Solar Nova Scotia

CANADIAN SOLAR HOME DESIGN MANUAL

for anyone wanting more than a suntan!

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On almost every page we have provided helpful hints and tips to enhance your viewing experience!

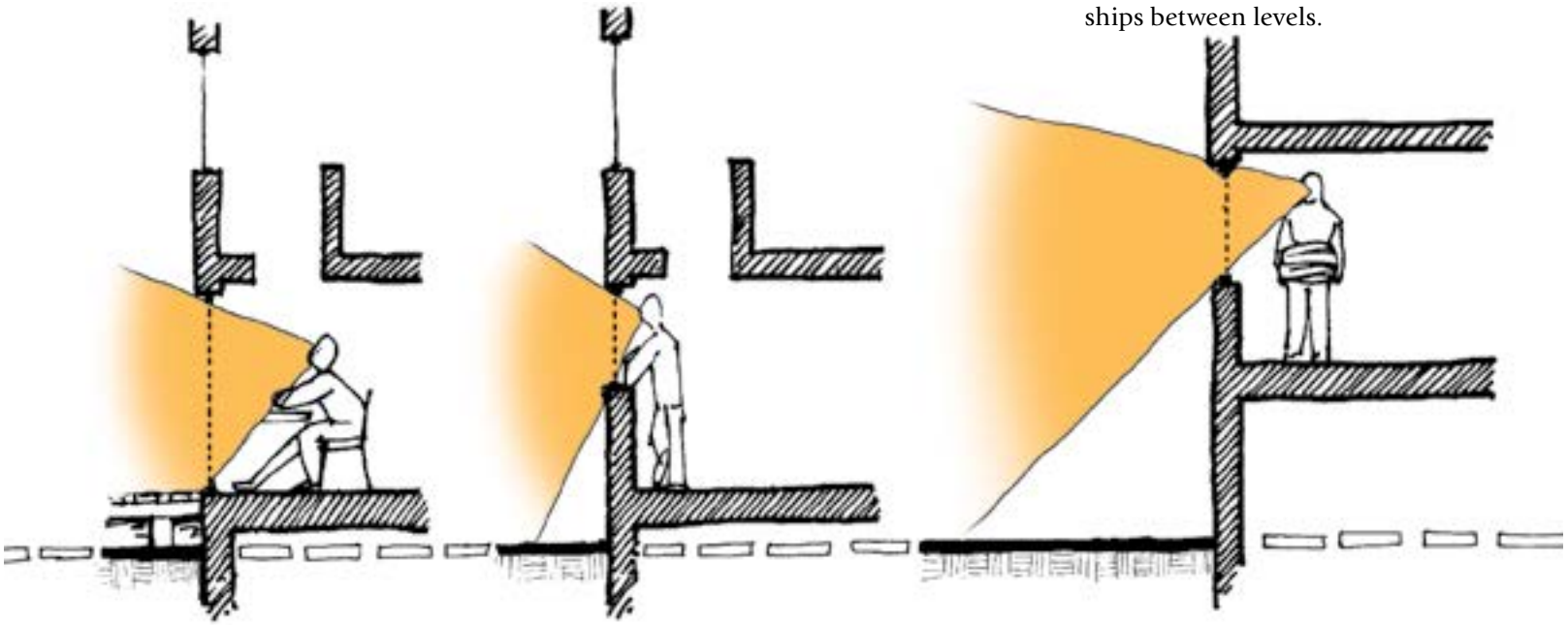
HOUSE DESIGN & PLANNING

In the beginning, there was the building site, and, of course, you. The site design section took you through the process of understanding and adapting you and your ideas to nature's reality. House design extends this process. Your home should make the most of your site's strengths and compensate for its weaknesses. So how does your site affect the design of your home?

Solar access will create potential heat and light for your home. For passive solar heat, you want to maximize south-facing glass. During the summer, you want to limit the amount of direct solar gain into the house and encourage cooling cross-ventilation. For light, why you need it - and when - will determine glass placement. To optimize solar hot water and PV electricity production, you want an appropriatly sized south-facing roof area at a slope roughly equal to the latitude of your region.

There are three main 'streams' of solar technology for buildings: passive solar design, solar thermal systems and photovoltaic power generation. All three of these streams have design considerations that need to be included in planning your new home or renovation.

becomes substantial. When you look out of this window from a seated position, your eye will meet the ground a long way out from the building. If you drop the window sill height, that distance is shortened. If your floor level is slightly below ground, and the sill is placed slightly above ground level, your eye will meet the ground very close to the edge of the house. At this distance, you can see a blade of grass, a flower or an ant on a leaf – a much more intimate relationship with your surroundings than the conventional floor level. The diagrams below explores this and other relationships between levels.



GROUND LEVEL (wood floor structure)

- eye contact with the ground when seated or standing (through patio door)
- intimate view of surroundings
- continuity of floor level with exterior deck, breaks connection with ground

GROUND LEVEL (high window sill)

- eye contact with the ground is distanced by window sill height
- less intimate view of surroundings, dependent on window sill height
- no continuity between floor level & ground level

GROUND LEVEL plus one half level

- eye contact with ground is distanced by floor & window sill height
- no intimate view of ground level
- intimate view of surrounding trees, dependent on window sill height
- no continuity between floor level & ground level

Experiment with these different floor levels. Notice what rooms in different houses and other buildings feel like in relation to the ground. Also note the height of the windows and how that affects the feeling of the room - do you see more of the ground or the sky?

Greenhouses Gases Produced	
Province	[kg CO2 equivalent/kW·h]
Nova Scotia	0.76
New Brunswick	0.43
Prince Edward Island	1.12
Newfoundland	0.02
Quebec	0.01
Ontario	0.27
Manitoba	0.03
Saskatchewan	0.84
Alberta	0.91
British Columbia	0.02
Territories	0.26

GREENHOUSE GASES PRODUCED BY ELECTRICAL GENERATION ACROSS CANADA
Poissant et el. PV Electricity & Solar Resources Assessments. Natural Resources Canada. 2006.

Opposite Page:
TYPICAL HEATING SYSTEM SEASONAL EFFICIENCIES AND ENERGY SAVINGS
* COP = Coefficient of Performance, a measure of the heat delivered by a heat pump over the heating season per unit of electricity consumed.
** Base represents the energy consumed by a standard furnace.
Information from CANREN website www.canren.gc.ca/prod_serv/

Photos courtesy of Rob Dumont, Saskatchewan Research Council

Heating oil produces 0.07311 kg of CO_2-equivalent per megaJoule of energy used.
Natural Gas produces 0.04968 kg of CO_2-equivalent per megaJoule of energy used.
To determine the greenhouse gas emissions from your oil or natural gas heating system, you need to multiply the figures above by the efficiency of the system (ie, a 70% efficient furnace produces 0.07311 kg * 1.30 (or 0.095 kg) CO_2-equivalent per megaJoule of energy.

types of systems

CLOSED LOOP

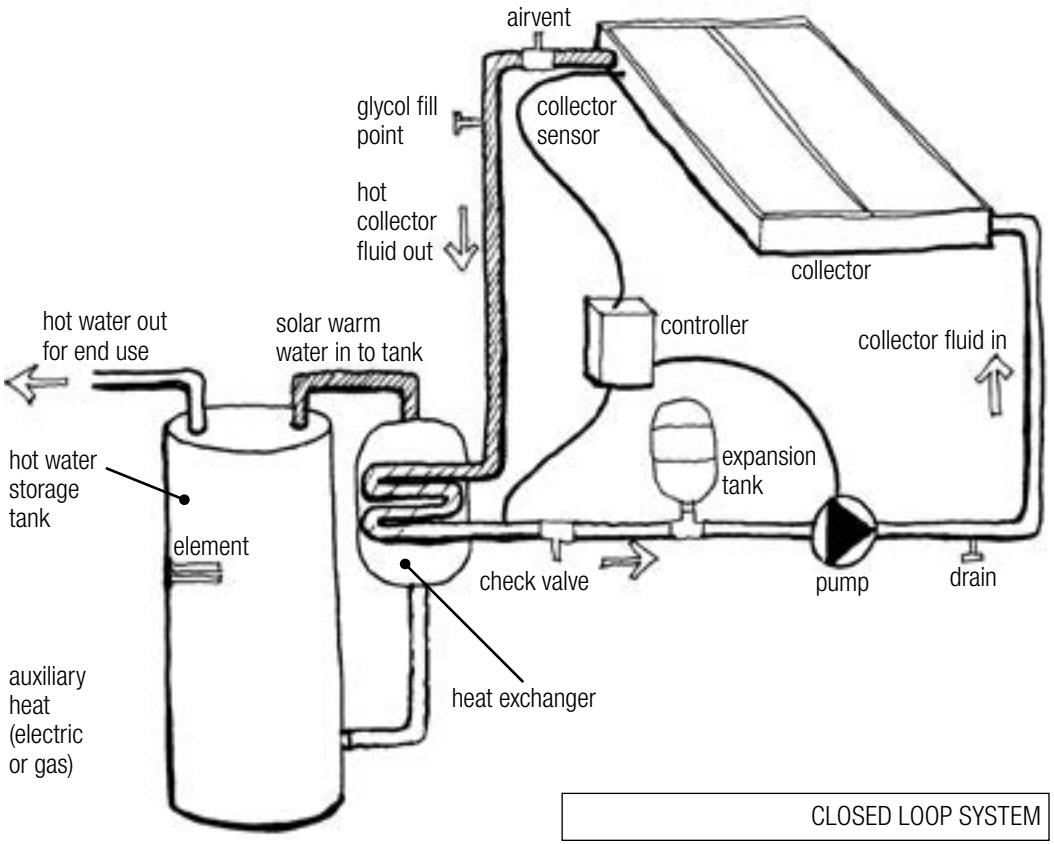
A closed loop system is best suited to cold climates, as there is less chance of damage to the collector system due to freezing. The collectors are connected to a heat exchanger by a loop of pipe. The heat exchanger is connected by another loop of pipe to a solar storage tank and a conventional hot water tank that acts as a backup system. The heat exchanger can be stand-alone or integrated into the solar storage tank. The rest of the plumbing and fixtures in the house are conventional, and require no special fittings. A small PV module can be added to power the heat exchanger pump.

Photo courtesy of Natural Resources Canada, Building Group.

Systems can include a storage tank with an integrated heat exchanger or a stand-alone heat exchanger. Some storage tanks are available with two and three integral heat exchange coils for multiple fuel sources.

This is a very good match, as the PV-powered pump only runs when the sun is shining – which happens to be the time that the SDHW system is working.

The collectors absorb heat from the sun, which is then absorbed by the heat transfer liquid that runs in the loop of pipe between the collectors and the heat exchanger. When the collectors become hotter than the water near the bottom of the solar storage tank, an automatic controller switches on a pump. The heat transfer liquid, usually a mixture of non-toxic glycol anti-freeze and water, is pumped from the collectors to the heat exchanger. The heat from the glycol solution is transferred from the heat exchanger to the water in the solar storage tank, then the glycol is pumped back up to the collectors to be heated again.



CLOSED LOOP SYSTEM

envirohome 2000

KENTVILLE, NOVA SCOTIA 2003

A FEW KEY FACTS

- *Heated Space: 176 m² (1900 sq.ft.)*
- *PV System: 24 panel rooftop array, BP Solar SX-75TU (polycrystalline)*
- *Wind Turbine: 1.0 kWp Whisper*
- *Inverter: Xantrex PB-SW4048 (sine wave)*
- *Net metering equipment: Time-of-Use meter*
- *Fuel Source Displaced: full-size oil space/water heating system & grid electricity (generation mix = 60% oil and coal)*
- *Approximate Savings: Annual purchased energy should be zero, depending on household lifestyle.*
- *Payback: No energy efficiency measures were taken without consideration of payback, house was built at similar cost to other conventionally-built homes in the area.*

Designer (or Engineering): Crowell Construction
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The Envirohome 2000 is a two-bedroom barrier-free bungalow built in rural Nova Scotia, featuring an integrated approach to efficient energy use that has resulted in several national and provincial awards for the builder.

Solar hot water panels provide a significant portion of the home's space and water heating needs. Back-up heating needs are met by a high-efficiency ground-source heat pump. The thermal energy generated by the decomposition of sewage in the septic tank is also used. A roof-mounted array of photovoltaic panels produces electricity, with excess electricity sold back to the utility company. Over the course of a year the home is expected to use almost no net purchased energy.

This house features:
Solar thermal space and water heating
Ground-source heat pump
Photovoltaics
Wind

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