

# **PowerSense**

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# Making Your Home More Efficient ~ Caulking and Weather Stripping

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When warm air leaks out of your house, it's costing you money. Air leakage can account for 1/3 of the total heat loss. This can cost you between \$100 and \$1000 a year depending on your heat source.

## Caulking and Weather-stripping I

Weather-stripping is the easiest and least costly way to control heat loss by air leakage and improves comfort by eliminating drafts.

The first step is to determine where the air is leaking. There are two easy ways to do this

- 1) Leakage can be detected by hanging a short strip of tissue paper or plastic wrap from a clothes hanger and holding it near doors, windows and vents. The test strip moves in the air currents and locates the drafts.
- 2) Leakage can be detected by holding a smoking "draft indicator" near doors, windows and vents. The smoke follows the air currents and locates the drafts.

Air leakage is easier to detect when the air pressure difference between inside and outside is the greatest. Choose a cool, windy day in the fall or a cold winter day. Run all exhaust fans and turn on the furnace to increase the pressure difference. Move your draft indicator around door and window edges, electrical outlets and other potential leakage areas and mark drafty spots with chalk. Check the drafty areas to see if there is weather-stripping. It may need adjusting, or if it is cracked or worn out, it should be replaced.

Caulking is applied where two surfaces meet but do not move, such as sill plates or duct outlets. Applying caulking requires a little more effort and skill than weather-stripping. Some areas such as plumbing stacks, chimneys or electrical outlets require specialized or combination weather-stripping and caulking techniques.

Houses are built of a number of different materials. Because the materials expand and contract at different rates with temperature and moisture changes, cracks and gaps can occur. Exterior gaps are a concern because water can penetrate and cause deterioration, interior gaps because air leakage causes heat loss and heated air carries moisture, which may condense in the wall and cause damage.

## Surface Preparation

A properly prepared surface is essential for weather-stripping to provide an effective, long-lasting seal. Surface preparation involves several quick and easy steps. Materials to be weather-stripped should be thoroughly cleaned to remove dirt, oil, grease, flaking paint, wood splinters, etc. Uneven surfaces should be leveled with a hand plane or sander. Major gaps or cracks should be filled with a latex wood filler.

The costs associated with weather-stripping and caulking are small. Installation takes time, but is not difficult. Fuel savings are considerable. Improving air tightness should be considered a must.

## Making Your Home More Efficient ~ Keeping the Heat in – Insulation

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Through conduction, convection and radiation, heat always flows from hot to cold. All three modes of heat transfer are occurring simultaneously within your home. When the objective is to keep the heat in your home, stopping or slowing all three modes of heat loss is a must. Convection occurs when air moves heat from one point to another, conduction occurs when heat travels through a solid and radiation occurs when a hot object is placed near a cooler object.

Air sealing, through the use of caulking and weather-stripping, is one method of addressing convection. Since hot air rises, start in the attic and check for gaps around plumbing stacks, light fixtures, ductwork, attic hatch, chimney flue, and other attic penetration points.

Insulation helps reduce conduction and some non-traditional insulation's even address convection. However, it is not possible to stop all conduction and at some point adding insulation will have diminishing returns. PowerSense recommends insulating to R 40 levels in the attic as this area gives the best return for the insulating dollar. The R-value for walls is a recommended R 20, however it can be costly to add insulation to walls and the best time may be when the house is being re-sided.

To reduce the radiation heat loss, you can install radiant barriers. They require a 1/2-inch air space next to the reflective surface to have any effect at all. Be aware that the claimed R-values for these radiant barrier products are misleading, the true R-values are much lower.

If you are thinking of renovations to make your home more energy efficient, our Home Improvements Program may help! [Click here to find out more!](#)

## Caulking and Weather Stripping II

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### Caulking

Caulking should be considered as a form of weather-stripping for specific applications. Caulk should be applied in situations where two surfaces meet but do not move. Applying caulking requires a little more effort and skill than weather-stripping. Houses are built of various materials and because these materials expand and contract at different rates with changes in moisture and temperature, cracks and gaps will occur. Exterior gaps are a concern because bulk water can penetrate and cause structural deterioration. Interior gaps are a concern because air leakage costs you in terms of heat loss/comfort and heated air carries moisture, which can condense inside the walls. The best place to seal with caulking is on the inside, to prevent moisture accumulation in the wall and ceiling cavities.

Select your caulking carefully, caulking is designed with different applications in mind. Some caulking is designed to adhere to specific types of materials; other caulking offers enhanced flexibility. There are caulking, which will remain sticky forever, and caulking, which are formulated for high heat situations. Always read the label and select the caulk according to your job requirements.

Before using caulking always remove old caulking completely; make sure all surfaces are dry and free of dirt, loose materials, grease or oil. Generally you do not apply caulking when temperatures are below 10 C (50 F).

### Weather-stripping

Weather-stripping is one of the most cost-effective ways of reducing your heating bill. Weather-stripping is used to seal any opening and closing window, hatch or door. There is a tremendous variety of weather-stripping available and the trick is to choose the type most suitable for the application and your skill level as a handy person. Prices range from pennies per foot to dollars per foot. Weather-stripping is available in compression types, wedging types and magnet types.

**Rope Caulk**, usually sold in rolls, consists of a long, thin bead of puttylike material that works well as a gap filler. It can be messy to work with and looks less professional.

**Tape Caulk**, flat with a peel-off paper backing, is a newer version of the same idea. It is less messy and more expensive than rope caulk.

**Liquid weather-stripping** is a transparent caulking compound that cures in a few days. Application with a caulking gun is easy, and we were able to peel off the cured compound with no trouble.

**Foam Strips** are inexpensive and easy to apply. They usually have an adhesive backing with a peel-off protective covering. Open-cell (polyurethane) foam is light and highly compressible, while closed-cell (vinyl) foam is denser, firmer, and more durable. Neither kind of foam will last for many seasons.

**Sponge Rubber**, made from a neoprene, is another type of foam strip. It's denser and firmer than polyurethane or vinyl. Toughest of all is ethylene propylene diene monomer (EPDM); a synthetic rubber like material that is smooth and nonporous but has a spongy texture.

**Plastic "V" Strips** are one form of "tension strip", so called because they form a seal by pressing against another surface with their integral spring like tension. One side of the "V" has a self-adhesive backing to attach to the inside surface of a window channel or between the edge of a door and the doorjamb. Plastic "V" strips perform well in both compression and sliding fits.

**Door Sweeps (self adhesive)**, sometimes called door bottoms, usually consist of a flexible sealing strip-flap of rubber, vinyl, felt, or nylon bristles – fastened to a rigid backing made of vinyl, metal, or wood.

## Simple Repairs

**Felt Strips** are an old-fashioned weather-stripping material, commonly made from wool and chiefly intended for compression fits. Felt strips must usually be tacked or stapled in place.

**Flexible Gaskets** typically consist of a hollow tube of vinyl, silicone rubber, EPDM, or other synthetic material fused to a flexible flange that you nail or staple to a window or door.

**Rigid-Backed Gaskets** are similar to flexible ones but are attached to a rigid flange made of metal, wood, or hard vinyl. This combination can be effective and durable.

**Hemmed Gaskets** are simply strips of felt or flexible vinyl crimped along one edge into an aluminum-retaining strip.

**Door Sweeps** are like rigid-backed gaskets that you mount with nails or screws on the bottom of a door. A door sweep will come equipped with a large vinyl fin, neoprene strip, or set of nylon bristles to create a sliding or "sweeping" gasket seal against the threshold plate.

**Standard Replacement weather-stripping** consists of a row of pile bristles on a flexible plastic backing strip. Installation is usually as easy as laying the new strip into the channel provided for it and pressing one edge with a screwdriver until it pops in.

## Upgrade Repairs

**Spring-Metal Strips** perform similarly to the newer plastic "V" strips, but they are more durable and more difficult to install.

**Magnetic weather-stripping** resembles a refrigerator-door gasket in operation and appearance. It comes in two pieces: a plastic, bellows like compressible gasket with a built-in magnet that fits on the jamb and a steel strip that you attach to the door.

**Interlocking weather-stripping** is very effective but requires care and skill to install.

**Door Shoes** work on the same principle as door sweeps, but are more heavy-duty. They consist of a metal retainer that holds a thick piece of vinyl and fits on the bottom of a door. Installation can be difficult.

## Insulation Types

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Insulation is any material that is resistant to the flow of heat. A good insulative material will reduce the effects of one or more of the methods of heat transfer: radiation, convection, and conduction. The effectiveness of insulation is measured in terms of 'R' or 'RSI' (metric) numbers – the higher the numbers the less heat will escape through the material.

But Resistance Values are not the only consideration; fire, mold, insects, vermin, and moisture resistance properties - as well as it's cost, ease of application and vapour permeance - are other factors that must be included in an insulation decision. Each insulation has properties that make it a better choice than other types in certain applications or conditions... there is no such thing as the "... best all around insulation", so choose your insulation wisely to ensure the maximum benefits for your dollar spent.

Insulation commonly used in Alberta's homes are broken down into three main types: batt, rigid, and loose-fill - materials in the latter category being 'blown', 'poured' or 'sprayed' onto surfaces or into cavities.

**Batt/Blanket** – Made from glass fibre or mineral wool, friction fit batt insulation is used in attics, floors, above and below grade frame walls. Installable without special equipment, batts are lightweight and will not slump or settle if carefully fit into wall cavities.

**Loose Fill** – Cellulose (re-cycled newsprint), glass fibre, and mineral wool 'loose-fill' insulations can be poured, blow-in, and spray applied. For use in attics, enclosed cavities, roofs, walls or floors. Should not be used below ground level.

**Rigid Board** – Available in fibre glass, extruded or expanded polystyrene, polyisocyanurate, and phenolic foam board, these insulations have a wide range of R-Values, compression resistance and drainage properties. For use on roofs, ceilings, floors, interior or exterior faces of walls both above and below grade.

**Spray-On** – Technically more of an application technique than an insulation type, spray on insulations are slowly gaining popularity in residential construction. Spray applied polyurethane foams work well with irregular surfaces such as the rim joist areas of a platform framed home, in geodesic domes, prefabricated metal buildings, and free form concrete structures.

Some types of insulation are also very efficient air barriers (rigid) while other types are not (batt). Such insulations should be used in conjunction with other materials (air barriers) in a 'system approach' to ensure maximum performance.

## **Insulation Levels** (Recommended)

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One of the most important lessons learned over the years is that the house works as a system. Each part of the house interacts with all the other parts and changes made in one area will effect other areas.

When deciding on insulation levels one needs to use a balanced approach. For example, it makes no sense to have a very high insulation level in the ceiling with an uninsulated basement or low insulation levels in the exterior walls. Proper installation is just as important as the amount of insulation used. If there is no insulation in existing walls, blown-in insulation can be added. If considering re-siding, 1" to 2" of board insulation under the new siding is recommended.

(R-1 = .176 RSI)

### **Minimum Standard**

1. Above Grade Walls = R-12 (RSI-2.1)
2. Basement Walls-2' below grade = R-8 (RSI-1.4)
3. Ceilings = R-34 (RSI-6.0)
4. Floors over unheated spaces = R-12 (RSI-2.1)
5. Exposed Cantilevers = R-20 (RSI-3.5)

### **Minimum Recommended**

1. Above Grade Walls = R-20 (RSI-3.5)
2. Basement Walls = R-12 (RSI-2.1)
3. Ceiling = R-40 (RSI-7.0)
4. Floors over unheated spaces = R-20 (RSI-3.5)
5. Exposed Cantilevers = R-28 (RSI-4.9)

### **Recommended Low Energy Home**

1. Basement Floors = R-10 (RSI-1.8)
2. Basement Walls = R-20 (RSI-3.5)
3. Above Grade Walls = R-40 (RSI-7.0)
4. Ceiling = R-60 (RSI-10.6)
5. Floors over unheated spaces = R-40 (RSI-7.0)
6. Exposed Cantilevers = R-40 (RSI-7.0)

## Maintenance and Trouble-shooting for your Furnace

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Many of the maintenance and trouble shooting tasks are best left up to qualified heating mechanics – such as burner adjustment and heat exchanger examination - but there are some tasks you can do yourself.

***Inspect the exhaust vent:*** look for corrosion, vent crimping, deteriorated aluminum tape and signs of backdrafting. Look up the vent with a strong flashlight to check for blockages.

***Change the air filter:*** at least four times a year and preferably once a month to ensure that the blower propels air at peak efficiency and that resistance in your duct work is kept to a minimum (dirty ducts cause turbulence). If you own an electronic air filter, clean it regularly.

***Maintain the motor/blower system*** by oiling the motor at prescribed locations once a year (don't over do it, two drops will do). Ensure that the blower bearings are kept greased and that the blades of the blower are cleaned yearly to remove grime. Check the drive belt tension between the blower and the motor to ensure that it is within proper tolerances (at midpoint the belt can be depressed no more than 1"). Also, check for pulley alignment.

### **\*REMEMBER TO TURN THE POWER OFF WHEN MAKING ANY ADJUSTMENTS\***

Ensure that air is flowing through all your supply registers and check all duct dampers to ensure that they are in their proper positions. Vacuum all register grilles to remove accumulated dirt.

If you have “cold rooms” in your home, consider insulating the heating ducts as that will keep the air within the ducts warmer. Adjusting the duct dampers is also important to balance out the airflow to each room.

If you think that your furnace is coming on too often, contact a heating contractor. Perhaps the thermostat needs to be adjusted to reduce furnace cycling, by re-setting the internal thermostat anticipators.



## Your House as a System

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Houses are built to provide comfortable protection from the elements. How well your home achieves this goal determines the size of your utility bills. The seemingly unrelated interactions between the building envelope, the occupants, and the mechanical equipment are best described by “Your house as a system”.

These three components - envelope, occupants, and mechanical - create the environment where the interplay between the key physical characteristics of air, heat and moisture take place. If you make changes to a component of the home you will change the relationships between air, heat and moisture.

For example, the purchase of new energy efficient windows can lead to increased humidity in the home because the newer windows leak less air. This can be resolved with a humidistat to control ventilation fans. What the example illustrates, is the fact that any type of change to the building envelope can have both positive and negative effects on the resident's comfort levels. It is important to look at the whole system, not just one part.

When you consider the house as a system, any change to the envelope, occupants, and mechanical components will result in side effects which you can predict. Being able to predict the changes a building will undergo has the benefit of allowing for better planning of renovations.

## House Design

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The final design of a home is the result of many considerations and influences, which are weighed, balanced and tempered with compromise. Ideally, a house design should take into account lifestyle, financial constraints, climatic conditions, soil conditions, choice of materials, construction techniques, orientation, the potential use of passive energy sources and last but not least... aesthetics. This list is not in order of importance but is established by each individual's own set of priorities.

In our northern climate, energy efficiency is very important. To attain a high degree of energy efficiency in your new home, you must pay close attention to site conditions, climate, solar access and prevailing winds in order to design and situate a home to your greatest advantage. Up to date and innovative construction techniques can markedly reduce the space heating and lighting requirements within the structure – which are the major energy costs in the home. Careful selection of energy efficient appliances can complete the picture of a well-designed, low energy home.

### Low Energy House Design

The following are insulation guidelines for building a low-energy home in a northern climate.

R1 = 0.176 RSI

R10 - basement floors (underneath or above)

R20 - basement wall

R40 - above grade walls

R60 - ceiling

R40 - floors over unheated spaces

R40 - exposed cantilevers

These insulation figures are considered the minimum levels for any low energy home.

### Renovated Design

There is a growing trend amongst homeowners to renovate (retrofit) their existing home rather than build a new one. In the past, retrofitting a home was purely cosmetic - improving the interior or exterior facade. Now homes are being upgraded to increase comfort and thermal performance. A renovation may be small - adding more insulation or new windows - or major such as greenhouse, solarium, or bedroom additions. Some homes have been totally redone into super-insulated, passive solar homes.

When retrofitting to reduce heating bills, one should proceed by doing the things that will cost the least and progress to more costly improvements at a later date. Simply caulking and weather-stripping your home – or upgrading a low insulation level in your attic – are very cost-effective ways to reduce your heating bill.

The larger jobs, such as re-insulating the walls or replacing the windows or furnace, should only be done after carefully considering several questions:

- 1) Am I trying to increase comfort levels or resale value?
- 2) Will these improvements be recovered when I sell the house?
- 3) How long will the payback be on these energy saving improvements?
- 4) How long will I live in this house?

Retrofitting a house may increase the interior humidity levels. In some cases this can become a problem to the occupants' health and the integrity of the structure. This potentially damaging situation seems to be occurring increasingly in homes that are 'tightened' and have had the furnace replaced with a high-efficiency, sidewall-venting unit. These houses should have as a minimum, a good, properly vented bathroom fan, a good range hood fan and a timer or humidistat control device to provide some ventilation. In extreme cases, a heat recovery ventilator may be needed to reduce the humidity level and balance the energy consumption and heat loss due to constant ventilation.

Although energy savings can never be as large as in buildings designed from scratch, retrofitting can save up to 40% of your heating bill and make your home more comfortable.

## **The Smart House**

Smart houses refer to the concept of home automation being incorporated into newly built homes. The wiring system is complex and must replace nearly all the conventional wiring, but once done the intelligent building can communicate within itself to provide the most effective and economical operation.

The smart house system enables automated control of features such as heating, ventilating, air conditioning, lighting, security, entertainment and communications.

A microprocessor translates your instructions to the various devices located in your home, these instructions can be pre programmed or delivered by phone, really what we're talking about is the computer control of your home and everything in it.

## Doors

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Entry doors, patio doors and garage doors are portals to the outside environment. But doors are weak points in the building envelope from an insulation, air leakage and security point of view.

Doors may be made from wood, steel alloy, aluminum, fiberglass or wood composite. They may be insulated or un-insulated. Insulated doors usually have an inside and outside metal skin and an injected core of urethane foam. Some garage doors have hollow profiles and optional rigid insulation blankets that fit toward the inside.

While wood doors are aesthetically pleasing, they are subject to warping, sagging, splitting, and checking as moisture content in the wood changes – a situation that will vary with climatic conditions and the installation procedure. Metal doors are far more durable, but will bow when the temperature outside is different than the indoor temperature. Proper weather-stripping can insure this is not a problem most of the time. Extreme temperatures can cause leakage points to open and close as the temperature difference changes.

The weather-stripping is the most critical part of the door system. It may be aluminum or vinyl V-strips; compressible rubber or nylon covered foam gaskets; vinyl or aluminum strips with rubber gaskets. The bottom of doors, unlike jambs, is subject to traffic wear and must be more durable. There are two ways to weather-strip this area – use a threshold or attach a door bottom or sweep. The doorsill must direct water away from the interior, and not contribute to ice build-up in the winter. Ice build-up can damage weather-stripping.

Storm doors of wood, aluminum or insulated metal helps reduce weathering on the primary door, and provide ventilation while keeping unwanted visitors and bugs out in the summer. Look for a strong and rigid frame and tempered or safety glass. On the down side, storm doors installed on the south side of the house can trap heat during warm sunny days, damaging the primary door or the weather-stripping on it. Do not install storm doors to catch the prevailing wind. Many a storm door has been damaged when opened by high winds.

Good installation is crucial. The frame should be installed square and plumb in the rough opening. Shims near each corner, at the hinges, in the middle and at the strike plate will correct for an out of square rough frame. Replace one screw per hinge on the strike plate with a wood screw capable of penetrating the frame and the stud of the rough opening at least one inch. Use closed cell foam rope or expanding foam sealant to seal the rough opening to the doorframe.

When choosing a door consider where it will be used. Does it need to look good? Does it need to provide a tight seal against air and water? Will it keep intruders out? Does it need to stop the flow of heat? Will it be the backboard for a basketball game?

## Garage Doors

Garage doors come in a variety of styles, materials, and operating types. Sectional or overhead doors, are most commonly found and have replaced hinged doors. They may be made from steel alloy, aluminum, wood, and fiberglass.

Most metal garage doors are hollow or have stamped panels. Others have polyethylene or polyurethane insulation sandwiched between two layers of metal. Some have a thermal break to

stop conductance of heat to the outer panel. A fiberglass blanket is available for some metal doors to improve their insulating ability. Steel doors are much more resistant to impact than aluminum, but must be hot dip galvanized to resist rust.

Wood doors are subject to warping and sagging with changes in humidity and temperature and require on-going maintenance.

Do your garage doors need to keep intruders out of an unheated storage space or are they used on a shop that needs to keep the heat in? Weather-stripping becomes important to keep water leakage and heat loss to a minimum. Consider the type and quality of weather-stripping incorporated into the design of the door. How easy is it to replace when it is worn? Curved openings are very hard to weather-strip effectively because of the recessed panels in a garage door.

## **Patio Doors**

Patio doors can be the largest windows in your house. All the components that make a good window also make a good patio door – good weather-stripping, good glazing, a non-conductive edge spacer, and a thermally efficient frame. Being a door, the sill and hardware are important; sills should be thermally broken and of a material that stands up to wear.

Patio doorframes use similar construction materials as those used in windows: wood, metal clad wood, vinyl, fiberglass and aluminum. The glazing may be single, double, Heat Mirror or Low-E coated. Triple glazing is very seldom found in a patio door as it is heavy and requires a very thick unit. Some patio doors have four individual sliding panels, others have two sliding panels and still others have one panel fixed and one panel that slides. Single pane, sliding panel units are not recommended for an energy efficient home.

Sliding doors are very difficult to weather-strip. Friction and foot traffic wears the weather-stripping out in short order. Rollers can also wear out, requiring replacement. A better type of sliding patio door that operates like an airplane door-popping out and sliding away from the weather-strip – is available, but is tricky to install.

Garden, Terrace or French doors are an alternative to traditional sliding patio doors. These are similar to double entry doors, with a large glazing area, and one or both opening inwards. The main body of the door may be metal with an insulated core, solid wood, or wood with aluminum cladding. These doors can be weather-stripped very effectively and can accommodate double, Heat Mirror, or Low-E glazing. Screens attach to the inside or are mounted on a track on the outside.

When designing a new home take into consideration the location of patio doors. Avoid northern exposures and prevailing winds. Good installation is also critical. Poor installation can cause drafts and increased condensation problems.

How do you control existing drafts and condensation? If possible use a third layer of glazing or shrinkable film to cover patio doors during winter when the doors are not in use. Kits are available and will reduce drafts and heat loss. Home made insulated panels and curtains are also an option.

# Windows

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## The Anatomy of a Window

Windows are a weak spot in the building envelope, for heat transfer, but we need them to provide view to the outside, natural daylight for the interior, ventilation, and sometimes heat. In our climate, windows can account for 25% of the heat loss in a house insulated to conventional standards and up to 40% in a house insulated to R-2000 standards. Upgrading windows may reduce heat loss, heat gain, air leakage, furniture fading, and increase comfort and resistance to condensation.

A window is a system composed of the frame, the glazing unit, the edge spacer and the weather-stripping. Each component has an effect on the overall energy performance of the window unit.

## The Glazing Unit

The glazing unit is the largest component of a window and loses and gains the most heat. Two-thirds of the heat loss through a glazing unit is by radiation. Adding a low-E coating can reduce these losses. Adding a low-E coating to a double glazed window may increase the R-value from R-2.0 to up to R-3.2. The coating reduces solar gain by 14% to 30%. Ultraviolet light that can fade fabrics is also reduced. The coating can reduce the radiated heat loss to the point where heat losses due to convection become dominant. Using a heavy gas such as argon or krypton between panes will reduce convected heat loss through a low-E window by 30% or more. There is no test method available at this time to measure how long gas fill will remain in a sealed unit, but research suggests a loss of about 2% per year.

Each additional air space that is added to a glazing unit increases the thermal resistance by R-1. More than three layers decrease solar gain more than they increase thermal resistance. Three panes of glass will give the unit slightly better insulating qualities than 2 panes with one low-E coating, but will allow more solar gain. The minimum spacing between the glass in a glazing unit should be 1/2".

The area 2 1/2 " around the edge of the glass loses more heat and has more potential for condensation than the centre of the glass. The glass at the edge is in very close contact with both the window frame and the spacer between the glass panes – another important consideration.

## Glazing Edge Spacers

A metal edge spacer between the panes of glass cools the edge of the glazing unit, increasing stresses and making the edge more susceptible to condensation. Better insulating spacer alternatives are the black rubber/metal spacer called a "Swiggle StripT", and the white silicon spacer called the "Super SpacerT". Replacing the metal edge spacer with an insulated spacer is especially important in Low-E coated windows. Using an insulated spacer in multiple glazed, low-E coated, argon filled glazing units can increase the thermal performance of the unit by as much as 20%.

## Window Frames

A frame can occupy 30% of the overall window area. A well designed PVC or fiberglass frame will have slightly less heat loss than a wood frame. Aluminum frames, even those with thermal breaks, do not perform as well. If a wood frame is clad in aluminum, be sure the cladding is well away from the glass and will not form a conduction path. The cladding can give the window a maintenance free exterior, but should be well sealed so moisture cannot harm the wood underneath. Vinyl and fiberglass frames are unaffected by water, but expand and contract with changes in temperature. Movement may be particularly bad with dark colours, and can lead to warping if insufficient room has been allowed for expansion. Wood swells and shrinks with changes in moisture content, and can warp if conditions are extreme. Good maintenance or an exterior cladding can reduce wood frame problems.

## Air Leakage

The overall construction of a window is often blamed when drafts and frost appear. This can be caused by air leakage around the frame or sash. If an opening window does not tightly seal with at least two types of continuous weather-stripping, any savings gained with upgraded glazing, edge spacers, or frame may be lost. Proper sealing between the rough opening and the window frame is also a must. See “Caulking and Weather-stripping” for ways to deal with this.

## Where to Start

The basic starting point when considering a new or replacement window in our climate should be a double glazed unit with a 1/2-inch air space created by an insulated edge spacer. The unit may be set into a wood, vinyl, or fiberglass frame. If your house has a high humidity level consider upgrading to triple glazing, low-E, argon fill or any combination of the three. If you require glare or heat control, low-E is a must. Consider the orientation of your windows, and the impact their location will have on heat loss and heat gain of the building. The larger the area of windows in a house the more important resistance to heat loss becomes. These improvements will increase the window's resistance to heat loss, although windows have still not reached insulation levels anywhere near that of walls. The most advanced “Super Window” on the market today has an overall R-value of 6.0.

Install the best possible windows you can afford, when building or renovating. No other component in the building envelope losses as much heat per square meter or costs as much to replace.

## Skylights

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Good quality skylights are an asset to any home as our winters are long and most of us stay indoors as much as possible. Skylights allow us to look at clouds and sky but more importantly, they allow light deeper into the home than wall mounted windows can, especially on cloudy days. In our climate, choice and placement of skylights has to be done carefully in order to avoid overheating in summer and dripping condensation in winter.

Homes that are built to modern standards can achieve relative humidity levels of 35% or more resulting in drooling skylights. The more layers of glazing a skylight has the more resistant it will be to condensation. This is especially important in cathedral ceiling and bathroom applications where the hot air at ceiling level can contain a much higher amount of water vapour. The deeper the well of the skylight, the less air circulation and the greater the potential for condensation. Flaring the well at the bottom of the shaft will increase air circulation and the amount of light being delivered by the skylight. Sealing a piece of glazing at the ceiling opening of the skylight well can also help.

Glazings for skylights are available in acrylic, polycarbonate, polystyrene and glass. They can be framed with aluminum, vinyl, wood or a combination of materials. When choosing a skylight look at:

- 1) The thermal qualities of the frame material – Polycarbonate, PVC or fiberglass have better insulating qualities than aluminum. A frame that creates cold corners on the glazing can increase the potential for condensation.
- 2) The properties of the glazing material – Is the material resistant to scratching, impact and ultraviolet breakdown? How much solar energy and ultraviolet light does the glazing transmit? Are tinting, Low e and triple glazing available?
- 3) Consider the slope of the roof in relation to the shape of the skylight – Flat skylights on a low slope roof tend to collect snow and dust on them more readily than dome or pyramidal shaped skylights.
- 4) Does the skylight open? – Opening skylights can vent hot air out of a house rapidly but may need regular maintenance in order to seal effectively when they are closed. Does the skylight have a screen?

When placing a skylight on your home, avoid southern or western exposures unless the glazing is tinted, or has a Low e coating that can block a good percentage of solar gain and ultra violet light. Skylights at these exposures can contribute to overheating during summer months. Consider the percentage of roof area that skylights will cover in any one room. Skylights are not insulators! Large areas of roof glazing can be a source of cold drafts on long January nights.

Good installation is the final step to a trouble free skylight. Proper flashing, caulking and drip cap orientation are critical to a good installation.

The light well that frames the skylight should be finished in a light colored paint or mirror to allow the well to reflect the maximum amount of light. The mirrored light well also presents a unique look at the sky and makes the skylight appear much larger than it really is.



# Air & Vapour Barriers

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## Air Barrier

The air barrier is used to prevent air from leaking in and out of the building. It is not the same as the vapour barrier, which prevents moisture from diffusing into the building structure. In many cases they are the same material, e.g. "polyethylene". This material only becomes an air barrier when it is sealed to become continuous around the entire building.

The barriers found in many older buildings were damaged during the construction phase if they are present at all. The openings, tears or gaps in the air barrier are concealed by the interior finish and allow vapour transmission into the wall or ceiling cavity. Air also passes through the walls and ceilings as the vapour barrier and air barrier are the same membrane in most buildings. Air leakage is the worst of the two as it can move far more water vapour into the building's walls than vapour transmission can.

In most homes today, the vapour barrier commonly used is a 4 mil or 6-mil polyethylene sheet stapled to the wall studs and ceiling trusses prior to drywalling. Other methods include the use of proprietary paints or several coats of oil base paint applied to the drywall. Extruded polystyrene with taped and caulked seams also makes a quality vapour barrier when applied to the inside of the home prior to drywalling. This technique also allows the material to serve a dual purpose as an air barrier.

Infiltration and exfiltration of air through the building envelope has come to be accepted as an intrinsic feature of a building; in residential construction some regard it as necessary for the proper ventilation and operation of the house. In contrast to these attitudes, it is suggested that air leakage wastes heat and is detrimental to the performance of a building.

Air leaking into a building cannot be treated or conditioned nor can its rate of supply or distribution to the occupied space be controlled. Attempts to do so by intentional pressurization of the building results in greater waste of energy and promotes increased condensation and thus deterioration of the building envelope. Air leakage through a building envelope, and between building compartments, can also disrupt the intended operation of heating, ventilating and air-conditioning systems and places limitations on the control of noise, fire and smoke.

Air leakage occurs as a result of air pressure differences created by fans, wind, and stack effect across unintentional openings in the building envelope. Little can be done to change the pressure differences resulting from natural climatic factors and pressure differences created by mechanical systems are required for air distribution within the building. The most direct approach is to reduce the number of openings through any structural membrane by the development and application of appropriate building details and construction practices.

## Installation

The installation of a continuous air barrier to stop air leakage in new construction may be laborious, but it can easily be done as the building is erected. In the case of existing buildings, the installation of such a barrier is more difficult and labour intensive since the building is already up, there are people living in it, and appliances, furniture and other objects are in the way. The need for an effective air barrier is paramount; effective planning and attention to detail make the job easier.

## **Effect**

Air proofing a building is an effective means of controlling water vapour travel through the building shell because unwanted holes or gaps in the walls and ceilings are the main culprits in the transmission of water vapour into the building shell. It is also effective in improving comfort by eliminating drafts. Finally, it reduces your heating bills as you don't have to pay for heating unwanted cold air.

## **Conclusions**

Improving the airtightness of walls, windows, floors and roofs is an essential step toward energy conservation in buildings. Air leakage should never be relied upon for ventilation or air supply or exhaust, but should be recognized as an impediment to the proper operation and control of ventilation systems. Specific mechanical ventilation systems should be required in all buildings to provide an adjustable rate of fresh air supply and exhaust with consideration given to the inclusion of energy recovery methods.

Efforts should be made to develop construction details, arrangements of materials and construction methods that will result in walls, windows, floors and roofs being more airtight with provision made for intentional and controllable ventilation openings through the building envelope where necessary. If this is achieved, not only will optimum operation of the building be more readily attained, but it will be easier to evaluate the actual air leakage characteristics of the completed building, easier to monitor the energy associated with ventilation, and easier to predict performance more accurately under anticipated climatic conditions.

## **Vapour Barrier**

In a typical household, somewhere between 10 to 15 kg (9 to 14 L) of moisture is generated every day by perspiration, cooking, laundering and bathing. This moisture – in the form of water vapour – becomes mixed with the house air. Two factors influence the reduction of water vapour in the home: 1) the rate at which it is carried out of the house by ventilation and 2) exfiltration.

## **Relative Humidity**

The term 'relative humidity' is used to express the amount of water vapour in the air. If the amount of water vapour is increased, the relative humidity of the air also increases – but only to a point. If water vapour is continuously added to air, there comes a time when the air can no longer hold any more. This is called the saturation point, and the air is said to have 100% relative humidity, or 100% RH. If more water vapour is added, the excess will condense on local surfaces. Air's ability to hold water vapour depends on the air temperature. As air temperature increases, so does its capacity to hold water vapour. If we have two equal volumes of air, each with 100% RH, but one much warmer than the other, then the warmer one will contain a greater amount of water vapour. It follows that if we take a volume of cold air, with 100% RH, and raise its temperature, its relative humidity will decrease even though it contains the same amount of water vapour.

Suppose we were to open all the doors and windows of a house in winter, and flood the house with cold outside air that may have a relative humidity of 80% (that is, it is carrying 80% of the water vapour that it is capable of holding at that temperature). Next, we close all doors and windows and allow the air to heat up to normal house temperature. We would soon notice that the air had become very dry – its relative humidity was very low. The explanation is that in normal winter temperatures the air can support only a very small amount of water vapour, therefore, even though its relative humidity is high, the actual amount of water vapour is low. When the air is brought into the house and heated up, it can hold far more water vapour than it actually contains, therefore its relative humidity may fall to as little as one or two percent.

To look at the opposite kind of effect: suppose we take a volume of warm air with a relative humidity of 80% and cool it to somewhere near the freezing point. It will gradually lose its ability to support water vapour and the relative humidity will gradually increase until, at some point during the cooling process, it will become saturated, or 100% RH. It is said to have reached the dewpoint temperature. This dewpoint temperature obviously depends on the amount of water vapour that was in the air to begin with. If it was close to saturation at its original temperature, then its dewpoint temperature would be only a few degrees lower. In some cases the dewpoint temperature may be below the freezing point, in which case the excess water vapour would be deposited as frost instead of condensation.

## **Permeance of Materials**

Most construction materials are porous enough that water vapour passes through. This applies to a greater or lesser degree; to paper, plaster, wood, insulation and even concrete. In some materials, such as loose fill insulation, water vapour can pass through the material with relative ease. Such materials are said to have a high 'permeance'. Vapour barrier materials, such as polyethylene sheet, are required to have a very low permeance because their main purpose is to resist the movement of water vapour.

## **How a Vapour Barrier Works**

To understand how a vapour barrier works, first consider what happens in a house in winter if there is no vapour barrier. The house interior is warm and the relative humidity is usually somewhere between 20% and 30%. The exterior is cold and the relative humidity is usually high, somewhere around 80%. The air inside the house has a much greater water vapour content than that outside, and it follows that the vapour pressure inside the house is higher than that outside. This pressure difference causes the water vapour to move outwards through the house envelope, and particularly through the exterior walls and ceiling. Since there is no vapour barrier, the walls and ceiling offer little resistance to the movement of water vapour, therefore the rate of water vapour movement can be very high. When the water vapour moves outwards through the wall and ceiling it will get progressively colder because of the temperature drop through these structures. At some point, a dew point condition will be reached and the water vapour will condense or form frost, depending on whether the dewpoint temperature happens to be above or below freezing. Both frost and condensed water give off water vapour, which continues to move outwards through the wall and ceiling, producing frost or condensation beyond the dewpoint location. Therefore, at every point beyond the dewpoint location, two mechanisms are at work: the first is the build-up of condensed water or frost due to the movement of water

vapour from the house interior; the second mechanism involves the removal of the build-up by evaporation or sublimation (a process in which ice gives off water vapour), creating a fresh supply of water vapour that can move even further outwards.

## **Vapour Barrier Materials**

The most common vapour barrier material is polyethylene sheets. To stop diffusion of moisture the poly does not have to be continuous, but it is often sealed tight like a plastic bag to also act as an air barrier. In some new houses the drywall with vapour barrier point acts as the barrier.

## **Possibility of Structural Damage**

In this type of house, with no vapour barrier, the process of frost build-up will usually continue through winter, giving a progressive accumulation of frost on roof sheathing and wall sheathing. In spring, or whenever the exterior sheathing temperature rises above the freezing point, the frost will begin to melt. The melt water will drop or flow where gravity takes it. In the roof, it may fall onto the ceiling, causing wetting or discoloration. In severe cases there may be enough melt water to flood the ceiling, causing water to flow through ceiling fixtures and, perhaps, causing ceiling collapse. In the walls, the meltwater will tend to accumulate on blocking or on the sill-plate, where it may discolor the drywall or cause rot, fungus and odour problems within the wall structure. In some cases, the accumulation of water on the sill-plate could be several inches deep. This could cause total deterioration of the lower drywall under the baseboard or through electrical fixtures.

The vapour barrier works, not by eliminating the movement of moisture into the walls and ceiling, but by reducing the movement to a rate that the house structure can handle.

## **Positioning the Vapour Barrier**

It is important to consider the positioning of the vapour barrier. The position of the vapour barrier in the walls and ceiling is dictated by only one technical criterion: it must lie inside the dewpoint location in a typical worst case situation, such as the mean low January temperature. If the vapour barrier lies outside the dewpoint location, water vapour will penetrate the wall until it reaches this location. It will then condense or form frost. There will be a natural tendency, as discussed earlier, for the condensed water or frost to give off water vapour that will move further outwards through the wall. However, this further outward movement is restricted by the vapour barrier, and, as a result, there will be a continuous build-up of water or frost on the interior surface of the vapour barrier. This could result in effects as severe as those mentioned previously.

## **Guarding against the creation of a second vapour barrier**

Another problem arises when a wall has two major restrictions to water vapour movement. This could occur as a result of retrofit, when a wall may accidentally be fitted with two vapour barriers. It may also occur when the exterior sheathing has a low permeance and is tightly sealed, so that it acts effectively like a second vapour barrier. Under these conditions, the risk of build-up is determined by two factors: the rate at which water vapour penetrates the inner vapour barrier, and the rate at which it penetrates the outer one. If the inner rate exceeds the

outer one, and if the dewpoint location falls between the two effective vapour barriers, build-up will occur. In this respect, a number of builders have expressed concerns about the use of low permeance insulating foams as sheathing material. In some cases there does appear to be a risk that a second vapour barrier might be set up.

We recommend that, where low-permeance sheathing might constitute a second vapour barrier, a deliberate attempt should be made to introduce breathing gaps between the sheathing panels or where the sheathing terminates at the top of the wall. Ideally, the breathing openings should be just large enough to allow the water vapour to leave the wall space as fast as it enters it, but not large enough to allow air circulation through the wall space (excessive air circulation through the insulation can impair the insulating effect).

## Attic Ventilation

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Ventilation of the attic or roof space is required to eliminate humidity and minimize condensation within the attic cavity, to keep insulation dry, and reduce heat build up during hot summer days keeping the house cooler.

Ventilation required by the BC and National Building Code is (1) one square foot of venting for each 300 square feet of ceiling area, for roofs over 1 in 6 slope, or (1) one square foot of venting for each 150 square feet of ceiling area for roofs under 1 in 6 slope. These figures are based on free ventilation area. Screens or louvers must be accounted for. Of the total square feet of venting, 50% should be soffit venting and 50% roof, gable or ridge venting to ensure good cross-ventilation. Venting should be equally distributed on opposite sides of the roof.

Wind turbines work, but can over-ventilate the attic by creating a negative pressure during windy conditions. This can cause more leakage of air from the living area of the house, especially if leakage areas are not well sealed, creating additional moisture problems during the winter. If a problem with over ventilation exists the wind turbines should be covered with a burlap bag during the winter season to prevent spinning. However they work quite well in summer for keeping the attic space cooler.

Powered attic fans, which operate on a thermostat control, will control summer heat build-up but are more costly to operate. If installing a power attic vent be sure it is installed high enough in the peak that it will not disturb loose fill attic insulation.

### **Important factors in attic venting are:**

- Presence of an air/vapour barrier and ensuring that insulation does not block off or impede any ventilation flow into the attic. Air movement through the attic space will vary with both velocity and direction of wind.
- If a moisture problem is evident in your attic, it is usually more important to seal air leaks in the vapour barrier than to increase ventilation in the attic. Increased ventilation may well cause a negative pressure, which in turn will only increase the rate of leakage.

## Framing

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### Requirements of exterior walls:

- a) must have strength and rigidity
- b) must control heat flow
- c) must control air flow
- d) must control water vapour flow
- e) must control liquid water movement
- f) must have stability and durability of materials
- g) must be able to contain fire within the space and protect the space from fire outside the building
- h) should have aesthetic considerations with regards to the appearance of the all
- i) should take into account the total cost of the wall system

### Some problems associated with exterior walls:

- a) cracking of the exterior cladding (particularly masonry)
- b) spalling (large sections coming loose) of exterior cladding (particularly stucco)
- c) efflorescence (staining or discoloration) of the exterior cladding. (brick or block)
- d) rain penetration to the interior of the building
- e) problems associated with concealed condensation
- f) surface condensation on the warm side of the wall

Air tightness is critical to the longevity of an exterior wall system, so concentrate on installing a completely sealed air-vapour barrier. The common method used to install an air-vapour barrier is the placement of polyethylene film (6 mil) on the warm side of the insulation. This should be completely sealed to prevent any leakage into the wall cavity of moist air. Another method is to use the interior finish (i.e. drywall board, plywood, etc.) as an air barrier, then utilize interior paint as the vapour barrier. Gaskets are used to join all building materials.

### Some various wall construction methods include:

- a) 2 x 4 @ 16" O.C. c/w R12 batt insulation and sheathing
- b) 2 x 6 @ 24" O.C. c/w R20 batt insulation and board insulation or sheathing
- c) 2 x 8 plates with 2 x 4 @ 16" O.C. inside and 2 x 4 @ 24" O.C. outside c/w 5/16" sheathing or board insulation
- d) 2 x 4 @ 16" O.C. with 2 x 2 horizontal strapping @ 24" O.C. c/w R12 batt insulation and 5/16" sheathing c/w R10 foam insulation inside or R8 batt insulation inside
- e) double wall – 13" thick 2 x 4 @ 16" O.C. inside 2 x 4 @ 24" O.C. outside with 2 layers of R 12 batt insulation 1 layer of R20 between – 5/16" sheathing outside.

The last option would be the most cost effective per "R" value.

Another method used primarily to ensure a complete seal and continuous vapour barrier is to construct the outside wall with either 2 x 4 or 2 x 6 @ 24" O.C. with R12 or R20 batt insulation. A 6-mil poly vapour barrier is positioned on the warm side of the wall and sealed completely. 2 x 2 @ 24" O.C. strapping is then applied horizontally to the inside of the wall. This cavity is utilized to run the electrical wiring and outlets. Drywall board is then applied as the final step to the inside. Another option to this method for additional insulation is to apply rigid insulation to the exterior of the wall in lieu of sheathing and then finally the exterior finish.

One must ensure insulation is installed tight to the exterior sheathing in the wall cavity so as not to allow an air space between the insulation and exterior sheathing. An air space can encourage convective currents further complicated by electrical boxes and wiring protruding into the wall cavity creating further voids.



## Foundations

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A foundation beneath a house usually refers to footings or pilings that support either a wall or a slab. The height of the wall will determine if it is called a slab, grade beam, crawlspace or a basement. Concrete, preserved wood, concrete block or panelized materials may be used to construct a foundation – depending on the water table, space requirements and soil type.

### Feet on Solid Ground

The foundation is the critical support system on which the rest of the house is built. A foundation that shifts creates cracks, uneven fitting doors, floor tilting and possible water leakage. Soil type, moisture content of the soil, and depth of frost penetration must be looked at before the foundation is laid. A wide variety of soils exist in BC. Check local building codes or municipal building permit departments for clues to specific soil conditions in your area, and do some digging before you put down the feet of your home.

### Water Leakage

Water in a basement, crawlspace or under a slab, may introduce molds or high humidity levels into a house. The first rule of waterproofing a foundation is to keep it away from water and water away from it. Consider the type of soil and the depth of the water table very carefully before deciding on what type of foundation to place under your house. A high water table or drastic changes in the water content of surrounding soil before or after construction can cause shifting and water leakage in the foundation. Insure the foundation has good drainage both above and below ground. Treat the exterior of the foundation, the floor of the crawlspace or the slab – be it wood or concrete – with an appropriate material to further insure that water stays out.

### Warm and Cozy

Uninsulated basements, slabs and crawlspaces can account for up to 40% of the total house heat loss. For new homes consider insulating basements from the exterior. Exterior insulation allows more useable interior space, provides an additional moisture barrier for the wall, and can cover the rim joist area – an area that is very tricky to insulate from the interior. Placing the concrete toward the inside of the house provides a thermal flywheel to moderate temperature fluctuations. With existing homes, it is usually more practical to insulate the basement from the interior. Crawlspaces may be insulated directly under the floor or on the perimeter walls. Insulation under slabs is critical if the slab contains radiant floor heating.

## R-Values

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### R-Values of Various Building Materials

R=thermal resistance; the reciprocal of thermal conductance or overall co-efficient of heat transmission. The total resistance of R of a wall is the sum of R-values of its components, including air films and spaces. The higher the number, the higher the insulating value.

#### ***Interior Building Board***

Gypsum or plaster board	0.5 in.	0.45
Plywood – Douglas Fir	0.25in.	0.31
Plywood – Douglas Fir	0.5 in.	0.62
Plywood – Douglas Fir	0.625in.	0.77
Medium Density Hardboard	1.0 in.	1.37
Particleboard – Low density	1.0 in.	1.41
Particleboard – Medium density	1.0 in.	1.06
Particleboard – High density	1.0 in.	0.85
Particleboard – Underlayment	0.625 in.	0.82
Waferboard	1.0 in.	1.59

#### ***Plastering Materials***

Cement plaster, sand aggregate	1.0 in.	0.20
Gypsum plaster:		
Lightweight aggregate	0.5 in.	0.32
Perlite aggregate	1.0 in.	0.67
Sand aggregate	1.0 in.	0.18
Vermiculite aggregate	1.0 in.	0.59

#### ***Building Membrane***

Vapour Seal, Plastic Film	Negligible
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#### ***Finishing Floor Materials***

Carpet and Fibrous Pad		2.08
Carpet and Rubber Pad		1.23
Cork tile	0.125 in.	0.28
Terrazzo	1.0 in.	0.08
Wood, hardwood finish	0.75 in.	0.68

## **Alternative Insulating Materials**

Perlite, expanded	1.0 in.	2.4 – 3.7
Vermiculite, exfoliated	1.0 in.	2.13 – 2.27

## **Siding Materials (on Flat Surface)**

### ***Shingles***

Wood, 16 in., 7.5 exposure		0.87
Wood, double, 16 in., 12 in, exposure		1.19

### ***Siding***

Hardboard siding, 0.438 in.		0.67
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### ***Woods***

Maple, oak and similar hardwoods	1.0 in.	0.80 – 0.94
Fir, pine, and similar softwoods	1.0 in.	0.89 – 1.48

## **Masonry Materials**

Cement mortar	1.0 in.	0.10 – 0.20
Stucco	1.0 in.	0.20
Brick, common	1.0 in.	0.11 – 0.45
Concrete Blocks, limestone aggregate,	8 in., 2 cores	negligible

### ***Roofing***

Asphalt roll roofing	1.0 in.	0.15
Built-up roofing	0.375 in.	0.33
Slate	0.5 in.	0.05
Wood Shingles, plain and plastic film faced		0.94

## Don't put up with a Chilly Winter in your Mobile Home

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Many mobile homes, particularly older models, are susceptible to the energy-sapping effects of a tough BC Winter.

Here are some tips for winterizing your mobile home so that you can enjoy a warmer winter:

- Caulk joints between flooring and wall paneling, between sheets of paneling and between the ceiling and the paneling.
- Caulk gaps between interior paneling and window frames.
- In furnace rooms, seal the joint between the ceiling and the chimney with a galvanized metal chimney collar and a heat-resistant caulking compound.
- Protect water pipes with a CSA-approved heat tracer tape and insulation if necessary.
- A second layer of window glass or an interior storm window significantly reduces energy consumption.
- An enclosed porch protects the door of the home from the wind.

**For more on weather proofing, [click here](#).**

## Mowing your Lawn

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Pollution is a concern to all of us, and a recent study found that gas powered lawn mowers are extremely dirty. In most cases, they give off much more pollution than the equivalent amount of generation needed to operate an electrical lawn mower.

Comparison testing looked at the operational features of both gas and electric mowers, some of the responses included: a 93% rating of cordless electric mowers as more convenient, and a 75% rating of gas mowers as better at cutting tall heavy grass. In both lawn appearance and machine performance, gas and electric were rated even.

The major concern raised about cordless electric mowers was the operational life of the battery between charges. The testing revealed that under normal operating conditions a fully charged battery would provide ample power for at least one hour. Only 3% of the test group who exchanged their gas mowers for cordless electric mowers felt they would like the gas mower back.

A wide selection of features (mulching, bagging, etc.) are already available from many manufacturers. As cleaner air becomes more of an issue, expect the number of cordless electric mowers to proliferate.

## Choosing an Air Conditioner

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If you're thinking of buying an air conditioner, seriously consider the short hot season in BC and the energy saving and economic benefits of using fans or natural ventilation.

However, if air conditioning is still for you, look for a model that provides the best combination of energy efficiency and cooling capacity.

Don't buy a more powerful air conditioner than you need. If you want to cool a small bedroom, you probably need a 5,000 BTU/hour window air conditioner. To cool your entire house, you could require a 24,000 BTU/hour central air conditioning system.

Whatever you buy, check the energy efficiency rating, EER for window units, and SEER for central systems. The higher the rating, the more efficient the unit and the less it costs to operate. PowerSense recommends a SEER of 12 or higher.

A better alternative to mechanical cooling devices is to take advantage of the natural cooling potential of your home.

- Window styles influence the volume of air that breezes into your home. Casement windows are your best bet since the entire window area opens up.
- Check which side of your home is more exposed to local winds. Open the windows on that side, and experiment with opening other windows to promote a flow-through of internal air.
- Use your kitchen fan when cooking to vent the warm, humid air outdoors.
- Floors without carpets help to promote natural cooling.

### **If you're building, renovating or updating...**

- Plan the building's layout and orientation to take maximum advantage of prevailing winds.
- Window styles and placement make a big difference to a home's natural ventilation efficiency.
- Look into installing whole-house fan systems, like heat recovery ventilators and ceiling fans, to provide continuous air movement.
- Plant deciduous shade trees and optimize your roof overhang to minimize solar gain

You may also want to consider an Air Source Heat pump for your heating and cooling needs. [Click here to find out more!](#)

## PowerSense Checklist

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Rate yourself! This handy checklist can help you save money. Give yourself one point for each tip you follow and check your score below.

### Appliances

- ☐ Check EnerGuide rating when buying appliances.
- ☐ Wash full loads of laundry.
- ☐ Avoid keeping the fridge door open.
- ☐ Locate fridge away from the stove and radiators.
- ☐ Clean the coils on the back of your fridge.
- ☐ Check fridge and freezer door seals.
- ☐ Empty and unplug fridge during vacations.
- ☐ Defrost fridge and freezer regularly.
- ☐ Set thermostats at 4°C (40°F) for fridges and -18°C (0°F) for freezers.
- ☐ Use oven to cook multiple items.
- ☐ Turn oven off 1/2 hour before finishing time.
- ☐ Match pots to stove element size.
- ☐ Cover pots and use lower heat settings.

### Lighting

- ☐ Use fluorescent and task lighting where possible.
- ☐ Clean light bulbs and fixtures regularly.
- ☐ Use dimmer switches for some lights.
- ☐ Use lower wattage bulbs for general lighting.
- ☐ Use timers on lights during vacations.
- ☐ Turn off TV and lights when not in use.

### Draftproofing

- ☐ Check caulking around windows.
- ☐ Ensure all windows have at least two panes.
- ☐ Check weather-stripping around your doors and windows.
- ☐ Install draft-enders on wall outlets.
- ☐ Check the attic hatch for tightness and airseal.

### Space Heating

- ☐ Keep hot and cold registers unobstructed.
- ☐ Clean or replace furnace filter monthly.
- ☐ Service furnace at start of heating season.
- ☐ Lower your thermostat to 15°C (59°F) at night or when not at home.
- ☐ A comfortable daytime temperature is 22°C (72°F) for most people, higher for infants and seniors.

### Hot Water Heating

- ☐ Take short showers instead of baths.
- ☐ Install low flow shower heads.
- ☐ Fix dripping faucets.
- ☐ Set hot water tank thermostat below 55°C (131°F).
- ☐ Drain your hot water tank every six months.

### Transportation

- ☐ Install a timer on your block heater.
- ☐ Avoid idling vehicles for long periods.
- ☐ Check your tire pressure periodically.
- ☐ Keep a logbook of gas and auto servicing.
- ☐ Walk to the local store.
- ☐ Car pool at least once a month.
- ☐ Use public transit when possible.

### Other

- ☐ Open curtains and blinds in the morning.
- ☐ Keep monthly records to compare utility bills.
- ☐ Ensure good attic ventilation.
- ☐ Log your own gas meter readings monthly.
- ☐ Insulate attic, exterior walls and basement to proper levels.
- ☐ Decorate in light colours to brighten rooms.

**Score under 25** – There's room for improvement. The money you're spending on wasted energy might be better spent elsewhere. Read through the tips again to see where you can reduce your energy waste.

**Score 26–40** – You're a good energy saver, but there's some points that you haven't thought of. Check the list again for hints on wise energy use.

**Score over 40** – Congratulations! You're an energy miser. And chances are your family has a little extra money at the end of each month. Keep up the good work!



## PowerSense General Tips

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Scan through this list of tips. Each one can help you control your energy costs. The tips are categorized in terms of general, summer and winter-related.

- What is a kWh? A kWh is a kilowatt-hour, which is used for measuring electricity use. For example, a 100-watt light bulb that is on for 10 hours or more of use will use 1,000 watts for that time period which is one kWh. Multiplying your kilowatts per hour use by the cost per kWh will tell you how much an electrical device costs to operate.
- While you are cooking, cleaning, or exercising, you may want to set the house temperature a little lower. You will save energy, and the house will not be too warm for you.
- A setback thermostat can be used to turn down the temperature in the home at night or when you are away during the day. Remember not to turn down the temperature more than 5 degrees because it will not be cost-effective to raise the temperature quickly when it is set too low.
- The EnerGuide rating is a label on an appliance that tells you how much electricity the appliance consumes. For example, an appliance from one manufacturer is rated at 648 kWh per year, while a similar unit from another manufacturer is rated at 1020 kWh per year. If all other features on the two appliances were similar, you should select the one that costs less to operate.
- Using timers on devices such as electric blankets, lights, and hot tubs will prevent needless waste of energy.
- Learning to cook with small appliances such as toaster ovens, microwaves, and electric frying pans instead of your range will reduce the amount of power you use.
- Did you know that more than half of a home's electricity is consumed in the kitchen? Adopting energy efficient practices with kitchen appliances will save you money. For example, an electric kettle uses less electricity and will boil water faster than your stovetop.
- Defrosting your manual defrost fridge and freezer when frost build-up occurs, will make these appliances work more efficiently.
- Appliances with "instant on" features such as clocks, VCR's, televisions, stereos, etc., are not actually off when switched off. Unplugging these devices during holidays will save you power, and will also prevent unwanted damage from power surges.
- Opening windows and doors to let cool air in when your house is damp, is not the best way to reduce humidity. Use devices such as bathroom and kitchen exhaust fans to control the moisture at the source, or open a window only slightly. This will help prevent entry of cooler air that needs to be heated.
- You will save money by switching off lights when you are not using them. Switching incandescent lights on and off does not affect the life of the bulb. However, as frequent switching can shorten the life of a fluorescent tube, switch it off when the space will be unoccupied for longer than 10 minutes.
- When you need to replace old pots, consider switching to glassware. Glass cookware does triple duty as it can also be used in your microwave and conventional ovens at lower temperatures.

- Most utility bills provide a figure indicating your electrical consumption in Kilowatt-hours. By comparing your electrical use month to month, you can begin to look at ways to manage the amount of electricity you use in your household.
- Preheating a conventional oven for 10 to 12 minutes consumes from 0.45 to 0.59 kilowatt hours, more than half the energy used for the cooking time. The oven needs only 10 minutes to heat to the desired temperature, so most preheating is not necessary and wastes energy.
- By cooking foods together that require the same oven temperature, you'll make better use of your oven. Place dishes so that they do not touch each other or the oven walls. At least one inch is needed for air circulation and even cooking around each dish.
- Did you know that leaving the oven door open to peek, stir, or baste consumes 0.2 to 0.5 kWh of energy? Take food out of the oven to baste or turn, closing the door to keep heat in. Keep your oven clean and in good repair, and check to make sure that the gasket around the door has a good seal.
- During normal everyday use, a self-clean oven is more energy efficient than a regular one because it has extra insulation and therefore costs slightly less to operate.
- You'll make a stovetop element more efficient if you use a pressure cooker because it cuts down on the cooking time. A microwave or toaster oven is even better for cooking because of the lower power consumption.
- Using a microwave oven to thaw meat is great if you're in a hurry. But if you have time, thaw meat in the refrigerator as heat absorbed by the defrosting food helps the refrigerator keep its cool and saves energy.
- Most of the energy use in a dishwasher is used during the drying process. Using a rinse agent to reduce spotting, and air-drying the dishes is a good way to reduce dishwasher costs.
- It's a good idea to cool hot food before putting it in the refrigerator so that your appliance is not working overtime to cool itself down when hot foods are placed inside.
- The ideal temperature for your hot water tank should be 125 degrees F or 60 degrees C. This is a safe temperature for your tank and it works for a typical family – anything higher will of course increase your energy consumption.
- Hot tubs are big energy consumers, and should be covered with a hard insulation lid. Insulating the shell and exposed plumbing lines will also reduce energy consumption. For further savings, consider adding a timer on your circulation pump – the water really only needs to be circulated 3-6 hours per day.
- A shower will use less water than a bath only if the shower is 10 minutes long or shorter. Consider using a good quality low-flow showerhead to decrease the consumption of water.
- A leaking tap loses 8,640 litres of water per year, which is expensive to heat. To reduce heat loss, wrap an electric hot water tank with a CSA approved electric hot water tank blanket, and insulate the first 6 feet of the pipe leading from the tank.
- For maximum efficiency, unless your machine has an adjustable water level setting, wash only full loads. And don't overload your washer or dryer.
- When drying perma-press clothes, check them often. Perma-press items won't wrinkle if they are removed from the dryer when just dry or damp dry, then put them on hangers immediately.

- Using a silver covering for your ironing board will reflect heat upwards. This will cut down on your ironing time and save you energy.
- Use bright colours in a room with little sunlight so that you can reduce the amount of time light-bulbs need to be turned on. Remember that light colours reflect light, and dark colours absorb light.
- An electric eye light or motion sensor on outdoor and indoor lights is a great way to control the amount of time your lights are turned on.
- A standard 100-watt light bulb lasts about 750 to 1,000 hours. A “long-life” bulb of the same wattage will last 2,500 hours or more, but will produce only 80 percent or less light. Both use the same amount of electricity. The standard incandescent bulbs are best when brightness is more important than long life. Long life bulbs are better in awkward to reach areas such as stairwells.
- A compact fluorescent light is a great replacement for standard incandescent lights because they use less power. But because of their increased cost, they are really only economically beneficial when used in areas where regular bulbs are left on for more than 4 hours a day.
- Use lower-wattage bulbs in areas such as hallways and storage areas that don't require much light. If you do need bright light, a single 100-watt bulb gives the same amount of light as two 60-watt bulbs, but uses about 15 percent less energy.
- Clean fixtures, bulbs and lamp parts at least once a year in your home or business as dust and dirt accumulation lowers efficiency and light levels. Remember to disconnect the power first.
- Miniature or compact fluorescent lamps are small-size, low-wattage lamps with the same features as regular fluorescent lamps. They come with adapters, which screw into incandescent sockets so you don't have to change your fixture. They are higher in price and should only be used in areas where regular bulbs are on for four hours or more. Compact fluorescent lamps last about five years.
- You can save money by having a timer turn off your electric blanket as soon as you get into bed. You don't need to heat the bed after retiring, as your body generates heat.
- An electric clothes dryer is a big energy user. Make sure it is vented properly with the shortest and straightest duct possible, and keep the lint trap clean to make your appliance more efficient.
- When building or buying a new home, consider an R-2000. In an R-2000 home, emphasis is placed on controlling air leakage, and insulation levels are much higher. Though R-2000 homes cost more to build than conventional homes, they incorporate better building techniques, and cost much less to heat and cool.
- A comfortable indoor relative humidity can often mean a lower heating temperature. During the winter, your relative humidity should be about 30%, and during the summer, 40-50% would be ideal.
- Just as wind chill makes you feel colder, wind blowing against your house makes it harder to heat. A row of evergreen trees planted at least 3 metres from your home in the direction of the prevailing winds will help act as a wind block.
- Using your microwave to partially cook a meal before using the range will save money since the microwave uses a lot less energy than your range.

- Thermostats work best when they are located where they can take an accurate measurement of the temperature of a room. This means locating them away from sources of heat or draft.
- What is the ideal temperature for your home? A comfortable daytime temperature for most people is 22 degrees C. however, young children and seniors often prefer warmer temperatures.
- A crawlspace with a dirt floor should be covered in a sheet of 6 mil polyethelene (plastic) to prevent moisture from the earth from causing mildew growth and possibly causing rot in the floor above the crawlspace.
- Another way to save on your electric bill and contribute to safety and security is to install a timer on your outdoor lights set to turn lights on at dusk and off in the late evening.
- Using a proper furnace filter and maintaining it regularly will not only make your furnace operate better, but will save your money too.
- When taking a vacation, turn UP the temperature in your refrigerator. Normally your refrigerator should be set at 4 degrees C and the freezer section at minus 18 degrees. As the door will not be opened while you are away, and the unit will not have to work as hard to keep foodstuffs cold, the temperature does not need to be set as low.
- If you're going to be on holidays for more than 5 days, set your hot-water tank temperature lower to save money. Most tanks come with a convenient "vacation" setting, which makes setback a simple task.
- Solar and wind energy sources are becoming more popular for energy generation. However, it is currently more economical to generate power with conventional techniques. Ongoing research and innovation needs to be encouraged so that we can become more sustainable in our approach to energy production.
- When purchasing new windows, do as much research as possible to find the best windows for your home. Consider things such as frame materials, spacing materials, glazings, special coatings, gas fills, opening mechanism, and warranties when researching new window purchases.
- Casement windows with a crank-style opening mechanism have traditionally been the best when it comes to sealing out the cold.
- In-floor radiant heating is a unique way to heat the lower levels of your home. When installing these systems, it is always best to place insulation under the basement slab to maximize the efficiency of radiant floor heating.
- Using bathroom and kitchen exhaust fans will help to reduce the amount of excess humidity in your home.
- A pilot light on your furnace should be burning as a blue cone-shaped flame. If it is yellow or "jumpy" then you're wasting gas, and the furnace needs adjustment. Call your local gas company for assistance. When installing a new furnace, consider energy efficient electronic ignition, which does not waste gas on a constantly burning pilot light.
- Did you know that as much as 90% of the energy consumed by a washing machine is used in heating the water? Consider using cold water washes or smaller loads to save on energy costs.

- Dust on a light bulb or dirt on a glass fixture can reduce the light it gives off by 10 percent and makes it seem that you need a brighter, higher wattage light. Kitchen fixtures can be a major problem accumulating a mixture of grease and dirt.
- Installing electronic dimmer switches on light bulbs can allow you to set the proper amount of light for your particular use. Also, they extend the life of light bulbs by up to 50% and save energy too. Dimmer switches should not be used on fluorescent lighting.
- Walking around the home with a lighted incense stick and placing it near doors, windows, trim, and outlet covers will help you to find your air leakage points. Just follow the smoke!
- A properly insulated attic should have at least 10 inches of insulation. If not, it is time to upgrade to at least one foot. Insulation in the attic should also be dry and level.
- Insulation works by trapping tiny pockets of air inside the material to slow down thermal movement. Insulation should always be dry and free of drafts so that it can work effectively.
- Teaching young children to turn off lights and toys is a habit that should be as much a part of playtime as picking up toys. Education is the key to a lifelong energy-saving consciousness. Teach your children that it's the small things that help save energy.
- Did you know that the average single-family home loses 20 to 40 percent of its heat through air leaks! Eliminating air leaks is the most cost-effective way of saving heating dollars.
- While caulking stops air leakage at fixed joints that swell and shrink with seasonal changes, weather-stripping controls air leakage at joints that open such as windows, doors, and attic hatches. Remember to use the right type of weather-stripping for each application so that it works properly and lasts a long time.
- Check to make sure that your exhaust fans vent directly to the outside and not simply into the attic or soffit space. Venting moist air into the attic can damage the wood and insulation and can lead to problems with icicles.
- If you are planning to install an air-exchange unit for your home's ventilation system, then consider buying a unit with a heat-recovery option so that you can recover up to 80% of the heat from the stale air that is expelled from your home.
- When building a new home or renovating your bathroom, consider installing a good quality low-flow toilet. Flushing accounts for a major part of household water use, and newer low water use toilets can conserve water and save money too!
- Did you know that a single litre of motor oil can contaminate over a million litres of groundwater? Never pour motor oil, paints, solvents, cleaners, medication or chemicals so that local water treatment facilities can work properly without toxic contamination from households.
- A poorly tuned car engine can decrease fuel consumption by up to 15%. Servicing your automobile regularly, keeping your engine "tuned up" and maintaining adequate tire pressure will help reduce your fuel use and help the environment as well.

## PowerSense Tips ~ Summer

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***Scan through this list of tips. Each one can help you control your energy costs.***

- If you do your laundry early in the morning or in the evening during the hot summer, you'll avoid heating up your house. Vent your dryer to the outside to help exhaust hot air and avoid lint backing up to the motor.
- If you have a forced-air heating system, you can use your furnace fan at a reduced speed to circulate cooler basement air to the upstairs during the hottest parts of the day.
- A ceiling fan costs approximately three cents an hour to operate. While it won't cool down the air, it will circulate air and make the room feel cooler.
- Where the house siding meets the foundation is where heat in the winter and cool air in the summer can escape. For insulation, on the west and north sides of your house, plant low-growing shrubs, so they won't block windows and prevent sunlight from brightening and heating your home.
- On the south side of your home, plant low-growing shrubs beneath windows to help cool hot summer air before it reaches window openings. Plant shade trees on the south and west sides of your house to help absorb the sun's heat. During the winter, bank your home's foundation with snow to add no-cost insulation. Remove the snow just before the spring thaw starts to prevent excess moisture from running into your foundation.
- Remember to have the grade of the earth slope away from your foundation around the perimeter of your home. This will allow water to drain freely away from your basement or crawlspace.
- Did you know that a regular gas powered lawnmower is a major polluter? Electric lawnmowers do not produce any toxic emissions, and work just as well as gas mowers. If you find the extension cord to be a problem, then consider a newer battery-powered unit.
- A garbage disposal system for your sink cost money to operate and uses large quantities of water. Consider composting instead. Composting produces rich earth, which can be used around your home, and it also helps to reduce the amount of garbage sent to the landfill.
- If you have an outdoor pool, cover it properly when it is not in use. This will cut down on evaporative losses, and keep it cleaner and warmer thereby reducing energy costs.
- Did you know that the effectiveness of lawn care chemicals diminishes as we use them? Contact your local environmental organization to find out about non-toxic alternatives to lawn care.
- During the warm months, household water use for lawns increases dramatically. Unfortunately, we often over-water only to have it run off or burn off with the sun. The best time to water is in the early morning after the dew has dried to reduce evaporation. And remember that your lawn only needs about one inch of water per week. Let's all work together for water savings!

- Did you know that both deciduous and evergreen trees provide shade from the hot summer sun as well as acting as living air conditioners that cool the earth by evaporating water into the air. Plant a tree today!
- Room-sized air conditioners are labeled with an Energy Efficiency Rating (EER) number. The higher the EER, the better in terms of energy use. A number of 10 or above is good.
- Central Air-conditioners have a rating known as the Season Energy Efficiency Rating (SEER). When purchasing a Central Air-conditioning system, look carefully at this number. A SEER of 12 or more is good.

## PowerSense Tips ~ Winter

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**Scan through this list of tips. Each one can help you control your energy costs.**

- This Christmas, use timers for your outdoor lights to save you power. Also consider using more efficient 5-watt bulbs with reflectors instead of 7-watt bulbs. It will look as nice and you won't need as many bulbs.
- Proper distribution of warm air in the home is an important part of heating your house. When you have a high cathedral ceiling, consider using a ceiling fan on a low setting during the winter to push some warm air from the ceiling to the lower parts of the room.
- When no one is in the room, turn off your Christmas tree lights to save power. Also, position bulbs so that they do not touch any needles. Christmas trees dry out over the holiday season, which could be a fire hazard.
- Caulking around windows, sill plates, doors, and other air entry-points is a good way to reduce warm air leakage in your home. Remember to read the label of your caulking. Different areas of the home need different types of caulking to work effectively and last long.
- Remember to have your furnace tuned-up regularly by a qualified heating contractor at least once every two years to ensure efficient and safe operation.
- Your furnace air filter should be replaced at least once every one to two months during the heating season to ensure safe and reliable operation of your furnace.
- During the winter, storing a freezer in an unheated garage will not save you money. The oil in your freezer's motor is not made for cold temperatures, and fluctuating temperatures are hard on the motor. It's actually easier on the motor and compressor if the temperature is constant. The best location for a freezer is a basement where the surrounding air is cool. Make sure the freezer is level and set at the optimum temperature of minus 18 degrees Celsius.
- A regular fireplace, though cozy, can be a major energy waster as warm air from the house is used to fuel the fire and is drawn up the chimney. Close the damper when not in use and, if possible, install glass doors to reduce heat loss after the fire has gone out. If you're installing a fireplace, get one with a heat exchanger for more energy efficiency.
- Condensation often builds up when new windows are installed. This is because damp air that previously left through your old leaky windows is now staying inside the home. Controlling your home's sources of moisture will help prevent fog and frost build-up inside your home.
- When plugging in your car's block heater, use a timer to reduce the amount of time you are drawing power. Better yet, use a device like a "Power-Saver Cord". This easily installed cord will only draw power when it senses cold temperature. If the outdoor temperature warms up, the cord will automatically cut power to the block heater. These types of cords usually pay for themselves within a year.



- The most cost-effective way to reduce your heating bills is to ensure that your home's caulking and weather-stripping is upgraded regularly and of good quality. This will reduce the amount of warm air your home will lose. Heated air loss is the single biggest contributor to high heating bills.
- Studies have shown that in some cases, planting just three trees as windbreaks can decrease heating bills for some households by as much as 30 percent. Trees planted properly will redirect winds away from doors or windows, or right over your house and significantly slow wind speeds. Trees also reduce snow accumulation and soil erosion!
- Installing an air barrier on the exterior of your home can greatly reduce the amount of heat loss in your home, and help to eliminate drafts.
- Ice build-up on a rooftop is usually related to inadequate ventilation. Installing low-profile roof vents and/or gable vents, and making sure that you have soffits free of obstruction will help to ventilate the roof properly. Eliminating warm air leakage from the home into the attic will also help to prevent ice build-up.
- If you install properly fitting blinds or heavy curtains on north facing windows, you can cut down your heating bills by up to 5%.
- Next time your furnace is operating, feel along the ductwork for any air leakage occurring along the edges. Sealing these cracks up with duct tape will help to deliver more of your heated air directly to the rooms where it is required.