney.

HOT WATER DISTRIBUTION

See Hydronic System below.

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 per cent. Some models exhaust through the basement wall.

NEW OIL FURNACE

Efficiencies (AFUE) range from 78 to 86 per cent. 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. If a home meets all the requirements of the program, including an actual test of the house after it is built, it is certified as meeting the standard.

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.
See also Chapter 12, Efficiency ratings, for more details.

SEER
(seasonal energy efficiency ratio)

See Chapter 12, Efficiency ratings, for more details.

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.

STEADY-STATE EFFICIENCY

See Chapter 12, Efficiency ratings, for more information.

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. One ton equals 12,000 BTU/h. (These are Imperial measurements.)

WATT

See Kilowatt.

CHAPTER 12

Efficiency ratings:

AFUE, COP, HSPF, SEER & EER

Before you use the energy charts, take a few moments to familiarize yourself with the efficiency ratings you'll find on various pieces of equipment.

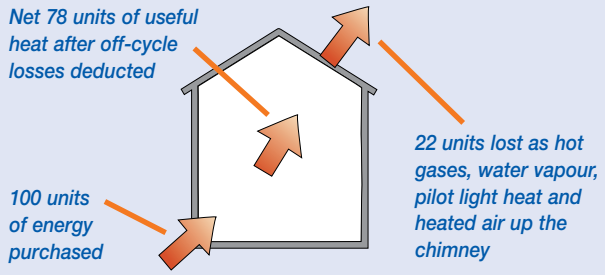
Boilers and furnaces

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 like 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.

An example of 78 per cent AFUE:



$$\text{Annual fuel utilization efficiency (AFUE)} = \frac{\text{Amount of heat reaching the house during operation} - \text{Heat loss during off cycle}}{\text{Amount of heat available in fuel}}$$

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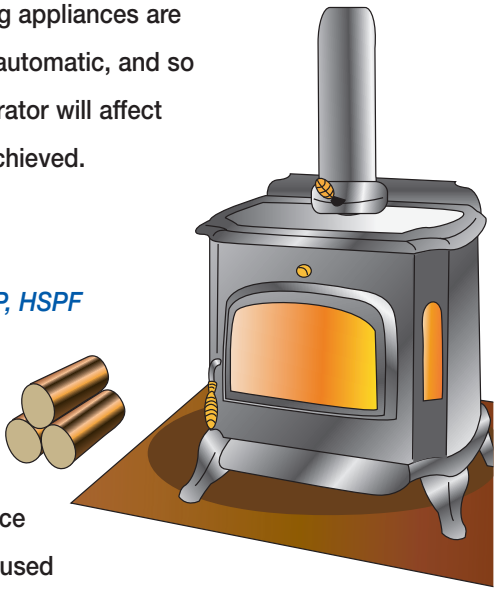
It measures the equipment's performance after it has been running a short while and all components have reached their normal operating temperature. The steady-state efficiency of furnaces and boilers is determined by comparing the amount of heat that's available in the fuel to the amount that is converted 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 standard normally exceeds 60 per cent and averages 70 per cent efficiency. Conventional wood-burning appliances which are not certified as low emission average 50 per cent efficiency, with a range of 35 - 70 per cent. Although some wood-burning equipment is specifically certified for efficiency, most is not.

Also, most wood-burning appliances are manually operated, not automatic, and 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 called the **coefficient of performance – 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 (using a standard condition of 10˚C for the 'entering water' temperature).

The heating efficiency rating for an air source heat pump is called the **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. The minimum requirement in Ontario is 10. 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 BTU/hour) by the power input (in watts). Look for an EER of at least 10.5.

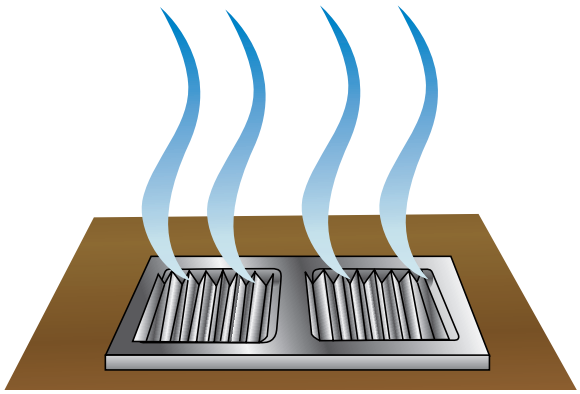
Hot water equipment

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 the following energy factor ranges for new storage-type water heaters:

- *Gas 0.56 to 0.86*
- *Electric 0.87 to 0.98*
- *Oil 0.53 to .68*

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



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