

RENOVATING FOR ENERGY SAVINGS

Case studies

October 2004 Issue 9



Row Houses

Row houses can be found in all parts of Canada. In some regions, row houses with two or three units are also known as duplexes or triplexes. Typically built as economical housing, the average finished living space is about 150 m² (1,600 sq. ft.).

What you've got

- Two-storey building
- Unfinished full basement
- Some units have garages as part of basement

Newer "up-market" units with a finished basement can have an average floor area of about 220 m² (2,400 sq. ft.).

How it's built

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

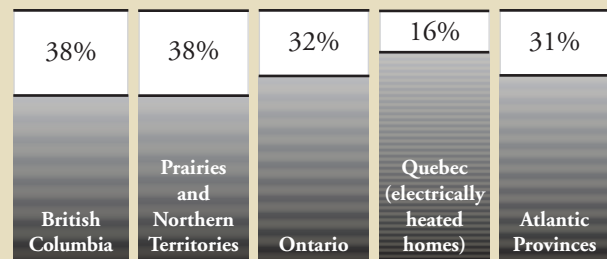
This is simply a general description:

- Exterior Walls: 2 x 4 in. stud walls with RSI 2.1 (R-12) batt insulation
- Ceiling: insulation: RSI 3.8 (R-21)

How to select energy-saving improvements for row houses. 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.



- Windows: double-glazed or single-glazed with storms (except for coastal B.C.)
- Original exterior doors: hollow wood panels
- Foundation: uninsulated poured, concrete or concrete block, usually unfinished

Improvements can

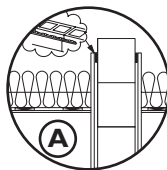
- Reduce energy use for space heating
- Reduce drafts
- Reduce summer overheating
- Reduce moisture and condensation problems
- Reduce noise from outside the house
- Reduce greenhouse gas emissions
- Improve indoor air quality
- Improve humidity levels in dry, northern houses
- Increase comfort level.

Problems and Opportunities

- Air leakage area is distributed throughout the house, but is often concentrated at the header area (where the floor framing meets the foundation wall) and at the common wall. If all air leakage paths are combined, the average row house would have a hole that is about 920 cm² (or roughly 12 x 12 in.). The leakiest units are found in B.C., with a hole about 1,700 cm².
- Row 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 in each unit. Units built since the late 1980s, especially in Atlantic Canada, may have a “whole-house” balanced ventilation system using an air exchanger or a heat recovery ventilator (HRV).
- Many row houses will still have their original furnace or boiler. If they have been replaced, they will likely be older, low-efficiency equipment that is only about 68 per cent (or less) efficient. Units built since the late 1990s may have mid-efficiency equipment installed. Water heating is usually provided by a conventional tank.
- Many row houses are built as part of a complex, with common property and rules concerning the appearance of individual units. Depending on the regulations for your home, some recommended energy-efficiency upgrades may need approval from the condominium corporation.

Draftproof Everywhere!

- Draftproof or air seal, the top of exterior foundation walls, around window and door frames, at attic hatches and chimneys, ceiling penetrations around light fixtures and wiring, and service penetrations through the exterior walls.
- Other areas to consider include through the exterior walls and common walls between units, and floors over garages.
- The common wall between units should be tightly air sealed to maintain fire and sound resistance. Typically, there are many service penetrations for wiring and plumbing that are not well-sealed.

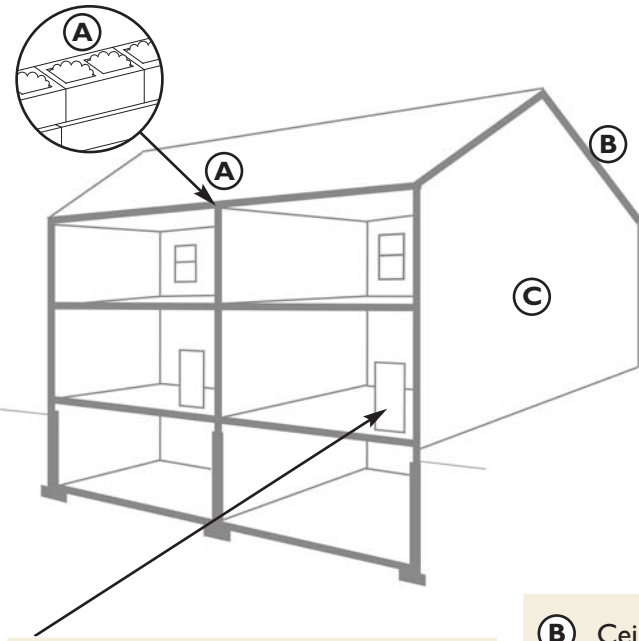


- There is usually a considerable amount of air leakage where the staircase is against an outside or common wall.
- In older, renovated row houses where the plaster has been removed to expose the brick common wall, there can be much heat loss upward, through air leakage at the ceiling level, but this may not be noticed because the common wall remains warm. To address air leakage problems in the common wall inspect the attic. If the interior finish of the common walls is 'furred off' from the hollow block fire wall, leaving a space between the two surfaces, seal it up. Where the walls are not 'furred off', use foamed-in insulation to seal off the hollow block firewall.
- In newer units, or in units that have had bathroom renovations, where one-piece bath or shower enclosures are installed against exterior walls, the air barrier may be discontinuous or damaged. This can be a source of great air leakage that results in significant discomfort when the bath or shower is in use. Caulk with waterproof material around the whole exposed face of the bath enclosure, including at the floor. Also, caulk at the wall/floor junction behind the baseboard to short-circuit the air leakage path in the bathroom along the exterior wall.
- An unfinished garage ceiling can be insulated, and draftproofed at the same time, by using spray-on foam insulation. It is important to pay special attention to air sealing between the garage and living space, to prevent exhaust fumes from entering the house.
- All the cracks and gaps in the foundation walls and floors should be caulked and sealed. Insulate and draftproof the basement header area with expanding spray foam to reduce drafts across the first floor.
- If there is a sump in the basement, it should have a tight-fitting cover installed.
- If this house has a walkout basement, please refer to #10 in this series: “*Homes with Walkout Basements.*”

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

Improvements that can save energy in row houses.

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.



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 insulated spacers and frames). Wood-frame windows can be retrofitted using custom, double glazed inserts. If window repair is required, replacements should be high-performance units.

Make sure that existing windows are well-sealed at the joint between window frame and wall, and that weather stripping and storms are in good repair as part of your draftproofing measures. If you have aluminum frame “sashless sliders”, (where the glazing sits directly in tracks in the frame), you can reduce condensation problems by installing new sliders set in sashes, or adding magnetic storms to the interior or replace the complete unit. If window repair is required, replacements should be high performance units. Replacing windows may require permission from your condominium corporation.

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.

Replacing doors may require permission from your condominium corporation.

Ⓑ 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. Flat roofs can be packed with blown-in insulation, or, when being re-roofed, a layer of rigid board insulation can be applied to the exterior prior to installing the new roofing, similar to upgrading exterior walls by adding rigid board under new siding.

Basement Walls

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:

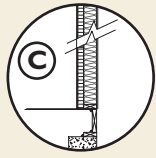
- A) lay polyethylene sheets or tarpaper on the basement wall, build a stud wall with batt insulation and seal the warm side with polyethylene;
- B) use an approved, rigid-board insulation thick enough to give RSI 2.1 (R-12) and finish it with a fire-resistant material (e.g., gypsum board);
- C) lay 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.

Insulating the foundation walls on an unfinished basement—inside or outside—has the following advantages: the basement is warmer; it is easier to achieve a continuous insulation and air leakage barrier than in the basement ceiling; piping and ducting end up within the conditioned space of the house so they don't need protection against freezing.

Exterior Walls

It is most likely that your condominium corporation will not allow insulation upgrades on the outside face of the exterior walls, unless the upgrade is being carried out on the whole complex. Upgrading your exterior wall on the inside face would include installing rigid board insulation against existing drywall, with another layer of drywall over for a finished wall surface. High-density foam or polyisocyanurate board gives the highest insulation values for similar thicknesses. It is not necessary to insulate the common wall.



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.

When you investigate a new oil or gas unit, ensure you have adequate clearance for a direct-vent exhaust. Short frontages and backyard patios may complicate the installation.

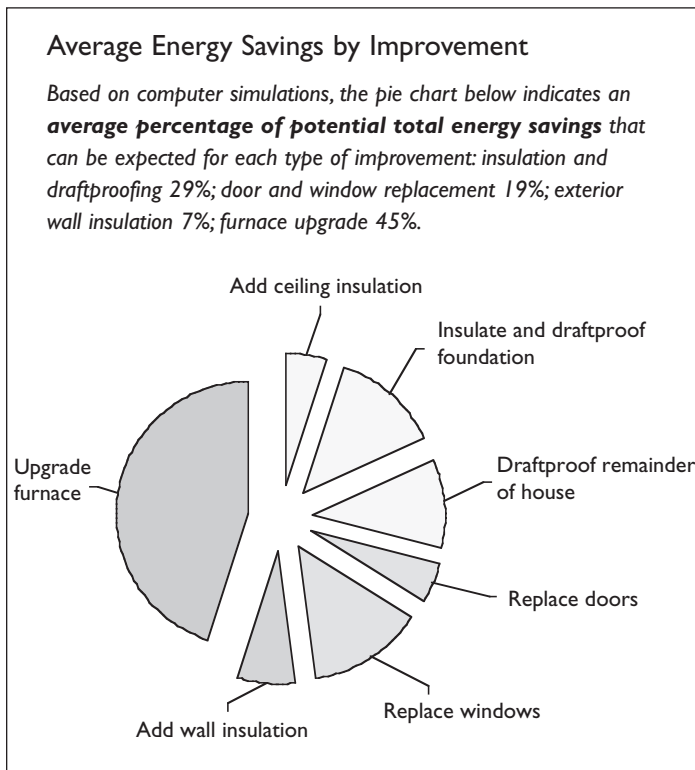
General Energy Efficiency Notes

- 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

- Issue 1 Pre-World War II Houses
- Issue 2 Post-War 1 1/2-Storey Homes
- 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)

- ***Building, Renovating and Maintaining***
www.cmhc.ca/en/co/renoho/index.cfm
- ***About Your House Series***
www.cmhc.ca/en/co/co_001.cfm

Natural Resources Canada

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