RENOVATING FOR ENERGY SAVINGS

Case studies

October 2004 Issue 11

Common Additions

Many houses are renovated and added to over time. Not all additions and renovations have the benefit of professional contractors, and the quality of construction may vary. Here are five of the most common types of additions, and the typical energy saving measures that can be applied to each.

Enclosed Porches

Older homes often feature large covered porches that have been closed in to create additional living space. These rooms are not especially airtight and heating may be provided by an extension off the home's heating system, or by small electric baseboard heaters. Air sealing and insulating roofs, walls and crawl spaces will reduce heat loss and improve comfort levels.

How it's Built

- Exterior walls: 2x4 stud walls with up to RSI 2.1 (R-12) batt insulation
- Ceiling: Often vaulted, average RSI 3.4 (R-20) insulation
- Windows: double-glazed or single-glazed with storms
- Foundation: unheated crawl space with minimal insulation in floor

Upper Floor Dormer

The upper floor is often the warmest part of a house, as heat rises. This means that the leakier the upper floor is, the more rapidly you lose heat from the whole house. Dormers have many joints and corners that need special attention. The joint between the dormer and the original roof is also a problem area, as is a kneewall. Air sealing and insulating roofs, walls and attic floors will reduce heat loss and improve comfort levels.

How it's Built

- Exterior walls: 2x4 stud walls with up to RSI 2.1 (R-12) batt insulation
- Ceiling: often vaulted, average RSI 2.1 to 3.4 (R-12 to 20) insulation
- Windows: double-glazed or single-glazed with storms (except for coastal B.C.)

Simple One-Room Additions

These rooms are not especially airtight and heating may be provided by an extension off the home's heating system, or by small electric baseboard heaters. Air sealing and insulating roofs, walls and crawl spaces will reduce heat loss and improve comfort levels.

How it's Built

- Exterior walls: 2x 4 stud walls with up to RSI 2.1 (R-12) batt insulation
- Ceiling: often rafters or trusses, average RSI 3.4 (R-20) insulation
- Windows: double-glazed or single-glazed with storms (except for coastal B.C.)
- Foundation: unheated crawl space with minimal insulation in floor

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Carport/Garage as Living Space

These rooms are not especially airtight and heating may be provided by an extension off the home's heating system, or by small electric baseboard heaters. Air sealing and insulating roofs, walls and concrete slabs will reduce heat loss and improve comfort levels.

How it's Built

- Exterior walls: 2x4 stud walls with up to RSI 2.1 (R-12) batt insulation
- Ceiling: often rafters or trusses, average RSI 2.1 (R-12) insulation
- Windows: double-glazed or single-glazed with storms (except for coastal B.C.)
- Foundation: uninsulated concrete slab

Sunroom/Solarium

How the sunroom/solarium can benefit from energy improvements depends on how the space is used. If it is used year-round as a fully conditioned living space, the savings will be greater than an occasionally heated sunspace where the temperature is allowed to fluctuate. A metal-framed greenhouse unit attached to the house cannot be improved thermally, and should only be used seasonally. If heat is needed to prevent freezing of plants, only a minimum amount should be heated. Wood-framed sunrooms and solariums are usually treated as one-room additions.

How it's Built

- Prefabricated, metal-framed units with or without thermal breaks
- Wood-frame construction
- Walls: 2x4 stud walls with up to RSI 2.1 (R-12) batt insulation (newer additions might be 2x6 with RSI 3.4 (R-20) insulation
- Ceiling: wood frame construction, average RSI 2.1 to 3.4 (R-12 to R-20) insulation
- Windows: types and styles across the range of available products, but most will have older, double-glazed windows, some with plastic glazing panels.
- Foundation: unheated crawl space with minimal insulation in floor

Space Heating System

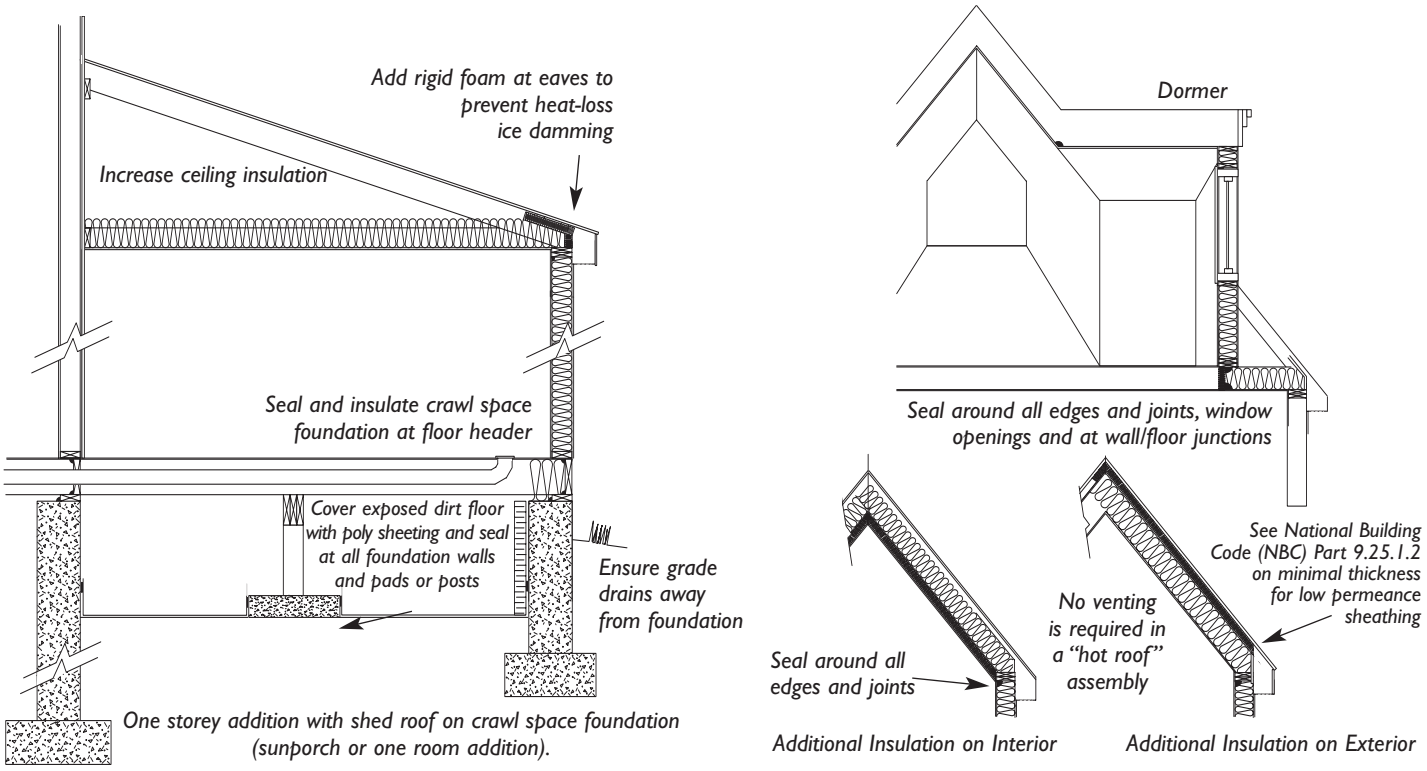
Additions can be heated by a direct-vent gas-fired baseboard heater, a sealed, direct-vent gas fireplace or a free-standing EPA-approved woodstove. However, it can be more economical to heat an addition from the home's furnace. This will require running ductwork to the addition. If you are installing ductwork, keep it within the heated space, or in a heated and well-insulated closed crawl space. Ducts already running through an unheated crawl space must be air sealed and insulated to at least RSI 3.4 (R-20). If you have extended your furnace to a closed-in porch or addition, make sure there is adequate supply and return air ducting in place.

Solariums/Sunrooms: additional energy can be saved if the heat is turned down in these spaces when it is not needed. Space heating energy needs can also be reduced if, on sunny days, warm air from the sunroom or greenhouse is allowed to circulate into the house. If many plants are kept in a warm greenhouse, moisture and mold problems may show up in the house.

Before considering a furnace or boiler replacement, carry out draftproofing and insulation improvements to the original house as well as the addition, then have a qualified contractor carry out a heat loss calculation to properly size the new furnace to your upgraded home's requirements.

Improvements that can save energy in Common Additions.

Energy improvements may be done on their own account or at the same time as other renovations. Take the time to 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 offer you advice on 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 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.

For solariums used year-round, upgrading windows to high-performance units should be considered. It may be difficult to upgrade windows on prefabricated greenhouse-type solariums unless the frame can accommodate multi-pane glass panels. Depending on the metal frame, consider magnetically attached interior plexiglass storm windows to create an additonal thermal barrier. For non-metal units, permanently attached interior storms are also available.

North-facing windows in solariums and sunrooms should be replaced with insulated panels to reduce the total glass area and make the sunroom more comfortable. This can also apply to enclosed porches with large expanses of north-facing glass.

Foundations

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 (2 ft.) below grade for poured concrete; from top to bottom for concrete block.

Most crawl space foundations should be treated as if they were basements. There are two types of crawl spaces: “open”, where the crawl space is not heated but vented to the outside, and the floor over is insulated; and “closed” where the crawl space is heated, the walls should be insulated. There should not be any vents to the outside of a closed crawl space.

If there are no moisture problems in your poured or concrete block foundation, draftproof and insulate crawl space walls for their full height. This includes the rim joist and joist space in the floor above, to at least RSI 2.1 (R-12) or RSI 3.4 (R-20) if using electric heat.

Heated crawl space: close off vents after insulating the walls and installing a moisture barrier over the crawl space floor. The moisture barrier can be a 6-mil polyethylene sheet over the ground or the concrete, with all seams overlapped, weighed down with a few stones and sealed at the edges.

Unheated crawl space vented to the outdoors: If you can't insulate the walls from the interior, then the insulation in the floor should be increased to completely fill the floor joist cavity. It is most likely easier to insulate the crawl space walls from the outside than to completely fill the floor cavity, especially if the crawl space is less than 1.2 m (4 ft) high. In either case, a moisture barrier must also be applied to the crawl space floor.

In any crawl space, it may be difficult to create a continuous seal for the moisture barrier, especially if the crawl space is very shallow, or if there are posts and foundation pads in the way. The less continuous the moisture barrier is, the less successful your draftproofing measures will be.

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

Concrete slab foundations in renovated carports or garages can be made more comfortable while reducing energy requirements with rigid board insulation fitted between 2x2 sleepers over a continuous moisture barrier laid on top of the concrete floor. Make sure there will still be sufficient height in the room(s) after the addition of the sleepers, a subfloor and finished floor assembly.

Exterior Walls

Usually it is not practical to upgrade the wall insulation if the cavities are already filled with insulation, however; replacing the siding is a common upgrade on an older house. This is the best time to add a layer of exterior insulation with 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 professional contractor's advice on how best to approach this retrofit on your house.

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. It may not be possible to add more insulation between the rafters of the sloped ceiling in a dormer, sunroom or covered porch. The best solution is to have the ceiling (and exposed walls) filled with foam-in insulation, for high insulation values and a good air seal in one step.

If foam-in insulation is not an option, add a layer of rigid foam insulation to the existing interior finish and then cover with a fire-rated finishing product such as gypsum board. Losing a little height (25mm/1 in. of foam + 12mm/0.5 in. gypsum board) can increase your insulation level by RSI 0.8 to 1.5 (R-4 to R-8), depending on the product used. More importantly, a well-sealed layer of insulation on the interior can reduce drafts significantly. The kneewalls can be insulated the same way. Another option is to have a layer of rigid board insulation added to the exterior as part of a re-roofing job. A professional can ensure that the upgraded roof assembly meets building code requirements.

Draftproof Everywhere!

- Special attention needs to be given to areas where the addition is connected to the original house. The air barrier and insulation in the areas where new construction joins the original is often not properly installed, so there can be large gaps. Air sealing the construction at these points will reduce heat loss and improve comfort levels. Other areas to consider include the top of foundation walls, around windows, ceiling penetrations, at attic hatches, around light fixtures and wiring and service penetrations through

exterior walls. Keep weatherstripping at doors and windows in good condition.

- Dormers are especially prone to high rates of heat loss, as they are typically in the upper level of the house where the heat gathers. A well-sealed layer of rigid board insulation added to the interior of a dormer can reduce air leakage significantly. Another important area to consider is the connection between a crawl space and the adjoining basement, especially when the crawl space is heated.

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

Planning a new addition?

See also the publication *A New Addition* by CMHC, available online at: http://192.197.69.106/en/co/renoho/refash/refash_001.cfm

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 (61°F) 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.

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.

CMHC's
Renovating for Energy Savings series

Issue 1 Pre-World War II Houses
Issue 2 Post-War 1½-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 Walk-out 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.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.APHQ.com tel. 514-353-9960 or ACQ (Association de la construction du Québec) at www.ACQ.orgTel. 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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