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FOREWORD

This manual was published by the Association provinciale des constructeurs d’habitations du Québec (APCHQ).

With more than 12,000 members, the APCHQ plays a prominent role in the residential construction and renovation industries.

Its mission is to promote the professionalism of its members and represent their interests so they can pursue their activities while meeting consumer expectations.

The APCHQ is well aware that consumers are keen to use eco-friendly products and appliances and, with this in mind, strongly recommends that its members take the time to explain the advantages of the new “green” products that are now available on the market – and to make sure that the clients’ expectations are indeed realistic.

Obviously, the choices presented here are only for general information. There are many other interesting options and solutions that may be implemented by contractors depending on the project and the region.
INTRODUCTION

What is a green building? That was the critical question confronting the APCHQ when the time came to devise a tool that builders could use to offer a range of eco-friendly options to new home buyers who are increasingly aware of environmental issues.

It is not an easy question to answer. If you polled several people on the issue, you would probably get as many individual responses and “shades of green” as specific requirements. How can one strike a balance between green building, consumer needs and affordability?

In the first place, to find a solution, one must look at the building, not as a whole, but as an assemblage of components, each of which could be individually improved. The components currently in use in building construction must be studied to determine which construction methods can produce more eco-friendly results. The next step is to look for practical solutions, choose appropriate materials and estimate costs.

By proceeding in this manner, the APCHQ has been able to define a number of choices that builders may offer their clients, choices that are easier to define and cost out. This makes it simpler for consumers to choose how much of the budget they want to allocate to these items.

Building healthier homes is an important starting point in protecting the environment. The industry has shown increasing interest in all aspects of green building techniques and should be ready to offer products and services that are adapted to the real needs of consumers and take into account both their environmental concerns and their budget.

With this in mind, the APCHQ has put together. The Guide to Green Choices*, a reference manual based on consumer expectations and on the various options available to builders. The influence of home builders on sustainable, eco-friendly development will continue to increase as “green” choices become more accessible and better adapted to the needs of the target clientele.
Building materials should be chosen for reasons related to health and the environment. The choices below are grouped under four environmental indicators to help identify the benefits of each.

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CHOICE GUIDE

Summary Diagram
These days we keep hearing the phrase “sustainable development”, but what does it really mean? Here is the definition suggested by the World Commission on Environment and Development in 1987 in a report entitled “Our Common Future”.

“Sustainable development is a type of development that aims to ensure the well-being of current generations without compromising that of future generations.” In other words, all humans have equal rights to the use of the Earth’s resources, but also equal responsibility in ensuring their conservation for future generations.

Sustainable development involves three main elements: economic, social and environmental. Integrating these into our daily activities is one way for an individual or a community to contribute to sustainable development.

The economic aspect concerns the fight against poverty, supporting fair trade, changes in production processes and modifying consumer spending habits. The social aspect includes access to health and educational services, improved living conditions, reducing world hunger and child exploitation. The environmental aspect looks at reducing pollutants, fighting deforestation, protecting biodiversity and promoting renewable energy sources.

Even the littlest things can help ensure sustainable development. Many of these small efforts are related to leading our daily lives at home. The purpose of this manual is to make the reader aware of this reality and to help him or her make good, solid, “sustainable” decisions.
SUSTAINABLE CHOICES FOR HOUSING

Pollution, climate change and the depletion of natural resources are some of the many indicators proving that our well-being, our health and the health of future generations are threatened. Every single individual must be made aware that his or her behaviour may have a deleterious effect on the environment.

The residential sector contributes to environmental problems at every stage in the life cycle of a building. That is why even the choice of building materials must take into account criteria affecting health and the environment. Each of these criteria, called indicators in this guide, corresponds to sustainable choices that can help make a greener home.

Water consumption, energy efficiency, air quality and GHG reduction (greenhouse gases), and, finally, sustainable homes and recycling are the four indicators used to determine how a given construction material impacts the environment.
A reduction in the amount of water used in the home can significantly reduce the impact we have on the environment. This water savings effort in turn reduces the costs inherent in municipal water treatment operations and results in lower water and electric bills (hot water). Before we suggest ways to reduce your water consumption, we should look at the ways water is used.

**Household Use**

An average home consumes 329 litres per person per day, 35% of which is used for baths and showers, 30% for toilets, 25% for laundry and cleaning and 10% for cooking and food preparation. For comparison purposes, the average in Europe is 200 litres per person.

When a water meter is used for measuring and billing water consumption, the daily average consumption is 266 litres; when water is billed at a flat rate, it reaches 467 litres (statistics for 2004).

**The Numbers**

The toilet bowl is the worst offender in water consumption, at 15 to 19 litres per flush. A five-minute shower uses 100 litres; a bath, 60 litres; washing hands, 8 litres; brushing teeth, 10 litres; watering the lawn, 35 litres per minute; the dishwasher, 40 litres; and the washing machine, 225 litres.

<table>
<thead>
<tr>
<th>TYPE</th>
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<tbody>
<tr>
<td>Flush</td>
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<tr>
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<tr>
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<td>225 L</td>
</tr>
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</table>

Source – Environment Canada
Water Consumption

Toilets

Before 1980, toilets commonly used up to 20 litres of water. 13-litre toilets appeared at the beginning of the 90s. Today, we have low-flow toilets that function on only 6 litres of water. This decrease in water use can reduce water consumption by 50 % to 70 %.

Two major factors affect the quantity of water saved: volume and frequency. On average, a family of four uses 400 litres per day just for the toilet. Replacing 13-litre toilets with 6-litre models can save from 200 to 280 litres of water per day.

Double flush toilets are now available on the market. These are even more interesting, as they allow the user to choose either a 6-litre flush or a 3-litre flush. This increases the water saving by another 25 %.

In 2005, Statistics Canada reported that 41 % of Canadian households were using water-saving toilets, as compared to only 15 % in 1994.

Sources – CMHC – Statistics Canada
**Low-Flow Shower Head**

Traditional shower heads use 14 litres of water per minute, some as much as 20 litres. Water flows through eco-friendly low-flow shower heads at around 5 litres per minute, and some models can be adjusted to levels between 3.8 and 9.5 litres per minute.

Most models effectively reduce water and energy consumption with no corresponding drop in water pressure. It is possible to save around 15 % of water heating costs and 30 % of water consumption in the shower.

Additional savings can be realized if the shower head is equipped with an on/off valve that can stop the water temporarily while soaping up or shampooing hair. When ready to rinse, turning the valve back to the “on” position restarts the water at the same temperature and flow rate as before.

An average four-person family uses 460 litres of water per day. If they install a 9.5-litre shower head, they can save 150 litres per day, that is no less than 55,000 litres per year. With a 5-litre shower head, the saving is almost double, 275 litres, for an astounding 100,000 litres per year!

In 2005, Statistics Canada reported that 60 % of Canadian households declared that they were using a low-flow shower head, as compared to only 42 % in 1994.

People who have wells and septic tanks will also economize on electricity, as the pumps will not run as much.

Source – OEE Natural Resources Canada
Electronic or Proximity Sensor Faucet

Electronic faucets were first installed in commercial areas for reasons of hygiene and water conservation. They are now being used in residential construction.

An electronic faucet is equipped with a motion sensor that turns the water on automatically. This makes it easier to prepare meals and stay clean and, unquestionably, saves both water and energy.

These taps come with a number of features: the user can control the cold and hot water flow each time, ensure that the temperature and flow remain constant, let the water run for a set time after hands have been removed, differentiate between moving and non-moving objects, etc.

Some are more versatile and can be activated either manually or automatically by the sensor. Their electricity can be supplied through the home’s circuitry or come from batteries that can last up to a year, depending on use.

Using electronic faucets, water used during hand washing with the tap on could be reduced to only 5 litres instead of 8, and for brushing teeth, 3 litres instead of 10. In this way, a family of four using 200 litres per day could reduce their water consumption by half, saving 35,000 litres per year!
Water Consumption

Rainwater Harvesting

Rainwater is harvested by collecting it in cisterns or barrels so that it can be reused for watering lawns and gardens or for washing the car. Why should drinking water be used in situations where there is no need to use filtered water?

Installing a rainwater catchment system is a win-win situation for the community. It reduces the amount of water pumped out of the aquifer, it reduces pollution caused by chemical products used in water treatment plants, it saves energy because the water is not treated and perfectly clean water is returned to the environment.

The harvesting system is quite simple. Water flows through the eaves troughs on the house and drains into a container designed for this purpose. An overflow device is installed to deal with draining off excess water, either from the eaves troughs or through a bypass mechanism installed on the water reservoir.

The general population is more and more attuned to this type of procedure. According to Statistics Canada, as early as 2005, 14 % of Canadian households were using a water catchment device such as a barrel or a cistern and 24 % were watering their gardens using timed watering systems.

Rinsing your car with rainwater leaves no white spots.
Grey Water Recycling

Grey water is water that has been used for the bath, the shower or the washing machine. It is possible to install a water treatment system that recycles this water for flushing toilets. The water treatment system collects grey water and directs it through piping that is independent of the toilet plumbing towards a reservoir in which the grey water is filtered and disinfected. The water is then directed towards the toilets through pipes used only for this purpose.

In order to avoid contamination of drinking water, a cross-connection with a backflow valve system must be installed between the potable water pipes and the grey water pipes. Since the system is designed to contain a given volume of water, two potentially harmful situations may occur: too much or too little water. In the first case, the excess is directed towards the sewage system. In the second, the connection with the potable water ensures that a minimum volume of water is maintained in the system to prevent it from running dry.

Since the toilet in the average residence is responsible for 30% of the home’s water consumption, an equal quantity of water could be saved. Considering that a typical tank contains 200 litres, a family of four using 400 litres of water per day for flushing the toilets would, of course, have to spread their showers and baths out over the day to ensure that the reservoir remains full. The best-case scenario for saving 400 litres per day would result in a total annual saving of 146,000 litres of water – enough to fill a fair-sized swimming pool!

On average, Canadians use 329 litres of water per person per day, 30% of which is used to flush toilets.
Conseiller Rénoclimat à vos clients, c’est améliorer vos services. Aidez vos clients à améliorer leur confort, à diminuer leur facture d’énergie et à augmenter la valeur de révente de leur résidence.

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Energy, like water, is closely associated with the comfort level provided in the home. It is used in a multitude of ways: for lighting, air conditioning, heating, hot water, operating electronic devices and household appliances. Because we consume a great deal of energy, we have a significant effect on the environment.

It is a fact that heating and air conditioning generate large quantities of greenhouse gases. The greenhouse effect is explained in the section entitled “Air Quality and Reducing GHG”. There are several different methods that can be employed to reduce harmful emissions while making substantial savings.

There are many different levels of intervention, from simply using a less-energy-consuming light bulb to installing a solar energy system. Three categories of actions can be taken into consideration: 1) making relatively simple additions such as compact fluorescent lights or electronic thermostats; 2) building in, from the start, elements that improve the home’s energy performance such as high quality insulation or better windows; 3) using renewable energy sources such as solar or geothermal.

One thing is certain. Whether you choose to apply one or more of these options, it can only have a positive effect on the environment.
Electronic Thermostat

Electronic thermostats maintain a much more uniform temperature in the home than conventional bimetallic or mechanical thermostats. They also make it possible to save up to 10% of heating costs.

Conventional thermostats function on a simple mechanical reaction between the apparatus and the room temperature. This is not an efficient control method, because it allows the room temperature to fluctuate ± 2 °C from the set temperature, a range of as much as 4 °C.

Electronic thermostats are equipped with a sensor which is operational at all times and reacts to the least change in room temperature. With variations of only plus or minus 0.5 °C, the temperature is much more stable, as the mean difference is never greater than 1 °C. This variation is illustrated in the drawing shown below.

Even greater energy savings can be realized with a programmable thermostat if the device is set so that it automatically lowers the temperature during the night and during periods when there is no one in the home. As an example, lowering the temperature by 3 °C over an 8-hour night reduces heating costs by 4.5 %: a tiny adjustment that results in significant savings.
**Lighting Products**

It is easy to substitute compact fluorescent bulbs for ordinary incandescent ones because they fit into the same standard socket. The illumination they produce is very similar to that of a traditional bulb and quite different, in spite of what some may say, from the cold white light emitted by fluorescent fixtures in some commercial establishments.

Compact fluorescents can last as much as ten times longer than standard incandescent bulbs, up to 5 to 6 years, as compared to 6 months for the older style. Their life span varies with the number of on/off cycles. That is why they are not recommended for rooms and areas like halls and bathrooms that are used frequently for short periods of time. Considering that it takes them a few minutes to reach their optimum brilliance, it is better to use them in areas like the kitchen and living room where people stay for longer periods.

Compact fluorescent bulbs cost more to buy, but their life span makes them a good investment. They also consume up to 75% less energy to produce the same amount of light. A 23-watt compact fluorescent, for example, provides as much illumination as a 100-watt incandescent.

Light bulbs of this type come in a number of different shapes and sizes to suit most applications: the “normal” bulb shape, helical, candle, floodlight or globe. Some models can be used with a dimmer switch.

From an environmental point of view, these bulbs are considered hazardous waste because they contain traces of mercury. There is not enough for it to be a health hazard, but some precautions need to be taken when disposing of them. This is why recycling services have been set up with the retailers.
ENERGY STAR Windows

In the last few years, the ENERGY STAR symbol has been appearing on appliances and products that meet certain technical criteria. It certifies that these products are among the most energy-efficient on the market. This symbol was created in 1992 for the international high-efficiency program ENERGY STAR instituted by the Environmental Protection Agency (EPA) in the United States.

This program was designed to promote practices that contribute to a reduction of greenhouse gas emissions. Recognizing and using ecoenergetic products helps protect the environment and, at the same time, reduce energy bills.

The Office of Energy Efficiency (OEE) at Natural Resources Canada has been promoting this program and controlling the use of the ENERGY STAR trade mark in Canada since 2001. The symbol has now been applied to a wide range of products, one of which is energy-efficient windows.

The four main characteristics of this type of windows:

- Low-emissivity (Low-E) windows are coated with a very thin, invisible metallic layer that is applied directly to the glass. Unlike ordinary glass windows, energy-efficient glass prevents excess heat from coming into the home during the day and limits heat loss during the night.

- The space between the glass panes is filled with an inert gas, sometimes krypton, but more often argon, because it is less costly. These gases are heavier than air and not good heat conductors. This means less heat is lost through convection and conduction.

- Since the spacers are a weak point in the window construction, they are now being made out of low-conductivity materials. This has the double advantage of helping reduce energy loss and keeping the perimeter of the glass pane warmer so that condensation is also reduced in winter.

- They are much more energy efficient because new, improved, higher insulation value frames are now being used.
High-energy-efficient windows provide several interesting advantages: economy, comfort, durability and environment.

Heating costs can be reduced by as much as 10%, a significant amount, as heating costs may represent 50% of the total electrical bill. These windows also reduce drafts and diminish outside noise. Last, but not least, condensation problems are almost eliminated.

These windows have a useful life of 20 years, which has further positive impact on the environment, as they need to be replaced less often and therefore reduce the amount of solid waste that will be directed to sanitary landfills.
Energy-Efficient Appliances

Energy consumption in a home can also be reduced by choosing energy-efficient appliances: refrigerator, stove, dishwasher, and especially the washer-dryer combination.

Products showing the ENERGY STAR symbol meet all the standards established by the program.

Purchasing these products instead of the classic models can help reduce the electrical bill and contribute to protecting the environment: consuming less electricity means that less needs to be generated, and when less is generated, greenhouse gas emissions are also reduced.
**Insulated Concrete Formwork**

Insulated concrete formwork can be a very interesting choice for the foundations of a home. The formwork remains in place after the concrete has cured, greatly improving the energy efficiency of the building. As an additional plus, curing conditions are much improved when concrete is poured using this type of form, ensuring higher quality concrete with fewer cracks.

Hollow polystyrene blocks are stacked up on the footing to create a form for the foundation wall. Urethane is blown on the surface under the first row of blocks to ensure that the base of the formwork remains watertight. Vertical and horizontal steel bars are inserted into the blocks, making the foundation much more crack-resistant.

Once the formwork is up, the concrete can be poured. To make sure the foundation remains watertight, a waterproof membrane is installed over the external insulation below grade.

Choosing to use insulated formwork is a step towards sustainable development. Humidity is the leading cause of deterioration of concrete. Improper or inadequate curing causes cracks to appear. The two key factors in producing a solid, long-lived foundation are ensuring that it remains watertight and that the curing process is properly handled.
Grey Water Heat Recovery

Representing 20% to 30% of the total bill, hot water heating runs a close second to home heating as the greatest energy expenditure in a home. The heat recovery device can be added to the plumbing system to absorb heat from grey water and transfer it safely to the cold potable water with no risk of contamination.

The idea is to put the heat recovery device in to replace one part of the vertical drain. The recovery apparatus consists of a copper drain pipe with a copper potable water pipe wound around it in spirals.

When hot water used in the shower or the bath runs down through the heat recovery drain, it warms the cold water running in the spiral around the pipe. In this way, heat from the grey water is transmitted to the cold water, raising its temperature before it gets to the water heater. The same type of device can also be installed on the cold water pipe to the shower.

On average, the water temperature rises by about 16°C before entering the hot water heater. Water coming in at 9°C from the municipal system can therefore be heated to 25°C. When the hot water heater is filled with tepid water, it is possible to reduce the cost of heating that water by 40%. In this way, using a heat recovery device can save 5 to 10% of the total energy costs for a home.
Energy Efficiency

**Basement Insulation**

Improving the level of insulation is one way to improve the energy efficiency of a home. Standards indicated in the Building Code are necessarily minimums. There is no reason not to go beyond these minimal requirements to improve performance and increase the comfort of the occupants.

In a conventional home, there is no specific thermal performance prescribed for the basement floor. It could be very interesting to add a layer of R5 (RSI 0.88) rigid insulation under the slab, over the whole surface of the floor.

![Diagram of basement insulation](image)

Basement foundation walls must have insulation rated at R-12 (RSI 2.2) two feet down from grade level. Insulation performance could be significantly improved by using insulation rated at R-17 (RSI 3.0) from top to bottom on the wall.

The basement is known to be a humid area. There are certain measures that can be taken to prevent the spread of mould. One is to use paperless drywall; another is using metal studs in place of wood studs, as shown in the following two illustrations of walls and subfloors.
In order to reduce the humidity of concrete walls, it is wise to let them dry as long as possible. Insulating material is then installed directly over the concrete, eliminating any air space between. It is better to use metal studs (rather than wood) and paperless drywall, as these materials do not absorb water easily. The continuity of the insulating structure is ensured by inserting a foam strip under the bottom plate and using sprayed insulation between the drywall on the wall and that on the framing header.

It is also wise to let a basement slab dry as long as possible; therefore, the subfloor should normally be installed last. Dry wood, such as plywood, should be installed in two crosswise layers to ensure proper ventilation between the space under the floor covering and the adjacent walls.
Foam Insulation for Foundations

Sprayed polyurethane foam insulation could be used instead of the rigid insulating material mentioned above.

One of its main advantages is that it acts in three ways, as a thermal insulator, as an air barrier and as a vapour barrier. It is also highly mould-resistant, and, after installation, there is no debris left to dump in a landfill site.

Some products are even manufactured from recycled materials, such as plastics used for bottles.

Using sprayed urethane foam insulation definitely improves the energy efficiency of a building. A direct result of this reduced energy consumption is a corresponding reduction of CO₂ emissions, one of the main greenhouse gases.
*Insulating Outside Walls*

The National Building Code requires that exterior walls have a minimum thermal resistance of R-19 (RSI 3,4). This resistance factor could be increased to R-24 (RSI 4,3) or more by choosing one of the following options.

On the inboard side, a 2” X 6” stud wall insulated with fibreglass batts is covered with a 13 mm (1/2”) thick panel laminated with an aluminum vapour barrier, before strapping and drywall are installed. The intermediate fibreboard layer is installed on the outboard surface, then the weather barrier and final siding are installed. (Ref: A 041.180.06.625.11 Novoclimat)

Another effective method involves installing a 30 mm (1 – 3/16”) medium-permeance insulating panel on the outboard side of the 2” X 6” studs. The weather barrier is installed over this, and an air space is left between the weather barrier and the exterior siding. The vapour barrier, strapping and drywall complete the wall on the inboard side. (Ref: B 041.116.06.001.11 Novoclimat)
Insulating Outside Walls (ctd.)

The insulating materials suggested on the preceding page provide a thermal resistance of about R-5. There are other products on the market that can be used in place of, or as a complement to, fibreglass batts between the studs.

One of these is sprayed polyurethane foam, which can function both as an air-barrier and water-barrier. Its thermal resistance varies from R-6 to R-7 per inch, making it one of the best insulating materials available. It can be used to replace fibreglass between the studs; it can also be applied in a layer about 25 mm (1") thick over the intermediate membrane instead of the insulating panels suggested on the preceding page.

Cellulose fibre, made of 80% recycled materials, is another product that can be used to insulate walls. Its thermal resistance is around R-3.7 per inch. To install it, holes are drilled in the vapour barrier at approximately 2" intervals, between the studs. The cellulose under pressure is injected into the cavity until the desired thickness/density is reached.

Since it is made with recycled materials, using this type of insulation can be a major contribution to the protection of our forests. Recycling one tonne of paper saves 19 trees.
Insulating the Roof

The National Building Code requires that a roof have a thermal resistance of at least R-30 (RSI 5.3). Installing an extra thickness of loose fill insulation can easily raise this to R-41 (RSI 7.3).

Cellulose fibre is made from recycled paper. A one-foot-thick (30 cm) layer provides an insulation value of about R-40.

Choosing this type of insulating material has a double advantage: it increases the energy efficiency of the home and limits waste of natural resources.
Passive Solar Energy

Passive solar energy means using daylight to help heat a home. The most important component for capturing solar energy is the windows.

The design and positioning of the windows, the curtains used and the amount of shade are all crucial to their performance in heating the home, and these must be determined when the home itself is planned.

As far as possible, more windows should be located on the south side of the house than on the north. In winter, the sun’s rays strike the earth at a lower angle and easily shine through south-facing windows; in summer, when the sun is higher, these same windows receive less light. Overhanging eaves can also reduce the amount of heat coming in.

In summer, undesirable excess heat comes mostly from windows on the west side of the home. Shade trees can be planted in strategic locations to alleviate this problem. If trees are not an option, curtains may be used.

A large window with a single pane of glass lets in more sunlight than the same area divided into many smaller squares. The greater area of glass in fact captures more solar energy.

Energy savings from the use of passive solar energy can be significant. In winter, passive solar can reduce heating costs. In summer, air conditioning costs can also be reduced by applying the same principles.
Solar Hot Water Heater

The sun is a source of renewable energy that can be used to heat water. Depending on the type of solar hot water heater chosen, it is possible to store enough energy to supply up to half of the hot water needed for a family of four.

A residential solar water heating system usually combines three components: solar collectors are installed on a south-facing roof; a heat exchanger and pump transfer the energy absorbed by the collectors to a hot water tank that is located next to and connected to a classic hot water heater.

There are two types of solar hot water heaters on the market: seasonal and permanent. The seasonal models are designed for use in a summer cottage and cannot be used in winter. The permanent models are more costly, but they are designed to be used year-round.

Since they are powered by a clean, renewable energy source, solar hot water heaters make an excellent choice for reducing consumption of traditional heating fuels and electricity.
Geothermics

Geothermal energy drawn from the earth can be used for heating. The earth stores up energy from the sun’s rays. When thermal energy from the ground is used to heat a home, it is quickly renewed by the sun and is therefore considered to be inexhaustible.

The system is made up of a series of buried pipes filled with fluid and a geothermal heat pump that serves two purposes: heating the home in winter and cooling it in summer. A central forced air system is used to distribute air throughout the house.

Which system you choose depends on a number of factors: urban or rural environment, the type of ground, the size of the property and, of course, the capacity required. You then must choose either a closed-circuit Freon system or a system with heat transfer fluids.

Installation of the closed-circuit system with Freon requires very little space, so it is adequate for a small new home on a small urban or suburban lot. The closed-circuit system with heat transfer liquids is much larger and requires 75 % pure water and 25 % food-based antifreeze to operate. It is crucial that the antifreeze be a biodegradable product of vegetable origin so that there is no risk for the environment if there are any leaks.

Using a geothermal system reduces greenhouse gas emissions and lowers heating costs by 35% to 65%.
Air Quality & Reducing GHG
VOCs (Volatile Organic Compounds) are used in the manufacture of a number of common household products such as paint, solvents, carpets, glues and plywoods. “Volatile” means that the product evaporates very quickly. VOCs are released into the air when these products are made or used. When they are present in the air inside a home, they can be hazardous to the health of the occupants.

Smog forms when VOCs evaporate into the atmosphere and react with sunlight to create smog. The word “smog” is a combination of the words “smoke” and “fog”: smog is formed when very polluted air reacts to strong sunlight.

As for GHG (greenhouse gases), they exist in nature and are vital to the Earth’s natural climate control system. Unfortunately, human activities have greatly increased the proportion of greenhouse gases in the atmosphere, and this could be causing global warming.

The greenhouse effect can be explained in this way: there is a layer of gases around the planet Earth that functions much in the same way as the glass walls of a greenhouse. Heat from the sun passes through the atmosphere, but the heat that is given off by the earth remains trapped inside the gaseous envelope.

One of the most important greenhouse gases is CO₂ (carbon dioxide), which is given off mainly by devices that burn oil or natural gas. Since heating and air conditioning require huge quantities of energy, they are also responsible for a significant portion of our CO₂ emissions.

In the chapter on energy efficiency, solutions were suggested for improving the performance of a building so that energy consumption could be reduced, and consequently, less greenhouse gas produced. There are also other interesting choices on the market, such as high-efficiency fireplaces. As for eliminating VOCs, low-emissivity products are now available, including paints and solvents. Some of these options are discussed in the next sections.
Zero VOC Paint

VOCs volatilize when paint is applied and while it is drying. Once the paint has dried, they are less present in the air. Some paints, however, continue to give off small quantities of VOCs over a considerable time.

VOCs affect indoor air quality and can cause health problems. People who are exposed to VOCs can exhibit symptoms such as coughs or headaches, with the most extreme effects appearing in young children, pregnant mothers and those who have asthma or allergies.

In order to reduce VOC emissions, the Canadian government has recently proposed its Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations. Whatever happens with this regulation, it is clear that measures will be taken to control this problem.

There are paints on the market that contain no (or very small quantities of) VOCs. They can be identified by their labels, indicating “Zero VOC” or “Low VOC”. Reducing VOC emissions will have undeniable benefits, both for human health and the environment.
Heat Recovery Ventilator

Modern homes are built to be airtight, so there is little exchange between inside and outside air, with the resulting negative effects on the quality of the interior air. A heat recovery ventilator purifies the air in your home.

Stale, used air can contain many different pollutants. Cooking, laundry, plants and heating wood stored indoors all help to create excess humidity. Some types of particle board, furniture and carpets give off urea formaldehyde. Cleaning products, aerosols, paints and solvents leak chemical agents into the air. Wood fires can produce carbon dioxide (CO₂).

A heat recovery ventilator exhausts stale air to the outside and replaces it with fresh air that is filtered before being vented into the house. The system includes a device that extracts the heat from stale air before expelling it and transfers the heat to incoming cool air. This heat exchange reduces the energy required to bring outside air up to a comfortable indoor temperature. About 60% of the heat can be recovered in this way.

Humidity levels in the home can be more efficiently controlled, winter and summer. This means that a heat recovery ventilator helps keep the occupants more comfortable and the indoor environment healthier.
Composite Wood Panels

Wood panels of all kinds are used in the construction of a new home, in kitchen and bathroom cupboards, counters, sub-floors, wall sheathing...

There is an extremely wide range of products on the market: particle board made with post-industrial wood fibre, medium density fibreboard (MDF), strawboard panels, plywood panels, oriented strandboard (OSB), exterior plywood, etc.

Materials must be chosen for their low formaldehyde levels. Formaldehyde is naturally present in wood, so it cannot be completely eliminated. It is a colourless, odourless gas, but its emissions can cause health problems – for plant workers as well as consumers.

Urea formaldehyde is often present in the glues used to make panels. It is important to know that higher levels of this gas are emitted when the temperature and humidity are high, as is frequently the case in bathrooms.

Over the last few years, in an effort to help preserve the environment, many companies have already begun making formaldehyde-free glue. When purchasing panels, it is wise to ask the pertinent questions and be sure the panels contain no formaldehyde.
Air Quality & Reducing GHG

High Efficiency Wood-burning Fireplace

Even though heating with wood produces CO₂, it does not pollute in the same way as burning natural gas or oil. A growing tree absorbs CO₂ from the air and liberates it when burned. Wood is seen as a renewable resource, as long as sustainable forest management is practiced where it is cut and the forest is allowed to renew itself.

Incomplete combustion is the major cause of pollution from wood-burning appliances. When wood is burned in a conventional fireplace, unburned particles rise through the chimney as smoke. These particles pollute the air. Some of them may also leak into the house and affect the quality of the inside air.

To reduce smoke pollution from wood-burning appliances, new technologies have been created to improve combustion performance. Compared with ordinary fireplaces, these new models can reduce particulate emissions by up to 90%. Modern high-efficiency appliances also consume 30% less wood for the same quantity of heat.

To be deemed in compliance, the fireplaces in question must meet the standards established in the Canadian Standards Association’s CAN/CSA B415.1 or those set out in 40 CFR 60 subpart AAA by the United States Environmental Protection Agency (EPA). The conformity mark of one or the other of these standards must be stamped or labelled on the appliance.
Stop Wasting
Natural Resources
We must stop wasting natural resources to ensure their conservation and sustainability.

Recovery and recycling of materials helps reduce the amount of waste that ends up in sanitary landfills.

Many of the products mentioned in this section could be found elsewhere, as they affect the health of the environment in different ways.

As an example, more durable, low-VOC carpets are made from renewable resources or recycled materials. Choosing a product of this type has a positive impact on air quality as well as waste reduction.

We no longer have a choice: we must systematically recover all recyclable materials.
Eco-Friendly Carpets

The average useful life of a carpet is 10 years. Vinyl, nylon, polyethylene and polyurethane are used in their manufacture. Because they contain substances that are not biodegradable, when they become waste, they may give off toxic substances and become hazardous for the environment.

Manufacturers are now offering more eco-friendly carpets. Some have modified the processes in their plants so that they would be less damaging to the environment. There are plenty of examples.

Many products are now certified Green Label Plus, which means that they give off fewer than 0.5 milligrams of VOCs per square metre.

Some carpets are made of wool, a renewable, biodegradable material. Others now have a useful life of up to 20 years or are made from Nylon 6, which can be infinitely recycled.

Some businesses are now recycling used carpets to make carpet backings. Others are transforming plastic bottles into polyester fibres. More and more carpets contain recycled materials and can themselves be completely recycled after use.

Manufacturing plants have been progressively integrating eco-friendly processes and procedures into their daily operations: to improve air quality, for recycling, for improved energy efficiency, to reduce waste and harmful emissions, to conserve water, to reduce packing materials, to limit transportation, or even in the use of renewable energy sources.

In short, it is now simple to find carpets on the market that respect the environment and help maintain pure air in the home.
Asphalt Shingles

Asphalt shingles are the most common material used for residential roofing. Their manufacture requires oil as well as a great deal of energy, and it produces pollution, especially VOCs.

Their useful life is influenced by many factors, including climate and wind strength, so it can vary from 15 to 25 years. This means that they contribute large quantities of waste to landfill sites – over a million tonnes per year in Canada.

Reducing the quantity of this type of waste will help reduce its negative impact on the environment. That means that it is important to choose shingles with a longer useful life. There are some shingles on the market today that can last as much as 30 to 40 years.

Choosing shingles with a longer useful life contributes to the preservation of your home and the environment.
Aluminum Shingles

Aluminum shingles have a useful life of up to 40 years. This type of shingle has many advantages, including its resistance to water, rot and insects. It can also be recycled, which makes it an excellent choice.

When a home is roofed with aluminum shingles, heating, and especially air-conditioning costs can be reduced by as much as 25%. In summer, these shingles reflect heat from the sun, keeping the home cooler. Even when they are dark in colour, reflective paint serves the same purpose.

Some shingles contain as much as 95% recycled materials. Some are ENERGY STAR certified.

Last, but not least, these shingles come in shapes and designs to suit all tastes. Some look like asphalt shingles, others imitate the wood-grain of cedar shingles, etc.
Stop Wasting Natural Resources

FSC-Certified Wood

The FSC (Forest Stewardship Council) is an international organization whose goal is to promote responsible forest management worldwide and ensure the sustainability of forests and their ecosystems. It promotes responsible forestry practices such as selective cutting.

The FSC symbol on construction material certifies that the wood comes from a properly managed forest. There are more and more products on the market that have this certification. They can be used in many ways in the construction of a home, from the framing to the wall studs, to the parquet or hardwood floor and even the finish mouldings. Certified products are available in many types of wood: softwood, hardwood and exotic woods (pine, fir, spruce, maple, oak, birch, bamboo, eucalyptus).

Many building material retailers do not yet have these materials in stock, but the consumer should ask for them. Every time you purchase FCS-certified wood products, you are helping to preserve natural resources. It is also important to note that buying local wood reduces transportation costs, another important factor in preserving the environment.

The FSC was formed in 1993 by representatives of organizations from 25 different countries. These organizations operate in the environment sector, in forestry, and in the timber trade.
Stop Wasting Natural Resources

**Exterior Patio Made With Torrefied Wood**

To increase the useful life of your patio, all you have to do is choose a more durable building material. Torrefied wood could be a very interesting choice, as it contains no chemicals that might contaminate the environment.

Torrefied wood is treated at very high temperatures to eliminate any humidity. It is completely dry, more water resistant and less likely to rot.

Depending on the length of the treatment, the colour of the wood varies from light brown to almost the colour of red cedar, even when using less popular species, so locally available wood can easily be treated and used. The pollution associated with long-distance transport can be eliminated.

However, when using torrefied wood, some precautions must be taken. The size of the structural supports cannot be calculated in the same way as with standard construction timber because the treatment process reduces its bending strength. Cut ends must be waterproofed and a waterproof seal should be applied over the whole surface to preserve its attractive appearance.

The durability of torrefied wood makes it well worth the cost; even at 50% more than good-quality treated lumber. Not only is it a good investment in the middle term, it is also a positive action for the environment.
Stop Wasting Natural Resources

**Waterproofing Foundations**

Waterproofing membranes with a useful life of 50 years can be used to make foundations watertight. Made with recycled HDPE and covered with new polyethylene, they are completely water and vapour tight. One type is designed for walls and another for concrete slabs.

Not only is this product non-toxic and safe when installed, it is also recyclable. Any waste material remaining after the foundation has been dealt with can be recycled and reused to make more of the same.

Since the membrane is dimpled, a very narrow air space is created between the foundation walls and the graded soil. Any water percolating through the soil near the walls will run off into the French drain.

Any humidity coming from the inside will condense and the water will run down to the foot of the foundation in the same way.

The waterproofing membrane for the floor is laid on the gravel underneath the concrete slab. This is a capillary break equivalent to 4" of gravel. It functions as a vapour barrier under the slab and also as a barrier to any gases, such as radon that might be rising out of the earth.

These waterproof membranes continue to protect walls and floors from humidity for many years.
We hear the words “sustainable development” every day, and we can put its principles into practice in our everyday life. This document shows that any future homeowner can help participate in preserving the environment by making solid, responsible choices.

Obviously, there are many other options on the market, and new ones will continue to appear. This guide will have attained its objectives if it has made builders and their clients more aware of the issues and better able to make wise choices, and if it helps them change some of their old habits while still respecting each other and the environment.
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