insulating for energy efficiency

overview

Thermal insulation, when correctly installed, slows heat escaping your home in winter and entering your home in summer, making your home more comfortable and saving money on energy bills. The following information will assist you in identifying the most effective and energy-efficient way to insulate your home.

Background

On cold days heat escapes from your home, and on warm days heat flows into your home. Insulation can slow this process, reducing your energy costs and improving your comfort. Many people believe that because hot air rises, most heat loss will be through the ceiling. This is not necessarily true. Heat moves equally in all directions, from a warm spot to a colder one.

To get the full benefit and energy savings of insulation, you must insulate your entire home.

The following recommendations are intended to help you save money on your energy costs over the long term and make your home more comfortable.

Adding insulation

Unless your home was constructed with special attention to energy efficiency, adding insulation will reduce your energy bills. Additional insulation will make it easier to maintain a uniform temperature throughout your home and can also reduce noise levels. Insulation can be added as a do-it-yourself project but, given the complexity of the task, you may prefer to hire a professional contractor to perform the service for you. Either way, it's important to choose and install the insulation correctly.

The decision of how much insulation to add to your home will depend on how much insulation is already in the house, how the house was built and the difficulty involved in adding insulation. If you decide to add insulation, you will need to know which insulation to use.

What are insulation values?

Over time, insulation has changed, reflecting new products and innovations in the home comfort field. Insulation is manufactured and sold by its thermal resistance value (RSI) or the Imperial measurement (R) value; both are a precise measure of the insulation's resistance to heat flow. In each case, the higher the RSI or R value, the slower the heat transfer rate through the insulating material.

How much insulation?

While our provincial building code dictates minimum insulation levels needed in new homes, the Government of Canada's **Model National Energy Codes for Houses** recommends levels that generally exceed the minimum.

BC hydro
powersmart

Start with *Table 1* to determine your specific climate zone. The zones represent locations in the province that have a similar number of heating degree days. Heating degree days are a measure of the heating requirements, and are based on the difference between the average daily outdoor tempertaure and 18°C (65°F). Cumulative totals for the month or heating season are used to estimate heating energy needs. A home in Zone C will have greater heating requirements than a home in Zone A and will thus benefit from higher insulation levels. *Table 2* lists the levels of insulation recommended for the different zones within our province.

Table 1: *Communities grouped into zones by heating degree-days (HDD) below 18°C*

Zone A up to 5000 HDD	Zone B 5000–6500 HDD	Zone C Over 6500 HDD
Vancouver Island Lower Mainland South Interior North Coast Cache Creek Clearwater Cranbrook Golden Merritt Quesnel Rossland Stewart Terrace	North/Central Interior Blue River Burns Lake Dawson Creek Mackenzie 100 Mile House Prince George Valemount Vanderhoof Williams Lake	Far North Cassiar Fort Nelson Smith River

Table 2: *Recommended insulation values by climate zone*

	Zone A	Zone B	Zone C
Walls			
RSI	3.5	4.2	4.76
R	20.0	24.0	26.0
Basement Walls			
RSI	3.5	3.5	3.5
R	20.0	20.0	20.0
Ceiling			
RSI	7.0	8.5	9.9
R	40.0	48.0	56.0
Solid Roof Deck			
RSI	4.9	7.0	7.0
R	28.0	40.0	40.0
Floor (over unheated spaces)			
RSI	4.9	7.0	7.0
R	28.0	40.0	40.0

Units: RSI (m2•K/W); R-value (ft • h• °F/Btu)

Where to install insulation

The following briefly describes how to better insulate your home. For detailed information, check out the Natural Resources Canada Office of Energy Efficiency's, **Keeping the heat in** booklet. This publication can be ordered online at http://oee.nrcan.gc.ca/publications or by calling 1 800 387-2000.

Frame wall — new construction

Full wall insulation is recommended for the outside walls of your home. Fill all voids between the wall studs and cover with a vapour barrier. Voids include spaces between studs, at corners, behind the inside wall where it joins the outside wall, openings and cracks around windows and doors, and the header joists between floors. To prevent freezing, insulation should be fitted behind pipes and electrical boxes. Insulation should be split to go over wires when no other method is possible.

Frame wall – existing construction

When no insulation exists in an outside wall, each stud space should be blown full with a high density cellulose fibre insulation. Extreme care should be taken during this application to ensure no voids exist on completion. Where some insulation already exists in the walls, do not attempt to fill voids with blown cellulose fibre, as it may not distribute properly within the space and could result in costly retrofit projects.

Where an outside renovation is considered, such as new siding, adding exterior grade rigid insulation sheathing can increase the R-value of the wall. New siding or stucco may then be applied.

Basement wall insulation

Frame construction basement walls should be insulated the same as the walls on the main floor. A sealer should be used between the masonry wall or the floor and the sill plate, or bottom wall plate. The sealant is required to prevent air leakage and heat loss where the two meet. A vapour barrier should also be installed on the warm side of the insulation.

Any portion of a masonry wall that is 30 cm (12 inches) or more above grade should be insulated to the same level as the exposed frame walls. Insulation should continue down the masonry wall to the floor or footing.

If the above-grade portion of the masonry wall is less than 30 cm (12 inches), insulation can be applied to the interior or exterior of the wall. If applied to the exterior, rigid insulation products specifically approved for below-grade applications should be used.

Crawlspace wall insulation

In climate Zones B and C, enclosed crawlspace walls should be insulated and heated to at least 16°C (60°F). This will maintain comfortable temperatures of the floor surface above and prevent water pipes from freezing. As an alternative, in areas of climate Zone A where the crawlspace doesn't need constant heating, you may insulate the underside of the floor above and all ductwork and water pipes.

Screened vents with a tight-fitting removable door must be installed to provide a free vent area of 1/500th of the crawlspace floor area. At least two vents should be installed and located across from each other to ensure a flow of air across the crawlspace. If the crawlspace is heated, the vents should be closed during the heating season and open whenever the crawlspace is not being heated.

Ceiling insulation

Ceilings with attics are the easiest and cheapest areas to insulate in your home. Before adding insulation to a ceiling where none currently exists, a vapour barrier should be installed. Sheets of polyethylene film can be spread over the entire area and tucked into place, flat against the ceiling. When adding to existing insulation, do not use a vapour barrier on top of the existing insulation, as this will trap moisture. Make sure no gaps or spaces are left unfilled between insulation and ceiling joists. Attic hatch covers should be weather-stripped and insulated the same as the rest of the ceiling. Be careful not to block ventilation airflow from vents in the eaves, as this can lead to damaging moisture buildup.

Floor insulation

Floors over areas exposed to outdoor temperatures should be insulated as noted in *Table 2*. The vapour barrier must always be placed on the warm side of the insulation, whether it is adhered to the bare floor or stapled to the sub-floor prior to insulating. If the sub-floor is made of plywood, simply seal all joints with caulking or construction adhesive. There is no need to add vapour barrier to plywood sub-flooring.

Slab-on-grade

Slab-on-grade floors should be insulated with at least RSI 0.88 (R5) rigid insulation around the perimeter for 60 cm (24 inches) in from the perimeter. If the floor has embedded heating ducts, cables or pipes, it should be insulated to RSI 1.76 (R10) under the entire area.

Slab edge insulation

One metre of exposed, uninsulated slab edge loses as much heat as several square metres of insulated wall area. If the slab is heated, the slab edge heat loss almost doubles. Insulating the exposed perimeter of the slab can reduce heat loss and maintain warmer floor surface temperatures inside your home.

Which insulation should I use?

Choosing the best insulation for your particular job is dependent on the job itself. Some insulation types are easier to work with in a range of applications, while others are best suited to specific jobs. It is important to know that the different forms of insulation can be used together to achieve the best results in your particular application. For example, you can add batt or roll insulation over loose-fill or vice versa; however, heavier weighted material should not be placed over easily compressed materials, as this will reduce the total R-value.

Forms of insulation

Brief descriptions of the different forms of insulation available are provided here as a handy guide.

Blanket refers to products available in either rolls or batts. These products are flexible and are usually made from mineral fibres. They are available in widths suited to standard spacing of wall studs or attic and floor joists. Blanket insulation comes with or without vapour barrier and flame-resistant facings. This insulation is lightweight, relatively easy to install, will not slump or settle and is fire and mould resistant. Small amounts of moisture will have little effect on the R-value, and blankets can be cut to fit. Caution should be taken with blanket insulation as the fibres can cause eye, skin and respiratory irritation during installation.

Blown-in loose-fill insulation includes loose fibres or fibre pellets that are blown into building cavities or attics using special equipment. Another form includes fibres that are co-sprayed with an adhesive to make them resistant to settling.

Cellulose fibre insulation is made from finely shredded newsprint, chemically treated to resist fire and fungal growth. Due to the small size of the particles, cellulose can flow around obstructions to give a uniform fill. This insulation can settle over time, resulting in lower than expected R-values, if not blown to manufacturer's recommended density. Cellulose fibre can be installed with rented equipment or hand poured, and usually has chemical additives to make it resistant to fire, vermin and fungal growth.

Blown glass fibre is similar to glass fibre blankets except that the material is chopped up. The particles in glass fibre tend to be larger than cellulose particles; therefore, it doesn't always flow as freely around obstructions. This form of insulation is fire and mould resistant and small amounts of moisture have little effect on the R-value. Caution should be taken when handling this material as it can cause eye, skin and respiratory irritation during installation.

Vermiculite comes in treated and untreated varieties. The treated material is coated with asphalt to make it water-repellent for use in high-moisture areas. Untreated vermiculite absorbs water and dries very slowly. Vermiculite is non-combustible, odourless and non-irritating.

Foamed-in-place polyurethane foam insulation is a closed-cell variety that can be used in a variety of spray applications. The material is mixed on-site with special equipment for large applications. For small applications, the foam is available in spray cans for sealing around window frames, plumbing entrances, etc. The foam will act as an air barrier but not a vapour barrier and should be protected from prolonged exposure to sunlight. When the foam is used in the interior of a home, it must be covered with a fire-resistant material such as drywall.

Rigid insulation is made from fibrous materials or plastic foams and is pressed into board-like forms and moulded pipe-coverings. This form of insulation also offers acoustical buffering, making it a great choice for rooms where low noise levels are desired. Some forms of rigid insulation also come with a reflective foil covering that reduces heat flow when next to an air space. Rigid insulation, in different forms, can be used for interior and exterior sheathing but, if used in the interior of your home, must be covered with a fire-resistant material such as drywall.

When choosing insulation for your home. Ventilation and moisture control are important along with vapour barriers.

Sealants

Sealants are better suited to smaller applications, such as sealing around windows or doors or to seal joints between building components. Make sure the sealant you are using is compatible with the surface you are applying it to.

Gaskets

Specialty gaskets have been developed for sealing joints where caulking may not be appropriate.

Sill plate gaskets can be installed between the foundation and sill plate during construction or where existing house walls meet a new addition.

Electrical outlet and lighting fixture gaskets are designed to fit behind cover plates of electrical receptacles, switches and lighting mounts, reducing air leakage into walls and attics. These gaskets are most effective when used in conjunction with caulking and child safety plugs.

Neoprene gaskets are flexible and very durable. They can be used for sealing joints where movement is expected, such as on plumbing stacks.

Other Factors

When choosing insulation for your home, you need to consider other factors besides the amount of insulation or the RSI/R values of the insulating material. Ventilation and moisture control are important along with vapour barriers.

Ventilation

Ventilation will prevent elevated moisture levels, which can lead to condensation on window surfaces and give rise to surface mould and mildew in your home during the heating season. Condensation can also happen within walls and roof spaces.

Ventilating your home is important to prevent mould, rot and mildew, which could damage the structure and cause health problems for you and your family. When installing new insulation, make sure you do not insulate over ventilation, air exchange and air exhaust openings. If heavy condensation is present, you should consider installing a mechanical ventilation system. An air-to-air heat exchanger can be used to pre-heat cold incoming air with warm exhaust air to reduce ventilation heating load and annual heating costs.

For more information about ventilating your home visit **www.bchydro.com**.

Additional regional ventilation information can be found at your local municipal office or in the provincial building code, which can be ordered from:

Crown Publications
546 Yates Street
Victoria, BC V8W 1K8
604 386-4636

Vapour barriers

Installing a vapour barrier to the warm side of insulation can prevent moisture from entering walls and attics. An effective vapour barrier must be vapour diffusion resistant, durable and continuous around the entire home.

A number of building materials resist vapour diffusion well enough to be used as vapour barriers. These materials include polyethylene, oil-based and special vapour barrier paints, some insulation materials and exterior-grade plywood. Different materials may act as the vapour barrier in different parts of the house. When retrofitting a wall, always ensure that the interior surface of the wall is vapour resistant to prevent moisture from getting into the wall.

In some cases the same material may work as both an air barrier and a vapour barrier. Polyethylene sheets and foil-backed gypsum drywall can combine these functions. To avoid confusion of terms, when a material is doing both jobs it will be called an air and vapour barrier.

Do not seal or fill over any exhaust or air intake vents, as this may lead to a hazardous situation.

Warning for combustion safety

Furnaces, fireplaces, wood stoves and any other fuel-burning appliances require air for combustion and diluting and exhausting the products of combustion out of the home. If there is not enough air, it is possible that the chimney or flue could backdraft or spill dangerous gases into the home. Do not seal or fill over any exhaust or air intake vents, as this may lead to a hazardous situation.

To ensure that your home has adequate air intake and venting to prevent air quality and moisture problems, some work may need to be done to your home. Most combustion safety work can be done by the do-it-yourselfer with a few special tools and the right materials. If you prefer not to do the work yourself, a qualified contractor with specialized equipment and experience may be the best choice. Regardless of who completes the retrofit work, it is important that the work follows all safety and health regulations and recommendations for long-term savings and comfort.

Recessed lighting fixtures

The electrical code prohibits the use of recessed lighting fixtures blanketed in thermal insulation because heat build-up can lead to a fire hazard. If these fixtures are to be covered, they must have a thermal protection device with an insulation rating over 90° C to switch them off should overheating occur. In addition, the lighting fixtures must be Canadian Standards Association (CSA) approved for this type of installation. As an additional safety precaution, recessed lighting fixtures should be surrounded, at a distance of not less than 50 mm (two inches), by a box constructed of plasterboard, plywood or other substantial material. The lights or bulbs in the fixture must not exceed the maximum wattage allowable for the particular light fixture. A CSA label does not mean that the light fixture is suitable to be insulated. Check with your local inspection authority or if in doubt, don't insulate.

Wiring

Where insulation will cover electrical wiring, the wiring should be examined before insulating. All wiring connections should be covered in junction boxes and any wiring with deteriorated electrical insulation should be replaced. If you are in doubt, have the wiring examined by a qualified contractor.

Chimney clearances

The Provincial Fire Commissioner's office requires that adequate clearance be maintained between chimneys and combustible insulation, such as cellulose fibre. These clearances are 50 mm (two inches) for masonry and all-fuel metal chimneys; 25 mm (one inch) for type B gas vents and 45.5 cm (18 inches) for single wall metal C vents.

Installation

Please ensure that all installations meet your requirements, manufacturer's instructions and all applicable codes, standards and regulations. BC Hydro is not responsible for installations.

For more Power Smart information call:

Lower Mainland 604 431-9463

Elsewhere in B.C. 1 877 431-9463

www.bchydro.com

Conservation is the first and best way to help meet B.C.'s future electricity needs.

Printed with vegetable-based inks on paper made with 100% post-consumer waste. Please recycle.

BC hydro powersmart

70700 April 2007