

RENOVATING FOR ENERGY SAVINGS

Case studies

October 2004 Issue 7



Mobile Homes

Mobile and mini-homes have been built since the 1950s, with more than 250,000 units located in all parts of Canada. They have an average floor area of about 110 m² (1,200 sq.ft.)

What you've got

- One level factory-built home
- "Single- or double-wide"
- Canadian-built units since 1972 have a label indicating compliance with the CSA-Z240 or CSA-A277 standard.

On older homes, this is usually placed outside near an exterior door, on newer homes, it is usually placed on the electrical panel or in one of the kitchen cupboard doors.

How it's built

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

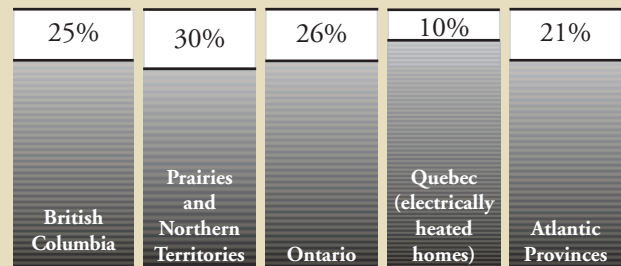
This is simply a general description:

- Exterior walls: up to mid-80s: 2 x 4 in. exterior walls and RSI 2.1 (R-12) batt insulation; mid-80s to present: most have 2 x 6 in. walls and RSI 3.5 (R-20) batt insulation
- Ceiling insulation: RSI 4.2 (R-24) to RSI 5.92 (R-34)

How to select energy-saving improvements for mobile 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.



- Windows: double-glazed or single-glazed with storms (except for coastal B.C.)
- Exterior doors: solid wood with storms on older homes, insulated steel on newer homes
- Foundation: mainly pile foundation with unheated, un-insulated crawl space; some on basements or closed crawl spaces

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

- Homes built before the mid-1970s have higher air leakage rates than newer units, especially those found in coastal B.C. Homes built after the mid-1970s are usually very airtight. Leakage areas are distributed throughout the house, but in double-wide units, the joint between the two halves can be a significant source of air leakage. If all air leakage paths are combined, the average mobile or mini home would have a hole that is about 970 cm² (or roughly 12 x 13 in.).
- In many cases, those homes with forced-air systems do not have ducted cold air returns, making uniform, whole-house ventilation difficult. While the furnace fan can be run continuously, together with bathroom and kitchen range hood exhaust fan, it can be difficult to maintain uniform good indoor air quality.
- When these homes have been designed for pile foundations, they generally use mid-efficiency closed combustion furnaces and conventional hot water tanks located within the living space. When designed for a basement, they generally use conventional open combustion, low- to mid-efficiency furnaces and conventional water tanks located in the basement.

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).

It may be difficult to find a high-efficiency furnace that is small enough. In this case, it may be worth considering an EPA-approved woodstove, or a gas fireplace that can carry the living space through the day. Back-up heat supply could be provided by electric baseboard or convective heaters.

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. Again, consult with your heating contractor to find out what's available in your area.

Increase the efficiency of your forced air system by sealing ductwork wherever it is easily accessible.

Draftproof Everywhere!

- Draftproof, or air seal, ceiling penetrations around light fixtures and wiring, and service penetrations through the exterior walls, and floor such as the dryer duct and electrical wiring entering the home. In double-wide homes, the joint between the two modules may be a source of significant air leakage, and should be air sealed.

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

Improvements that can Save Energy in Modular/Mobile homes.

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.

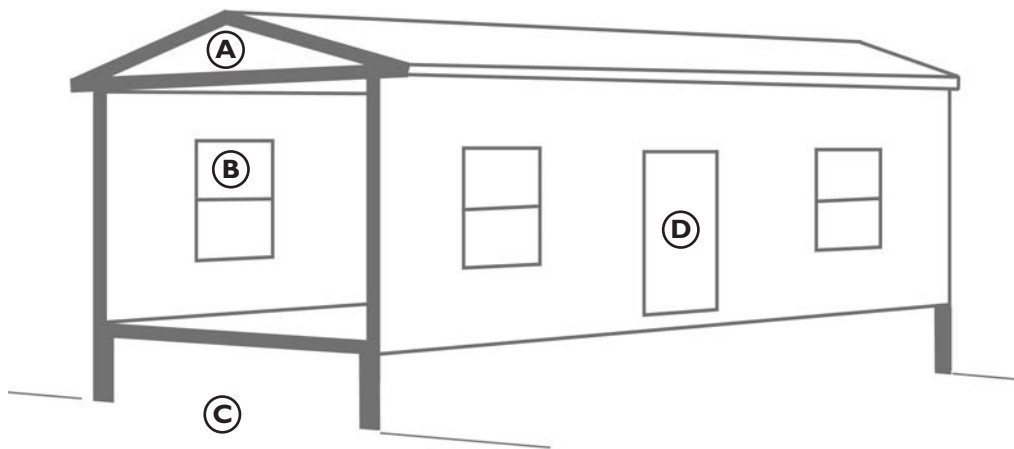
A Ceiling/Roof Insulation

Reduce heat loss by increasing ceiling insulation to at least RSI 4.9 (R-28) if there is access to the attic space. If there is a vaulted ceiling in the main living space, the insulation can be increased from the interior with minimal change to the room height. Rigid board insulation, with the seams taped and sealed, can be attached to the existing ceiling. It must then be covered with a fire-rated material, such as gypsum board.

B 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, an insulated spacer and frames).

Make sure that existing windows are well-sealed at the joint between window frame and wall, and that weatherstripping 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.



D 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. Keep the weatherstripping in good condition on all existing doors and storms.

If your main entry faces the direction of the prevailing winter wind with little protection, adding a vestibule or air-lock entry may improve comfort by tempering cold air when the door is opened.

C Basements and Crawlspaces

If your mobile or mini-home is on a pile foundation with an uninsulated skirt, ensure that the 'belly' is completely filled with insulation and that the road barrier material (which acts as your air barrier) is in good repair.

Reduce moisture problems and soil gas concerns in crawlspaces and basements by covering dirt floors. A concrete floor should have a continuous layer of polyethylene installed first. If a concrete floor is not installed, cover dirt floors with polyethylene sheets, overlap and seal seams by 30 cm (12 in.) and run the poly 15 cm (6 in.) up the walls. A layer of sand will protect the poly air and vapour barrier. If you plan to use the space for storage, or need access to mechanicals, a concrete floor is advisable.

If your mobile or mini-home is built on a concrete or concrete block foundation, it should be treated like a basement. 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.

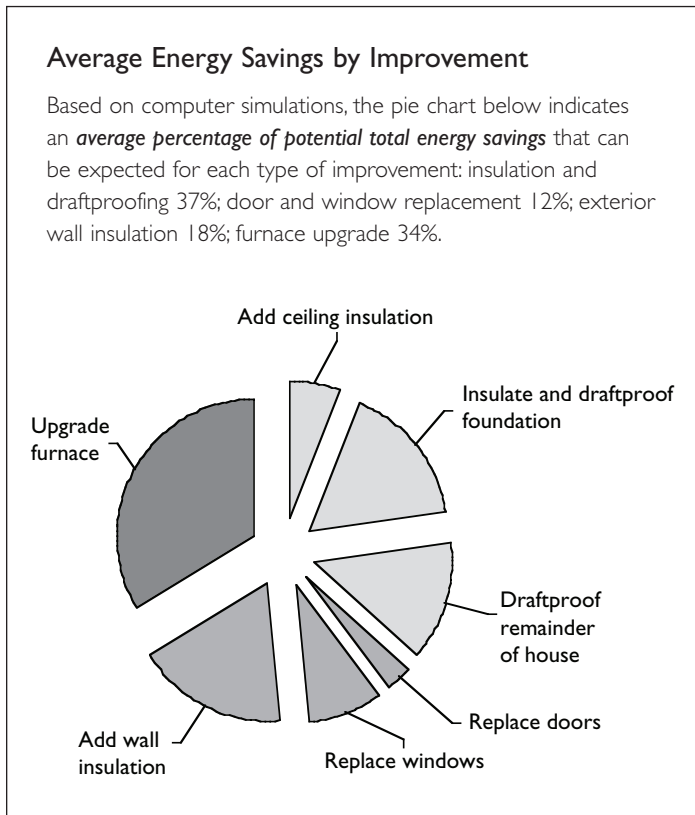
Insulating the foundation walls on an unfinished basement—inside or outside—has the following advantages: the basement is warmer; it is easier to achieve a continuous insulation and air leakage barrier than in the basement ceiling; piping and ducting end up within the conditioned space of the house so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

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***
www.cmhc.ca/en/co/co_001.cfm

Natural Resources Canada

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