

RENOVATING FOR ENERGY SAVINGS

Case studies

October 2004 Issue 6



Split Entry Homes

Split entry or bi-level houses have been built since the late 1950s. More than 680,000 have been built in all parts of Canada. The upper level has an average floor area of 100 m² (1100 sq. ft.).

What you've got

- Two levels
- Entry to house on a landing in the staircase, midway between the lower and upper floors
- Basement floor about 1.2 m (4 ft.) below finished grade
- Living area and bedrooms on main floor
- Basement area partially finished, typically contains family/tv room and one or two other finished rooms
- Often a cantilever on one or both sides of entry

How it's built

Actual construction details used in your house may differ, and over the years some improvements may have been done.

This is simply a general description:

- Exterior walls: 2 x 4 stud walls with RSI 2.1 (R-12) batt insulation
- Ceiling insulation: average RSI 3.5 (R-20)

How to select energy-saving improvements for split entry homes. These improvements will save energy and reduce your heating bills, while making your house more comfortable to live in.

POTENTIAL ENERGY SAVINGS

If all of the recommended improvements presented here are carried out, overall energy use can be reduced as shown below. Actual energy use is affected by weather and lifestyle, so specific energy savings may vary. If you, or a previous owner, have already carried out some energy-saving measures, the actual reduction in energy use will differ. The energy savings presented here are based on computer simulations done specifically for this type of house in each Canadian region.

36%	35%	31%	22%	31%
British Columbia	Prairies and Northern Territories	Ontario	Quebec (electrically heated homes)	Atlantic Provinces

- Windows: double-glazed or single-glazed with storms (except for coastal B.C.)
- Exterior doors: hollow core wood panels (earliest) or solid wood
- Foundation: walls are "furred out" and finished with drywall or wood panelling, with minimal insulation; often fully insulated, pressure-treated wood foundations in the North

Improvements can

- Reduce energy use for space heating
- Reduce drafts
- Reduce summer overheating
- Reduce moisture and condensation problems
- Reduce noise from outside the house
- Reduce greenhouse gas emissions
- Improve indoor air quality
- Improve humidity levels in dry northern houses
- Increase comfort level

Problems and Opportunities

- Air leakage is distributed throughout the house, but is often concentrated where the wood framing sits on the foundation wall, and at the joist header. Many split entry houses have cantilevers (overhangs) on the front that are not well sealed or insulated. If all air leakage paths are combined, the average split entry house would have a hole that is about 800 cm² (or roughly 11 x 11 in.).
- Older houses do not generally have an effective ventilation system to maintain proper indoor air quality. There may be a noisy bathroom fan and a kitchen range hood fan.
- Many split entry houses still have the original furnace or boiler, or if they have been replaced, they will likely be older, low-efficiency equipment that is only about 68 per cent (or less) efficient. Other than improved thermostats, electric baseboard equipment has not changed greatly in efficiency over the years. Water heating is usually provided by a conventional tank.

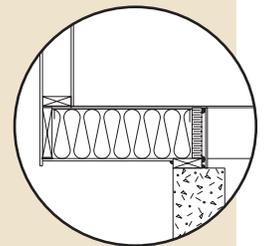
Space Heating System

Consider replacing your warm-air furnace or boiler with a new high efficiency unit. Your heating contractor can do a heat loss calculation to properly size the furnace to your home's requirements. If your home has central air conditioning, the new furnace will also have to be matched to the existing A/C unit. In some cases, space and water heating systems can be integrated so that only one boiler or heating unit is required to carry out both tasks.

Install newer, more accurate thermostats in electrically heated houses.

Draftproof Everywhere!

- Draftproof, or air seal around window and door frames, at attic hatches and chimneys, ceiling penetrations around light fixtures and wiring, and service penetrations through the exterior walls. Keep weatherstripping at doors and windows in good condition. Pay close attention to sealing the joint between the concrete foundation wall and the stud wall.
- Where one-piece bath or shower enclosures are installed against exterior walls, there may be significant air leakage because of a break in the air barrier. Caulk around the whole exposed face and the wall/floor junction behind the baseboard along the exterior wall. When these units are on basement floors, there is often a gap in the concrete slab where the drain exits. Friction-fit a piece of rigid foam insulation and seal the edges. If the drain is inaccessible, caulk around the exposed face of the enclosure.
- A cantilever (overhang) will have significant air leakage and affects comfort levels. Where possible, draftproof and insulate from the interior at the floor joist area. Exterior draftproofing of this area should be included in an exterior insulation/new siding retrofit. Exterior grade plywood fitted into the underside of the overhang should be sealed to the header above and the top of the stud wall of the lower floor. Don't forget to insulate overhanging floors.
- If there is an attached garage under a portion of the house, air seal the garage wall and ceiling, not only to reduce heat loss but also to stop exhaust fumes from entering the house.
- A “cold room” under the front entry stairs should have an insulated and weatherstripped door. The underside of the landing and stairs and the interior walls of the cold room should be insulated as well to reduce heat transfer between the living space and the cold room. Cold rooms are notorious for mold growth. If you are already experiencing mold problems here, use the room as part of the basement. Remove the door, clean up the mold, and insulate to the same extent as the rest of the basement (including the cold room ceiling).



For details on draftproofing, see *Keeping the Heat In* by Natural Resources Canada.

Improvements that can save energy in Split Entry homes in Canada.

The best time to carry out energy-saving improvements is when you are planning other renovations. Carry out the air sealing and insulation upgrades before you invest in a new heating or mechanical system. A tighter house with better thermal properties has a smaller heating load and a different ventilation requirement. A qualified contractor can help you with this.

F Exterior Walls

If you redo the siding on your house, take this opportunity to increase insulation levels and do some air sealing. Insulation can be blown into the wall cavities from the outside. If the wall cavities are already insulated, add a layer of exterior insulation and a house wrap air barrier. If at the same time, you can replace the windows with better-performing units, the combined retrofit gives your older house a facelift, better energy efficiency and higher levels of comfort while saving you money on labour costs. Obtain a professional contractor's advice on how to approach this retrofit.

A Exterior Doors

Consider replacing older, wooden exterior doors with metal insulated units, which are more durable, easier to weatherstrip and maintain their appearance with lower maintenance needs. Make sure that the weatherstripping on your existing exterior doors is in good condition.

B Basement

Before insulating foundation walls, make sure they are in good repair and check site drainage. Good drainage means no moisture problems once the walls are insulated. If existing moisture problems cannot be fixed, insulate the walls from the outside (at least 600 mm (2ft.) below grade for poured concrete, from top to bottom for concrete block).

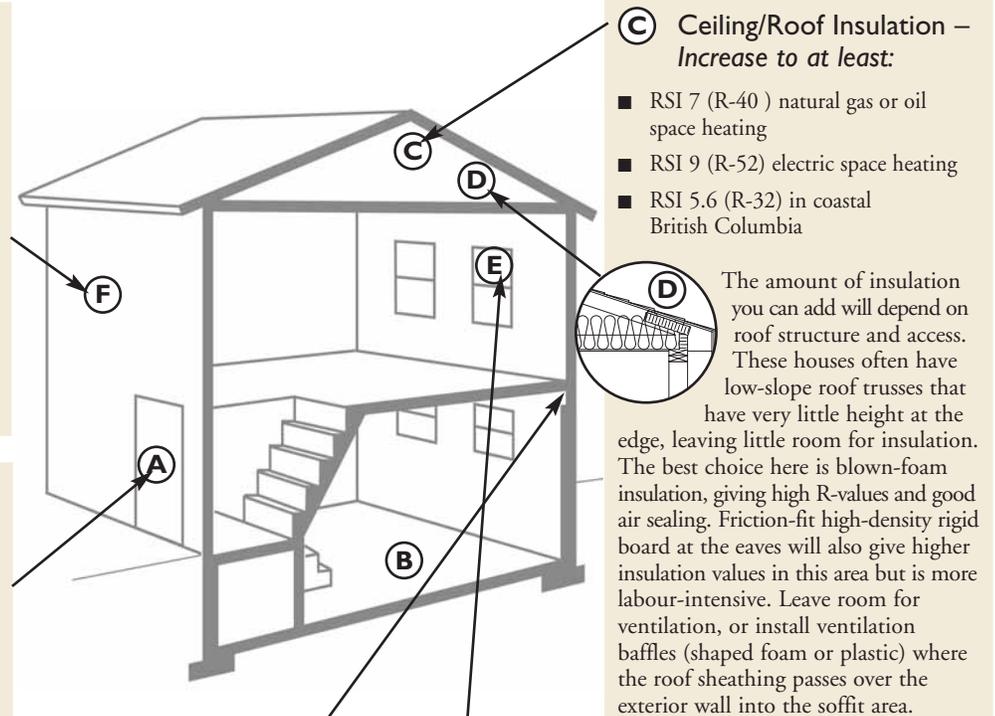
If you are insulating from the inside, most building codes require a moisture barrier on the basement wall, and an air and vapour barrier on the warm side of the insulation. Here are three ways to meet most code requirements:

- lay polyethylene sheets or tar paper on the basement wall, build a stud wall with batt insulation and seal the warm side with polyethylene;
- use an approved, rigid-board insulation thick enough to give RSI 2.1 (R-12) and finish it with a fire-resistant material (e.g., gypsum board);
- lay 25 mm (1 in.) of extruded polystyrene board insulation against the basement wall, build a stud wall with batt insulation and finish with gypsum board.

Headers should have at least RSI 2.1 (R-12) rigid foam friction fit into each cavity and sealed with caulking or foam-in insulation to reduce air leakage. Blown-in polyurethane foam can also be used.

The concrete foundation walls are usually poorly insulated. If the interior finish is panelling that can be reinstalled easily, upgrading this area can be reasonably inexpensive. If not, insulate on the outside as described above.

Ensure that proper window wells are installed, or that existing wells are in good repair.



C Ceiling/Roof Insulation – Increase to at least:

- RSI 7 (R-40) natural gas or oil space heating
- RSI 9 (R-52) electric space heating
- RSI 5.6 (R-32) in coastal British Columbia

The amount of insulation you can add will depend on roof structure and access. These houses often have low-slope roof trusses that have very little height at the edge, leaving little room for insulation. The best choice here is blown-foam insulation, giving high R-values and good air sealing. Friction-fit high-density rigid board at the eaves will also give higher insulation values in this area but is more labour-intensive. Leave room for ventilation, or install ventilation baffles (shaped foam or plastic) where the roof sheathing passes over the exterior wall into the soffit area.

E Windows

Energy-efficient windows greatly improve comfort levels, virtually expanding the usable space in the house, as the area near the windows is no longer cold and drafty. Replacing windows can also improve house appearance, and increase resale value. The most energy-efficient choice is high-performance units with selective glazing (such as double-glazed units with a low-e coating, argon gas fill and insulating spacers).

Splits built between 1960 and 1980 may have aluminum frame “sashless sliders”, (where the glazing sits directly in tracks in the frame). Reduce condensation problems by installing new sliders set in sashes, or adding magnetic storms to the interior or replace the complete unit. These windows are most likely reaching the end of their usable life and should be replaced. Start by upgrading basement windows, which are of special concern in splits because they make up a good portion of the exposed wall surface of the lower floor, reducing the effective insulating value and increasing the air leakage potential of the above-grade wall. This affects the comfort level throughout the house.

If window repair is required, replacements should be high performance units.

Double- and single-hung windows should be weatherstripped on the sides, top and bottom of moving sash. Caulk the fixed portion.

General Energy Efficiency Notes

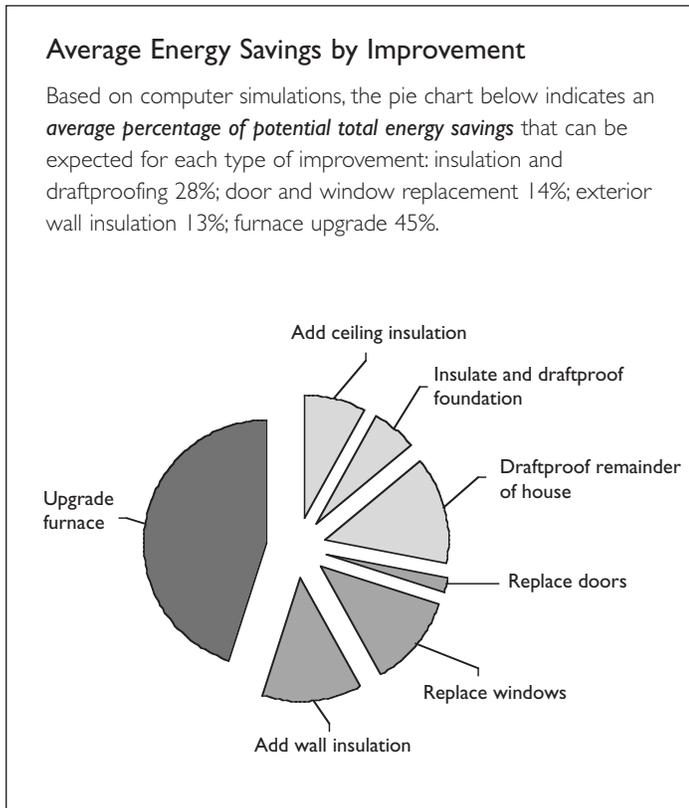
- Cover hot water pipes within 3 m (9 ft.) of the water tank with pipe insulation—and if possible, insulate all accessible hot water pipes.
- Insulate electric hot water tanks with an insulation blanket.
- Install programmable thermostats to lower temperatures at night or during the day when your home is unoccupied: stay at or above 16°C (61F) minimum temperature to prevent condensation and mold problems, and maintain heat in all rooms.
- Replace leaky dampers and repair chimney flues on woodstoves and fireplaces.
- Glass doors on fireplaces will reduce air leakage up the chimney when not in use.
- Consider other options for fireplaces: an electric fireplace insert (no fuel safety issues), EPA-rated insert unit, or convert to a direct-vent natural gas fireplace insert.
- Gas fireplaces: look for direct-vent units with intermittent electronic ignition systems, or other easy means of turning off and relighting the pilot light.
- Replace your old oil- or gas-fired water heater with a side-wall vent unit or a high-efficiency electric water heater. This eliminates the chimney and associated air leakage and backdrafting problems.

Check into integrated space and water heating systems (i.e., a boiler for space heating fitted with a “tankless coil” or “indirect heater” that provides domestic hot water). A solar hot water system can produce up to 60 per cent of your annual water heating needs. Solar hot water systems, instantaneous water heaters and other options are becoming more affordable as they become more readily available.

- Before replacing your existing furnace or boiler, carry out any air sealing, draftproofing, insulation upgrades and other energy-saving improvements to the walls, windows and doors—and then give your whole heating system a tune-up.
- **It is important to know how airtight your house is to ensure there is no backdrafting of flue gases into the house when exhaust fans are operating. A combustion safety test, carried out by a qualified contractor, can indicate if depressurization is a potential problem.**
- Control energy loss in the furnace room by installing automatic, motorized duct dampers on the combustion air line. The same can be done on the fresh-air intake of most furnaces. This prevents large amounts of cold air from entering the plenum between firing cycles.
- Oil heating systems are often oversized. Changing to a smaller nozzle size can improve system performance.
- Controlled air change—fresh air in, stale air out—is important for good indoor air quality. If you have a forced-air heating system it may be possible to add a heat recovery ventilator (HRV) to the system. In houses without forced-air heating or fuel-fired equipment, a good quality quiet fan in a central bathroom or hall and an exterior-exhausting range hood fan may be an appropriate option. Your ventilation system should be designed and installed by a qualified technician to ensure that the operation and venting of any combustion appliance in the house is not compromised.
- In the coldest periods of winter, the indoor humidity should be between 30 and 35 per cent to avoid condensation on windows. Invest in a low-cost hygrometer to monitor the relative humidity levels in your home. If winter humidity levels are too high, try increasing your ventilation rate (for example, by running a small bathroom fan continuously).
- When winter humidity levels are low, it is often due to excessive air leakage. Better air sealing will raise humidity and save energy. If, after air sealing work has been completed, there is still a problem with low humidity levels, a humidification system may be required.

Other energy-saving improvements

- Water-saving fixtures: low-flush or dual-flush toilets, faucet and shower flow restricters, front-loading clothes washer that reduce water heating loads.
- Energy-efficient appliances: replace and recycle older refrigerators, freezers, electric ranges and dishwashers with Energy Star® rated models.
- Energy-efficient lighting: the average house has 27 lightbulbs in it. On average, lighting in a house consumes 1,800 kWh annually. Switch to fluorescent, compact fluorescent and task lighting.



Special Health and Safety Considerations		
<i>When you make improvements to your home you change the way it operates. This can affect the health and safety of the house and occupants. Review the following table carefully before carrying out your energy improvements.</i>		
If you do this	It can cause this	Can be solved by this
Draftproof your house	Depressurization by exhaust fans could cause backdrafting of combustion flue gases.	Replace combustion appliances with direct-vent appliances or incorporate make-up air. If there is a fireplace or woodstove, ensure there is adequate venting and that combustion air is available.
Check ventilation	Exhaust-only ventilation can lead to excessive depressurization and spillage of flue gases from combustion equipment. Supply-only ventilation can lead to excessive pressurization and condensation/frost problems.	Have a qualified contractor carry out a depressurization test to determine if a balanced ventilation system is required.
Upgrade the furnace	Higher noise levels if the ducts are not properly sized for the higher airflows.	Size the heating system for both the heating load and existing ducting, seal all exposed ductwork connections to reduce vibration.
Install high-efficiency water heater and furnace	Reduced air-change rate, stuffiness and higher humidity levels because high-efficiency sealed combustion units exhaust very little house air compared to a standard unit with a chimney.	Install a proper ventilation system.
Replace the windows	Increased airtightness can lead to higher humidity levels, resulting in condensation on the windows and other cooler surfaces.	Install a proper ventilation system with automatic humidity control.

CMHC's

Renovating for Energy Savings series

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- Issue 3 Post-1960s Two-Storey Homes
- Issue 4 1960s-70s One-Storey Homes
- Issue 5 Split-Level Homes
- Issue 6 Split-Entry Homes
- Issue 7 Mobile Homes
- Issue 8 Duplexes and Triplexes
- Issue 9 Row Houses
- Issue 10 Homes with Walkout Basements
- Issue 11 Common Additions

Additional Information and Resources

CMHC Canadian Housing Information Centre (CHIC)

- **About Your House**
www.cmhc-schl.gc.ca/en/co/co_001.cfm
- **Before You Renovate**
www.cmhc-schl.gc.ca/en/co/renoho/index.cfm

Natural Resources Canada

- **Office of Energy Efficiency**
www.oe.e.nrcan.gc.ca Tel. 1 800 387-2000
- **Publications**
www.oe.e.nrcan.gc.ca/publications/infosource
- **Keeping the Heat In**
www.oe.e.nrcan.gc.ca/keep_heat_in/

Canadian Home Builders' Association (CHBA)

The impact of specific improvements for your house can also be provided by technicians and qualified trades persons. The Renovation Council of your local Home Builders' Association can provide some references, or contact the CHBA
www.chba.ca Tel. (613) 230-3060

- **In Quebec, please contact the APCHQ** (Association provinciale des constructeurs d'habitations du Québec) at www.APCHQ.net tel. (514) 353-9960 or ACQ (Association de la construction du Québec) at www.ACQ.org Tel. (514) 354-0609
- **The Renovation Roadmap**
Website developed by CHBA, CMHC and NRCAN
www.myhomereno.com

Provincial Governments

Provincial Government departments will frequently provide detailed recommendations for your region.

Local Utilities

Your local energy utility can usually provide detailed recommendations for your region.

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