ATCO EnergySense

Reference Material

ecoEnergy Home-retrofit

H2K 10.20

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ecoENERGY REFERENCE MATERIAL

The ecoENERGY home energy evaluation is designed to accomplish several goals: improve the energy efficiency of your home while reducing its environmental impact, improve the comfort level in your home and address the indoor air quality found in your home. Because the house is a system of integrated components, changing one aspect will likely have an impact on another area. These potential impacts need to be considered as you upgrade your home. The focus of the evaluation is on the building envelope (exterior components), space and water heating equipment, water consumption and on the indoor air quality, including humidity and moisture, controlled ventilation and odours.

The ecoENERGY home energy evaluation is designed to help Canadians become more aware of the impact each of us has on our environment, and how we can reduce that impact while at the same time reducing the costs of operating our homes and living in a more comfortable home. By making energy efficiency improvements to your home, whether large or small, you will also be reducing your home energy consumption and reduce the environmental impact of greenhouse gases.This section of the report, prepared by Natural Resources Canada and ATCO EnergySense, is provided to give you more detail on the upgrade recommendations made in your ecoENERGY Evaluation Report. **You are not restricted to any of the upgrade recommendations shown in "Your Home Energy Action Checklist". You can choose from any and or all of the eligible improvements shown in the "Grant Table for ecoENERGY Retrofit-Homes" documentation to a limit of $5,000 in grants.**

IMPROVEMENTS & UPGRADES

The improvements and upgrades to follow are divided into two sections: **Your Home Energy Action Items** and **Energy Savings Tips**. Your Home Energy Action Items are those listed at the beginning of your ecoENERGY Report under Your Home Energy Action Checklist that would potentially qualify for incentives. Refer to your ecoENERGY Report to items that you had expressed an interest in or the Evaluator deemed to be a priority item and to section A of this Reference Material for a more detailed explanation and assistance. Energy Savings Tips provide information on other things that you can do in and around the house that will improve the efficiency, comfort and air quality of your home but do not result in additional incentives. Also, refer to the variety of publications that supplement your ecoENERGY Report. Website links and other contact information are also provided to various organizations, professional associations and others where detailed information can be found.

Your ecoENERGY Report is fuel-neutral. It is not biased toward the use of any particular energy source or toward any particular equipment or manufacturer. However, in Alberta costs for different energy sources vary from those in other parts of the country. How the energy source is derived and delivered will affect its environmental impact as well. It is important that you as a consumer do your homework to determine capital costs, operating & energy costs and environmental impact if you are considering switching from one energy source to another.

If you will be undertaking some or all of the upgrades yourself, ensure that you follow all required local, provincial and national building codes that may be applicable and that any necessary building permits are issued. Building codes, particularly insulation requirements, are the minimum requirements needed to pass inspection.

Before starting your renovation project or energy upgrades, please take the time to thoroughly review the entire report and the associated information. The requirements outlined by Natural Resources Canada (NRCan) for any incentive-qualifying upgrade are clearly identified under "Your Home Energy Action Checklist" of your ecoENERGY Report and inside "Grant Table for ecoENERGY Retrofit-Homes" document included with your homeowner kit. Any Action upgrade you complete must meet the requirements specified by NRCan and documentation (detailed receipt, provided to the Evaluator, operating manual, nameplate data, brochures and/or labels) must clearly indicate that the Action

upgrade meets the requirements. Save all documentation and present to the evaluator at the time of the follow-up evaluation. Upgrades that do not meet NRCan's requirements or failure to provide receipts and documentation showing proof will disqualify you from receiving an incentive.

There are numerous reports available on testing done by third party independent organizations, such as *Canada Mortgage and Housing Corporation* and *Consumer Reports*, on every conceivable type of building product and consumer product to help you narrow the field of choices for your home improvement. By doing a little research before purchasing, you can ensure that you are satisfied with the performance of the product(s) you are buying. Professional associations have also formed amongst many different trades and groups of manufacturers. These help to educate within the association membership and to the public and also serve to police members of the association. They can be a very good source of information and education, and helpful in finding a qualified contractor.

Federal, provincial and municipal governments may offer additional grants or rebates from time to time on energy efficiency upgrades. Contact your government office and the ecoACTION website (www.ecoaction.gc.ca) and click on "Grants and Rebates" regarding energy saving programs. Manufacturers, retailers and utilities and may also provide rebates or sale prices that can act as an incentive for you to upgrade your home.

Climate Change Central (www.climatechangecentral.com) offers grants to Alberta residents, most of which flow through the ecoENERGY grant process. Furnace grants must be applied for separately. Please visit the website for details.

A. "YOUR HOME ENERGY ACTION CHECKLIST" ITEMS

A.1 Heating System

A furnace or boiler typically has a lifespan of 20 to 30 years. However, even though your older heating system may be operating safely, it is considerably less efficient than the new high efficiency heating systems available today, resulting in up to 25 - 35% of your space heating dollars going up the chimney. Even some relatively new heating systems are less efficient compared to the high efficiency 90% to 98% efficiency natural gas models available today. Replacing your heating system with a high efficiency model will result in significant energy and cost savings. Review the ecoENERGY grant table for specific qualifying requirements.

High efficiency ENERGY STAR® natural gas furnaces and boilers range between 85% and 98% efficiency. This rating is referred to as the Annual Fuel Utilization Efficiency (AFUE) and is displayed on the EnerGuide rating label on the appliance or in the owner's manual. Qualifying products are listed on the NRCan website (http://oee.nrcan.gc.ca/residential/business/manufacturers/search/gas-furnace-search.cfm?attr=4). To qualify for an ecoENERGY grant, the natural gas heating system must achieve a minimum rating of 90% for boilers and 92% or higher for furnaces.

A high efficiency condensing furnace or boiler has another important benefit in addition to producing more heat from the energy burned. It reduces the temperature of the flue gases to the point where they can be vented through a PVC or ABS plastic pipe out a side wall of the house. This eliminates the need for a chimney (except for the water heater), which is a major source of heat loss in homes with old furnaces. When a high efficiency water heater (see Section A.5) is also installed, the old chimney can be removed entirely.

Condensing gas furnaces and boilers typically have sealed combustion systems that draw their combustion air from, and vent the exhaust gases directly to, the outside. This system reduces heat loss and unwanted drafts and can greatly reduce the risk of back-drafting or the spillage of combustion gases into the home.

Many high efficiency condensing furnaces are available with a DC (or ECM) variable speed fan motor. Having a variable speed motor will reduce your electrical operating costs, particularly when the fan is operating continuously or for extended periods of time. High-efficiency DC motors use two-thirds less electricity than a standard motor. Operating the furnace fan continuously circulates air throughout the house, improving heat distribution and comfort levels. Also, a motorized damper on the fresh air duct will control how much fresh air is being brought into the house, and may be advisable where the furnace fan is operating continuously (see Section B.10).

When obtaining a quotation from a heating contractor, ask the contractor to conduct a heat loss calculation to ensure that the heating system is properly sized for your home. The contractor should hold current certification for Heat Loss / Heat Gain Calculations from the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI). For a list of certified contractors, visit www.hrai.ca and click on "Find a Contractor". Undersized systems will not be able to provide adequate heat on the coldest days, while oversized systems cycle on and off and can result in wasted energy. It is recommended that you perform the major insulation upgrades (i.e. basement & attic insulation) and air sealing first so that your new heating system can be more accurately sized.

A heating contractor having current certification for Residential Air System Design from the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) can ensure that your ductwork is adequately sized, located, balanced and sealed. Improperly designed ductwork can create comfort problems, such as rooms that are too hot or too cold, due to an inconsistent flow of air throughout the house.

It is quite common for homes that have replaced the standard furnace with a high efficiency condensing furnace to experience increased humidity in the home. This can be attributed to the closed combustion cycle found in condensing appliances, which reduces the air change rate of the home. While higher humidity levels are desirable in Alberta's dry winters, you may experience some condensation on windows.

For optimum savings, install a programmable set-back thermostat (see Section B.3). You can save about 2 percent in energy consumption for every degree Celsius of temperature set-back. And remember, to ensure maximum performance and efficiency, maintain your furnace and clean or replace the air filters regularly.

In homes heated with a boiler, a gas-fired hydronic heating system consists of a boiler that heats water. The hot water is then piped to convective heaters, such as cast-iron radiators, baseboard and cabinet heaters, a piping system that runs through the floor or ceiling, or fan-assisted coils. For the maximum energy efficiency of your hydronic heating system, consider the following features:

- Maintenance-free cartridge-style pumps that are compact and energy-efficient
- Balanced supply and return flows for even heat distribution
- Adequate air vents and an air scoop
- Insulating piping that is exposed or accessible
- An outdoor temperature sensor to control boiler water temperatures
- A reflective foil membrane behind cast iron radiators to reflect heat into the room
- Programmable electronic thermostats with a set-back feature

Also, be sure to maintain the water and pressure levels, regularly clean the convective heaters and avoid restricting the air flow around them. Always discuss any changes or modifications to your heating system with a reputable heating firm.

The replacement of your heating equipment with an ENERGY STAR-qualified gas furnace or boiler is eligible for an ecoENERGY Retrofit - Homes grant. Note that the grant amounts differ for furnaces based on the AFUE rating of the furnace and the presence of an energy-efficient direct current (DC) variable-speed motor. For further information on the eligibility requirements, refer to the ecoENERGY Retrofit Grant Table.

For more information, refer to "*Choose the Right Condensing Gas Furnace*" included with your ecoENERGY homeowner kit & *"Heating with Gas"* available through the Office of Energy Efficiency.

Geothermal Systems

If you are considering installing a ground-source or water-source geothermal (or earth-energy) system, review carefully all costs associated with this system, including initial capital costs and operating costs. The environmental impact of using a geothermal system in Alberta is typically higher than using a natural gas fired furnace or boiler. The majority of electricity used to operate the geothermal system is generated at coal or natural gas thermal electric plants.

To qualify under the ecoENERGY retrofit program, a ground-source or water source geothermal system must meet the following standards:

- CAN/CSA-C448 Design and Installation of Earth Energy Systems; and,
- Must be installed by a company qualified by the Canadian GeoExchange Coalition

Contact the Canadian GeoExchange Coalition (www.geo-exchange.ca) or (ph: (514) 807-7559) for more information on systems and for qualified designers and installers.

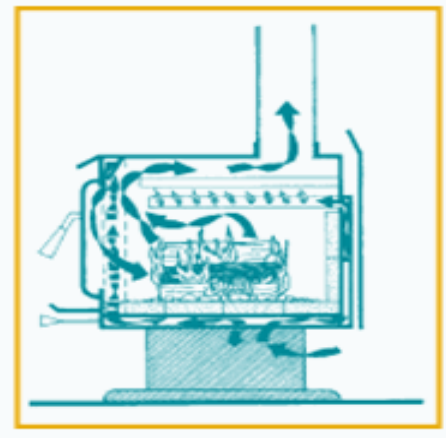
For more information, refer to *"Residential Earth Energy Systems: A Buyer's Guide"* available through Natural Resources Canada & *"Heating and Cooling with a Heat Pump"* available through the Office of Energy Efficiency

A.2 Fireplace

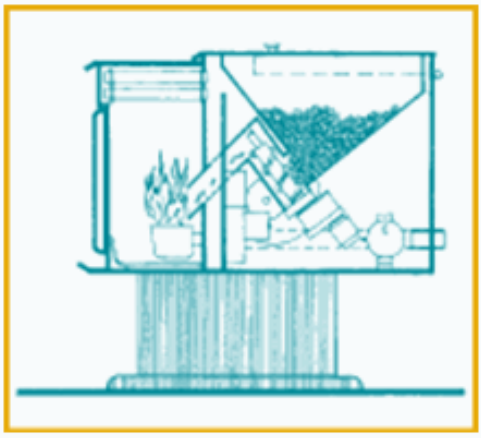
Wood-burning Fireplace Replacement

Most wood-burning fireplaces and wood stoves that have been installed in homes through the years are inefficient. Under the ecoENERGY Retrofit program, you can **replace** your existing wood-burning appliance with another wood-burning appliance or wood pellet stove that is much more efficient and emits far less pollutants into the atmosphere. To qualify for a grant under ecoENERGY, the replacement must meet U.S. Environmental Protection Agency (EPA) 40 CFR Part 60 or CSA-B415.1-M92 standards. The standards set maximums for emissions from wood-burning appliances. Note that clean-burning masonry heaters are exempt from these standards but are still eligible under ecoENERGY Retrofit – Homes. When selecting a replacement, look for an appliance that has low emissions and high efficiency. Ensure that the installation complies with local building and fire codes.

The evolution of wood heating has resulted in wood-burning appliances that are attractive, clean-burning and more efficient, with increased heat output. Advanced, energy-efficient wood-burning appliances comprise stoves (including pellet stoves), hearth-mount stoves, high-efficiency fireplaces, fireplace inserts and masonry heaters which are designed to provide primary or secondary heat for a home.



High Efficiency Wood Stove



High Efficiency Pellet Stove

Pellet stoves typically include a hopper that holds 20–60 kg of fuel and a screw auger that automatically moves the fuel from the hopper into the combustion chamber. Some stoves feature bulk feeding from an external storage supply. The fuel burns cleanly because it is fed to the chamber at a controlled rate and matched with the right amount of combustion air. Many pellet stoves include directly connected combustion air and direct venting. The ash and clinker residue are easy to remove.

Wood-fired equipment should be installed or serviced by a wood heating professional. For a list of certified professionals, contact the Wood Energy Technology Transfer (WETT) at www.wettinc.ca or 1-888-358-9388.

For more information on wood-burning appliances, refer to "*A Guide to Residential Wood Heating*" available through CanREN, and to the following websites: Environment Canada Residential Wood Heating (http://www.ec.gc.ca/residentiel-residential/default.asp?lang=En&n=E9FE1750-1); U.S. EPA Woodstoves (http://www.epa.gov/burnwise); Wood Energy Technology Transfer (http://www.wettinc.ca); Wood Heat Organization Inc. (http://www.woodheat.org)

Fireplace Damper Maintenance

Check the draft damper of your wood-burning fireplace or stove to make sure that it closes tightly when the fireplace is not in use. If it does not close properly, it is recommended that you have it repaired or replaced.

To ensure the safe operation of conventional wood burning fireplaces and stoves without a dedicated combustion air duct, keep a nearby window slightly open until embers are completely extinguished.

Refer to *"Heating with Gas*" (pages 43-47) available through the Office of Energy Efficiency and to *"Keeping the Heat In*" (pages 17, 45, 51, & 116) included with your ecoENERGY homeowner kit.

Installing a New Fireplace?

When installing a fireplace or stove, install a high efficiency direct vent unit. This is a closed system which brings combustion air in from the outside and does not take air from the occupied space. Direct vent type gas fireplaces and stoves operate at substantially higher efficiencies than conventional fireplaces. High efficiency fireplaces and stoves are available in either natural gas or wood burning models. For wood burning stoves and fireplaces, look for models approved by the Environmental Protection Agency (EPA). A cold and uncomfortable area, such as a lower level family room, can be effectively and easily heated with a high efficiency fireplace or stove.

Natural Resources Canada publishes an EnerGuide FE (Fireplace Efficiency) rating guide and listing of gas fireplaces. Go to www.oee.nrcan.gc.ca/residential/business/manufacturers/gas-fireplaces.cfm?attr=4 and click on List of Models to do some comparisons.

FEATURES OF AN ENERGY EFFICIENT GAS FIREPLACE:

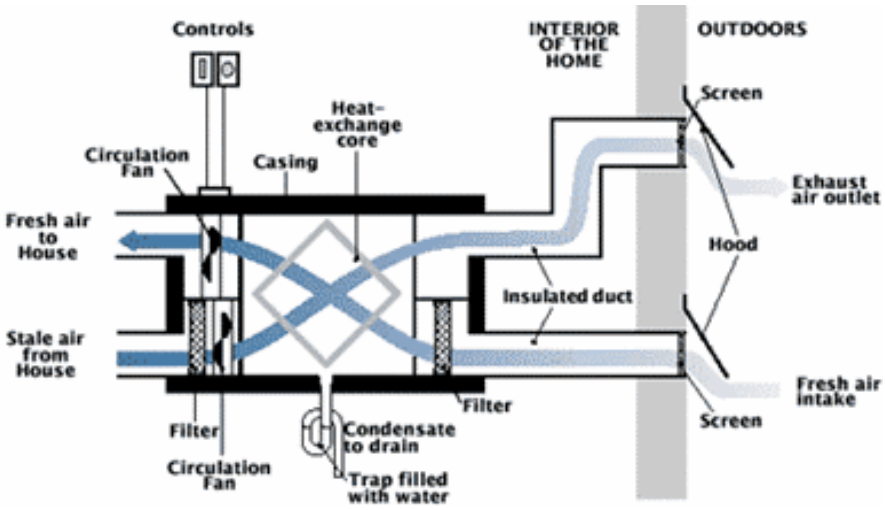
1) Direct-vent design
2) An electronic ignition system
3) Radiation-transparent ceramic glass front
4) Good turndown to prevent localized overheating
5) A quiet squirrel-cage type circulating fan to help transfer convective heat to the room
6) Secondary heat exchanger
7) Insulated outer casing to prevent heat loss through the walls

For more information, refer to "*All About Gas Fireplaces*" available through the Office of Energy Efficiency.

A.3 Ventilation System

Indoor air quality is a major focus of the ecoENERGY home energy evaluation. Making your home air tight and energy efficient is important, but so is providing the right amount of ventilation. Without adequate ventilation the home would become humid and stuffy, potentially leading to mould problems, structural defects and combustion gas spillage. Remember, the house is a system and it needs controlled mechanical ventilation to be able to breathe.

Controlled mechanical ventilation is the key to an energy efficient, healthy home. When the ventilation is controlled, you will be able to more effectively regulate the humidity level in your home and control when you want fresh air brought in and stale air removed from the home. This will save on your heating dollars and remove any possible condensation problems occurring within the building envelope, as can happen with uncontrolled air leakage.



If your home has been found to have an inadequate rate of air change, or could potentially become too air tight after sealing up air leaks, then a heat recovery ventilator (HRV) will be recommended. An HRV is a mechanical air changer that exhausts stale, humid indoor air and brings in fresh air from outside. As the indoor air bypasses the outside air, heat from the indoor air is transferred to the outside air. A heat recovery ventilator is the preferred method of providing ventilation as it reduces energy costs and can be controlled manually or automatically. It can also be turned off when the house is unoccupied or during the summer when windows are open.

Ventilation systems should be designed and installed by an individual who holds current certification from the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI). For a list of certified designers and installers, visit www.hrai.ca and click on "Find a Contractor".

Where the normal ACH is between 0.2 and 0.3 (where there isn't an HRV present), it is recommended that a Energy Efficient bathroom exhaust fan be operated during April and October to increase the ventilation throughout the home. These are typically the months where indoor and outdoor temperatures are relatively close, minimizing air movement between indoors and outdoors.

Exhaust fans are recommended for all bathrooms and in the kitchen (see Sections B.6 & B.7).

To qualify for a grant under the ecoENERGY Retrofit program, the HRV must be certified by the Home Ventilating Institute. Qualifying equipment is listed on the HVI website at www.hvi.org or you can call 1-847-526-2010 for more information.

Refer to the NRCan publication "*Heat Recovery Ventilator*", *"Moisture Problems"* booklet included with your ecoENERGY homeowner kit, *"Operating & Maintaining Your HRV"* available through the Office of Energy Efficiency & *"About Your House: Maintaining Your HRV"* available through CMHC for additional information on HRV's

A.4 Air Conditioning

If you have an existing central air conditioner or window air conditioner, under the ecoENERGY program you can **replace** it with an ENERGY STAR® central air conditioner or ENERGY STAR® window air conditioner, respectively, and qualify for a grant. Check the ecoENERGY Grant Table for qualifying requirements.

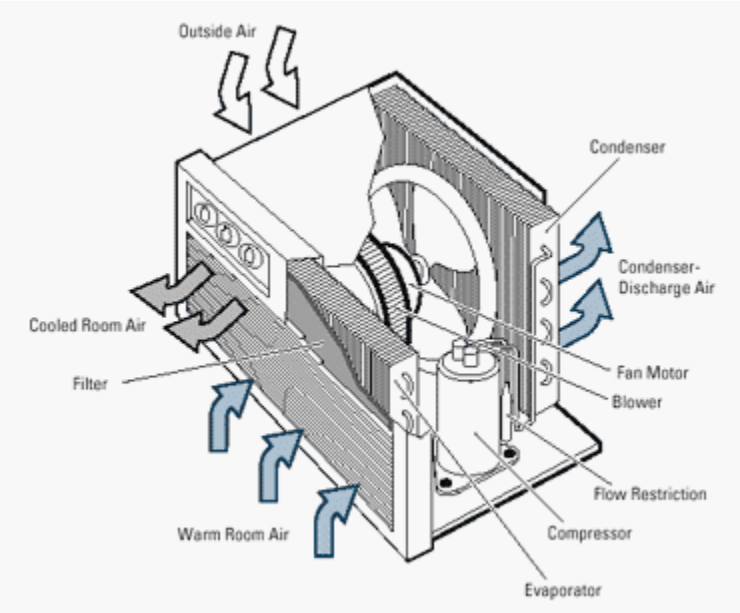
Air conditioners should be serviced and maintained regularly, since they can become inefficient when dirty or when the refrigerant runs low. You can do some of the simple maintenance yourself, but you may also want to have a competent service contractor do a periodic inspection of your unit. Check your owner's manual for information on maintaining your air conditioning system.

Room Air Conditioners

A room air conditioner (AC) is a low-cost, short-term option for small, enclosed spaces. For larger areas, several units can be used. A central AC or a mini-split AC system may be a more cost-effective, longer-term investment.

You can choose from a variety of models of room air conditioners:

- Window-mounted units for installation in single- and double-hung windows, horizontal sliding windows and casement windows.
- Wall-mounted units, which use a sleeve to allow for through-the-wall mounting instead of window mounting.
- Free-standing portable units are easily moved on casters; some require temporary ducting to the outdoors (these units are not ENERGY STAR®-qualified).



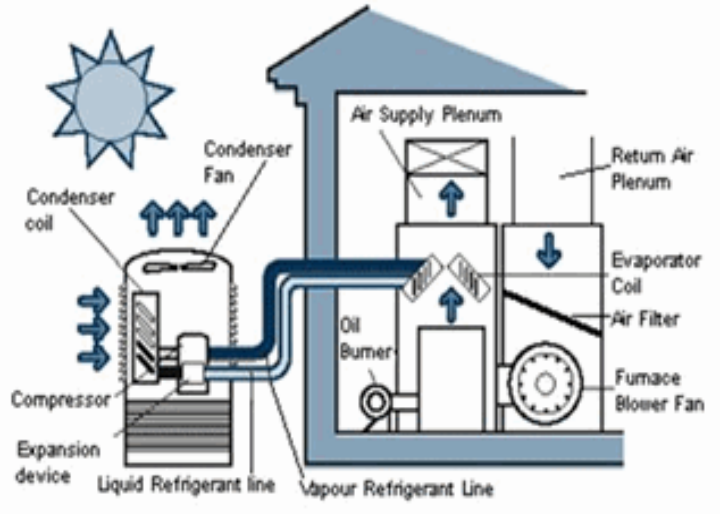
Choose an air conditioner with the proper cooling capacity for your application. An oversized unit may not stay on long enough to properly dehumidify the room, and an undersized unit will not be able to handle the cooling load in extremely hot weather.

If possible, locate room air conditioners on a north wall or on a wall that is shaded. Do not block the air conditioner vents with drapes or furniture. Clean the air filter regularly, and follow the manufacturer's operating and maintenance instructions to keep the unit running efficiently.

Split-System Central Air Conditioners

Just like heating systems, cooling systems should be sized after all other energy-efficiency renovations are completed. Making other energy efficiency improvements to the home, including landscaping that allows for shading of the home, may negate the need for an air conditioner and its associated operating costs. A properly sized cooling system will reduce cycling and remove humidity from the air more effectively. Sizing of central air conditioning systems should be determined by a heating/air conditioner contractor who holds current certification for Heat Loss/Heat Gain Calculations from the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI). For a list of certified contractors, visit www.hrai.ca and click "Find a Contractor".

Your central air conditioner is a split system, which means it has both an outside and an inside component. The outside component contains the condenser coil and inside, the evaporator coil.



The evaporator coil is typically hidden in the plenum attached to the furnace, and refrigerant tubing connects the two cooling components. The furnace fan circulates the cooled air throughout the home via the heating ducts.

ENERGY STAR®-qualified air conditioning systems use up to 20 percent less energy than standard new central air conditioners. To ensure maximum specified efficiency and uncompromised longevity of the new system, replace the matched indoor and outdoor components.

For more information on air conditioning, refer to "*Air Conditioning Your Home*" available through the Office of Energy Efficiency

A.5 Domestic Hot Water Heating

After space heating, water heating is the second largest user of energy in most Albertans', and Canadians', homes, accounting for some 25% to 30% of your total natural gas consumption (where natural gas is used for space heating and water heating). Part of this energy consumption is wasted through standby heat loss and wasted hot water. Standby heat loss is heat lost through tank walls, water piping and heat loss up the chimney.

The normal life expectancy of a hot water tank in Alberta is about 12 years. Over time minerals and sediment will build up at the bottom of the tank which will remain even when the tank is partially drained regularly as part of normal maintenance. This causes the burner to operate more frequently to maintain the desired water temperature, lowering the overall efficiency of the heater. Waiting to replace the tank until the end of its life cycle could also mean facing a flooded basement.

In addition to replacing your domestic hot water (DHW) tank with a high efficiency DHW system, the following tips will reduce your water and energy consumption:

- Fix dripping taps.
- Install low-flow showerheads, with ratings of less than 9.5 liters per minute.
- Install faucet aerators.
- Wash laundry with cold water.
- Insulate metallic, hot and cold water pipes with pipe insulation.

Important Terms When Buying a New Water Heater:

Energy Factor (EF)—The EF rating shows how effective the thermal efficiency of the water heater compares to others. The higher the number, the more efficient the water heater will be.

First Hour Rating (FHR)—This is displayed on the EnerGuide label of the water heater and is a measure of how much hot water the heater will replace during a busy hour. Instantaneous, or on-demand, hot water heaters do not have a first hour rating.

Water Heater Technologies:

Under the ecoENERGY Retrofit program, replacing your existing DHW tank with an instantaneous or condensing instantaneous (also known as the tankless or on-demand) gas water heater or a condensing gas hot water tank qualify for a retrofit incentive where the energy factor (EF) is 0.80 or higher. High efficiency water heaters with direct vent combustion or sealed combustion are safer, also, as the risk of combustion gases backdrafting is greatly reduced or eliminated.

Instantaneous water heaters have extremely limited or no storage capacity. A high output burner rapidly heats the flowing water when a faucet is turned on. Since there is limited or no water storage, standby losses associated with regular DHW tanks are eliminated and overall efficiency is higher.

A single, gas-fired instantaneous water heater has the capacity to meet the hot water needs of most homes. Flow rates, based on specified inlet and delivery water temperatures, are critical for assessing the type of unit required for a home. It is recommended to look for models rated at over 15 liters per minute (4 U.S. gallons per minute). For example, cold water inlet temperatures and high-demand faucets can result in low flow rates or reduced hot water temperatures. Most manufacturers use inlet water temperatures that are warmer than the supply water temperatures found in Alberta for their flow rate charts. Factor these temperature differences into your decision making.

These units are commonly mounted on exterior walls and vented directly out the wall. For higher efficiency, look for heaters without pilot lights.

High-efficiency, condensing water heaters have a specially designed heat exchanger that recovers heat from the water vapour in the combustion gases. Together with electronic ignition, sealed combustion, increased tank insulation and factory-installed heat traps, this feature contributes to high efficiency levels. Condensing water heaters are not required to be vented to a chimney and have a condensate drain at the bottom of the tank.

Although more common in commercial installations, a high efficiency condensing water heater is a good choice for households with a high demand for hot water. One condensing DHW heater with its high FHR can replace two standard tanks, in most instances. In some cases, these heaters can be used to provide both space and water heating.

For more information on water heaters, refer to *"Heating with Gas*" (Chapter 8) and to the American Council for an Energy Efficient Economy website (http://www.aceee.org/consumerguide/topwater.htm)

A.5.1 Solar Domestic Hot Water System:

With Alberta's abundance of blue skies and sunshine, you may wish to install a solar domestic hot water system. If you have a south or mostly south facing exposure with little or no shading that would allow for the installation of solar panels on the exterior of your home (either the roof or walls), then a solar hot water system can reduce your water heating costs by 40 to 50%. Grants are available through the ecoENERGY Retrofit program for qualifying systems. To qualify, the solar domestic hot water system must meet the following standard:

- CAN/CSA F379.1 for packaged systems

Review the qualifying requirements on the ecoENERGY Grant Table for more information.

A list of installers and dealers is available through the Canadian Solar Industries Association. You can contact them through:

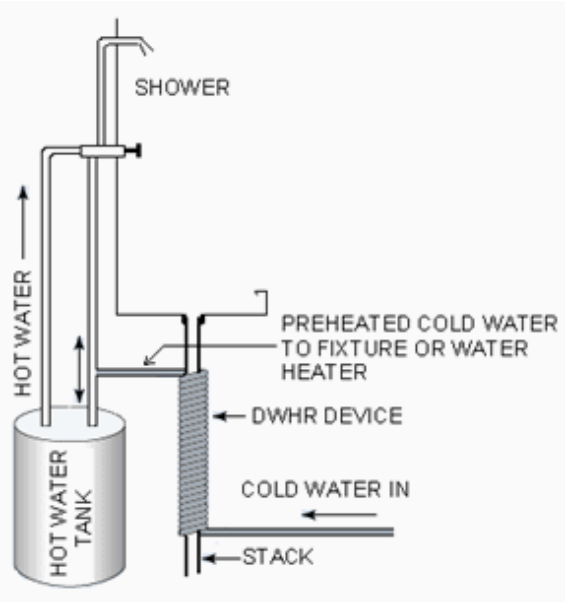
e-mail: info@cansia.ca
website: www.cansia.ca
telephone: (613) 736-9077

Your installer or dealer will be able to help you with a system that meets ecoENERGY's requirements.

For more information, refer to "*Solar Water Heating Systems: A Buyer's Guide*" available through CanREN and to the Solar Energy Society of Canada (www.sesci.ca)

A.5.2 Drain-Water Heat Recovery

A drain-water heat-recovery (DWHR) system provides a simple, maintenance-free way to reclaim some of the heat from shower-water lost down the drain. These systems can recover up to 40 per cent of the heat in warm water going down the drain.



Here's how it works: In a conventional system, cold water enters a domestic hot water (DHW) heater where it is heated up. When someone showers, the hot water proceeds from the DHW heater to the shower where it is lost down the drain. In a DWHR system, cold water first runs through a copper coil wound tightly around the vertical plumbing drain that serves the shower. Copper is an excellent heat conductor that conducts the warmth of the drain water to the cold water in the coil without mixing the water sources. As the cold water continues to wind up through the coil around the plumbing drain, heat exchange continues to take place between the drain water and cold water. The cold water is preheated and continues to the hot water heater. Alternatively, the preheated water can be diverted to the cold-water line that also serves the shower. The amount of hot water required from the water tank is then reduced.

DWHR systems cannot serve showers in basements, single-storey homes without basements, or where there are no vertical stacks below a shower.

INSULATION

To work properly, insulation must be kept dry and draft-free through use of an air-barrier or moisture barrier (where applicable) on the cool side and an air/vapour barrier on the warm side of the material. Prior to improving or adding insulation and vapour barriers to your home, consult with respected resources such as your Keeping the Heat In publication and CMHC for best building practices.

There are many different types of insulation available to choose from, with varying R Values and costs involved. Each insulation type has its advantages and disadvantages, as well as specific areas of the home where it will perform better than other types.

Review carefully the ecoENERGY Retrofit grant table and how insulation levels will affect potential grants. Grants are based on existing insulation levels in some cases, how much insulation is added and the percentage of area that has been upgraded.

Warning! Some manufacturers and representatives of foil-faced bubble insulation and other insulations with foil faced reflective surfaces are making exaggerated claims of the thermal resistance (R value) of their products. These claims are not recognized by various governmental agencies responsible for housing and building materials and have not been verified by specific testing methods used by recognized third party testing authorities. Where these materials are found during the ecoENERGY evaluation, the thermal resistance values determined by government sources will be used in calculating the insulation levels.

For more information on insulation types, refer to *"Keeping the Heat In" (Chapter* 2) included with your ecoENERGY homeowner kit

Working with Insulation

Protect and cover all foam insulation products with a minimum of ½" drywall on the interior to reduce flame spread and smoke generation in the case of a fire. To reduce skin and eye irritation and inhaling fibers and dust when working with all insulation materials, wear loose-fitting clothes with long sleeves and tight cuffs, work gloves, a hard hat and proper footwear. Use a half-mask respirator with a particulate filter and goggles while handling insulation and wash clothing separately after use.

Do not compress insulation. Insulation is designed to work by trapping air within its structure. Removing the air allows heat to conduct more readily through the material.

Some older **vermiculite** insulations installed in homes may contain asbestos. If it is contained in walls or attic spaces and is not disturbed, it poses very little risk to occupant health. However, if vermiculite is detected in the course of a renovation, or if you suspect it might be in your home and you plan to remodel or renovate (including insulation or air sealing work), contact professionals who are trained and qualified to handle asbestos before proceeding. For a list of qualified professionals, look in the Yellow Pages ™ under "Asbestos Abatement and Removal". For more information on vermiculite please read Health Canada's publication, "***Vermiculite Insulation Containing Amphibole Asbestos***" (http://www.hc-sc.gc.ca/iyh-vsv/prod/insulation-isolant_e.html or (613) 957-2991).

A.6 Attic Insulation

In addition to reducing energy use, increasing the insulation level of your attic will keep your house warmer during the winter and cooler during the summer. Effective insulation and air sealing slow the movement of heat and air, and help prevent moisture accumulation in the attic.

When increasing the level of insulation in your attic, take into consideration any settling that may occur over time with some types of loose fill insulation. A loose fill type of insulation (cellulose, fiberglass, rockwool) for the attic is a better option for attic insulation as it can be installed more easily and with better control in those hard to reach places.

A nominal level of R50 (about 14 inches, depending on the insulation type) is recommended for your attic space to maximize your energy savings and potential ecoENERGY retrofit grant. Adding attic insulation beyond the standard is a low cost item that will pay for itself in a short time.

Spray foam insulations can be a very effective method of upgrading a cathedral ceiling space. The right type of insulation can provide high R values, provide an airtight seal and act as an air/vapour barrier.

Grants are determined by the attic / ceiling insulation at the time of the initial evaluation, the insulation level at the time of the follow-up evaluation and the percentage of ceiling area upgraded. Where more than one attic / ceiling space exists, grants will be pro-rated to the area that has been upgraded.

Please Note: To qualify for an ecoENERGY Retrofit grant for upgraded attic / ceiling space, the space **must** be inspected by the evaluator at the initial and follow-up evaluation. However, where a ceiling space such as a cathedral ceiling was inaccessible to the evaluator at the time of the evaluation, Natural Resources Canada has allowed for the homeowner to document the findings and to submit these to the service organization (ATCO EnergySense). To be eligible, you must provide in writing the dimensions of the space in question and the type and depth of insulation found when you opened up the ceiling. You must also document the area, insulation type and depth with digital photographs. The written explanation and digital photographs are to be submitted by e-mail to ATCO EnergySense (please call 310-7283 for further directions) prior to proceeding with the upgrade. Include your ATCO file number and ecoENERGY file number in the "Subject" heading. Upon approval by e-mail, you can upgrade the ceiling space. Before closing up the ceiling space again, document with digital photographs the area affected, insulation type and depth and a written explanation of the upgrade and dimensions. These again are to be submitted to ATCO EnergySense by e-mail. Detailed material / labour receipts are to be provided to the evaluator at the time of the follow-up evaluation.

Before You Insulate

When insulating attics, the importance of air sealing cannot be overstated. Before insulating, seal all openings and penetrations to stop interior air from entering the attic. Seal gaps around ceiling light fixtures, plumbing stacks, wiring, chimneys and the tops of interior walls. Install weatherstripping around the attic hatch or door, and use hooks with eye bolts or a latch to hold the hatch firmly against the weatherstripping.

Build up the attic hatch opening with a plywood frame at least as tall as the depth of the proposed insulation to prevent insulation from falling out when you open up the hatch. Many insulation contractors staple cardboard around the opening, which is flimsy and doesn't stand up over time.

Ensure that soffit venting is not blocked by the insulation. Baffles may need to be installed against the underside of the roof along the soffit to ensure proper ventilation.

Insulating Cathedral Ceilings

Insulating a cathedral ceiling usually requires the services of a contractor. The main difficulty with cathedral ceilings is the limited space for insulation and ventilation.

When insulating a cathedral ceiling, you must minimize moisture penetration from the house into the roof space, which can lead to moisture problems, reduce the effectiveness of the insulation and damage interior finishes and the roof structure. Therefore, it is critical to seal all air leaks into the ceiling, to keep the humidity level in the house at a reasonable level and to eliminate existing moisture problems.

Thermal bridging occurs when joists or rafters, which have a relatively low insulating value, conduct heat directly from the ceiling to the exterior of the house. Therefore, it is preferable to eliminate or reduce thermal bridging through the ceiling joists or rafters when you insulate cathedral ceilings. In addition to the heat loss, thermal bridging can cause staining or condensation on the ceiling finish along the joists.

Cathedral ceilings can be insulated using one of the following methods:

- insulating from the exterior
- insulating from the interior by removing the existing ceiling
- insulating from the interior by insulating over the existing ceiling
- insulating the roof space

Insulating from the Exterior

Insulating from the exterior is the preferred method for cathedral ceilings but is one of the most labour intensive. This method usually requires that you remove the roof surface to expose the roof space. Therefore, it is more cost effective to perform this work if your roof needs to be repaired or replaced.

Insulating from the Interior by Removing the Existing Ceiling

Insulating from the interior by removing the ceiling is also labour intensive because it involves removing the existing ceiling finish, possibly removing the existing insulation and vapour barrier; installing insulation and an air and vapour barrier; and installing a new ceiling throughout the house. As well, it is difficult to correctly insulate and seal the top of the interior partitions with this method.

Insulating from the Interior by Insulating Over the Existing Ceiling

This method is somewhat less labour intensive because the existing ceiling can be left in place and insulation and a new air and vapour barrier is installed over the ceiling, followed by a new ceiling finish. As with the method explained above, it is difficult to correctly insulate and seal the top of the interior partitions with this method.

Insulating the Roof Space

To insulate the roof space, loose-fill insulation is blown in to fill the cavity between the ceiling and the roof. This method is performed by an insulation contractor.

This method of insulating can eliminate ventilation and is not recommended unless extra care is taken to reduce air leakage into the roof space and prevent potential moisture damage. Unfortunately, air leakage locations in a cathedral ceiling, such as penetrations for electrical wiring, plumbing stacks and the tops of partition walls, are not easily accessible for sealing. In addition, this insulation method may not reduce thermal bridging if the joists are not covered with insulation.

Alternatives to loose-fill insulation (i.e. cellulose) include polyurethane spray foam and polyicynene spray foam. Polyurethane spray foam is a high density foam that has a higher R-value and can act as an air/vapour barrier, while polyicynene spray foam is a less dense foam (higher permeability) that creates a complete air barrier.

Insulating Flat Roofs

Insulating a flat roof is not a simple undertaking and usually requires the services of a qualified contractor. The main challenge is the limited space for insulation and ventilation.

When insulating a flat roof, it is crucial to minimize air leakage from the house into the roof space, which can lead to moisture problems, reduce the effectiveness of the insulation and damage interior finishes and the roof structure. Therefore, ensure that all air leaks into the ceiling are sealed and any existing moisture problems are corrected before insulating.

It is also useful to reduce thermal bridging, which is caused when the ceiling joists — because of their relatively low insulating value — conduct heat directly from the ceiling to the exterior of the house. In addition to heat loss, thermal bridging can cause staining or condensation on the ceiling finish along the joists.

Here are three methods for insulating flat roofs:

Insulating from the Exterior

This is the preferred method but one of the most labour intensive. It usually requires the removal of the roof surface to expose the roof space. It is therefore more cost-effective to perform this work if your roof needs to be repaired or replaced.

Insulating from the Interior

This method is also labour intensive since it involves installing a new ceiling throughout the house. It also makes it difficult to properly insulate and seal the top of interior partitions.

Blowing Loose-Fill Insulation into the Existing Roof Space

This method, which is better performed by an insulation contractor, may eliminate ventilation, depending on the type of roof. An alternative to loose-fill insulation is to use a spray foam insulation. See earlier discussion under “Insulating Cathedral Ceilings”.

For more information on how to insulate your attic, refer to “*Keeping the Heat In*” Chapter 4 and *“About Your House: Insulating Your House”* available through CMHC

A.7 Exterior Wall Insulation

Upgrading exterior wall insulation can be achieved by installing loose fill or expandable spray foam insulation into an empty wall cavity, adding insulation from the inside or by adding rigid foam or fiberglass board insulation underneath a new exterior finish. Another method is to add another exterior insulated wall against the existing exterior wall. Upgrading your wall insulation will help alleviate concerns with cold rooms and drafts and reduce heat loss through the walls.

Before you begin, first check the walls from the interior and exterior for evidence of moisture damage: stains, mould, rotten wood, flaking brick and peeling paint. Also, make sure that damage to the walls is not being caused by problems with the roof and that all flashings are secure. All these problems must be fixed before proceeding. Seal gaps and cracks in the exterior wall-finish, and around window and door frames to prevent water from penetrating into the walls. Do not seal, however, any drainage holes at the bottom of brick-veneer walls or window frames, as these holes are necessary to minimize the impact of water penetration on the wall assembly. Consider additional upgrades related to the walls before retrofitting them, such as electrical wiring, and the installation of air- and vapour-barriers.

Main Walls - Exterior Insulation

Improving the exterior wall insulation levels by adding rigid foam board (usually 1 inch to 2 inch thickness) under a new exterior finish is the most common method of upgrading the insulation level of walls. Removing the existing exterior finish before adding more insulation is advised as this allows for inspection of the wall to find any mould or moisture problems that must be repaired first. It also allows for a better fit of the new insulation being added.

Vapour Barrier Properties of the Exterior Walls

Before you insulate the walls, assess the vapour barrier properties of the interior side of the wall. A vapour barrier film that is installed behind the interior surface (drywall / plaster) of a wall or a paint that has vapour barrier properties applied to the interior surface can be an effective barrier to the migration of water vapour into the wall structure.

Water Vapour Permeability of the Insulation

When you choose rigid board insulation to insulate the walls from the exterior, consider the water vapour permeance (i.e. breathability) of the material. The installation of insulation or cladding that has vapour barrier characteristics (such as extruded polystyrene board) on the exterior side of a wall can cause condensation problems within the wall if no vapour barrier exists on the interior side. Follow the manufacturer's recommendations and building code requirements for your area concerning the installation of low-permeance insulation on the exterior side of existing walls.

Air Tightness of the Exterior Walls

Before you install strapping (rainscreen) and the exterior wall finish (i.e. stucco, siding), consider installing a sheet-type air barrier over the insulation. The air barrier must be continuous and well sealed at joints and along its edges, such as around windows and doors.

If you do not install an air barrier from the exterior, you should seal the interior surface of the wall, although this method is not as effective as an exterior air barrier. Seal the interior wall along the perimeter of doors and windows and seal all other cracks and openings. Install gaskets around electrical outlets and switches.

Protection from Water Penetration

Install flashing above the doors and windows and at the point of contact between the foundation wall and the above-grade wall. Use flashing that is suited for the type of exterior cladding that is used. Flashing prevents water from penetrating the joints between various materials and can redirect water from within the wall structure to the outside.

Note: Any insulation or insulated siding must be fastened tightly to the wall, with no air circulating behind it.

Adding Insulation from the Inside

You can choose between these two methods to insulate your main walls from the interior: 1/ remove the existing wall finish and insulate the wall cavity or 2/ add insulation over the existing wall finish.

1/ Remove the Existing Wall Finish and Insulate the Wall Cavity

This labour-intensive but effective method includes some or all of the following steps, depending on your house:

- Remove the existing wall trim, mouldings, baseboards, interior finish, and vapour barrier;
- Build up the wall frame to accommodate more insulation;
- Extend the window and door frames, and move electrical outlets in so that they are flush with the new wall finish (note: ensure that any water and plumbing pipes are on the warm side of the insulation to prevent freezing);
- Replace or upgrade old insulation in the cavities (note: pay, special attention to not to compress the insulation and make sure that no air spaces are left in the wall cavities.);
- Apply rigid-board insulation continuously over the framing;
- Install an air- and vapour-barrier, ensuring that the air barrier is continuous and sealed at joints, around window and door frames, electrical outlets, etc.;
- Install strapping and a new interior finish.

2/ Add Insulation over the Existing Wall Finish

This less labour-intensive method includes some or all of the following steps, depending on your house:

- Remove all wall trims, mouldings and baseboards;
- Puncture the painted wall and vapour barrier approximately every four square feet to avoid having a double vapour barrier;
- Extend the window and door frames, and move electrical outlets in so they are flush with the new wall finish (note: ensure that any water and plumbing pipes will be on the warm side of the insulation to prevent freezing);
- Glue or fasten rigid-board insulation directly to the existing wall finish;
- Add an air- and vapour-barrier, making sure that the air barrier is continuous and sealed at joints, around window- and door-frames, electrical outlets, etc.;
- Install strapping and a new interior finish.
- For both of these methods, foam insulation materials must be covered with a fire-resistant material, such as drywall. Hiring an electrician is recommended for any required electrical work.

Blown-In Insulation

If the main walls in your house have an empty wood-frame cavity, you can hire a professional insulation contractor to blow spray foam or loose-fill insulation inside the cavity. Remember, however, that this cavity is usually only 3 ½ inch (90 mm) deep. If there is already insulation in the cavity, the benefits of blowing more insulation into it will likely be small and the contractor may have difficulty doing a good job. Wood-frame houses with a brick veneer usually have a 1 inch (25 mm) drainage cavity between the bricks and the frame wall. This drainage cavity must not be filled or insulated and the drainage holes at the bottom of the brick on the exterior must not be plugged.

Blown-in cellulose fiber will more readily fill irregular spaces than other insulation materials. Cellulose can also significantly restrict air flow when blown to proper densities. The density should be no less than3 ½ lb/cu. Ft^3 (56 kg/m^3). Spray foam insulations will also work very well in filling an empty wall cavity. There are two types of spray foam insulation: polyicynene (R3.6 / inch), which can act as an air barrier as well, and polyurethane (R5.8-6.8 / inch), which can act also as an air/vapour barrier.

There are three ways of blowing insulation into a wood frame cavity:

From the inside: This approach works best when combined with redecoration or renovation. Small holes of 15 to 50 mm (5/8 to 2 in.) are drilled through the interior wall finish and the insulation is blown directly into the wall. The holes must be completely sealed after the job is done. New paint or wallpaper may need to be applied to the walls, which should be impermeable.

From the outside: Most kinds of exterior siding can be drilled or lifted to permit access to the stud wall behind. For walls with brick veneer, single bricks can be temporarily removed. Each stud space will require two or more holes using this method, at least one at the top and another at the bottom. To avoid water entry if it rains, make sure the installer patches the holes section by section instead of leaving them all until the end.

From the basement or attic: This can be the easiest approach as long as the cavity is open from top to bottom. For this method, the contractor either drills holes in the bottom plate between each stud from the basement to blow in the insulation. Alternatively, the insulation is blown in from the attic.

All stud spaces in the wall should be filled. There should be allowances for windows, doors, fire stops, cross braces and other obstructions in the wall cavity. By knowing the size of the wall to be filled and the density of the application, you and the contractor can estimate and agree on the number of bags of insulation that will be needed. Remember that it's very important to seal all air leaks in the wall from the interior to prevent warm, moist air from entering the walls and creating moisture problems. Also keep your humidity levels low. Canada Mortgage and Housing Corporation (CMHC) recommends keeping humidity between 30 and 50 percent. A coat or two of low-permeability paint, such as latex vapour-barrier paint, applied to the inside surface of the wall provides a vapour barrier.

Consult with reputable resources, such as CMHC, for more ways and means of improving the insulation level of exterior walls.

Refer to the ecoENERGY Retrofit grant table for insulation requirements. To qualify for 100% coverage, the wall between the house and attached garage must be insulated also.

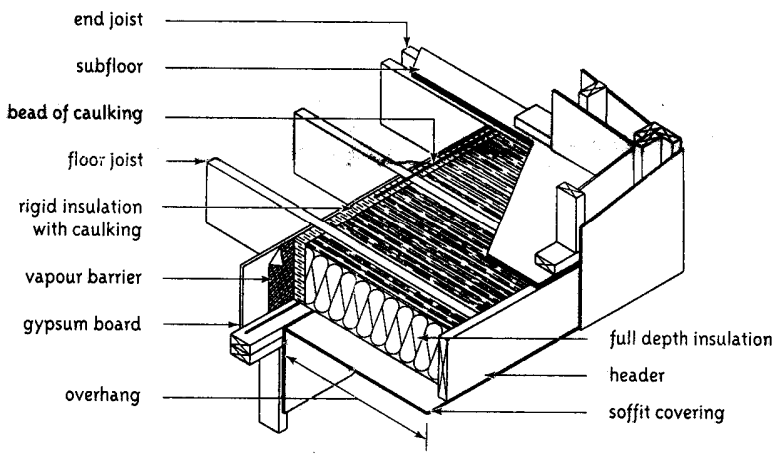
For more information on insulating walls, as well as insulation materials, their properties and installation methods, refer to "*Keeping the Heat In*" (Chapter 6) included with your ecoENERGY homeowner kit and CMHC's "About Your House" and "Renovating for Energy Savings" fact sheets.

A.8 Cantilevered Floor Insulation

A cantilevered (or exposed) floor is one that protrudes beyond the exterior wall of the floor below, leaving that area of floor exposed to the cold outside air. Cantilevered floors are a major source of cold room concerns, and require very careful attention to detail to ensure that it is insulated and sealed properly to keep the room warm. Cantilevered floors are commonly found in bay windows, closets and nooks as well as rooms extending over attached garages.

Different insulating materials and methods can be used to upgrade the insulation levels in cantilevered and exposed floors, depending upon the size of the exposed floor and the design of the house. The most effective method of insulating cantilevered floors is with a spray foam insulation. Spray foam insulations are a very effective method of dealing with the cantilever as they will act as insulation, air sealant and vapour barrier (depending on the type of foam) in one. Spray foam insulation contractors can be

Floor framing at projections.



found in the Yellow Pages under “Insulation Contractors”.

The following method can be used to seal and insulate a cantilevered floor:

When possible, remove the finish from underneath the exposed floor or overhang to seal air leaks and install a vapour barrier.

First, place a vapour barrier against the underside of the floor between the joists. Do not place the vapour barrier around and under the joists because it can trap moisture inside the joists. A vapour barrier is not required for painted floors and floors made of plywood-like materials because they can act as a vapour barrier.

Next, seal openings in the floor.

Carefully fill the entire space between the joists with fiberglass or rockwool insulation and ensure that no air space remains between the underside of the floor and the insulation. Do not squish or flatten insulation as this removes its thermal resistance properties.

For overhangs, install foam board insulation vertically between the joists at the top of foundation walls or other exterior walls to restrict air movement and heat loss between the joists (see diagram). Air seal the foam board with caulking on all edges.

Tape the seams in heating ducts and insulate all ducts that run through overhangs or exposed floors.

Ensure water and drainage pipes are located on the warm side of the insulation and are protected from freezing.

Attach a layer of rigid board insulation to the underside of the floor joists to reduce thermal bridging through the joists. Thermal bridging occurs when solid building materials conduct heat because the materials have a relatively low insulation value. Alternatively, install heavyweight building paper or a polyolefin air barrier before installing the finish underneath the floor or overhang.

Cover all exposed foam board with drywall or other suitable material that will act as a fire barrier.

Consult with reputable resources, such as CMHC, for other ways and means of improving the insulation level of exposed floors. For large areas of exposed floors, you may want to hire a professional contractor to ensure the job is completed most effectively.

For more information, refer to *“Keeping the Heat In*” (pages 89 and 103-104) included with your ecoENERGY homeowner kit

A.9 Basement Insulation

An uninsulated and poorly sealed basement can result in 20% to 35% of a home’s total heat loss. Even a small portion of un-insulated basement can reduce the overall effective R value of the basement and be a significant source of heat loss. A properly insulated basement, with a carefully installed moisture barrier and vapour barrier, will reduce heat loss considerably and make the entire home more comfortable.

A recommendation to insulate your basement will only appear under Your Home Energy Action Checklist if 20% or more of the basement is un-insulated. This is the starting point from which grants will become available. However, you should insulate the entire basement to reduce heat loss and improve comfort levels whether there is a grant available or not.

Before insulating, first check for moisture in your foundation walls. Tell-tale signs are staining or mould growth, blistering, peeling paint, efflorescence (a whitish deposit on the surface), spalling or surface deterioration, condensation on walls and metal objects and / or a musty smell.

Repair water leaks caused by cracks, holes and construction joints in the floor and walls. You should also control humidity levels and there should be appropriate damp-proofing or waterproofing on the foundation walls to prevent moisture from wicking through the foundation wall.

To prevent moisture problems, slope the ground away from the house exterior and direct eaves trough downspouts away from the foundation. Maintain and seal sumps and sump pumps, and install sewer backup equipment if required.

The type and condition of your foundation will determine if you can insulate from the outside or from the inside. Exterior insulation is the preferred but more costly method. Foundations of rubble, brick, stone and concrete block (these are relatively rare in Alberta) are best insulated from the exterior. However, you may wish to have an engineer verify your foundation's structural integrity before undertaking any work.

Poured concrete foundations (most common) can be insulated from either the outside or inside, providing there are no serious water or structural problems. Preserved wood foundations (PWF), made with sheathing and studs, are generally insulated by filling in the stud space. Slab-on-grade foundations are typically insulated on the exterior edge. Occasionally, they are insulated on top of the slab and under the floor finish.

Insulating Basements from the Inside

Before insulating foundation walls from the interior, a moisture barrier is applied to the inside face of the walls up to the grade level. However, the use of foam board, especially in basements and crawl spaces, may act as a moisture barrier and limit the utility of a separate sheet moisture barrier.

The two most common methods of insulating foundations from the interior are to **1/** install a wood-frame wall and batt insulation or **2/** apply rigid-board insulation directly to the foundation walls. Wood-frame walls allow for wiring and plumbing to be installed and then hidden; plus it provides solid backing for finishing materials (drywall). If you use the wood-framed wall method, you can build the wall out from the foundation wall by 2 ½ - 3 ½ inches so that a horizontal layer of batt insulation (R-8 to R-12) can be installed behind the framed wall.

A hybrid system of water-resistant foam board (type IV or V polystyrene, polyurethane or polyisocyanurate) with R values of R-5 to R-6 / inch (RSI 0.035/mm to 0.045/mm) glued directly to the foundation wall, and then the installation of a wood frame wall with additional insulation in the stud space is gaining popularity.

Insulating Basements from the Outside

The most effective way to insulate foundation walls is to do so from the exterior. Insulating foundation walls from the exterior keeps the walls warm, which moderates interior temperatures and reduces frost damage caused by freeze-thaw cycles. Also, when the foundation walls are exposed, waterproofing and weeping tile improvements can be made.

There are limitations to insulating from the exterior, such as disturbing landscaping, sidewalks, driveways and additions to the original building, adding to the cost and difficulty of the project. For areas that are difficult or impossible to insulate from the exterior, insulate from the interior.

Before excavating around a foundation, determine if there is a risk of foundation wall failure, if the soil is supporting the foundation, or if heavy equipment traffic could cause problems. Keep in mind that this type of renovation is best suited to dry, warm seasons so the products will be well applied and to avoid unnecessary costs associated with freezing and wet weather.

The most common types of insulation used to insulate foundations from the exterior are rigid-type extruded polystyrene, polyurethane and polyisocyanurate boards, with R values of R-5 to R-6 / inch.

Insulation must extend to the above-grade walls and be properly fastened, flashed and covered to protect the walls from physical and weather damage.

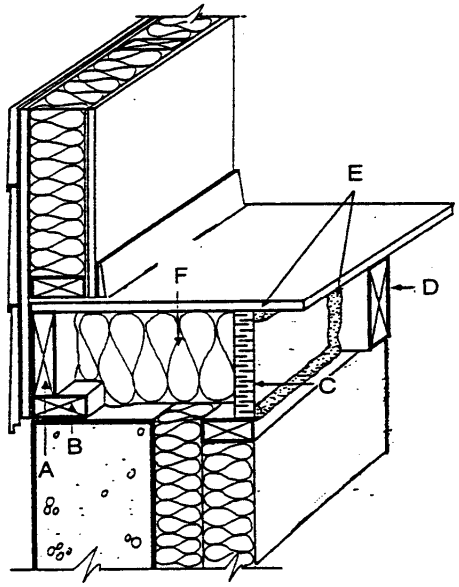
When the excavation is filled, ensure that the ground slopes away from the foundation to direct excess surface water away from the house. The usual slope is 10 percent or 8 inches (20cm) for the first 6 feet (2m) to allow for settling.

Basement insulation upgrades are eligible for ecoENERGY Retrofit - Homes grants. The grant amounts vary depending on the insulation values added and the surface area insulated. Go to *Your Home Energy Action Checklist* in the ecoENERGY Report to see the recommended insulation value for your foundation and the eligible grant amount. Taking photos of the foundation during installation and showing them to the energy advisor during the post-retrofit evaluation is recommended to ensure that you receive full credit for your installed insulation.

Refer to "*Keeping the Heat In*" Chapter 5 and CMHC's "*About Your House"* and "*Renovating for Energy Savings"* fact sheets for more information

A.9.1 Basement Header Insulation

The space between the floor joists and along the rim (outside) joist is often uninsulated or under insulated. Extra care should be given to seal off all air leakage points as well as to insulate and install a completely sealed vapour barrier. This will reduce heat loss from the home.



A. Basement Header
B. Sill Plate
C. Rigid Insulation
D. Floor Joist
E. Sealant / Caulking
F. Fiberglass Insulation

Spray foam insulations can be a very effective method of dealing with the basement header and rim area, as the right spray foam will act as an air sealant, insulation and vapour barrier in one. Spray foam insulation contractors can be found in the Yellow Pages under "Insulation Contractors".

To qualify for a grant under the ecoENERGY Retrofit program, a minimum of R-20 must be added to 100% of the basement header area, including any areas that already have some insulation. Refer to the ecoENERGY Retrofit grant table.

If some of the basement header is already insulated, the remainder should also be insulated to reduce your heating costs and make your home more comfortable.

Refer to "*Keeping the Heat In*" page 87

A.10 Crawl Space Insulation

An un-insulated and poorly sealed crawlspace can result in a significant portion of a home's total heat loss. Even a small portion of un-insulated crawlspace can reduce the overall effective R value of the crawlspace and be a significant source of heat loss. A properly insulated crawlspace, with a carefully installed moisture barrier and vapour barrier, will reduce heat loss considerably and make the entire home more comfortable.

Insulate heated (conditioned) crawlspaces (those with heating ducts and/or heating equipment inside) at the wall and insulate unheated (unconditioned) crawlspaces at the floor above the crawlspace.

Insulating Conditioned Crawl Spaces

Insulating crawl space walls improves comfort, by keeping the floors directly above warmer, and also helps prevent plumbing systems in the crawl space from freezing. Crawl space walls can be insulated from the interior or exterior.

A moisture barrier on the crawl space floor is strongly recommended, especially if your crawl space has an exposed, earth floor. Select 6 mil polyethylene and ensure to overlap and seal the joints with acoustical sealant. You can also reinforce them with technical tape (a red tape commonly used on exterior air barriers). As roots, wind, and air-pressure changes can loosen the polyethylene over time, seal and fasten it to the walls with acoustical sealant and strapping.

Continue the insulation and air- and vapour-barrier to the underside of the floor above when insulating the walls, since the header joist area is highly susceptible to air leakage and heat loss. Crawl space walls can be an excellent area for applications of spray-on polyurethane foam. However, be sure to check with your local building authority about building-code regulations to see if a fire-retardant product is required over the foam.

Insulating Unconditioned Crawl Spaces

By insulating and air sealing the floor above your unconditioned crawl space, you will improve home comfort and energy efficiency and also prevent insects or vermin from entering the building.

If the underside of the floor above the crawl space is accessible from the crawl space, first place a vapour barrier against the underside of the floor between the joists. Do not place the vapour barrier around and under the joists because it can trap moisture inside the joists. A vapour barrier is not required for painted floors and floors made of plywood-like materials because they can act as a vapour barrier.

Next, use spray foam and caulking to seal the header joist along the perimeter and at floor openings. This treatment reduces air leakage through the insulation and the floor.

Fill the entire space between the joists with insulation such as fiberglass or rockwool batts and ensure that no air space remains between the underside of the floor and the insulation. Ensure that all water pipes are on the warm side of the insulation and are protected from freezing.

Attach a layer of rigid board insulation to the underside of the floor joists to reduce thermal bridging through the joists. Thermal bridging occurs when solid building materials conduct heat because the materials have a relatively low insulation value.

Another very effective insulation method is to have a contractor apply spray foam insulation to the underside of the floor and fully or partially fill the joist space.

If the underside of the floor above the crawl space is not accessible from the crawl space, a contractor can blow insulation in between the joists from above or from the joist ends. The insulation must be blown in at a high density to prevent air spaces between the insulation and the floor above.

Grant Eligibility: The insulation of a crawl space is eligible for an ecoENERGY Retrofit – Homes grant. For information on the eligibility requirements, refer to the brochure entitled "*Retrofit Your Home and Qualify for a Grant!*"

Refer to "*Keeping the Heat In*" Chapter 5 for more information

A.11 Air Sealing

Reducing air infiltration and eliminating drafts is usually one of the most cost-effective measures a homeowner can undertake to cutting energy costs and improving indoor comfort. Air leakage can account for 35% or more of the heat loss in a home. In addition to reducing heat loss and improving comfort, air sealing protects the building structure and other materials from moisture damage and reduces the amount of dust and noise that enters from the outdoors.

A blower door test was performed on your home to measure the amount of air leakage, and to identify the main air leakage locations. The blower door test results are shown on the first page of this report and are explained below.

The **Air Leakage Rate at 50 Pascals** (ACH (Air Changes per Hour)) is the number of complete air changes per hour that occurs in your house when a pressure difference between the inside and outside of the home is set at 50 Pascals (Pa). A 50-Pa pressure difference simulates wind blowing at 56 kilometers per hour (35 mph) on your home. The higher the ACH, the leakier the house.

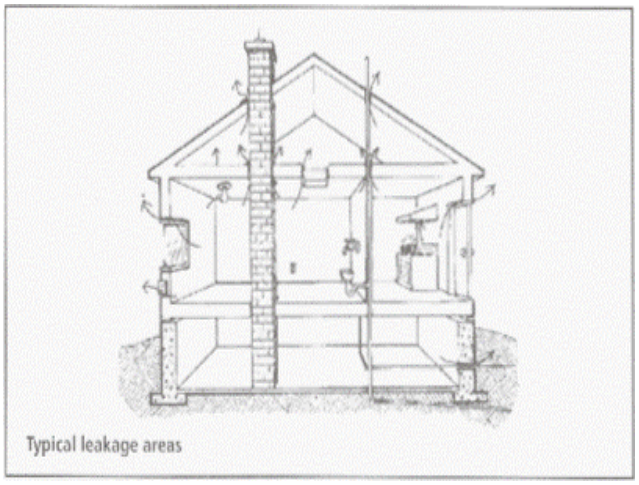
The **Equivalent Leakage Area** (ELA) represents the total air leakage area. It's like taking all of the air leakage areas (e.g., cracks, holes, etc.) in the home and putting them together to create one large hole in the building envelope. The larger the ELA, the leakier the house. An energy-efficient house might have an ELA as low as 40 in^2 (258 cm^2) while a very leaky house may have an ELA of more than 500 in^2 (3,226 cm^2)

As you reduce the air leakage points in your home, ensure that you have adequate ventilation by installing exhaust fans in bathrooms and kitchen and a source of controlled fresh air. A heat recovery ventilator (HRV) will be recommended where homes are assessed as being airtight without adequate ventilation.

Air Sealing Locations in Your Home

Here are some of the more common air leakage areas in a house. Refer to your copy of the "*Air-leakage Checklist*" completed by the evaluator which identifies improvement areas in your building envelope.

- electrical outlets
- electrical ceiling fixtures
- electrical box and wire penetration
- exterior pipe penetration & utility service entrances
- baseboard trims and mouldings
- window and door frames
- fireplace
- chimney
- attic hatch
- basement header (rim joists


Typical leakage areas

Air sealing can be a do-it-yourself project or you can hire a qualified, professional air sealer who can locate and seal leaks in your home and will likely do a more thorough job (check under "Insulation" in the Yellow Pages™). This may be an important consideration if you want to air seal your house to meet the specific air leakage goal shown under *Your Home Energy Action Checklist* of the ecoENERGY Report. You must meet or exceed the goal indicated to be eligible for an ecoENERGY Retrofit grant for air sealing. The results of the air sealing work will be measured at the time of your post-retrofit evaluation. Professional whole-house air sealing costs vary, depending on the size and complexity of the work.

Air Sealing Materials

Weatherstripping reduces air leakage by sealing gaps around moveable parts of windows and doors. Correctly installed, good quality weatherstripping is a cost-effective way to reduce air leakage. Check weatherstripping annually and replace worn materials before the cold weather sets in.

Caulking is used on the interior to seal small cracks and penetrations on the inside surface of your walls, ceilings and floors. Caulking is also used on the exterior to keep out rain, snow, wind as well as insects and rodents. Urethane foam is very good for filling larger joints and cavities.

For more information, refer to NRCan's *"Air-Leakage Control*" brochure and *"Keeping the Heat In"* (pages 32–38, 46-52, 108 and 112) included with your ecoENERGY homeowner kit

A.12 Doors, Windows & Skylights

Replacing your older doors, windows and skylights with ENERGY STAR® qualified units can qualify you for grants under the ecoENERGY Retrofit program. ENERGY STAR® ratings are divided into four zones across the country; in most of Alberta, the minimum zone requirement would be zone C with a section of southern Alberta in zone B. Note that these are the minimum qualifying requirements. It is recommended that you look beyond the minimum for ENERGY STAR® products that have higher ratings and lower heat losses. Remember that the selection of new windows for your home will affect energy efficiency and comfort levels for many years to come. In most instances, it does not cost significantly more to upgrade beyond the minimum requirements to even more energy efficient products. Technical breakthroughs such as low E-coatings, triple glazing, inert gas fills, internal-shading devices and improved edge spacers and frames all contribute to improved energy efficiency, solar control and thermal comfort. Look for products that have a higher R value / lower U value and higher ER value. The ENERGY STAR® website lists specifications from various manufacturers and window types as well as additional information on windows and doors that can serve as a good starting point.

When selecting a window, door or skylight manufacturer for your home, ask the manufacturer if it is an approved manufacturer under the ENERGY STAR® program and that the windows, doors and / or skylights you select are ENERGY STAR® qualified. Not all products by a manufacturer may be ENERGY STAR® qualified. The ENERGY STAR® website is a good starting point, but not all manufacturers have been added to the list at this time. When you have your follow-up evaluation done, you must provide documentation (detailed receipt, window labels, etc.) showing the windows and doors are ENERGY STAR®. Without the documentation, a grant cannot be given.

A “window” or a “door” for the purposes of the ecoENERGY Retrofit program and grants is the rough opening (RO) or the opening in the wall. For example, a window unit that has one sealed glazing and one opening portion that fits into one rough opening is considered one window.

For information on purchasing an energy-efficient windows, doors, skylights and patio doors, consult the NRCan publication entitled *Consumer's Guide to Buying Energy-Efficient Windows and Doors*. For information on ENERGY STAR® qualified windows, doors and skylights, go to www.energystar.gc.ca and click on “information for general consumers’, then 'Windows, Doors and Skylights' under 'Qualified Products'.

For more information, refer to the “*Windows, Doors & Skylights*” paper included with your ecoENERGY homeowner kit

A.12.1 Windows

You may be considering replacing some or all of your windows for various reasons, such as to improve aesthetics, reduce maintenance, increase house resale value, improve comfort, energy efficiency or safety, or to replace broken or inoperable windows. Replacing your old windows with new ENERGY STAR® windows will reduce the heat loss from your home and can significantly improve the comfort levels in your home. Review section **4. SPACE HEATING ANALYSIS** of the ecoENERGY Report to determine how window replacement may affect your energy consumption (note: projected energy savings are based on double glazed windows with low E coating and argon gas fill). The energy savings relative to capital cost can create a long simple payback period but consider other reasons why you might want to replace your windows. New windows will provide added benefit by improving the comfort level in the home, adding to the aesthetics of the house and allow for higher humidity levels before condensation occurs on the windows.

Older conventional single and double pane windows represent a source of heat loss, discomfort and condensation problems. Through modern energy efficient window technology, which includes low E coatings, argon gas fills, low conductivity spacers and insulated frames, you can achieve a reduction of heat loss and warmer window surfaces that improve comfort and reduce condensation.

While modestly more expensive than a double pane Low-E window, triple pane Low-E windows offer increased energy savings, higher comfort levels and allow higher humidity levels in the home before condensation occurs. They particularly should be considered where external noise is an issue and for large north facing windows. They should also be considered where furniture is located directly below the window. What many people perceive as cold drafts are actually convection currents flowing from the surface of the window. Triple pane Low-E windows will minimize these cold currents.

Patio doors are included in the count of window RO's. ENERGY STAR® qualified sliding patio doors, which are rated for four different climate zones, are among the most energy efficient in the marketplace. They'll help keep your home comfortable all year-round, reduce outside noise, and, depending on the amount of humidity in your home, there will be less condensation on them during cold weather. You may also want to consider replacing your patio doors with ENERGY STAR® garden doors or French doors.

For more information, refer to *"Improving Window Energy Efficiency"* and to *"Keeping the Heat In" (pages 23 and 107 - 112*) included with your ecoENERGY homeowner kit. Also, refer to *"Consumer's Guide to Buying Energy Efficient Windows and Doors"* available through the Office of Energy Efficiency and to *"About Your House: The ABC's of Windows"* available through CMHC.

Internal Storm Windows

Another option to replacing windows is to invest in internal storm windows. Made of acrylic or glass, these are installed seasonally to reduce heat loss and improve comfort. Specialty suppliers and glass shops will be able to assist you further. Plastic films are also available that can be installed seasonally. The ecoENERGY grant is not applicable to this option.

Refer to *"Improving Window Energy Efficiency*" and *"Keeping the Heat In"* pages 23, 109-111

A.12.2 Skylights

Skylights bring added light to a home and make it more attractive. However, if not designed or installed properly, they can lose far more heat than a standard roof or window. They can also present special problems such as water leakage, condensation, and summer overheating. In addition to the selection and installation of the skylight itself, you need to pay special attention to the details of the skylight well to ensure that there are high insulation values in the walls, thermal bridging is minimized, the vapour barrier is complete and sealed and there is a complete air barrier around the exterior (cold side) of the skylight well walls.

There is limited availability of ENERGY STAR® qualified skylights; you may have to do some searching to find a replacement model that works in your zone. Check the ENERGY STAR® website and with manufacturers. If possible, avoid high, poorly insulated curbs when having a new skylight installed.

Another option, or in addition to replacing the skylight, is to install a removable internal storm window at the ceiling level. Tightly seal all points of air leakage and ensure the skylight frame between the ceiling and roof has a continuous vapour barrier and is well insulated.

A.12.3 Doors

Replacing your old doors with insulated steel or fiberglass doors will reduce heat loss, and can also improve the aesthetics of your home and add to its security.

A good quality storm door is a helpful addition to the exterior door, adding another barrier to the outdoors and allowing additional fresh air into the home in the summer. When installing a storm door, consider how much sunlight is impacting the door. Too much sunlight can create a considerable heat build-up between the storm door and the exterior door and can cause warping of the door and deterioration of the finish. Storm doors are not considered an improvement under the ecoENERGY Retrofit program.

Fixing and replacing the weatherstripping and threshold sweep will reduce air leakage, improving the comfort level and reducing heat loss. A reputable glass shop or home improvement centre can help you choose the best weatherstripping for your door.

To qualify for a grant, the door, any window within the door and / or sidelite must all be ENERGY STAR® rated for the zone you live in.

Refer to *"Keeping the Heat In"* pages 36-37 and 112-113

A.13 Water Conservation

Replacing your existing toilets with low-flush or dual-flush models will result in significant water savings. Dual flush toilets use even less water by having two handles or buttons for either three liter or six liter flush, depending on the need. Generally, the three liter flush works well in accomplishing the necessary task. Reducing water consumption reduces the strain on river and aquifer systems and on water / wastewater treatment facilities, including pumping.

Models that qualify for an ecoENERGY Retrofit grant are listed at www.map-testing.com . At the time of the follow-up evaluation, provide documentation to the evaluator showing the toilet manufacturer and model number, as well as the receipt. Additional grants may be available from your municipality as well; contact them to find out if they have grants available and what requirements must be met. Retrofit kits for existing toilets do not qualify for grants.

Your municipality will also likely have additional water conservation measures and recommendations for you to implement.

For more information, refer to "*Buying a Toilet*" and "*Install Water Conserving Fixtures*", both available through CMHC

B. ENERGY SAVINGS TIPS

B.1 Attic Hatch

Building up the hatch opening with a plywood frame to a minimum of the insulation depth will allow insulation to be installed evenly right up to the hatch without falling down when you open the hatch.

The hatch itself should be insulated, and this can be done with several layers of rigid styrofoam insulation glued in place or by building a box on top of the hatch and filling it with fiberglass batt or loose fill insulation to the same level as the attic insulation. Weather-stripping should then be added to the hatch frame for the hatch to rest on and provide a tight air seal.

Refer to *"Keeping the Heat In"* page 52

B.2 Attic Ventilation

Prior to insulating the attic, ensure that there is adequate ventilation in the attic to remove excess heat and any moisture that made its way into the attic. Ventilation should be evenly spaced around the eave or soffit and between the roof and soffit to create cross flow within the attic and force the warm air out of the attic. The use of whirlybird type roof vents can create too much air flow in the winter through air leaks in the ceiling and should be blocked from rotating during the heating season. The attic should be cold on a winter's day. Insert cardboard or foam baffles at the soffit vents to allow air to travel past the insulation. The area of attic ventilation required should equal 1/300 of the area of ceiling area.

Refer to *"Keeping the Heat In"* (pages 58, 63) included with your ecoENERGY homeowner kit

B.3 Programmable Thermostat

Reducing the thermostat setting at night when you are sleeping and when you are away can result in significant energy savings (generally, 2% of your space heating energy for every degree over an eight hour period during the heating season). The most effective and consistent way to turn down the thermostat is by using a programmable thermostat. Using a programmable thermostat will also allow you to wake up to a warm house and also arrive home to a warm house. When shopping for a programmable thermostat, look for the ENERGY STAR® logo.

Most programmable thermostats are easy to install and easy to set up. Temperature settings, both the high and low temperatures, are largely a personal preference. Other factors to keep in mind is the age and construction of your home and how long it will take for your home to recover from the low setting to the high setting. Some experimentation may be required.

B.4 Energy Efficient Lighting & Controls

Installing energy efficient light sources, wherever suitable in and around the home, is an easy way to reduce your annual electrical consumption. Under the ecoACTION program, the federal government has announced that inefficient incandescent lamps (bulbs) used in common applications will be phased out by 2012.

Compact fluorescent lamps last up to an average 10 times longer than regular incandescent bulbs and use approximately one third of the energy to produce the same amount of light. For example, a 75 watt incandescent bulb can be replaced with a 20 – 25W compact fluorescent lamp and provide just as much light. Compact fluorescent lamps are available in a variety of wattages, shapes and sizes to accommodate most applications. Compact fluorescent lamps will have the most impact on those light fixtures that are on for the longest periods through the day.

Specialty compact fluorescent lamps are available for use with three way fixtures, dimmer circuits and outdoor applications.

Halogen lamps are slightly more efficient than a standard incandescent bulb. They are available in an assortment of spotlight and floodlight ranges for directional and accent lighting. Some energy savings can be achieved through the focused lighting that they provide. Halogen lighting is also easily dimmed.

One of the latest technological developments in high efficiency lighting is LED (light emitting diode) lighting. While these previously had been widely available for the last number of years in only Christmas lighting and landscape lighting, LED bulbs for other applications and LED fixtures are becoming more common. You can expect to see more applications of LED lighting in and around the house as popularity increases and prices decrease. LED lighting is now available in most lighting, hardware and home improvement stores.

Lighting controls are useful in reducing energy consumption, determining how much light is available and when the lights are on and off. Dimmer switches control how much light is available, creating ambience as well as energy savings. Motion sensors detect activity to turn lights on and off again when there is no activity. Timer switches turn lights on and off at set times or intervals. Lighting controls can operate independently and set manually or they can be part of a larger lighting or energy management system. Verify that the type of control you want to install will work with the light source and its application.

Look for the ENERGY STAR® symbol when selecting lights of the highest level of energy efficiency. For more information please check the ENERGY STAR® website.

B.5 Carbon Monoxide Detector

All fuel burning appliances require combustion air to burn the fuel, a proper mix of oxygen to the fuel and a means for the exhaust to escape from the home. When any of these conditions are not met, there is a potential for deadly carbon monoxide to enter into the house.

Always keep combustion air and fresh air ducts free of any blockages. Ensure that the chimney is clear and properly sized for the connected appliance. Have your appliances serviced periodically as required to ensure that they are burning the fuel properly.

Natural gas is a clean burning fuel, producing carbon dioxide and water vapour as byproducts when used in a safe manner. When using a conventional wood burning or gas fireplace or stove, provide a supply of combustion air until the fire is completely out.

Finally, install a carbon monoxide detector that meets Underwriters Laboratories of Canada (UL_C) or Canadian Standards Association (CSA) requirements according to the manufacturer's directions. The carbon monoxide detector is not meant to take the place of the proper use and maintenance of your fuel burning appliances.

B.6 Exhaust Fan In Kitchen

Installing an exhaust fan over the kitchen range and venting it to the outside will remove humidity and cooking odours from the home, as well as excess heat. Kitchen exhaust fans / range hoods are available in a range of flow rates and multi-speed or variable speed control. Look for a range hood that offers variable flow rates and quiet operation. Be aware that very high volume range hoods and downdraft fans could create a situation where the furnace and hot water heater may backdraft into the home; a supply air fan may need to be interlocked with the range hood to ensure that the exhausted air is being replaced safely. Consult with a qualified heating / ventilation specialist. Combustion gas spillage could result in a buildup of deadly carbon monoxide gas.

The flapper above the fan may need occasional cleaning to ensure it opens and closes properly.

When selecting a range hood or kitchen exhaust, look for the ENERGY STAR® label. ENERGY STAR® fans are more energy efficient and quieter. For more information on ENERGY STAR® qualifications, click on the energy star website and link to qualified products / heating cooling and ventilation.

For more information, refer to *"About Your House: The Importance of Bathroom and Kitchen Fans"* available through CMHC and to *"Keeping the Heat In"* pages 16 & 19

B.7 Exhaust Fan(s) In Bathroom(s)

It is recommended that an exhaust fan be installed in every bathroom to remove excess humidity from the home, whether it has a window or not. Excess humidity can lead to quick deterioration of the bathroom surfaces and cause mould problems. Exhaust fans need to be vented to the outside through an insulated duct.

As a rule of thumb, you can size your bathroom exhaust fan by allowing 1 cubic foot per minute (cfm) for each square foot of bathroom area. Fans sized at 80 to 100 cfm are common for bathrooms. Also, check out the sound rating level (rated in "sones"). A quiet fan is more likely to be used effectively.

Bathroom fans can be controlled by a simple switch or by a motion detector or timer switch, which can be much more convenient in ensuring the fan is used as well as turned off again.

When selecting a bathroom fan, look for the ENERGY STAR® label for a quiet, energy efficient fan. The energy star website has more information on qualifying fans.

The flapper above the fan may need occasional cleaning to ensure it opens and closes properly.

For more information, refer to *"About Your House: The Importance of Bathroom and Kitchen Fans"* available through CMHC and to *"Keeping the Heat In"* pages 16 & 19

B.8 Exhaust Fans Vented to Outside

Ensure that all exhaust fans are vented directly outside. Ducting needs to be insulated to prevent

condensation problems from occurring. Exhaust fans that are vented into crawlspaces and attics will leave warm, humid air in these spaces. As the air cools the moisture will condense and settle on insulation and building components, leading to reduced insulation performance and serious structural problems.

B.9 Motorized Dampers

Motorized dampers will reduce the energy consumption and improve the comfort level of the home when installed on the fresh air and combustion air ducts, as well as on exhaust ducts. Motorized dampers on the fresh air and combustion air ducts will reduce the amount of unwanted cold air coming into the home by opening the ducts only when there is a call for heat and the furnace fires. A motorized damper on the fresh air duct can result in significant energy savings and improved comfort especially when the furnace fan is operating continuously at low speed.

Motorized dampers are available through your mechanical contractor. For more information, please contact Hoyme Manufacturing Inc. at www.hoyme.com or 1-800-661-7382.

B.10 Combustion Air Duct

If you are installing a new heating system and you currently do not have a combustion air duct, your mechanical contractor will install one. Most high efficiency heating systems have a sealed combustion air duct connected directly to the heating system.

All fuel burning appliances require combustion air. Depending upon the age of your home, you may not have a combustion air duct. As you improve the insulation levels and reduce the air infiltration into the home, you will reduce the amount of air leaking into the home that was previously assumed to provide combustion air. If you are not replacing your heating system immediately, check with your mechanical contractor about installing a combustion air duct.

If your combustion air duct is the standard variety (not a sealed combustion heating system), then you may want to consider a motorized vent damper on the combustion air duct to improve the comfort level and for additional energy savings. For your safety, do not ever block the combustion air duct by any other means.

For more information, refer to *"Keeping the Heat In"* pages 17, 45 and 121

B.11 Fresh Air Duct

Depending upon the age of your home, you may not have a fresh air duct coming into your home. The fresh air duct provides outside air into the return air plenum of your furnace, ensuring that your home has an adequate supply of fresh air. If you are installing a new furnace, your heating contractor will install a fresh air duct.

If you are not replacing your heating system immediately and you are upgrading the insulation and reducing the air infiltration occurring in your home, consider having your mechanical contractor install a fresh air duct.

For increased energy savings and comfort consider installing a motorized vent damper on the fresh air duct, particularly if your furnace fan is operating continuously. Do not block the fresh air duct by any other means.

For more information, refer to *"Keeping the Heat In"* pages 17, 45 and 121

B.12 Humidifier

A lack of adequate humidity is a common winter problem in many homes across Alberta. This dry air contributes to static electricity, dry skin, and discomfort even when the temperature in the home is at what

should be a comfortable setting. Maintaining a proper humidity level in your home will help alleviate these problems and also protect your furnishings and hardwood floors.

Maintain your humidifier by cleaning the media pad and other components of any mineral buildup.

If you need to replace or install a new humidifier, there are a number of option available, including drum, flow through, steam, pan and atomizer. The most commonly recommended humidifier is a flow through type as it provides good humidification with minimal maintenance for mineral buildup. Your mechanical contractor, home renovation store or hardware store will be able to provide more information on specific models and sizes suitable for the size of your home and your water conditions.

Humidifiers are typically controlled by a humidistat that has a sensor and manual settings. These settings need to be adjusted according to the outside temperature and the conditions in your home to prevent condensation from occurring on the windows. As the temperature drops, the humidity level needs to be set lower. New high end thermostats are available that have built in humidistat and outdoor temperature sensors that will automatically set the humidity level, along with other functions.

For more information, refer to *"Keeping the Heat In"* page 119

B.13 Appliances & Electronics

Older appliances can use significantly more energy than new energy efficient ones. When purchasing a new clothes washer, dishwasher, freezer or refrigerator, look for the ENERGY STAR® symbol indicating that the appliance has achieved a high level of energy efficiency. New high efficiency appliances will pay for themselves quite quickly in energy savings.

Look for the ENERGY STAR® label when purchasing consumer electronics as well. Many devices continue to consume electricity even when the power is "off". ENERGY STAR® electronics minimize this standby consumption. Consider, also, controlling equipment with a power bar or switchable electrical plug. Power bars allow for easy on/off control of home electronics or computers, and provide protection to the equipment as well (see the manufacturer's documentation).

When shopping for kitchen ranges and clothes dryers, consider natural gas appliances. In addition to the lower cost of operation, natural gas appliances can offer better performance and control.

For more information on energy efficient appliances and consumer electronics, visit the ENERGY STAR® website.

For more information, refer to *"EnerGuide Appliances Directory"* and ENERGY STAR® brochures available through the Office of Energy Efficiency and to *"Managing Your Home Electricity Costs"* publication available through ATCO EnergySense

B.14 Vehicle Block Heater

On cold winter nights, avoid plugging in your vehicle's block heater for more than one to two hours (depending on outside temperature). Plugging your vehicle in for more than two hours only results in wasted energy. A timer is a handy method of having the vehicle ready to go in the morning instead of having to plug it in early in the morning. In most instances, it is not necessary to plug in your vehicle when it is warmer than -15^0C outside. Your vehicle should not have any problems starting without the block heater being plugged in at this temperature.

B.15 Hot Water Line Insulation

Insulating your hot water lines is an effective method of reducing water consumption and energy usage. Insulated water lines will reduce the wait time and the amount of wasted water before getting hot water out of

your tap. Use foam pipe insulation, which is easy to install and can be obtained from your local hardware or home improvement store. Install on all easily accessible hot water lines. Insulating the cold water lines will reduce or eliminate "sweating" or condensation on the lines, and reduce water consumption waiting for cold water.

For more information, refer to *"Keeping the Heat In"* page 117

B.16 Water Conservation

It may not be immediately obvious that reducing water consumption reduces energy consumption, however, energy is required to treat and pump fresh water and also for the treatment of wastewater. For some homeowners, reducing water consumption does not have a direct impact on energy bills. The energy used for pumping and treatment are built into the water and sewer charges. Reducing water consumption, however, can have a significant impact on your water bill, save our precious resources and reduce energy consumption. Maintaining your plumbing by eliminating leaks and drips is the first step in water conservation. Your municipality or water utility may offer rebates for installing water efficient fixtures.

If you are currently being billed a flat rate for your water consumption, request a metered service from your municipality or water utility. You could reduce your monthly costs immediately and you will also become aware of how much water you are currently using and how much you decrease your consumption as you make improvements.

There are many appliances and fixtures available today that can help you reduce your water consumption. Approximately one third of all indoor household water consumption is used for toilet flushing when conventional (13 liters or more) toilets are used. Toilets can be modified with toilet dams and other kits to reduce consumption or the existing toilet can be replaced with a new, efficient model. Old, standard toilets can use up to 20 liters per flush while new toilets use 6 liters or less. There are also dual flush toilets available that have the option of using 3 liters or 6 liters per flush, depending on which button is pressed.

Replace your standard, high volume shower head with a low volume shower head to reduce water consumption. There are many models available that will deliver a satisfactory shower, including models with variable spray settings and shut off buttons that can be used while lathering up.

When shopping for a new dishwasher or clothes washer, look for the ENERGY STAR® label indicating it is amongst the most efficient available. New front loading clothes washers and dishwashers can use considerably less water as well as energy and do a superior job of cleaning.

For landscaping, select plants that are indigenous to or tolerant of the specific climatic conditions where you live. This will reduce the need to provide extra water for the plants' survival. Water your plants and lawns only when required. Over watering and high frequency of watering not only wastes water, it is detrimental to plants. Plant selection and location can also reduce your home's energy consumption by providing a wind break or summer shading.

Refer to *"Technical Series 04-109 Maximum Performance Testing of Popular Water Efficient Toilet Models"* available through CMHC

B.17 Renewable Electrical Generation

As a long term solution to your energy requirements, you may want to consider generating some or all of your own clean, renewable electricity. Generating your own renewable electricity can be done through either wind power or solar energy. While not inexpensive, there is personal satisfaction in using a clean source of energy. Many areas in Alberta have abundant solar and / or wind resources available for you to take advantage of.

Renewable electrical generation can utilize either a stand-alone battery storage system or connection to the electric utility (grid intertie).

When considering alternate energy systems, check for any zoning restrictions that you may face and requirements for connection to the grid. For your safety and the safety of your property, follow all codes and have systems inspected.

The following organizations can provide further assistance in renewable energy:

CanSIA	Canadian Solar Industries Association	www.cansia.ca
SESCI	Solar Energy Society of Canada	www.sesci.ca
CanWEA	Canadian Wind Energy Association	www.canwea.ca
Alberta Micropower	Distributed Generation Interconnection	www.gridconnect.ca

For more information, refer to *"Photovoltaic Systems: A Buyer's Guide"* and *"Stand-Alone Wind Energy Systems: A Buyer's Guide"* both available through the Canadian Renewable Energy Network (CanREN), and *"About Your House: Photovoltaics"* available through CMHC

B.18 Solar Air Heating System

A solar air heating system preheats the cold winter air through a solar panel attached to the house prior to the air entering the house through the fresh air duct, heat recovery ventilator or stand-alone air distribution system. If you have a south facing wall or roof that is free of shading obstructions, this may be a cost effective means of utilizing solar energy.

For more information on solar systems and qualified contractors, contact the Canadian Solar Industries Association (CanSIA).

For More Information…….

The following organizations have a wealth of information for you to access that will equip you to undertake your home improvements and ensure that appliances and components are the most energy efficient types available.

Natural Resources Canada, Office of Energy Efficiency
www.nrcan.gc.ca
http://oee.nrcan.gc.ca
1-800-387-2000
Energy Efficiency Tips, Publications

Canadian Mortgage and Housing Corporation
www.cmhc-schl.gc.ca
1-800-668-2642
Housing and Construction, Home Improvements, Maintenance, Incentives & Programs

Climate Change Central
www.climatechangecentral.com
1-866-372-0999, Edmonton: (780) 408-4580, Calgary: (403) 517-2700
Programs & Incentives in Alberta, Energy Efficiency Rebates through manufacturers

ENERGY STAR®
www.oee.nrcan.gc.ca/energystar
1-800-387-2000
product ratings of building components, heating equipment, home appliances and electronics that meet or exceed the ENERGY STAR® rating criteria

Environment Canada Water Conservation Branch
www.ec.gc.ca/water/en/manage/effic/e_weff.htm
(819) 953-6161
Water conservation tips and links to other websites

Canadian Renewable Energy Network (CanREN)
www.canren.gc.ca
(613) 996-6220
Natural Resources Canada's renewable energy website with publications and links to other renewable / alternate energy websites

Government of Canada ecoACTION Program
www.ecoaction.gc.ca
1-800-O-CANADA
Helpful information and programs from the Government of Canada for reducing your environmental impact in all areas of your life

If you are planning to do a lot of the upgrade design and / or building yourself, or you are interested in learning more building practices and techniques, then the following publications may be of interest to you. Contact the publisher for costs and ordering details.

- "Canadian Wood-Frame House Construction" published by CMHC
- "CHBA Builders' Manual" published by the Canadian Home Builders' Association (www.chba.ca)

BLOWER DOOR TEST

The Blower Door test is completed for three reasons:

1) Exhaust Devices Depressurization Test

This test was conducted by closing all the doors and windows and turning on all of the exhaust fans and exhausting appliances in the house, including the dryer and built-in vacuum if applicable. The negative pressure created in the house was then measured with the blower door gauges. If the exhaust devices depressurization test resulted in a pressure difference of five Pascals or greater, then there is a possibility that your fuel burning appliances (water heater, heating system, and fireplace) could backdraft into the house. This could lead to a possible carbon monoxide buildup in the house. The backdraft conditions would be created when all of the exhausting appliances (or enough to create a 5 Pa difference) were being operated and then the heating system or water heater fired.

As a first line of defense, install a carbon monoxide detector to warn of any combustion spillage and carbon monoxide occurring. A more in-depth blower door test (CGSB-51.71 or CSA-F326-M91) may be required. An R-2000 home inspector can perform this test. For an R-2000 inspector, go to http://r-2000.gc.ca or phone 1-800-387-2000. To reduce the risk of backdrafting, do not operate all of the exhausting appliances at the same time. If necessary, open a window for a short period of time. If a high volume exhaust fan exists in the house, installing a make-up air fan (see “Exhaust Fan in Kitchen” (B.6)) may be required. A high efficiency closed combustion furnace and a direct vent or closed combustion water heater will also minimize or eliminate the risk. Be aware that further draftproofing of the home could make the situation worse.

2) Air Leakage Test

The air leakage test was conducted by the evaluator turning on the blower door and going throughout your home identifying specific points where air is infiltrating your building envelope. He or she pointed out areas that could use some draftproofing and some pointers on how this could be accomplished. Please review the Air Leakage Checklist of the areas in your home and review “Keeping the Heat In”.

3) Air Change Rate and Equivalent Leakage Area

The third part of the test uses the data gathered from the blower door fan operation. This data is used to calculate, through a computer program, the air change rate and the equivalent leakage area.

Shown in the ecoENERGY Report under the Action Checklist is the air leakage target that would reduce heat loss from your home and make it more comfortable as well as earn you grant dollars. Results of the blower door test are shown in Additional Upgrade Information / Air Sealing Upgrade. Where the natural air leakage during the month of October is less than 0.20 air changes per hour, a heat recovery ventilator (HRV) will be recommended to provide controlled mechanical ventilation into the home.

The equivalent leakage area is a reference number for you to put into perspective all of the cracks and air leaks found in your home, and is shown in square inches (144 square inches equals 1 square foot).