includes 16 flat-plate and two 12-volt solar electric (photovoltaic) collectors. They are located on the south roof and are mounted at a 35° slope with an azimuth of 10° west of south. The two photovoltaic collectors supply power to the system's water pump. The panels are mounted on Unistrut channels lagged to the roof and sealed with silicone to prevent leaks. Extra trusses were installed to ensure that the roof could support the additional load of the solar panels. The glycol piping runs down to the basement through the roof and walls. A rubber boot was installed around the piping on the roof to prevent water leaks. The mechanical equipment is located in the basement next to the in-floor radiant heating equipment.

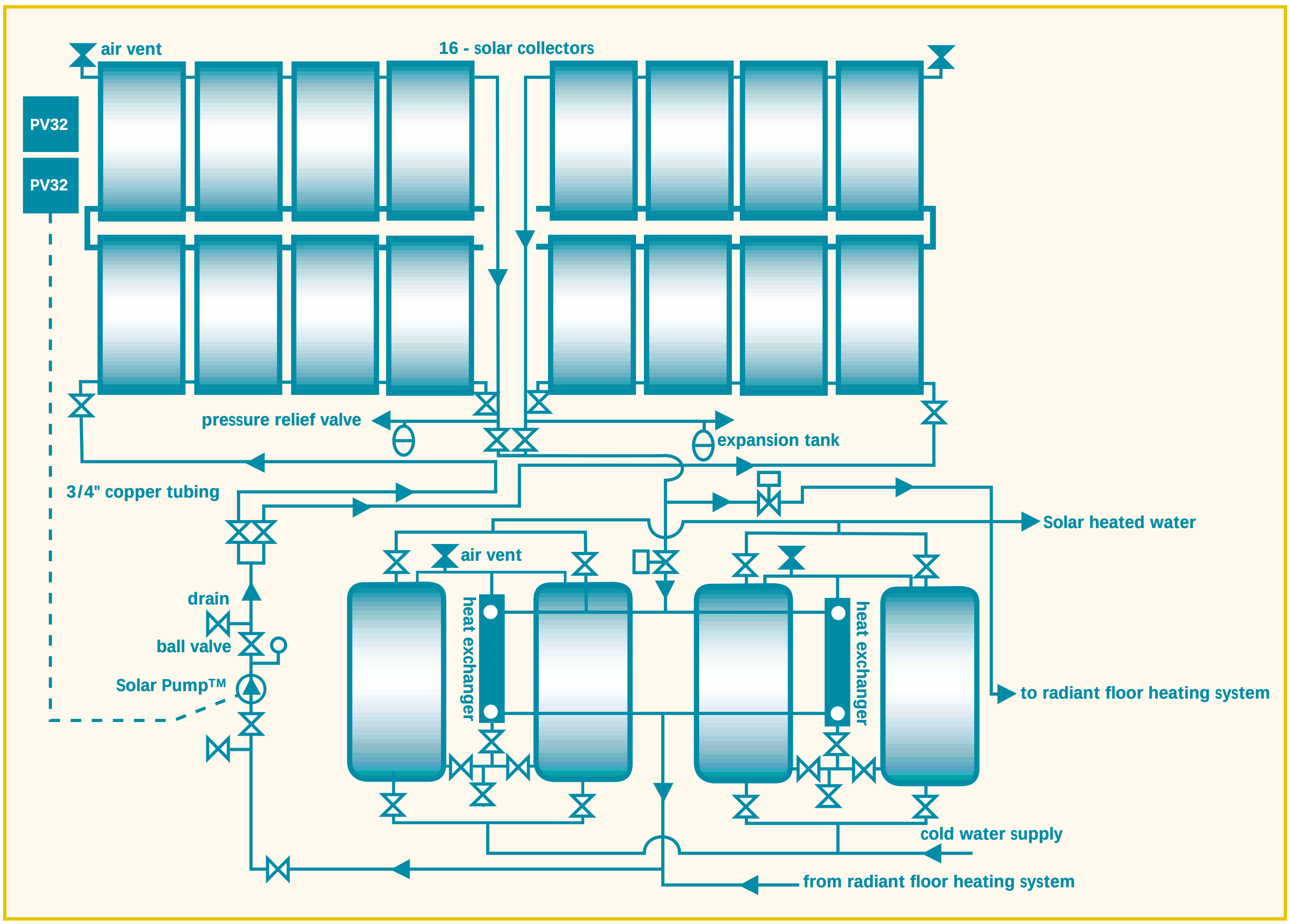
Diagram 1 shows the schematic of the solar hot water system. The system is designed to meet the domestic water heating needs of the complex first. The solar-heated water flows into four 455-litre tanks and is then fed through four 272-litre backup electric water heaters, connected in series (photo on page 3).

Any surplus solar-heated water is used to supplement the load of the in-floor radiant heating system. Water is fed into a 40-kilowatt electric boiler, which provides most of the inn's space heating, before flowing through the floor loop. After these needs have been met, any remaining energy is used to heat the domestic hot water tanks above their set-point.

The electrical code requires each electric water heater to have a fusible disconnect switch. This lets the owner shut off power to the tanks when they are not required, and thus manage demand to the complex.

The solar system is designed to displace 20 500 kilograms of carbon dioxide (CO_2) per year. The solar fraction (proportion of the load met by solar energy) for the domestic hot water is estimated to be 50 percent, based on an annual consumption of 468 cubic metres of water. The solar fraction for the space heating system is 25 percent, based on an annual electric heating load of 51 100 kilowatt hours (kWh). Because the system was installed only in 2000, operating data are not available.

Diagram 1 – Schematic diagram of the Chanterelle Inn's solar hot water system
Courtesy of Thermo Dynamics Ltd., Nova Scotia



The reduced solar capacity during the winter should not affect the overall performance during the prime season (April to October). Should more guests arrive in the winter, then Busch may have to investigate increasing the collectors' angle to 45° to reduce the snow cover. Usually, flat-plate solar collectors can clear themselves of snow once a small part of the glass is exposed to sunlight. Still, the 35° angle for the collectors is close to ideal for summer operations, so changing the angle is fundamentally an operating decision. Since Busch is concerned about the snow cover during much of the winter, she is examining the best way to keep the panels clear.

Owner Satisfaction

Busch is very satisfied with the installation and operation of her solar system. "The sound of the solar pumps operating, even on grey days, is lovely," she says.

Integrating a solar hot water system into the design of the facility during construction was a problem. However, SunRoss Energy Systems Ltd., the installer, made an extra effort to ensure that all trades understood the specifications of a building with this type of equipment.

Busch, when asked about planned maintenance, indicated that she "hadn't really thought about it." Most solar heating systems should have an annual scheduled maintenance, as it will affect the long-term performance and benefit of the system.

Project Cost

The total project cost was $36,700. With REDI's 25-percent contribution, the cost was reduced by approximately $9,100 for a net total of $27,600.

Operating and Maintenance Experience

The system is in its first year of operation. Busch has encountered no maintenance problems to date.

The solar collectors were partially covered with snow in January 2001, which is unusual for an average Nova Scotia winter. The snow cover made the collectors less effective, but this had few implications since the inn operates at minimal capacity during the winter, and only one of the four electric backup water heaters was being used.

Table 1

Technical Information, Solar Hot Water System
Chanterelle Inn, North River, Nova Scotia

Application:
Preheat Domestic Hot Water and Provide In-Floor Radiant Heat

System Type:
Liquid Closed-Loop

Collector Information

Type	Flat-plate, metal absorber
Number	16
Size	Total gross area: 47.5 m^2
Mounting Location	Rooftop
Slope	35.0°
Azimuth	10.0° west of south

Storage Information

Type	Water
Volume	1.82 m^3
Location	Basement
Loss Coefficient	10.8 watts/°C
Antifreeze	Glycol

Hot Water Data

Consumption	468 m^3/year
Total Annual Load	92 GJ (25 600 kWh)

Solar Contribution

Energy Displaced/Year	46 GJ (12 800 kWh)
Solar Fraction	50%
Type of Energy Displaced	Electric

Space-Heating Data

Total Annual Load	184 GJ (51 100 kWh)
Solar Contribution Energy Displaced/Year	46 GJ (12 800 kWh)
Solar Fraction	25%
Type of Energy Displaced	Electric

Cost of System

Total Without Incentive	$36,700
Total With Incentive	$27,600

O & M Costs	$100/year
Energy Savings	$2,660/year
Price of Electricity	$0.0959/kWh

Simple Payback Without Incentive (years)	13.9
Simple Payback With Incentive (years)	10.5

CO_2 Emission Factor	802 g/kWh
CO_2 Displacement	20 500 kg/yr

Project Contacts

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Case Study

Chanterelle Inn, Nova Scotia

Benefits from a commercial solar water heating system

Chanterelle Inn is a large country inn located in North River, Nova Scotia, approximately 50 kilometres north of Baddeck on the Cabot Trail. Although the inn operates year-round, most of the inn's guests, who come from around the world, visit during the spring, summer and fall.

The two-storey inn, shown in the photo with the Cape Breton Highlands in the background, was constructed in 2000. The wood-frame building measures 15 metres by 15 metres and has a full basement. It features eight suites on the upper floor, as well as a kitchen, a dining room, a lounge and another large suite on the main floor.

The building consumes no fossil fuels on site and depends upon solar energy with electricity backup for space and water heating. An in-floor radiant heating system also provides space heating for the inn.

The Solar Decision

Earlene Busch, owner of the inn, had three key environmental objectives in mind when she decided to construct the inn in 2000:

- The inn would provide a healthy environment for her guests, with no fossil fuels consumed on site.
- The inn would fit in with environmental concerns about the depletion of fossil fuels.
- The owner would consider power self-generation at the site in the future.

According to Busch, "Solar hot water seemed a natural fit with my three environmental objectives." One factor that helped her choose solar is Natural Resources Canada's Renewable Energy Deployment Initiative (REDI), which contributed 25 percent of the purchase and installation costs of the solar hot water system.

The System

Thermo Dynamics Ltd. of Dartmouth, Nova Scotia, designed and supplied the solar hot water system. SunRoss Energy Systems Ltd. of Port Hawkesbury, Nova Scotia, installed it.

Table 1 provides technical information and design parameters for the system, which