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 Solar Air Heating System

Solar energy can be used effectively to heat fresh air for use in a building ventilation system, but the application can also be used for process drying of crops and in stationary combustion systems, both inside Canada and abroad.

New and fully-renovated buildings require fresh air to be distributed by means of a ventilation system. When the air temperature is below 18°C, it needs to be heated before it can be distributed throughout the building. The drying of crops, manure and textiles are all examples of process applications where fresh outdoor air is heated so that it can pick up more moisture from the object being dried. There are many types of stationary combustion systems, from residential natural gas water heaters to large coal-fired generating stations. Preheating the air used in a stationary combustion system, and even in a fuel cell, will increase its operating efficiency.

Solar energy can be used to pre-heat the air supply cost-effectively for these and other applications, thereby reducing conventional energy consumption and saving money, as well as reducing the greenhouse gas emissions that are linked with climate change and global warming.

Perforated-plate solar collectors are one of the most efficient and most cost-effective technologies for heating fresh air. A perforated-plate absorber is simply a metal siding with many evenly-spaced holes spread across its surface. The solar collector system is created by mounting the absorber away from a wall to create a plenum, or air gap, which is tied into the building's make-up air system.

The collector is heated when the sun shines on it. As outdoor air naturally moves over the collector, it is heated and then drawn through the collector's many holes, providing high annual efficiencies for solar collection (efficiencies of 72% have been documented in Canada). Another benefit is the recapture of much of the heat that would normally flow out the wall, but the plenum captures this warm air and provides an insulation effect that is equivalent to doubling the RSI-value of the existing wall.

(Solar air collectors should not be confused with a Trombe wall, which is a form of space heater. Perforated-plate solar collectors do not rely on storage of thermal energy and are considered by some people to be passive solar collectors because there are few or no moving parts.)

Building owners may be concerned about rain penetration through the perforated-plate collectors, but rain rarely gets into the wall or, if it does, it quickly evaporates. There are also questions about the system's effectiveness in freezing temperatures, but perforated-plate solar collectors are actually more efficient at converting solar energy to usable heat when it is cold outside. It is an air pre-heating system and a backup heating source is often required.

Some important considerations

- The first and most important requirement for a solar air heating system is a need for fresh air in your building or process. An old leaky home usually doesn't require ventilation because enough fresh air penetrates the walls.

There should be at least one section of wall where the perforated-plate solar collector can be installed, facing between southeast and southwest. East- and

west-facing walls may also be suitable, depending upon the application.

- Installations usually include as much wall area as is practical. Air-flow per wall area is an important consideration for installation so that the system has an appropriate trade-off between efficiency and air temperature rise.

- Perforated-plate solar collectors add additional load to a building, so the strength of the supporting wall should be confirmed. The method of attaching the system to the wall will also depend upon the makeup of the supporting wall.

- The solar collectors can either be ducted directly into a conventional air system or the solar system can have its own fan, controller, dampers and/or distribution system.

- Black is the most efficient colour for absorbing solar energy, although other dark colours (such as green, charcoal, dark brown and tile red) can be accommodated if you are willing to accept an efficiency decrease of 10%.

- Porosity of the absorber is defined as the total open area of all holes divided by the total area of the wall. Though porosity does not strongly affect the efficiency of the absorber, it is considered in a system design to ensure that the airflow through the wall is reasonably balanced.

During the summer, a solar air heating system can bypass warm outside air to enhance cooling in the building. The volume and temperature of air delivered by a perforated-plate solar collector can be limited by a temperature controller and bypass dampers.

In some applications, such as apartment buildings, it is necessary to bypass the heated fresh air on warm days. Warehouses, manufacturing, process drying and stationary combustion applications do not usually require such control because either the entire ventilation system is shut down during the cooling season (and doors are opened) or heated air is required year round.

If your building or application requires heated air, consider saving energy and money with a solar collector system.

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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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