

IMPROVING HOME ENERGY EFFICIENCY

A GUIDE FOR RURAL HOMEOWNERS IN THE FRASER VALLEY



IN THIS GUIDE

Building a new home? Renovating your current home? Or do you just want to improve your home's energy efficiency? This guide offers rural residents and local builders tips to make your home more energy efficient, reduce energy costs and reduce its carbon footprint.

Inside, you'll find out how to:

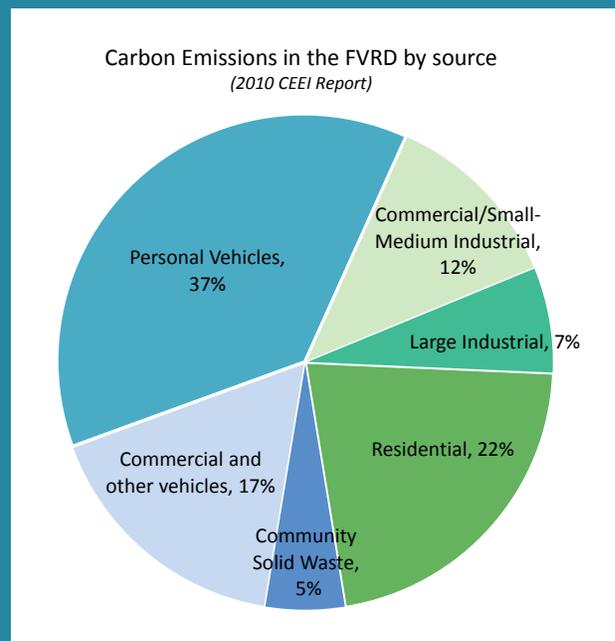
- Assess the efficiency of your home.
- Design efficient sites and buildings.
- Select efficient materials and products.
- Install alternative energy systems.
- Landscape to maximize heating in winter and cooling in summer.
- Build a "Net Zero" home.
- Find more information on energy saving opportunities, grants, and programs.

Before undertaking any work on your property or home, check with the Regional District, or the municipality you live in, to ensure you comply with applicable building and development regulations.

The Fraser Valley's Carbon Footprint

In 2010, FVRD residents and businesses produced about 1.6 million tonnes of carbon. 22% come from heating and powering our homes¹ (an average home in the Fraser Valley emits about 4 tonnes of carbon each year)². Another 37% come from personal vehicles. When we plan our communities, we can reduce the need to drive by:

- Supporting the development of rural centres, rather than rural sprawl;
- Creating walking and cycling paths that connect us to amenities in those centres; and,
- Placing buildings in close proximity so that they may share a neighbourhood heating system.



¹A Summary of Climate Change Effects on Watershed Hydrology, Pike et al., 2008. www.for.gov.bc.ca/hfd/pubs/Docs/En/En87.pdf

²Province of BC 2007 Community Energy and Emissions Inventory

BENEFITS TO IMPROVING ENERGY EFFICIENCY

There are many benefits to living in homes that are more energy efficient and produce less carbon emissions, including:

Save on monthly energy costs

More efficient homes cost less to heat, cool and power.

Live in comfort

Efficient homes are less draughty, have better air circulation, and are generally more comfortable to live in.

Reduce your vulnerability to energy prices

Future availability and cost of fossil fuels is volatile and uncertain. More efficient homes mean less exposure to changing markets.

Conserve our energy resource

The more energy we use, the more energy we need to produce. Finding new sources of energy can be expensive and negatively impact our environment.

Minimize climate impact

Global temperatures are warming, and research indicates there may be significant climate impacts such as accelerated snowmelt, increases in rainfall, and increased frequency and magnitude of extreme weather events. Mitigating carbon emissions can reduce the potential impacts of climate change.

Become more self-sufficient

Using alternative energy to replace fossil fuels can reduce your carbon footprint and your reliance on the grid.

There are currently over 100 certified Built Green BC homes in the Fraser Valley. Gold level homes save about 30% on energy costs each year.

Visit the Canadian Home Builder's Association of the Fraser Valley website for more information: www.chbafv.com

Potential Energy Savings

On average, a home in the Fraser Valley uses about 120 Gigajoules of energy per year. If a home built in the 1970s gets an energy efficient renovation, total energy use could go down by 30%.³



³ Natural Resources Canada (NRCan)

HOW EFFICIENT IS YOUR HOME?

Perform an Energy Audit

Hire a Professional

To determine the efficiency of your home, hire a professional to perform a home energy audit. These professionals use specialized equipment to provide an Energy Rating for your home. They are also experienced in identifying strategies for improving home energy efficiency, estimating the costs and potential savings of applicable strategies, and providing information on potential grant and rebate programs. Look for a practitioner that is accredited as a “Certified Energy Advisor” recognized by Natural Resources Canada (NRCan).

NRCan has a list of service organizations that provide home audits. Visit www.oeenrcan.gc.ca/home and look in the residential section.

Do It Yourself

Here are some tips for performing your own home energy audit:

- Review your energy bills to understand how much energy you currently use. BC Hydro and Terasen both have online billing systems that let you look at past bills.
- Gather safety equipment (dust mask, goggles, gloves, etc.) and be alert for potential hazards (asbestos around ducting and pipes, electrical wiring, fiberglass, etc.).
- Make a checklist of all rooms in the house and things to check in each room.
- Visit each room in the house, including the attic and basement. Plan to spend at least 2 hours completing the audit.



Lifesized Dollhouse by Heather Benning

A great starting point for performing your own audit is to read the City of Vancouver's Do-It-Yourself Home Energy Audit reference at: www.vancouver.ca/files/cov/green-energy-audit-guide.pdf

✓ HOME ENERGY AUDIT CHECKLIST:

- Is there insulation (in walls, ceilings and floors)? If so, what is the R-value*?
- Do outlets and fixtures have gaskets around them (on outside walls)?
- Are there signs of moisture problems?
- Are ducts insulated – especially in unheated areas?
- Are exhaust fans working? Are they being vented outside?
- Is the furnace filter clean?
- Are hot water pipes insulated?
- What temperature is the hot water tank set at?
- Are thermostats working?
- Is there weather stripping? Is it in good shape? Check windows and doors.
- Is the fireplace damper sealed when not in use?
- Are there gutters? Are they in good shape?

What next? With your audit complete, create a plan and budget to make improvements.

** R-value is a standard measurement for thermal resistance. In other words, it measures how effective your insulation is.*



ENERGY RATING SYSTEMS

What is an EnerGuide rating?

There are many different rating systems that allow us to measure the performance of our buildings according to certain environmental criteria. The EnerGuide rating specifically measures a home's energy performance, and allows us to compare one house to another. The rating goes from 0 to 100, where 100 "represents a house that is airtight, well insulated, sufficiently ventilated and requires no purchased energy on an annual basis". Typical EG ratings: ⁴

New house built to BC Building Code Standards	77
Energy efficient new house	80 to 90
House requiring little to no purchased energy	90 to 100

Other rating systems look at environmental performance using other criteria. Here is a quick snapshot of some of the other rating systems for homes:

R-2000 Standard:

A voluntary standard from Natural Resources Canada that is industry-endorsed, and focuses on building highly energy efficient homes in Canada. Typical R-2000 homes use 10 to 30% less energy than other new homes.

BuiltGreen:

An industry developed standard that offers certification for various criteria related to energy, water, indoor air quality, material, and waste. Certificates are issued for Bronze, Silver, Gold, and Platinum.

LEED® for Homes

Administered by the Canada and US Green Building Councils, LEED® provides a high performance environmental rating system for homes. Criteria include design, sites, water, energy, materials, indoor air quality, and education. Levels include Certified, Silver, Gold, and Platinum.

DESIGN YOUR BUILDING FOR ENERGY EFFICIENCY

Whether building a new home, or planning a major renovation, there are many low-cost design elements to consider for your site and building that can have a significant impact on the energy efficiency of your home. Here are a few energy efficient designs to consider:

Building Location and Shape

- Select a simple building shape that maximizes the ratio of living space to exterior envelope area to reduce heat loss.
- Where possible, orient your home towards the south to most efficiently use the sun for light and heat.
- Use materials like stone or concrete that passively absorb heat during the day and release it at night on the south side of the house and ensure it is shaded in the summer.
- Keep it small! The average house size in North America has doubled in 50 years, while the average family size has decreased. Designing compact spaces saves money when building, heating and maintaining your home.

Windows

- Maximize window areas on the south side to capture natural lighting and warmth from the sun when you need it.
- Minimize window areas on the east, west and north sides to reduce the amount of heat lost through windows.
- Strategically locate windows to best capture daylight and reduce the need for additional lighting.
- Use exterior window covers or overhangs on south and west windows that can block up to 95% of summer heat from being absorbed. (See example image to the right.)
- Strategically place windows for good ventilation.

Heating and Cooling

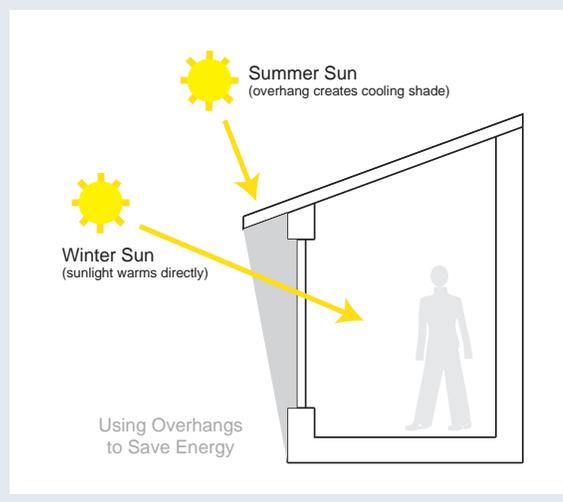
- Make your home “solar ready” by installing the plumbing and electrical to accommodate a future solar hot water system.
- Install Heat Recovery Ventilators (HRVs) to reclaim heat from exhaust airflow and use it to heat fresh incoming air. This is an important feature to ensure ventilation, particularly in a well-sealed envelope. HRVs require installation of extra ducting.

Passive Design

Passive design uses natural elements such as the angle of the sun and the direction of the wind to heat, cool, or light a building.

Using this approach can reduce space heating requirements to less than 1.4 kWh/ft² annually. For the average FVRD home that would be a savings of 85%.⁵

To learn more about passive design, visit www.passivehouse-international.org



⁵ based on average heating requirements from BC Hydro Conservation Potential Review for 2,000 sq ft home

BUILD or RENOVATE WITH ENERGY EFFICIENT MATERIALS AND PRODUCTS

Taking care to select the right materials and products as you begin a building or renovation project can save you money in heating bills, and make your home more comfortable.

Envelope and Insulation

- Make sure your roof and attic are well insulated. Over half of your home's heat can be lost through the roof.
- Install a good air leakage barrier to make sure your insulation is effective. Up to 25% of heat can be lost through air leakage.
- Other areas to insulate well are: all exterior walls, floors and crawl spaces, garages and garage doors.
- Draft-proof your home to reduce air leakage with caulking and weatherstripping.

Energy savings:

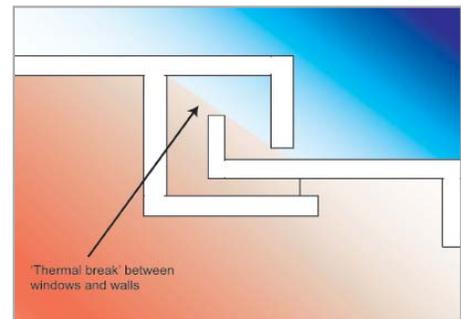
Energy efficient homes meeting the R-2000 standard consume at least 30% less energy than conventional homes (NRCAN, 2008).

Payback period:

Insulating areas of your home that were not previously insulated will payback in about 2 to 5 years. (City of Vancouver)

Windows

- About half of your home's heat can be lost through windows. It is important to choose high performance, ENERGY STAR® certified windows. Avoid "low-e" windows because these will limit the passive solar heat gain in the winter. "Low-e" should only be used in southern exposure that isn't shaded from the high summer sun.
- When installing windows, create a "thermal break" between the windows and insulated walls.



Energy savings: *BC Hydro states that efficient windows can save up to 25% on energy costs.*

Payback period: *New windows are expensive, so payback periods are typically more than 5 years.*

Hot Water Systems

- Consider installing an alternative energy system, such as solar or geo-exchange, to heat your hot water.
- Consider installing an on-demand hot water system that heats the water only when you need it.
- If you've decided to go with a tank-style hot water heater, choose a condensing hot water heater, or select an efficient ENERGY STAR® certified system with an Energy Factor of at least 0.90 (gas) or 2.0 (electric).
- Set the temperature of your tank to 49 degrees Celsius.

Energy savings:

Natural gas on-demand water heaters can use up to 30% less energy than a natural-gas storage tank water heater. (BC Hydro)

Payback period:

Payback periods depend on the number of people in your home. Typical payback will be more than 5 years, but can be estimated more accurately by a home energy audit.

Heating Systems

- Consider installing an alternative energy system, such as a geo-exchange or air source heat pump system.
- If choosing a gas furnace, select a high-efficiency furnace with a 95% AFUE (annual fuel utilization efficiency) or better.
- Install programmable thermostats and set them to lower temperatures when you are asleep, and when you are regularly out of the house. These have a 1 to 2 year payback.
- Perform annual maintenance on your furnace and ducts to make sure it continues to operate efficiently.

Energy savings:

High-efficiency furnaces can reduce your heating requirements by about 40%. That's about 15% of your home's total energy consumption per year. (CMHC Case Study, 1960s bungalow)

Payback period:

Payback periods depend on your home's size and energy use. Typical payback is more than 5 years, but can be estimated more accurately by a home energy audit.

Lighting

- Try LED lights with ENERGY STAR[®] certified labels, where available. LED lights last a long time (35 to 50 times longer than incandescent lights) and are at least 75% more efficient.
- Buy ENERGY STAR[®] certified light fixtures.
- Install motion sensors on light switches to make sure lights go out when no one is using the room.
- Use Compact Fluorescent Lights (CFL's) wherever LED lighting is not possible. CFLs last up to 10 times longer than incandescent bulbs and are 75% more efficient.

What is ENERGY STAR[®]?

ENERGY STAR is an internationally recognized label for products that meet a premium level of energy efficiency." In Canada, ENERGY STAR is administered by Natural Resources Canada, and products include:

- Major appliances
- Heating, cooling and ventilation equipment
- Office equipment
- Consumer electronics
- Windows and doors
- Lighting
- Commercial equipment

Visit www.oee.nrcan.gc.ca for more information.

Electricity savings: *Replacing 60-Watt incandescent bulbs with 15-Watt CFLs reduce lighting energy by 75% (about 15 to 20% of your electricity bill). (NR Can OEE)*

Payback period: *Installing CFL's is simple and has a very fast payback. Light Emitting Diode (LED) technology is newer and more expensive, but is quickly becoming more affordable.*

Plumbing, Fixtures, and Appliances

- Install low-flow shower heads and faucet aerators to reduce the amount of hot water used.
- Make sure all your hot water pipes are wrapped with insulation. Older hot water tanks should also be wrapped.
- Always look for appliances with EnerGuide ratings and ENERGY STAR certification.

Energy savings:

Typical ENERGY STAR labeled appliances can save 10 to 50% energy compared to standard products (Brown et al., 2002).

Payback period on plumbing:

These simple measures cost little and usually have very fast payback.

INSTALL ALTERNATIVE ENERGY SYSTEMS

Now that you have planned and/or built an energy efficient home consider installing alternative energy systems. To improve your return on investment make sure your home is as efficient as possible before looking into these systems - more efficient homes require smaller, less expensive systems.

GeoExchange (or ground source heat pump – GSHP) systems.

Heat from the ground or surface water can be captured by a geoexchange system to heat and cool your home. The ground space in most residential lots will provide enough energy to heat your home in winter and cool it in the summer. How does it work? Piping is installed either in the ground, or in a nearby pond or lake. A liquid is pumped through the pipes to capture the heat. This heat is extracted by a heat pump, and then distributed in your home. Geo-exchange systems can be attached to forced-air or hydronic distribution systems. The systems are very efficient, have low maintenance requirements and are expected to perform for 50 years or more.

Energy savings: 65% reduction in energy for heating and 20% to 50% reduction in energy for cooling. (Retscreen)

Payback: NRCan estimates a payback of about 15 years (ground water system) or 30 years (closed loop system).

Air source heat pumps (ASHP)

Heat pumps can also be used to extract heat from the outside air, even when it is cold. Just like ground source heat pumps, air source pumps can also cool your home in the summer. Usually heat pumps are used in combination with furnaces, not as a replacement.

Energy savings: may see 30% savings in energy with an ASHP. (NR Can OEE)

Payback: NRCan estimates a 3.5 to 6 year payback period for ASHPs installed in Vancouver.

BC Hydro Net Metering Program

BC residents can connect small alternative energy generating systems to the grid and get paid for extra power. Eligible systems include:

- Photovoltaic (solar)
- Wind
- Micro-hydro
- Fuel cell

Visit www.bchydro.com to find out more.

Heat Recovery Systems (HRV)

Heat recovery ventilators can be installed to improve circulation in your home by venting stale air and replacing it with fresh outdoor air. During the exchange, heat is recovered from the outgoing air and transferred to the incoming air. HRVs improve the quality of air in your home, while reducing the cost of heating fresh outdoor air. Visit NRCan's website for more information (www.oee.nrcan.gc.ca).

Drain Water Heat Recovery (DWHR) systems do the same by capturing heat from waste shower water going down the drain and transferring the heat to cold water entering your hot water tank.

Savings: HRVs recover 70 to 80% of the heat from the exhaust air and transfer it to the incoming air. (NR Can OEE)

Solar

Solar hot water systems: Capture the sun's heat more directly by installing solar panels on your roof to heat water. The water circulates through pipes on your roof, heats up, then goes back into your home. Sometimes the water will be hot enough to use directly, other times the water may need additional "top-up" heating from another source.

Solar photovoltaic (PV) systems: You can also use solar panels that convert the sun's energy into electricity. Because BC's electricity is primarily from hydro, solar PV systems will not reduce your home's carbon footprint. They may also have a longer payback in BC than in other areas with higher electricity costs.

Energy savings: Installing a solar hot water system can supplement up to 50% of water heating energy needs. A solar photovoltaic system can reduce your electricity needs by up to one-third. (Solar BC)

Payback: Solar hot water systems can reduce your water heating needs by up to half. Typical payback is between 5 and 15 years.

Is there enough sun in the Fraser Valley to use solar panels?

Yes! These systems are already used in many homes throughout the Lower Mainland and Fraser Valley. A home in the Fraser Valley that has a south-facing roof without shading, could provide:

- 35 to 45% of your annual hot water needs, or
- 25 to 30% of your annual power needs.

To assess your home's suitability for a solar system, visit www.solarrating.ca

Wind

Installing a small turbine can generate electricity by capturing energy from the wind, and depending on your wind resource, can lower your electricity bill by up to 100% (Canadian Wind Energy Association, 2010). Wind turbines may be appropriate in cases where:

- you have more than a ½ acre of property with good wind,
- your local zoning allows wind turbines,
- you've consulted your neighbours,
- and you want some independence from the grid.

See www.smallwindenergy.ca for more details or visit Abbotsford Middle School to see a wind turbine working in the Fraser Valley!

Micro-hydro generation

If you have a stream or creek running through your property, it may be possible to install a micro-hydro system that generates electricity for your home. Contact a local service provider to have your property assessed. These professionals can determine if there is sufficient flow and vertical drop to make the system feasible. You will also need a water licence from the Province of BC.



Ministry of Agriculture

Biomass on farms

Biomass can be converted into an energy source. Wood, agricultural residues (from crops or manure), and waste from the food industry and households can all be sources of biomass. The biomass may be converted to energy in a number of ways, including: composting or processing in an anaerobic digester to produce gas that is combusted for heat and electricity, or it can be converted to pipeline or liquid gas for vehicles. The Region does not support the incineration of biomass to generate electricity or heat.

For estimates of the energy and revenue that may be generated through on-farm anaerobic digestion systems, visit: www.bcfarmbiogas.ca

LANDSCAPE TO MAXIMIZE HEAT IN WINTER AND COOL IN SUMMER

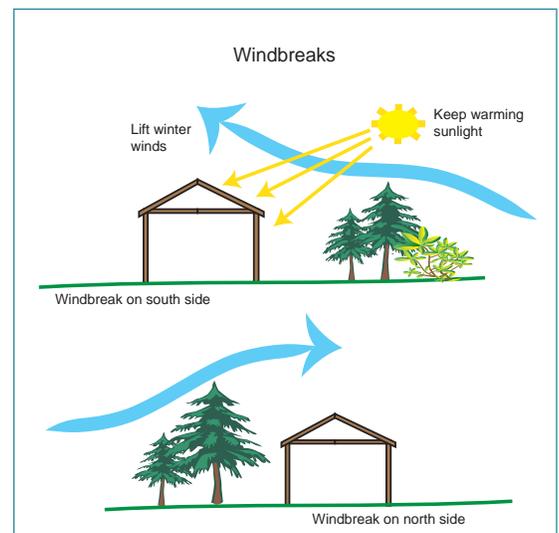
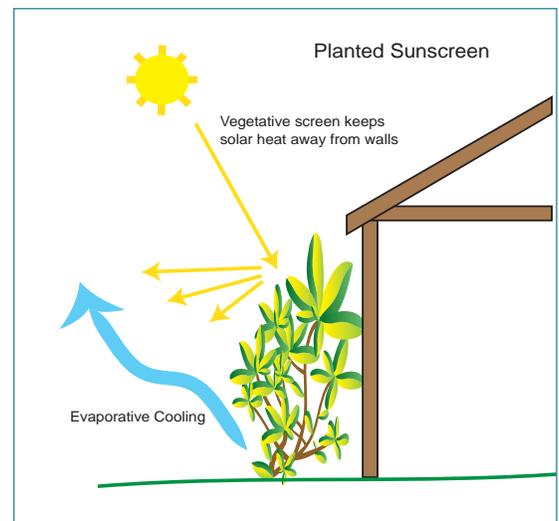
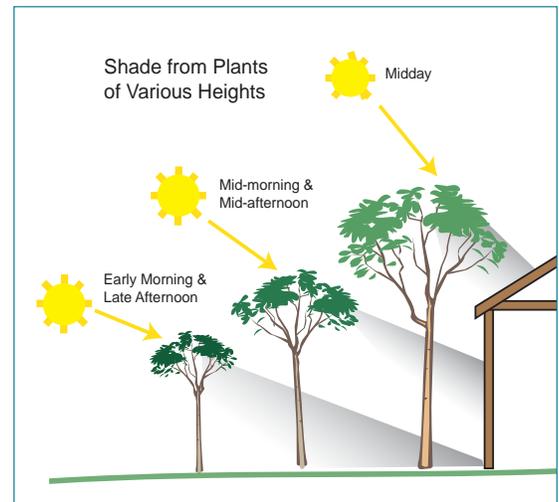
Well planned landscaping can have a significant impact on the efficient operation of your home. Careful placement of trees, shrubs and other structures relative to your home can provide shade and block wind, reducing your heating and cooling needs.

Energy savings:

In areas with cool winter winds, energy savings can be significant (e.g. can cut fuel consumption by about one-third). In summer, well placed plantings can significantly reduce the need for cooling energy (e.g. by 15 to 40%) and make your home more comfortable.

Top landscape design considerations include:

- Planting deciduous trees to provide summer shade to windows while allowing for winter heat gain once the leaves have dropped in the cooler months. (top right)
- Avoiding conifers or other obstacles on the south side that impede winter sun from reaching windows.
- Planting trees and shrubs to act as windbreaks. (below right)



ENERGY SAVINGS POTENTIAL

There are many ways to achieve energy savings in your home. Your budget, current energy use, and location can all influence what energy saving measures are right for you. Use the chart below to estimate potential home energy savings based on any combination of actions that is right for you.

Potential Action	Estimated Annual Energy savings	Estimated Annual GHG savings	Notes/References
Design			
Shade coverings for windows	10%	13%	www.bchydro.com/guides_tips/green-your-home/cooling_guide/shade_windows.html
Build			
Insulation and draftproofing	13%	16%	CMHC - avg 1-storey home built 1960s-1970s
Exterior wall insulation	3%	4%	CMHC - avg 1-storey home built 1960s-1970s
Windows	5%	6%	CMHC - avg 1-storey home built 1960s-1970s
Heating systems	14%	18%	Furnace upgrade: CMHC 1-storey home built 1960s-1970s
Hot water systems	9%	11%	Tankless gas heater compared to tank-style
Lighting	5%	1%	Switching from 60-Watt incandescent to 15-Watt CFL
Appliances	4%	1%	Typical ENERGY STAR labeled appliances can save 10 to 50 % energy compared to standard products (Brown et al., 2002)
Install			
Drain heat recovery	9%	11%	BC Hydro
GeoExchange	33%	41%	NR Can and Retscreen
Air source heat pumps	30%	38%	NR can - 40% less than GSHP (70% savings)
Solar hot water systems	15%	19%	solarrating.ca
Solar photovoltaic (PV) systems	7%	1%	solarrating.ca
Landscape			
Winter wind breaks	15%	19%	various studies

Source: Stantec Consulting

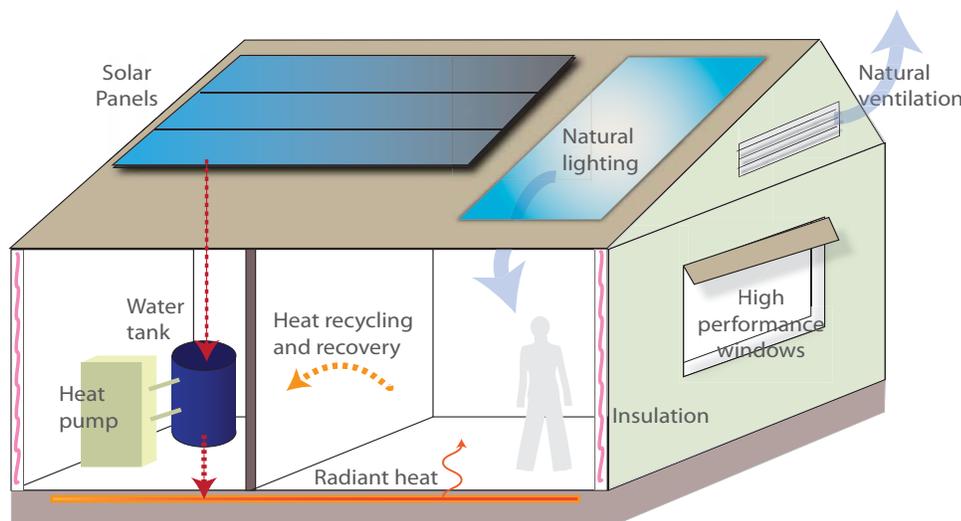
* Please note the table above denotes potential / approximate energy and GHG emission savings for several actions listed above. These are highly variable depending on local conditions (home size, age, number of occupants, etc.). The annual energy savings represent a percentage of TOTAL energy use in the home.

GO GREENER

AIM FOR HIGH STANDARDS LIKE “NET ZERO ENERGY”

What is a “Net Zero Energy” (NZE) home?

NZE homes produce at least as much energy as they consume on an annual basis. In order to achieve NZE, homes must, by design, be highly efficient in terms of energy use. Some common elements of a NZE home are illustrated below. This is a very high goal for a home in Canada, but it is achievable! There are several NZE homes being built, or completed in Canada. To learn more about ultra efficient, green homes and design principles and technologies that can minimize the environmental impact of home building visit the websites below.



Designs can vary greatly but a few of the most common elements of a net zero energy home include natural lighting, solar heating, good ventilation, high performance windows, heat recovery systems and good insulation.

Canadian Mortgage and Housing Corporation (CMHC) Equilibrium Housing Demonstration Initiative:

In 2007 CMHC selected 12 homes to demonstrate resource and energy-efficient technologies to reduce their environmental impact. Full descriptions of each of the homes are available online: www.cmhc-schl.gc.ca/en/inpr/su/eqho/

Eco-Sense (Victoria, BC):

North America's first code-approved load bearing cob house is also Net Zero Energy. It uses solar PV and wind power, solar thermal heating, a passive solar design, and feeds back into the grid. www.eco-sense.ca

Canada Living Building Challenge:

Developed by the Canada Green Building Council, the Living Building Challenge goes beyond LEED® Platinum and is designed to be the most stringent green building standard in the world. The goal is to build “a building that generates all of its own energy from renewable sources, captures and treats all of its water, and operates efficiently for maximum beauty”. Find out more at: www.cagbc.org.



WANT MORE INFORMATION?

Government (federal, provincial and local) websites:

- Province of BC's LiveSmart program www.livesmartbc.ca
- BC Hydro PowerSmart program www.bchydro.com/powersmart/residential.html
- Natural Resources Canada Office of Energy Efficiency www.oeo.nrcan.gc.ca/home
- CMHC guides to maintaining and renovating homes www.cmhc.ca/en/co/co_001.cfm
- City of Vancouver Green Building guides www.vancouver.ca/sustainability/building_green.htm

Association websites:

- Canadian Solar Industries Association www.cansia.ca
- Canadian GeoExchange Coalition www.geo-exchange.ca
- Canadian Wind Energy Association, small wind section www.smallwindenergy.ca
- Net Zero Energy Home Coalition www.netzeroenergyhome.ca/
- Canadian District Energy Association www.cdea.ca/

Green energy and building websites:

- BC Sustainable Energy Association www.bcsea.org
- Light House Sustainable Building Centre www.sustainablebuildingcentre.com/
- LEED Canada Green Building Rating System (Canada Green Building Council) www.cagbc.org
- PassivHaus dwellings – Sustainable home designs www.passivhaus.org.uk

Potential grants and funding sources

- Province of BC www.livesmartbc.ca/homes/h_rebates.html
- BC Hydro www.bchydro.com/rebates_savings/
- Terasen Gas www.fortisbc.com/Electricity/PowerSense/Pages/default.aspx
- Solar BC www.solarbc.ca
- Vancity www.vancity.com
- Discounted power saving kits www.eco-fitt.com/powersmart/



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