Solar Energy in Canada

Solar energy can meet three distinct applications: **heating water, heating air,** and **generation of electricity** in any residential or commercial setting. In most cases, solar energy provides the lowest lifecycle cost, and the lowest environmental impact from the release of greenhouse gases (GHG).

Designing a Residential Solar DHW System

The sun's energy can be gathered in south-facing panels called 'solar collectors.' These collectors convert the energy in sunlight into heat. Throughout the day, a system controller compares the temperatures of the collectors with the temperature of an indoor fluid storage reservoir and, when there is enough warmth in the collectors, a circulating pump is activated to bring the heat transfer fluid from the collectors into the house.

Orientation is critical to the performance of your solar system, and collectors should face as close to south as possible and be tilted above the horizon to equal the latitude of your site. Other orientations are acceptable, but efficiency is lower if the collectors do not face south. You must ensure that collectors are never shaded by trees or buildings, and are firmly attached to their moorings to avoid damage to property or persons during high winds.

You have four choices for the location of your solar heater:
- Flush-mounted on the roof if it faces south and if its 'tilt angle' (angle above horizontal) is close to your latitude.
- Rack-mounted on the roof if the tilt angle is lower than your latitude. A rack is used to raise the top of the collectors using special brackets.
- Wall-mounted on a south-facing wall, where a rack is used to tilt the collectors out from the wall to achieve the desired tilt angle.
- Ground-mounted rack on the ground close to the house, where a rack provides the proper orientation and angle for the collectors.

Collectors can also be mounted on a variable-axis tracking device to provide automatic orientation of collectors toward the sun. There is an initial cost for this option, but the sun trackers will keep collectors facing directly at the sun throughout the day and, therefore, increase energy gain by the system.

Remember that the 'Magnetic North' of your compass is not true north. Owners should also consult with local municipalities on any by-laws which restrict height of collectors or other conditions relating to plumbing or electrical work.

What type of solar heating system is right for me?

A solar water heating system is designed to convert sunlight into heat, and to transfer that heat into your domestic water supply. Systems in Canada must withstand freezing temperatures and any damage to piping, and three system types can be considered:

- Drain-back systems do not require any antifreeze in the external collector piping, and use only water to collect the heat. Drainbacks use gravity to drain the collectors when the sun sets or the temperature drops below freezing.

- Closed loop systems use propylene glycol or similar fluid chemical in heat transfer fluid to avoid freezing. Glycol is less efficient at transferring heat than water, but it is infused with corrosion inhibitors to prolong the life of copper plumbing. Systems that use a fluid other than water must use 'double wall' plumbing in the heat exchanger so the potable water supply cannot be contaminated by the chemical fluid

if the piping ruptured. The life expectancy of propylene glycol will depend on operating temperatures of your system but, in general, it should be checked annually and replaced every three years.

- Integrated systems combine solar domestic water heating and solar space heating in the home, and circulate heated water through radiators or hydronic heating pipes to provide radiant floor heating. Other systems integrate solar with a home's forced air furnace, circulating solar heated water through a coil in the furnace plenum, like a heat pump.

The collectors are crucial components of a solar water heater, and two categories of collectors dominate the Canadian solar landscape.

- Flat plate glazed collector systems are well-insulated and produce hot water even on cold days when the sky is clear. Metal tubes are connected to black metal absorber fins or 'plates' and sealed into a sturdy metal case. The case is insulated and topped with a sheet of glass to concentrate the sun's energy. The collector transfers the sun's energy from the metal fins to the heat transfer fluid circulating through its tubes, and then to a heat exchanger, and on to a storage reservoir tank inside the home. Flat plate glazed collectors are highly efficient; the transfer fluid can reach a temperature of 60°C over outside temperatures.

- Evacuated tube collectors ('solar diodes') pass heat along their length in only one direction. Although more expensive, these collectors are more efficient and make use of the latent heat of vaporization of a liquid.

Other important solar design considerations:

- The appropriate collector area and reservoir capacity will depend on your hot water demand. A typical family with two children will require 6 square metres of collector area (ie: two 4x8' collectors) and 270 litres (60 gallons) of water storage capacity.

- Piping runs should be as short as possible and well insulated, to minimize heat loss from the fluid as it circulates between the collectors and the heat exchanger. Insulation should surround both the 'supply' and 'return' lines.

Author: Jeffrey Knapp

The **Canadian Solar Industries Association** (CanSIA), with assistance from **Natural Resources Canada**, has produced this series of bulletins to explain the feasible applications of solar energy in Canada. To demonstrate how you can put the sun to work for you, CanSIA has posted these bulletins on its internet homepage, with additional information on solar energy and a comprehensive directory of companies that are involved in the design, sale and installation of solar energy across Canada. Members of CanSIA comply with a Code of Ethics. Please go to **www.CanSIA.ca**, or contact our office:

2415 Holly Lane, Suite 250, Ottawa, ON K1V 7P2
(613) 736-9077 (fax) 736-8938 (email) info@CanSIA.ca