

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).

Solar Energy in Radiant Floor Heating

A clear trend is developing in consumer preferences toward the use of radiant floor heating, and solar systems are compatible with radiant floor systems for a number of reasons.

- the radiant floor system requires water temperatures in the same range that the solar system can generate. Hydronic baseboards and fan coil systems, by comparison, require water temperatures that are much higher than most solar systems can provide.

- both the solar system and the radiant floor systems are environmentally friendly due to the saving they provide in the consumption of fossil fuels. The solar system can directly offset a portion of the fuel required to heat the water for the radiant floor system by approximately 30% when compared to conventional forced air systems.

The solar components include:

- 1) Solar collectors, either flat plate copper tube or evacuated tube design;
- 2) A storage tank with multiple internal heat exchangers that allow the solar system to put heat into the tank and others which allow the radiant floor system to extract it;
- 3) A control package, which involves a number of sensors to monitor the temperature at the collectors and in the storage tank, to ensure the system transfers the maximum amount of heat from the collectors to the tank;
- 4) A backup heat source to carry the heating load when the solar system is not able to meet demand

The radiant floor system includes:

- 5) Radiant floor tubing, typically 16 mm (0.5") PEX

plastic which is integrated into the floor;

6) A distribution manifold, usually one per floor, which allows for separate zones in individual rooms;

7) A control package, including thermostats, zone valves and circulation pumps.

A solar / radiant floor combination system can be installed in any type of building or any type of construction, including slab on grade, suspended concrete slab or wood frame construction.

Installation of the radiant floor system in a wood frame building usually requires that a layer of lightweight thermal mass material be used to cover the tubing (such as Gypspan, Gypcrete, etc).

Solar heating system and radiant floor system can be retrofitted in existing buildings, although they are more easily installed during new construction. In both installations, the solar system requires a south-facing roof or wall for the solar collectors. Most systems require two 4x8' panels, with more required as the load increases. The panels cannot be shaded by trees or other buildings. The storage tank also requires space in the mechanical room.

The collectors must be connected to the solar storage tank or heat exchanger by copper supply and return lines. Finding a route for these lines in a home with a finished basement can be difficult.

The installation of a radiant floor system involves integration of the tubing into the floor structure of all areas to be serviced by the system. In new construction, the building design can be adjusted to accommodate. The design of some existing

buildings does not allow this type of installation.

The main heating load is during winter months, but the solar system must be sized so that high output levels during summer months do not create an excess of hot water. Designing a solar system based on winter output will create a surplus in summer, and consideration should be given to directing this excess supply to domestic hot water consumption or a swimming pool. If not, a solar system will provide 10 percent of hot water heating load in the building.

The cost of a typical solar system with two flat plate collectors, storage tank and control package would be \$5,800. Installation costs will vary depending on building construction and whether the installation is new or retrofit, but the range is \$1,200 to \$2,000.

The materials package for a radiant floor system includes the PEX tubing, distribution manifolds, circulation pumps and controls, which will cost \$2.50 to \$3.50 per square foot. Installations on wood frame construction require the application of a thermal mass cover, at a cost of \$3 per square foot. The cost of installing the radiant floor system will vary depending on the type of floor construction.

Some portion of both the solar and the radiant floor system can be installed by the homeowner, particularly the basic plumbing and roof work. The company that supplies materials can provide a pipe layout to show location of loops and manifolds.

A hydronic radiant floor system presents a number of advantages when used with cement slab construction. The first is the increased comfort level for occupants, since the floor is a heated surface. The second is the reduction in heating costs.

Installation of the radiant floor system in a cement slab is accomplished in two steps. The first is the installation of the radiant floor piping, where the manifolds are generally installed in the wall cavity of an interior wall, with a flash-mounted access door. The heating system design adjusts the spacing of the piping according to the heat loss in each area of the building. The pipe loops are a continuous run of tubing so there are no joints in the slab itself. They start at the supply manifold, cover a portion of the floor surface, and then return to the same point for connection to the return manifold.

The second step is to place the concrete. The cement crew must be careful not to rupture the piping by striking it with a shovel or other tool.

The completion of the radiant floor heating system requires the connection of the manifolds to the heat source. In most installations, the supply and return lines are enclosed in the walls. If the building has a riser design, these lines will have to be integrated into the slab as well.

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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:

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