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Preserve Manitoba's Past.

GREEN GUIDE TO HERITAGE CONSERVATION

Canada's Historic Places / Lieux patrimoniaux du Canada

Manitoba

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The Historic Resources Branch gratefully acknowledges the contribution of the Government of Canada Historic Places Initiative in supporting the creation of this document.

Cover Photos: J.B. Davey and Son Building, Carberry, MB

Marringhurst Heritage House, Glenora area, MB

Electric Railway Chambers Building, Winnipeg, MB

Built heritage is a vital piece of our past. There are nearly 700 designated heritage sites in Manitoba – from ancient sites and burial grounds to houses, churches, bridges, farms, businesses, warehouses and parks. Built heritage is a significant resource that plays an important role in the economic, cultural and environmental sustainability of our rural areas, towns and cities.

Many heritage buildings were designed to last centuries and reusing them reduces the need for new construction. This saves energy and resources and retains the identity and character of our communities. The labor-intensive process of rehabilitating older heritage buildings supports local businesses, creates jobs and keeps wages in our community. We cannot build our way to sustainability by tearing down what we already have.

Although some old buildings may be less energy efficient than some newer ones, retrofits can be done to make our heritage buildings more efficient. Retaining existing elements of old buildings and seeking to improve their energy performance is a heritage conservation principle that makes sense for the planet and the economy.

Relationship between Heritage Conservation and Sustainability

This guide focuses on environmental sustainability. While we should all be doing our best to reduce personal consumption, buildings remain major consumers of energy and materials and are one of the main contributors to greenhouse gas.

Buildings are vast store rooms of energy. It takes a lot of energy to construct a building. For example, building a 50,000 square foot (4645 m^2) commercial building requires the same amount of energy it takes to drive a car 20,000 miles (32,187 kilometers) a year for 730 years.[1] It takes energy to extract raw materials from the earth and energy to manufacture finished building materials, more energy to transport those materials to a construction site and still more energy to assemble the building. All of this energy—the total energy required to produce and maintain the building over its entire lifecycle is known as **embodied energy**.

If a building is demolished and taken to the landfill, the energy locked up in it— its embodied energy – is wasted. There is a tremendous impact on the environment when something new is built. Avoiding new construction by retaining and reusing heritage buildings is an ecologically conscious decision.

Calculating the amount of energy embodied in a building is a primary goal in engineering studies. Theses studies are called **life cycle assessments** and they track the total amount of energy and materials that flow into and out of the environment when producing materials or components or when assembling them.[2] While new buildings meeting today's highest energy efficiency standards typically consume less energy for heating and cooling than older buildings without energy saving retrofits, this approach ignores the fact that many new building materials require a tremendous amount of energy to produce and most cannot be reused or recycled.

In April 2007, the provincial government outlined its Green Building Policy for new, provincially funded projects. It establishes the province's integral role in promoting environmental awareness and sustainable development across the province.
For more information, visit: www.manitoba.ca/greenbuilding

Recent research shows that it takes 35 to 50 years for an energy efficient, new building to save the amount of energy lost in demolishing an existing building.[3] By maintaining and upgrading heritage buildings, we retain the embodied energy they possess and prevent unnecessary waste in landfill sites. A properly upgraded historic building can be as efficient overall as a replacement building.[4]

There are various environmental initiatives – including the LEED (Leadership in Energy and Environmental Design) program – that promote the reuse of materials and buildings. However, none of these initiatives specifically tackle the reuse of designated heritage buildings. There are limits to the environmental energy efficiency upgrades that can be carried out on designated heritage buildings. Altering important interior spaces or architectural elements could result in the permanent loss of important historical value.

Although care must be taken, there are many improvements and retrofits that can work well in older heritage homes and commercial buildings. This guide will help building owners make informed decisions about which, if any, ecologically friendly changes to make and when to make them. The benefits of the suggestions in this guide are not limited to reducing **ecological footprints**. They also help preserve our heritage by extending the lives of buildings, while saving money.

Old Versus New

In 2004, the Historic Resources Branch of Manitoba Culture, Heritage and Tourism partnered with Parks Canada and the Athena Institute to compare the ecological effects of keeping historic buildings, as opposed to building new structures in the same locations. The report shows that significant environmental impacts can be avoided by preserving an existing building instead of building a new one. For more information, see *Athena Institute LCA for Existing Historic Buildings Report* at www.athenasmi.org.

Red River College (Princess Street Campus), Winnipeg, MB
The historic lane is preserved as a glass atrium between the two buildings. New and old technologies work together to achieve excellent energy efficiency for the building.

Red River College (Exchange District Campus), Winnipeg, MB
Adaptive Re-use. The facades of heritage buildings along Princess Street are re-purposed for the new complex rather than demolished.

HOW TO START GREENING A HISTORIC BUILDING

Parks Canada's Standards and Guidelines for the Conservation of Historic Places in Canada describes in detail the steps required for the proper conservation of historic building elements. The elements of a building that are most important to preserve are called **character-defining elements**.[5] Character-defining elements (CDEs) are important physical features of historic buildings which should not be significantly altered, even if they improve energy efficiency. If you can't define the historic character of a building and its site prior to work, then you may very well destroy it during the work. Owners of municipally and provincially designated heritage buildings can find out more about their buildings specific character-defining elements on the *Canadian Register of Historic Places* at www.historicplaces.ca; or by calling 1-866-632-6183. Physical features of heritage buildings that are not character-defining may be excellent candidates for environmental improvement.

Retrofitting should be limited to measures that provide reasonable energy savings, at reasonable costs, with the least intrusion or impact on the character of the building. Overzealous retrofitting, which introduces damage to historic building materials, should not be done.

St. Paul's Anglican Church, St. Francois Xavier area, MB.
Detail of repaired wood window frames

St. Paul's Anglican Church, St. Francois Xavier area, MB.
Window frames are retained and repaired by piecing in new material to match the old

If you are interested in conservation but your building is not designated, you can perform your own assessment of the character-defining elements of the building. These often include: windows, exterior cladding, roofs, porches or entrances; and some interior features and finishes. (Note: The US National Park Service offers an excellent interactive website to help property owners identify the distinctive materials, features, and spaces of the building to conserve. Visit: *Walk through Historic Buildings: Learn to Indentify the Visual Character of a Historic Building* at http://www.nps.gov/history/hps/tps/ walkthrough/start.htm

GREEN HISTORIC BUILDING CHECKLIST

Before the development of today's sophisticated building materials and equipment, architects designed their buildings using proven methods of construction, heating, cooling, ventilation and water use. Many historic buildings already have physical features that conserve energy or create a more comfortable, healthier indoor environment. These features should be maintained or restored and treated as part of the overall green strategy for the building.

Passive Solar Technologies

Older buildings were often built to increase daylight, reducing the need for artificial lighting. Courtyards or light wells allow light to penetrate deep into buildings. As light enters through windows, heat is absorbed and slowly released by the materials inside. Brick, stone and concrete help maintain consistent temperatures throughout the day. This is especially useful during winter. In summer, awnings, shades or shutters keep interiors cool.

Natural (Passive) Ventilation

Older buildings typically used operable windows to provide fresh air and light rather than the mechanical ventilation systems most modern buildings use. Any time the mechanical heating or air conditioning equipment can be turned off and the windows opened, energy is saved. Preserve high ceilings to allow air to circulate and light to enter a building.

Natural and Durable Materials

Stone, brick and wood require very little energy to process and don't pollute indoor air. They can also be repaired with minimal skills and tools and tend to be durable and renewable. Heavy masonry walls are an excellent thermal buffer that help prevent buildings from gaining or losing too much heat.

Insulation and Building Envelopes

Building envelope design in older buildings is most effective at allowing moisture to evaporate as it penetrates walls. Modern, impermeable building materials obstruct this process: instead of letting moisture out, they can often trap it inside, accelerating mold growth and decay. Be careful not to reduce air infiltration to the point where the building is completely sealed and moisture movement (inside to out) is prevented. Without some air movement, condensation problems could occur throughout the building.[6]

Heritage building owners looking to improve energy efficiency should first ensure the passive design features of the building are as efficient as possible, without making physical alterations. The second step is to have a green heritage retrofit plan that includes appropriate, energy efficiency upgrades to improve the building's overall thermal efficiency. These two steps can result in a 50 per cent decrease in energy use in historic buildings.[7]

GETTING STARTED WITH ENERGY EFFICIENT UPGRADES

Illustration by mckibillo. Used with permission.

Energy efficiency upgrades to historic buildings should begin with the simplest and least expensive retrofits offering the highest potential for saving energy. With historic materials and systems, a typical "one-size fits all" approach may not be possible. Solutions adapted for the situation may be required. If necessary, contact professionals in historic conservation (ex: architects, engineers and mechanical contractors) for help.

Once you have decided which elements to preserve and what to upgrade, develop a plan of action. The following list includes the most common retrofitting measures for historic buildings;

1 sealing against air infiltration
2 attic insulation
3 storm windows
4 basement and crawl space insulation
5 duct and pipe insulation
6 awnings and shading devices
7 doors and storm doors
8 interior wall insulation
9 heating, ventilation and air conditioning (HVAC)

Energy Assessments

Manitoba Hydro offers in-home energy assessments. They are a convenient way to find out what needs to be done to improve comfort and energy efficiency. To arrange for an assessment, contact Manitoba Hydro, toll free at 1-888-MBHYDRO (1-888-624-9376); or visit Manitoba Hydro at Power Smart Home Energy Evaluation Services at www.hydro.mb.ca.

1. Air Infiltration

Drafts often cause people to turn up the heat and run it longer. Reducing drafts (air infiltration) is a high priority in a green heritage retrofit plan. The cost is low, little skill is required and the benefits are substantial. In most situations, extensive sealing is the single most cost-effective energy improvement to make.

Major heating or cooling loss occurs when outside air infiltrates a historic building through loose windows, doors and cracks in the building envelope. Draft-proofing (adding weather stripping to doors and windows and caulking open cracks and joints) will substantially reduce infiltration, create a comfortable internal environment and lower energy bills. Avoid caulking and weather stripping materials that introduce inappropriate colors that impair the heritage character of the building and ensure adequate ventilation to control moisture.[8]

Special care should be taken with particularly damp buildings. Only after faults have been repaired and the building dried out (with good ventilation), should draft-proofing be considered.[9]

For more do-it-yourself information, see Manitoba Hydro's *Power Smart Sealing, Caulking and Weatherstipping* information booklet at www.hydro.mb.ca; or call Manitoba Hydro at 1-888-MBHYDRO (1-888-624-9376) for a copy.

Former CPR Station, Portage la Prairie, MB.
Adding weather-stripping to the refinished door provides a weather tight seal.

2. Attic Insulation

Adding insulation in accessible attic spaces is very effective at saving energy, reducing heat loss and can generally be done at a reasonable cost, but it does require some skill to install.

In the winter, moist heated air constantly rises and attempts to pass through ceilings and walls. It is better to allow some of the moisture to escape into a properly ventilated attic than to seal your heritage building up tight. Blanket or batt insulation with a treated kraft paper vapor retarder already attached to it, will effectively slow vapor movement without completely stopping it. Natural, fibre based materials (ex: cellulose) also provide good thermal insulation and do not hinder the movement of moisture. If there are older electric cables or lights, check with an electrician before covering them with insulation because they could overheat.

When an attic is unheated (not used for living space), insulation should be placed between the floor joists, with the vapor barrier facing down towards the warm living area. If the attic is a heated living space, then the insulation should be placed between the roof rafters with the vapor barrier facing into the room. New insulation can be installed over existing loose-fill insulation, but ensure that the new insulation doesn't have a vapor barrier, which would trap moisture inside the old insulation and cause decay.

Problems can occur if attic space is not properly ventilated. Lack of ventilation causes insulation to become moist and lose its thermal effectiveness. As a general rule, an attic is adequately ventilated when the open area of a vent or louver equals approximately 1/300 of the attic floor area.[10]

For more do-it-yourself information, see Manitoba Hydro's *Power Smart Energy Guide: Attic Insulation* information booklet at www.hydro.mb.ca; or call Manitoba Hydro at 1-888-MBHYDRO (1-888-624-9376) for a copy.

3. Storm Windows

Windows are often one of the most unique character-defining elements of heritage architecture and should be conserved whenever possible. Compared to insulated walls, any window (original or replacement) is a primary source of heat loss because they are both a poor thermal barrier and often a source of air infiltration. Storm windows reduce air leaks through the window sash by over 95 per cent. Weather stripping and sealing can greatly prevent air infiltration.[11]

If a historic building has existing storm windows (wood or metal framed) retain them in good working condition and ensure they are tight fitting. If there are no existing storm windows, add new metal or wood frame storms to the exterior of the window. This results in an assembly (historic window plus storm window) with an R factor of about 1.79. Exterior storm windows also protect the windows behind them, reducing maintenance and extending their use.

Wood storm windows do require maintenance, but they last the longest, are easy to repair and offer the highest insulating value. They also require significantly less energy to manufacture. Alternatively, triple-track metal storms windows are readily available, removable, come in numerous sizes, are reasonably priced and are fairly energy efficient. If metal frames visually impair the appearance of the building, have them prefinished to match the color of the historic frame.

Storm windows can also be installed on the inside of the building. However, the outer sash (the historic window) takes the brunt of the weather and holds condensation in cold weather. Water that collects on the inside of the historic sash can cause decay. If using plastic sheets as interior storm windows, make sure they are removed periodically to allow the historic sash to dry. Also, make sure the historic frame and sash are completely caulked and weather stripped. Be careful not to damage historic window moldings and finishes.[12]

Immaculate Conception Ukrainian Catholic Church, Cooks Creek, MB. *New wooden storm windows.*

Immaculate Conception Ukrainian Catholic Church, Cooks Creek MB. *New storm windows protect the historic wood windows while preserving the beauty and character of the original.*

Drafts around windows usually occur because the frame has been improperly sealed or lacks insulation. Installing weather stripping around drafty windows can save nearly 25 per cent in building energy costs. Caulking around window frames can reduce air leaks around the outside of the frame by 90 per cent. [13]

Improvements to windows should include:

- Repair or replace any broken, rotted or rusting frame material and replace broken or cracked glass.
- Seal all non-moving joints with a paintable sealant.
- Repair or install weather stripping.
- Seal (and where possible insulate) around frame opening
- Repair storm windows, or install new ones that are sensitive in material and design to the originals.
- If awnings or shutters were original equipment, repair or replace them.
- Drapes or blinds also improve efficiency in both hot and cold weather.[14]

Wood Window Replacement Costs

Older buildings are not usually insulated, so only a small percentage of heating and cooling energy is lost through windows. Most heat escapes through ceilings, walls, floors and gaps in the building envelope. The *Whole Building Design Guide* notes that: If the historic wall assembly has an R-value between 13 and 18, taking a window from R1 to R3 will not provide sufficient energy savings to offset the cost of replacement windows and associated waste.[15] There is little chance that replacement windows will pay for themselves in energy savings before they need to be replaced. For more information visit the National Institute of Building Sciences: Whole Building Design Guide at www.wbdg.org

Anatomy of a Historic Window

A. Jamb
B. Rail
C. Pane or Light
D. Top Sash
E. Stile
F. Meeting Rail
G. Muntin Strip
H. Bottom Sash
I. Casing
J. Stool

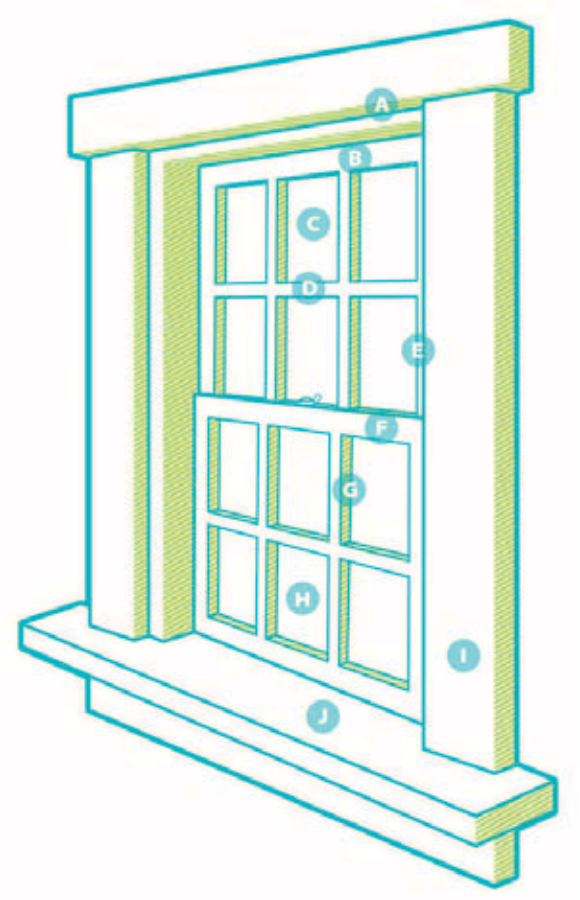

Illustration by mckibillo. Used with permission. Courtesy of PRESERVATION magazine, National Trust for Historic Preservation.

4. Basement and Crawl Space Insulation

Basements and crawl spaces in historic buildings offer excellent upgrading potential. But before adding insulation, address air leaks by repairing cracks or holes in the building envelope and weather strip windows and doors. Do not seal vents.

Excess moisture is often present in these spaces. Insulation material must be properly installed to reduce heat loss and prevent future moisture problems. When consulting insulation installers, be sure to ask about all options; a one-size approach could be very costly and damage the building.

In crawl spaces and some unheated basements, insulation should be placed between the first floor joists (the ceiling of the basement) with the vapor barrier against the warm face of the floor. Do not staple the insulation in place, because staples often rust away. Hold the insulation in place, either by tacking plastic chicken wire to the edges of the floor joist, or by using snap-in wire holders. In heated basements, basements that contain a furnace or exposed water and sewer pipes, insulation should be installed against the foundation walls.

Begin the insulation high up within the first floor joists, and proceed down the wall with the vapor barrier facing out into the warm living space. When rigid foam insulation boards are used to insulate the interior of masonry walls, they do not require added vapor barrier treatment. Be sure to ventilate unheated spaces and comply with all fire codes.

For more do-it-yourself information, see Manitoba Hydro's *Power Smart Energy Guide: Basement & Crawlspace Insulation* information booklet at www.hydro.mb.ca; or call Manitoba Hydro at 1-888-MBHYDRO (1-888-624-9376) for a copy.

H.P. Tergesen and Sons General Merchant, Gimli, MB. *Integrate improvements in energy efficiency into necessary repair work*

5. Duct and Pipe Insulation

Wrapping insulation around heating and cooling ducts and hot water pipes is a simple, inexpensive way to cut energy consumption and isn't likely to damage the historic buildings. Use insulation intended for this purpose and install it according to manufacturer's recommendations. Air conditioning ducts will be cold in the summer and have condensation. Ensure vapor barriers are facing into the living space, away from the duct.

6. Awnings, Shutters and Shade Trees

In the past, awnings, shutters and trees provided shade to keep buildings cooler in the summer. If you have them, keep them in good condition and take advantage of their energy savings. If archival photos show your building once had awnings or shutters, consider re-installing them, ensuring the historic facade isn't damaged or that the building's historic character isn't altered.[17]

For new trees, use deciduous varieties that provide shade in the summer but allow the sun to warm the building in the winter. When planting trees, ensure they are no closer than 10 feet (3 meters) to the building to avoid damage to the foundations. Adding awnings, shutters or shade trees may be expensive, but in summer, the benefits can justify the costs.

7. Doors and Storm Doors

Most historic wooden doors (solid wood or panelled) have decent thermal properties and should not be replaced, especially if they are important character-defining elements. Ensure that the frames and doors are well maintained, painted regularly and caulked and weather stripped as necessary.

8. Wall Insulation

Insulating walls is usually not recommended for heritage buildings because of the high cost and the high potential for damage. Also it takes a long time to see the cost savings. Adding insulation to the interior of a masonry wall (brick, stone etc.) can be problematic.

It is possible for moisture to collect in the masonry of a building, causing **freeze-thaw damage** that is difficult and expensive to repair. Extreme care must be exercised.

If the interior of a designated building has already had previous changes or if the interior features have little or no heritage significance (Refer to the buildings *Statement of Significance* on the *Canadian Register of Historic Places* at www.historicplaces.ca), interior insulation may work for the building. Add insulation to a wood or masonry wall by attaching the insulation to **furring strips** mounted on the interior wall faces. Rigid insulation – usually one or two inches (2.54 cm / 5.05 cm) thick – and batt insulation – usually 3.5 inches (9 cm) thick – can be added in this fashion. A vapor barrier must be added on the warm side of the wall. Ensure all building and fire codes are complied with.

For more do-it-yourself information, see Manitoba Hydro's Power Smart Energy Guide: Wall Insulation information booklet at www.hydro.mb.ca; or call Manitoba Hydro at 1-888-MBHYDRO (1-888-624-9376) for a copy.

Church doors salvaged during building restoration project.

9. Replacing Original Heating, Ventilation and Air Conditioning (HVAC) Equipment

The need for modern mechanical systems is one of the most common reasons to undertake work on a historic building. Building owners should improve or upgrade existing mechanical systems to high efficiency systems whenever possible. Proper planning helps reduce physical and visual damage caused by installing and maintaining new or upgraded systems. Identify less important or secondary spaces in the building where mechanical equipment can be placed and where distribution ducts can be run. Appropriate secondary spaces for housing mechanical equipment may include attics, basements, penthouses, mezzanines, existing vertical chases, stair towers, closets or vaults.[16] Investing in newer technologies (ex: geothermal heating and cooling) can also reduce energy consumption and building operating costs. New technologies may have high capital costs that have to be considered to gain a true understanding of yearly costs.

For more information visit *Manitoba Hydro Emerging Energy Technologies* at www.hydro.mb.ca; or call Manitoba Hydro at 1-888-MBHYDRO (1-888-624-9376).

GREEN TIPS CHECKLIST

Many historic buildings are used like new buildings and everyday strategies for energy conservation should be included in any green heritage retrofit plan.

- ☐ If lighting is not a character-defining element, switch to fluorescent or LED light bulbs; reduce the number of lights used and maximize natural light.
- ☐ Use a programmable thermostat for heating and cooling systems and control temperatures in the most-used rooms.
- ☐ Replace or repair missing or damaged awnings, shutters and other shades.
- ☐ Run ceiling fans on low in winter. In summer, run on medium or high when the space is occupied.

Appliances and equipment

- ☐ When replacing appliances, look for EnergyStar products and check for rebates and incentives. See Manitoba Hydro's Save Energy and Money with Energy Efficient Appliances information booklet at www.hydro.mb.ca; or call Manitoba Hydro at 1-888-MBHYDRO (1-888-624-9376) for a copy.
- ☐ Install an insulating jacket on electric hot water tanks and insulate hot water pipes.
- ☐ Set hot water tank thermostats at 54°C (130°F) to provide lots of hot water and save money.
- ☐ Have mechanical equipment serviced regularly to ensure maximum efficiency.

Water conservation

- ☐ If interior spaces are not character-defining elements, install low-flow or dual-flush toilets when toilets need replacing.
- ☐ Reduce lawn upkeep by planting drought-resistant grasses and sedges that require less water. For low traffic areas, consider replacing grass with low groundcover to reduce the need for water and fertilizer.

Materials and finishes

- ☐ Be careful when using modern building materials designed for contemporary building envelopes (ex: plastic or aluminum). Movement of moisture between older and newer materials increases the chance of materials deteriorating.
- ☐ Use recycled or recyclable products whenever possible.
- ☐ Use paints, finishes and adhesives that emit little or no volatile organic compounds. In the process known as "off-gassing," these toxic chemicals reduce indoor air quality and may even be carcinogenic.

Grants

Manitoba Hydro offers home owners financial help for energy upgrades to their homes. Ask a Manitoba Hydro energy expert for information: e-mail powersmartexpert@hydro.mb.ca: or call 480-5900 in Winnipeg, toll free at 1-888-624-9376; or visit Manitoba Hydro Power Smart Savings, Rebates & Loans at www.hydro.mb.ca.

GLOSSARY

batt insulation: a thermal or sound insulation material, which comes in varying widths and (R-value) thickness to conform to standard framing of walls and joists.

building envelope: sometimes known as the building shell, is the 'skin' of the building that keeps air, moisture and heat from moving in or out of a building

character-defining elements: the materials, forms, location, spatial configurations, uses and cultural associations or meanings that contribute to the heritage value of a historic place; must be retained to preserve its heritage value

ecological footprint: is the measure of human demand on the Earth's ecosystems and natural resources. Ecological footprint analysis compares human consumption of natural resources with planet Earth's ecological capacity to regenerate them

embodied energy: the non-renewable energy consumed over the entire lifecycle of a product (Energy is consumed in acquiring raw materials and processing, manufacturing and transporting them; also in construction, maintenance, repair, replacement and demolition)

EnergyStar: Natural Resources Canada's (NRCan's) Office of Energy Efficiency (OEE) promotes the international ENERGY STAR symbol in Canada and monitors its use. It is the international symbol of premium energy efficiency.

freeze-thaw damage: the pressure ice places on joints or cracks in building materials (usually masonry) widening them; when ice thaws, the water moves deeper into joints, refreezes and expands widening the crack causing increasing damage and deterioration over time

furring strips: flat pieces of lumber used to attach the interior or exterior finish

HVAC: (acronym) Heating, Ventilation and Air Conditioning

LEED® (Leadership in Energy and Environmental Design): a third-party certification program for the design, construction and operation of green buildings, recognizing performance in five areas: sustainable site development, water efficiency, energy efficiency, materials selection and indoor environmental quality.

R-value: a material's resistance to heat flow. Higher R-value numbers mean better insulating power

rehabilitating: to restore or bring to a condition of health or useful and constructive activity

retrofit: to install (new or modified parts or equipment) in something previously manufactured or constructed. To adapt to a new purpose or need

vapour barrier: layer of material used to retard or prevent the movement of water vapour (in cold climates from the warm side of buildings to the cold side)

volatile organic compounds: Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects.

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