



Energy Efficiency: Home Insulation - An Overview

(General)

What is Insulation?

Insulation comes in many forms, but the main purpose is to help prevent heat flow out of, or into a home. This means insulation prevents warm air from escaping from our homes in the winter and excess heat from entering in the summer.

Why Effective Insulation is So Important

- Canadian homes must be able to withstand long harsh winters, meaning heating a home is a major financial expense.
- Over 60% of home energy consumption in Canada is used to heat homes.
- Proper insulation will reduce your energy consumption, saving both money and greenhouse gas emissions.
- Better insulated materials mean better home comfort. Anyone who has been near a drafty window or door knows how uncomfortable it can be.



Where Insulation is Used in Our Homes

Windows

Windows and doors account for 25% of heat loss in Canadian homes. Windows come in a variety of options such as double pane, triple pane or filled with different insulative gases.

Doors

Doors without windows are most efficient. The larger the window in a door, the more heat loss and less efficient it is. Look for products with the Energy Star logo. Ensure weatherstripping is installed properly and undamaged as this can be just as important as the doors quality.



How Insulation Works

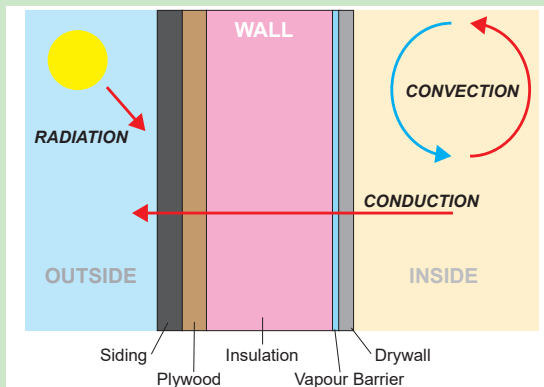
There are 3 ways heat is transferred and homes are designed to prevent all three.

Convection is the movement of heat through a fluid such as liquid or gas (like the warm air from your furnace). Warm air in your home will rise to the upper floors/attic while the cooler, more dense air will fall to the lower floors. This creates a circular current.

Conduction is the movement of heat through a solid material. In a house this could be the transfer of heat from an interior wall, to wooden studs inside a wall, to the exterior material on your home.

Radiation is the transfer of energy by electromagnetic waves without involving any particles. Heat is not produced until the energy waves come in contact with some material. For example, sunlight passing through a window warms the room or sunlight heating up the exterior walls of your home.

While a home's exterior walls will absorb energy from sunlight as radiation, it is the insulation that will help prevent conduction from transferring heat through the walls and out of your home. Heat can even be transferred directly through solid building material (i.e. wall studs). This process is called **thermal bridging**. Foam board insulation installed on one side of the thermal bridge will prevent this major form of heat loss.



Greenplanet Energy Analytics

Over 60% of home energy consumption in Canada is used to heat homes,



- Space heating 61.6%
- Water heating 19.3%
- Appliances 13.6%
- Lighting 3.6%
- Space cooling 1.9%

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Weatherstripping

The material used to insulate around door or window frames when there is not a complete seal.

Window Coverings

Insulating curtains or blinds will help prevent heat loss from windows. Any kind will help but you can buy ones made specifically for this.

Exterior Walls

Exterior walls account for the majority of surface area in a home, so this insulation is very important. In fact, 20% of all heat loss in a home is through exterior walls. This typically consists of fiberglass batt or mineral wool insulation.

Interior Walls

Often overlooked, interior wall insulation will improve noise control and help control indoor climate control. Occupants are able to customize temperature using vents in different rooms.

Interior Floor Insulation

Insulation between floors will result in more comfortable indoor climate, reduced energy consumption as well as noise.

Foundation Insulation

Basements account for 20% of a home's heat loss. Insulation can be added to either the interior or exterior. Exterior insulation provides the most effective insulation. However, it can be costly and time consuming as excavation is required. Interior insulation is the cheaper, easier option for DIY'ers.

Concrete Slab Insulation

Similar to foundation insulation, this can be installed under the slab during construction to keep the warm air in and the moisture out, but it can also be installed on top of the slab

Attic Insulation

Since heat always rises, attics must be well insulated. A combination of loose fill, batt, rock wool, or cellulose will resist heat flow between and above joist spaces.

Electrical Boxes

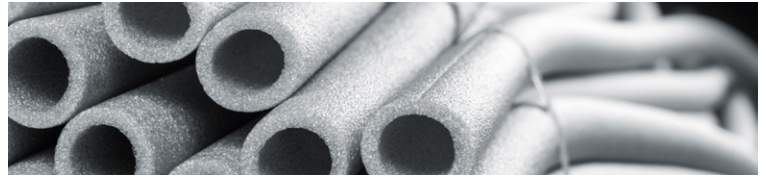
Electrical boxes create an open air space where wall insulation is unable to work effectively. Adding a foam insert behind the face plate and filling openings around the electrical box will help resist heat loss.

Ductwork

Heated air from furnaces is delivered to each room by ductwork which can lose heat. Reflective ductwork insulation reflects up to 97% of radiant heat loss, thereby heating the home more evenly.

Hot Water Tank

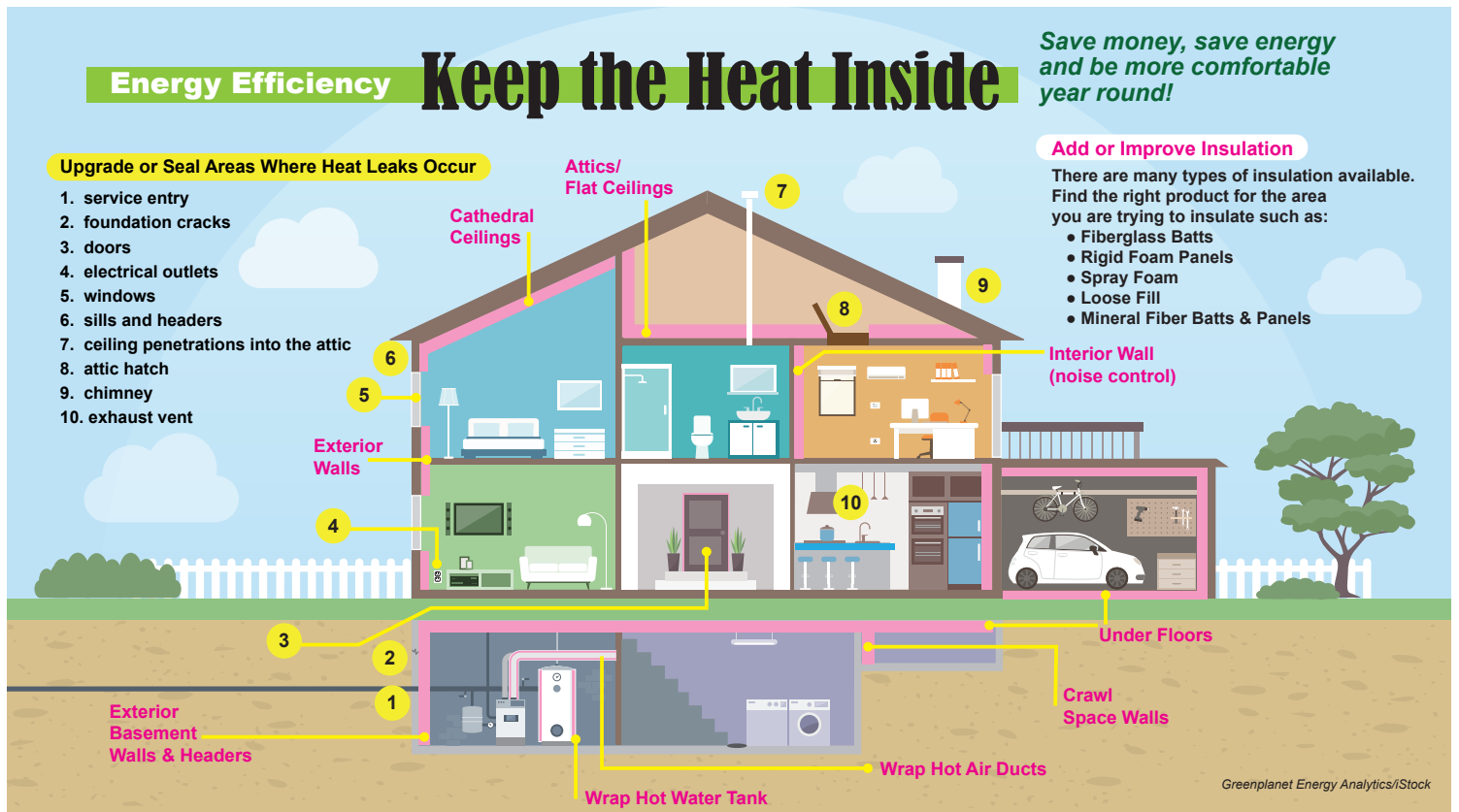
Heating water requires a fair bit of energy consumption, and an insulative wrap will act as a blanket, keeping the heat inside so your hot water tank does not need to work so hard.



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Hot Water Pipes

After turning off the hot water tap while doing dishes or taking a shower, hot water will sit in the line, unused. If uninsulated, the water will cool, meaning a hot water tank will need to produce more hot water than necessary as you run the shower or tap waiting for it to heat up again. The hot water pipes can be insulated to save energy.



Types of Insulation

Loose-Fill and Blown-In

This consists of a fluffy material, typically cellulose, fiberglass or mineral wool, that will conform to fit into any space. It is ideal for attics and as a retrofitting insulation material as it can fit into small spaces, and can also be used in walls.



Batt Insulation

A form of blanket insulation, batts are fluffy rectangular lengths of fiberglass or mineral wool, held in place with vapour barrier. They easily fit in between most joists and studs in walls or attics.

Reflective

Most insulating materials prevent heat transfer by conduction (through solids). Reflective insulation materials prevents heat transfer by radiation - by having a shiny surface that can reflect it like a mirror. Composed of aluminum foil, it is mostly used in homes in hot climates.

Foam or Rigid Board

A stiff panel composed of either polystyrene, polyisocyanurate (polyiso), or polyurethane. This can be used in an attic, basement, wall or floor application. It is more expensive than batt insulation, but it has a higher R-Value per inch of thickness.



Spray foam insulation

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Spray Foam

This is used as a sealant in areas where insulation is required in tight spaces such as cracks or joints. It can also be used to insulate the walls and attic of your home.

Spray foam is made of plastic resin and a catalyst. Using a spray kit, the foam is sprayed on directly, the foam expands in place and sets in seconds.

What is an R-Value?

- An R-value or “thermal resistance” is a measurement of an insulation’s ability to slow or resist the flow of heat. A higher number indicates a higher insulation value.
- An R-value is determined by the properties of a material, such as its conductive properties, density and thickness.
- When determining R-values of a wall or attic, it is important to note that they can be added together. Meaning, if there are multiple layers of materials it is important to take note of each layer’s R-value and add them together to calculate a total thermal resistance.
- For example, a home’s walls could have vinyl siding with foam board insulation (a rigid, firm block of fiberglass), complemented by loose and fluffy “blow-in” material on top. The true R-value of your walls must take into consideration all of the product’s individual R-values.

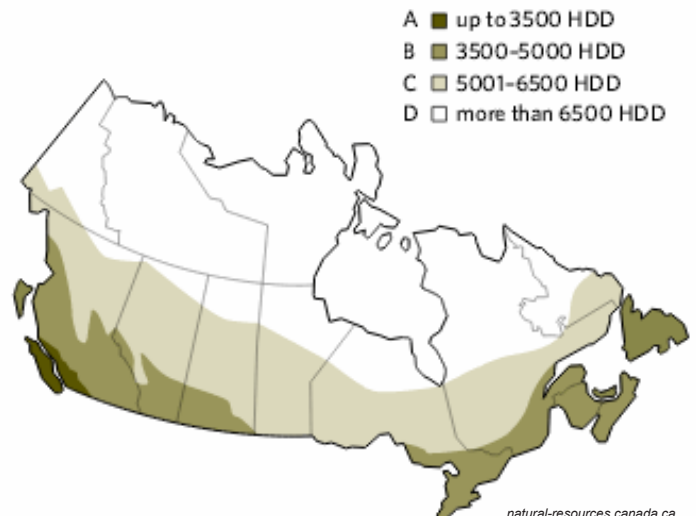
Climate Zones

Without taking into consideration what climate zone you live in when purchasing insulation, you will not maximize your potential savings. For example, Northern climates require more insulation than Vancouver Island.

HDD - Heating Degree Days

Walls, attic and basement insulation are divided into 4 zones in Canada: A, B, C and D

In order to classify regions into their own unique climate zones, engineers use a calculation called Heating Degree Days, or HDD for short. An HDD is the average amount of days that the temperature falls below 18 degrees Celsius. This allows engineers to determine the R Value that will work best for each climate zone in Canada.



Canadian R Value Zones

House Component	Zone A	Zone B	Zone C	Zone D
Walls	R 22	R 24	R 27	R 40
Basement Walls	R 19	R 19	R 24	R 25
Roof of Ceiling	R 40	R 50	R 60	R 60
Floor (over unheated spaces)	R 27	R 31	R 40	R 50

Upgrading Your Home Insulation

There are varying degrees of difficulty in upgrades or repairs that make your home more energy efficient. Consider saving yourself some money by invoking your inner DIY. Remember to observe safety precautions like wearing proper clothing, a mask, goggles and gloves. Otherwise, ensure that the job is taken care of by a professional.

Simple Solutions	Intermediate	Advanced
Spray foam cracks and gaps	Attic Loose Fill Blow-In	Interior and Exterior Wall Insulation
Caulking		Window Replacement
Weatherstripping		Doors Replacement
Insulating curtains or blinds		Basement Foundation Insulation
Duct Insulation Wrap		
Hot water piping Insulation		

Useful Links

Types of Insulation - Government of Canada

<https://www.energy.gov/energysaver/weatherize/insulation/types-insulation>

Keeping Heat in a Home - Government of Canada

<https://www.nrcan.gc.ca/energy-efficiency/energy-efficiency-homes/how-can-i-make-my-home-more-ener/keeping-heat/15768>

Guide - Keeping the Heat In - Government of Canada

https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/housing/Keeping%20the%20Heat%20In_e%20.pdf

What you need to know about home insulation - Global News

<https://globalnews.ca/news/1776037/what-you-need-to-know-about-home-insulation/>

Before You Insulate Your Attic - This Old House

<https://www.thisoldhouse.com/insulation/21018131/read-this-before-you-insulate-your-attic>