

Green Renovations

Renovations provide a way to update the interior and exterior of a home, add space and address problem areas. Home renovations also make it possible to improve energy efficiency, indoor air quality and comfort; reduce environmental impact and resource consumption; and make a home more affordable to live in, operate and maintain. For example, when renovating a kitchen, you may also be able to help reduce your energy bills or deal with concerns over cooking odours and moisture through appropriate equipment and material selection.

For many homeowners, adding green features to renovations can be both a challenge and an opportunity. The challenge is to understand what options exist for a given project and the need to balance such value-added measures with your budget. The opportunity is to take advantage of a renovation project that you need, or want, to do and add green, sustainable, features and practices to the work being undertaken at a relatively modest cost.

This guide goes over measures to “green” a renovation. While there are many different meanings of “green,” CMHC’s Healthy Housing™ principles offer a well-rounded interpretation:

1. Occupant Health/Healthy Indoor Environment

Healthy Housing promotes superior quality of indoor air, water, lighting and comfort.

2. Energy Efficiency and Renewable Energy Production

Healthy Housing reduces energy use in all areas, in all seasons. It minimizes heat loss in winter and gain in summer. It relies on efficient heating and ventilation systems, reduces the consumption of electricity and other fuels, and includes renewable energy systems when appropriate. It also considers the energy used, or embodied, in the manufacture of building materials and in house construction.

3. Resource Efficiency

Healthy Housing makes efficient use of all natural resources. Efficient use is made of building

materials through thoughtful design and careful construction. Construction, renovation and demolition waste is well managed. Durability of building components is essential to reduce future replacement needs. The Healthy House conserves resources, especially water and energy. It minimizes the use of materials by promoting flexible housing design that permits a home to be easily altered to accommodate life’s changing circumstances and needs.

4. Environmental Impact

Healthy Housing strives to reduce the impact of the residential sector on the environment at all stages of its life cycle. It reduces the impacts of pollutant emissions on air, water and land. It encourages site planning that reduces land requirements and considers broader community planning issues such as transportation. This involves a new way of thinking about how homes and communities contribute to the health of the planet.

5. Affordability

Healthy Housing must be appealing and financially accessible to consumers to succeed in the marketplace. The features of the Healthy House are generally consistent with housing affordability. Energy savings reduce operating costs, and the house's design can make it more affordable to build and adaptable to its occupants' changing needs over time. A well-planned renovation can allow other Healthy Housing features to be added more easily when the budget allows it.

Different shades of green can be achieved at various cost levels and still be effective. They can be incorporated into a component of a renovation or the whole job. With a little advance planning, allowances can be made to allow green features to be included at some point in the future as needs change and budgets allow. For example, a house can be pre-wired for future solar installation or pre-plumbed for a future greywater recycling system. In the end, it's your interests and budget that will determine how a renovation proceeds and how many green features may be incorporated in your project.

THE HOUSE AS A SYSTEM

A key part to successfully applying Healthy Housing principles to renovation projects is to view the house as a system. A house is an interactive, multi-component system. The major components of the "house-as-a-system" are:

- the **building envelope** (roof, walls, windows, doors and foundation) that separates the interior space from the exterior environment;
- the **mechanical systems** (including the heating and cooling systems, ventilation system, and exhaust fans, humidifiers and dehumidifiers etc.) that provide, remove or regulate heat, air and moisture conditions inside the house; and
- the **occupants** (number of people, their lifestyle, how the house is operated and lived in).

Each component can influence the performance of the entire system. As well, the house itself interacts with the surrounding environment and climate conditions where it is built.

By considering your house as a system, you can better avoid potential pitfalls and unintended consequences of your renovation project that, in turn, help support green objectives. As a result, any given green renovation technology, practice or feature should not be seen as a nice to have, add-on, feature. Rather, they should be viewed as elements that add real value to

common renovations both with respect to the benefits they provide and the problems they avoid.

For example, if you seal up or insulate the building envelope, this can affect how efficiently and safely the furnace operates. By air sealing the home to save energy, you may also reduce indoor-outdoor air exchange to the point where poor indoor air quality and moisture problems develop. Indoor air quality may also be impacted by the addition of new materials and finishes. If the type of heating appliance is changed, or a new (or higher capacity) fan is added to the home, or the number of occupants living in the house changes, this may also change how the house operates.

On the other hand, understanding house-as-a-system issues can help renovators address problems that the house or the homeowner is already experiencing. High energy bills can be resolved by including more insulation in the project, dealing with air leaks or retrofitting a new, high efficiency furnace. Indoor air quality problems such as dry air, lingering odours or stale air might also be addressed through a variety of measures aimed at reducing pollutant sources and improving ventilation.

Therefore, it is important for homeowners to understand house-as-a-system concepts and to account for them in the renovation work. This will help you to build solutions

into the work you are doing on the house. Ensuring house-as-a-system issues are addressed will also help the renovation achieve its green objectives and avoid costly mistakes.

PLANNING A GREEN RENOVATION

Setting Objectives

It's important to set out specific green objectives for the job at hand. Get informed about the different options for addressing the Healthy Housing principles as a part of the overall project.

Keep in mind that some green objectives may not be met right away due to tight budgets or the current lack of an appropriate option. In this case you may want to consider measures that would allow you to easily add green features in the future as time and budgets allow. This could include for example pre-wiring and plumbing for a future solar panel installation or adding a dual water supply system to accommodate alternate water sources such as rainwater for toilet flushing.

Green Renovation Tasks

1. Initial Green

Renovation Considerations

During the initial planning of your renovation, consider options for integrating green features and practices into the renovation. You will want to become aware of the full range of

options available and associated opportunities, costs and benefits.

Search for objective sources of information that fully explain the benefits and options for incorporating green measures in the project. You could organize your planning using the Healthy Housing principles to provide guidance on an environmentally sustainable approach to the project.

Some important questions to consider include:

- What are your objectives, issues and concerns regarding the project? For example, more space to work, modern cabinetry and storage are common goals that provide many opportunities to build in green features that can reduce energy bills, improve air quality, and provide durable, low-maintenance surfaces.
- How informed are you about the opportunities to green the renovation? It's easy to become overwhelmed or confused by the range of choices.
- What special health or other needs are there in the house? For example, does anyone have allergies, or is anyone environmentally hypersensitive? Are there accessibility needs? Do you or others want to stay in the home as long as possible?

- What are the range of benefits and options for incorporating green measures in the project? This may include energy savings, improved air quality, durability of materials, and improved adaptability of the home over time.

2. Site Inspection

A pre-renovation site inspection not only allows you to scope out the full extent of the work required to meet your objectives, it will also allow you to identify, and plan for, the inclusion of green features and to address any pre-existing problems. A qualified contractor, residential energy service provider or home inspector can help you address the following questions: What about the renovation job might affect other parts or systems of the house and vice-versa? What are the pre-existing problems and opportunities for addressing these issues before proceeding? Are special tests or inspections needed before proceeding? Are there any needed repairs before the project begins? Could any additional work be required as the renovation moves ahead to ensure a successful outcome?

3. Design

Having considered green options of interest and conducted a site inspection to scope out the project, it is now time to design the renovation

and define the opportunities for green features. For each of the renovation steps, each product used and each practice followed, consider the various options to green the renovation. Guidance on green tactics is provided for specific renovations in later sections. Typical questions to ask at this time include: How might green considerations affect the project's design? Where are the energy-saving opportunities? Where are the opportunities for improving indoor air quality? How can the environmental impact of the renovation be reduced and how can resources be conserved? Would work to increase airtightness require improving the ventilation system? How might increasing insulation affect furnace sizing requirements? What might get included as the renovation proceeds, and what other accommodations might be made to incorporate green features at a later date? How might the design of the renovation be improved to be more durable and retain its esthetics and utility over time in order to reduce the need for future renovations down the line and avoid wasting money, energy and materials?

4. Project Team Meeting

Depending on the scope of the renovation, it is important to ensure that all trades involved are aware of the green objectives

that apply to the overall project and their work. Early on, especially for major renovation projects, the team should get together with the homeowner

to discuss the renovation and the green objectives. This group would include the architect or designer (if there is one) and each of the trades involved in

Green Product Claims

There's a lot of misinformation and confusion about "green" products. Homeowners should beware of unsubstantiated or overstated claims. Products and materials with independent third-party certification are most trustworthy. Manufacturers or suppliers should also be able to produce independent test results to back up their claims. You can ask the manufacturer for independent testing results and a material safety data sheet (MSDS) to learn about any safety concerns.

To identify specific green products, you can also rely on certification programs like Natural Resources Canada's EnerGuide ratings, the Environmental Protection Agency's ENERGY STAR® ratings, the International Standards Organization (ISO) and the Canadian Standards Association (CSA). Green product labelling programs are also useful but it is useful to know what's behind each of the programs:

- GreenSpec™ Product Guide: BuildingGreen Inc., an independent company, maintains this regularly updated website to help building-industry professionals and policy makers improve the environmental performance, and reduce the adverse impacts, of buildings: <http://www.buildinggreen.com/menus/>
- GREENGUARD™: The GREENGUARD Environmental Institute is an ISO-IEC Guide 65:1996 accredited, third-party organization that certifies products and materials for low chemical emissions and provides a resource for choosing healthier products and materials for indoor environments: <http://www.greenguard.org/en/QuickSearch.aspx>
- EcoLogo™: This program certifies products and services based on compliance with environmental criteria established in consultation with industry, environmental groups, and independent experts, and based on life-cycle impacts. Founded in 1988 by the Government of Canada, the program is now managed by TerraChoice. <http://www.ecologo.org/en/index.asp>
- Green Seal™: This is a non-profit organization that develops life cycle-based sustainability standards for products, services and companies. It offers third-party certification for those that meet the criteria in the standard. <http://www.greenseal.org/>
- WaterSense: A U.S. Environmental Protection Agency-sponsored partnership program that promotes water efficiency and enhancing the market for water-efficient products, programs, and practices. It provides information about a range of bathroom fixtures. WaterSense-rated products allow consumers to reduce their water use while enjoying exceptional performance; <http://www.epa.gov/WaterSense/>.

the job. It is important for each trade to understand the objectives and their role and responsibilities in achieving them.

5. Selecting Materials and Products

There is likely a range of products suited to the job. Be aware of unsubstantiated claims by seeking information from objective sources and the personal experience of qualified and knowledgeable contractors.

6. Addressing Problems Before the Job Proceeds

Make sure you are aware of, and take, corrective actions to deal with any pre-existing problems identified during the site inspection to ensure the renovation goes smoothly. This could include dealing with structural problems, ventilation, leaks, dampness or mold, hazardous materials and other problems.

7. Renovation and Installation Activities

Go ahead with the job with the selected green features included. Note that a green renovation covers not only what is included in the renovation but also how the renovation is done. Take care to ensure that you and others living in the house, as well as the workers, are protected from dust, pollutant emissions, debris and hazardous materials generated during the work with proper site isolation and

depressurization if necessary (see *Site Maintenance and Cleanup* below). Ensure the job site is left as clean and well organized at the end of each day. Ensure that materials are properly disposed of and seek opportunities for recycling and reuse.

8. Addressing Additional Problems as They Arise During the Renovation

There may be unforeseen problems that crop up as the renovation proceeds. This could include structural problems, moisture damage, or hazardous materials. As such problems arise, your renovator will develop solutions and seek your approval, in writing, for any additional work and materials required to remedy the problem.

9. Site Maintenance and Cleanup

As well as controlling dust and fumes during the job and daily tidying, the site should be thoroughly cleaned. Steps should be included to protect workers and the occupants while the work is underway. Some points to consider include:

- Select new materials with as few irritants as possible. This includes the cabinets, flooring, and paints and finishes; wherever possible, plan to use finishes that have low emissions.
- If you select materials with odours and emissions, such as some types of cabinetry, buy

them in advance and store them in a well-ventilated place to let them release pollutants before installation.

- Ensure a ceiling to floor plastic sheet dust barrier is installed between the renovation area and the rest of the house.
- Arrange for workers to access the renovation via the shortest route to the outside that can be isolated by plastic sheets from the rest of the house.
- Arrange for window fans to ventilate the room to the outdoors if there are jobs that will result in pollutants being emitted to the space, such as painting, staining or using an adhesive to apply flooring.
- Make sure workers use dust bags or other systems to control dust if power saws or sanders are used.
- Seal registers and duct openings to prevent dust from spreading to other parts of the house and into the ductwork. If possible, avoid running the furnace or air conditioning system while the work is underway.
- Make sure workers use appropriate personal protection equipment (for example, safety glasses, face masks, gloves, coveralls, fall arresters, etc.).

- Ensure that a thorough cleanup, vacuuming and damp-mopping are done as necessary, after work each day and when the job is finished. For drywall dust, the vacuum will require a filter specifically designed for this purpose.
- Consider a thorough duct cleaning and furnace filter replacement at the end of the renovation.

10. Waste Disposal and Recycling

Prepare a waste management plan before starting the renovation. Consider how you will manage and separate waste on site for disposal, reuse, or recycling, and handle toxic wastes appropriately. This will help reduce the overall impact of the renovation project on the environment associated with material disposal and by offsetting the environmental impact of creating new construction materials and products that would otherwise have to be created if recycled materials were not available. Points to consider include:

- The local municipality may have special requirements for toxic waste, such as designated sites and times for drop off so plan accordingly.
- You may be able to salvage old wood trim and window and door casings if desired after the walls are refinished. However, be aware of lead paint.

- If old appliances are still working, give them away instead of throwing them out. Reusing old materials decreases pressure on natural resources and landfills. However, some old appliances such as refrigerators are such energy-wasters that they are best sent for scrap. Free pick-up and recycling services are available in some areas.
- Because new cabinetry can be expensive, reusing or refacing cabinets is a waste reducing option to discuss with the homeowner. Restoring countertops by repairing laminate or refinishing is also worth considering.
- Building materials that neither you nor the homeowner can use could still have some value. Consider selling or donating them to stores that resell building products. Another option is to donate the material through local Web buy-sell type sites. Certain local organizations (such as Habitat for Humanity) accept donations of building materials. The Salvation Army also accepts donated material of various types.
- On the job, you should clean up your own waste material and recycle or dispose of it as appropriate.

11. Operation and Maintenance Awareness

Once the renovation has been completed, ensure that you have all of the necessary manufacturer literature on the care, maintenance and operation of all aspects of the newly installed materials, equipment and systems. Be sure to inform everyone in the house how the renovation, including its green features, may affect the operation of the renovated house. For example, if there is a natural gas or propane oven installed as a part of a kitchen renovation, everyone will need to know the range hood should be operated every time the gas burners are on.

Put together an information kit containing operating manuals and warranty information for all new appliances, equipment and fixtures as well as any other useful pointers for maintaining the green features. Also, keep a photo record of the renovation to demonstrate what was done. This is important not only to document the successful completion of the project but also to provide future owners or renovators with useful information regarding the work done. The record can also be useful to inform prospective future buyers of the home of the green features built into the project—especially those that would otherwise be hidden such

as increased insulation levels, air sealing details and insulated pipe and ducts.

HELPFUL DIAGNOSTIC TOOLS FOR GREEN RENOVATIONS

There are various tests and inspections that can guide your green renovation strategy or may be useful in diagnosing potential problems and identifying solutions. These include:

- **Blower door test:** This test helps establish how leaky a house is and where the leaks are. This information is needed to develop air sealing strategies and to predict whether or not the renovation project might best include a ventilation system: <http://energy.gov/energysaver/articles/blower-door-tests>
- **Smoke generator:** During a blower door test, a hand-held smoke generator can be used to identify the location of air leaks.
- **Borescopes:** These are rigid or flexible optical tools to inspect the insides of walls or other structures through small holes that are either present on or drilled into the assembly being inspected. They have viewing optics and may have a camera or video camera attached. Instead of ripping out drywall or other coverings, you can use this device to inspect for missing insulation, moisture damage, mold or other issues.
- **EnerGuide Rating System (ERS) assessment:** The assessment and rating provide valuable information regarding the house's present level of energy efficiency and the level it could achieve with recommended upgrades. A blower door test may be included to characterize air leakage: <http://www.nrcan.gc.ca/energy/efficiency/housing/home-improvements/5005>
- **Hygrometer:** You can use a hygrometer (also known as a relative humidity indicator or sensor) to measure a house's relative humidity levels. A hygrometer can be used to take the guess work out of determining whether or not the indoor relative humidity is too high or too low. However, do bear in mind that single measurements may not represent longer term averages.
- **Indoor air quality evaluation:** Residential indoor air quality inspectors can help determine the cause of and solutions for many indoor air quality-related problems in houses.
- **Infrared thermography:** Thermographic equipment can be used to provide information on surface temperatures. The resulting images help an energy auditor determine whether or not there are gaps in or thermal bridges across insulation. Thermography can also be used to detect the location of air leaks that the renovation might address.

SOME FINAL THOUGHTS ON GREEN RENOVATIONS

- **Benefits of green renovations:** Market research has shown that homeowners are interested in taking steps to improve the environmental performance of their homes and that they may be more willing to pay for green features when they understand the costs and benefits. This means that by including green features in your renovations, your home may be more attractive to future buyers.
- **Be aware what can be achieved at different levels of effort and cost:** Greener renovations can be achieved to varying degrees ranging from the “light green” renovations that simply include no- and low-cost options to the renovation work being planned to “deep green” renovations where the renovation is altered to accommodate higher impact green features.

- **Beware of unsubstantiated green product claims:** Many products are purported to be green but many manufacturers are now submitting their products to credible third-party organizations that put such claims to the test. Also be aware that sometimes simply installing a device with a green feature may not produce any benefits if it is not used or operated properly. For instance, a programmable thermostat will not result in energy savings if it is not set to reduce furnace operation during unoccupied hours.
- **Mine for energy savings:** If the renovation could potentially reduce energy use, it may be advisable to retain the services of a residential energy advisor, who could assess the house, identify potential ways of saving energy and estimate energy and cost savings. Also consider opportunities to prepare the home for the addition of green features down the road (such as pre-wiring for solar panels or pre-plumbing for a solar hot water heater or a greywater system).
- **Get it in writing:** Make it clear what green measures your renovation contract will cover in addition to the basic renovation. This includes specifying the kinds of products and materials to be used in the project or acceptable alternatives.

- **An information kit:** It will be very useful to put together an operations manual or information kit describing the green features, how they will affect the operation of the home, and, how to optimize the performance of the house. The kit, which could be a simple three-ring binder, compact disc or memory stick, should include instructional materials for any new appliances, special maintenance requirements along with fact sheets or additional information on green features. The information should also point out healthy choices for cleaning and maintenance products to be used to care for

the completed renovation. This information will be useful to you, and future owners of the house.

GENERAL TACTICS FOR GREENING RENOVATIONS

The following list provides general tactics for achieving greener renovations for each of CMHC's Healthy Housing indicators. The list can be a useful reference when organizing a green renovation project to help ensure your renovation includes strategies, products, systems and technologies that can help improve the overall performance of your renovation project.

Occupant Health/Healthy Indoor Environments

- ❑ Ventilate combustion gases, cooking odours and moisture by an energy-efficient range hood vented outdoors
- ❑ Ventilate moisture and odours outdoors from bathrooms with energy-efficient bathroom fans
- ❑ Reduce material pollutant emissions by using low-emission flooring, cabinets, countertops, paint, adhesives, grouts, sealants and caulking
- ❑ Prevent mold growth by using moisture-resistant and easily cleaned materials in potentially wet areas behind sinks, under appliances, under and behind bathtubs and showers
- ❑ Enhance natural lighting with additional windows or making existing windows bigger
- ❑ Enhance comfort by improving insulation and airtightness
- ❑ Exchange and circulate outdoor air throughout the house
- ❑ Solve moisture problems before you renovate
- ❑ Provide controls to optimize ventilation
- ❑ Filter pollutants
- ❑ Provide soil gas control if needed

Energy Efficiency

- ☐ Provide insulation where it is missing or add more to existing. Replace older insulation with new, higher RSI-value materials such as spray-in polyurethane insulating foam or mineral wool
- ☐ Install energy-efficient windows and doors
- ☐ Include effective air barriers to reduce air leakage through measures such as continuous polyethylene sheets and caulking or airtight drywall approach
- ☐ Install energy-efficient appliances
- ☐ Insulate cold and hot water pipes exposed during the renovation
- ☐ Plan and install low-energy lighting
- ☐ Install high energy-efficiency heating, cooling and water heating appliances
- ☐ Recover heat from outgoing air and water
- ☐ Provide shading to prevent overheating
- ☐ Reduce hot water use with efficient showers, faucets, clothes washers
- ☐ Use power bars to cut power to non-essential electronics

Resource Conservation

- ☐ Select certified forest products for flooring, cabinetry, millwork; recycled content in countertops, tiles and drywall; low-embodied energy materials that are locally sourced and lightly processed
- ☐ Install water-efficient appliances and taps
- ☐ Choose materials and products that are durable, resilient and serviceable
- ☐ Design for accessibility and aging in place and change of use to extend the amount of time the occupants can easily access and live in the house
- ☐ Plan for future retrofits of green features
- ☐ Design to reduce material use through optimum value engineering processes and smart framing techniques
- ☐ Salvage and reuse materials, equipment, appliances
- ☐ Design for ease of future retrofits of green features
- ☐ Optimize design of mechanical systems to avoid oversizing

Reduced Environmental Impact

- ☐ Plan for renovation waste management, reuse/recycling of fixtures, cabinetry and other materials
- ☐ Choose low-pollutant emission products and materials
- ☐ Provide a built-in recycling centre and compost bin to ease and encourage use
- ☐ Include energy efficiency measures (see above) to reduce pollutant emissions from energy generation and use

Affordability

- ☐ Avoid expensive rework by identifying and addressing any concerns at the beginning of the job
- ☐ Control future maintenance and replacement costs through high-quality, durable materials
- ☐ Include energy- and water-saving features to reduce operating costs
- ☐ Use timeless design to reduce cost of future renovations
- ☐ Design for accessibility/aging in place to allow occupants to stay in the home as they age

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