

Renewable Energy Case Study

Central Maintenance Garage – Solar Air Heating



Facility Profile

The Central Maintenance Garage located at 843 Eastern Avenue, is a City of Toronto facility that serves as a vehicle maintenance workshop and garage. It also houses a driver’s training school and related administrative offices and has a total building area of 7,887 m² (84,897 ft²). The building, which is over 40 years old, is essentially a single-storey flat roof structure with concrete walls and a steel frame.

The *pre-retrofit* conditions were as follows: the building was heated by a natural gas-fired system and there was no building automation system in place (see BAS Case Study). There was an existing situation of negative air pressure in the building and a large quantity of cold infiltration air estimated to be about 48,000 cfm entered through the building envelope. Since the perimeter walls consisted of 66 per cent single-pane glass, an additional load was placed on the steam unit heaters further adding to the heating load.

Solar Air Heating System Implementation

- Over 600 m² (6,450 ft²) of black-coloured perforated-plate collector was installed on the highly visible south-facing wall of the facility (facing Lakeshore Blvd) to provide solar heated ventilation air. (see Fact Sheet on next page for more detail information on the solar air heating system)
- The system supplements the existing natural gas-fired heating system. Fresh air is drawn through the tiny holes of the external solar collector and is warmed as it rises. A system of fans and ducts channels the pre-heated fresh air into the workshop area
- Energy Efficient Lighting – As part of this project, the exterior south wall lighting was replaced with more energy efficient lighting

Benefits of Solar Energy Wall Implementation

- Use of innovative, green, renewable, solar energy technology captures as much as 80 per cent of the available incident solar energy
- Due to the deficiency of air there was a negative pressure in the building and the introduction of solar heated air into the facility will balance and alleviate this situation
- Reduced consumption of natural gas leading to cost savings and green house gas reductions
- Improvement of indoor air quality with the introduction of more fresh air, worker comfort and productivity
- Recaptures lost heat from the old wall, which consists of mostly single pane glazing
- The SOLARWALL™ serves as new cladding and improves the building façade

Project Summary	
Project commencement:	Sep.2002
Total project cost (incl. grants):	\$189,000
Estimated cost avoidance:	\$30,000 /yr
Simple payback period:	6.3 years
Estimated natural gas savings:	85,000 m ³ /yr
Estimated renewable energy delivered:	879,000 kWh/yr
Estimated CO ₂ emission reduction:	160 tonnes/yr
Project Funding: City of Toronto, NRCan, TAF	

Solar energy wall heats maintenance garage

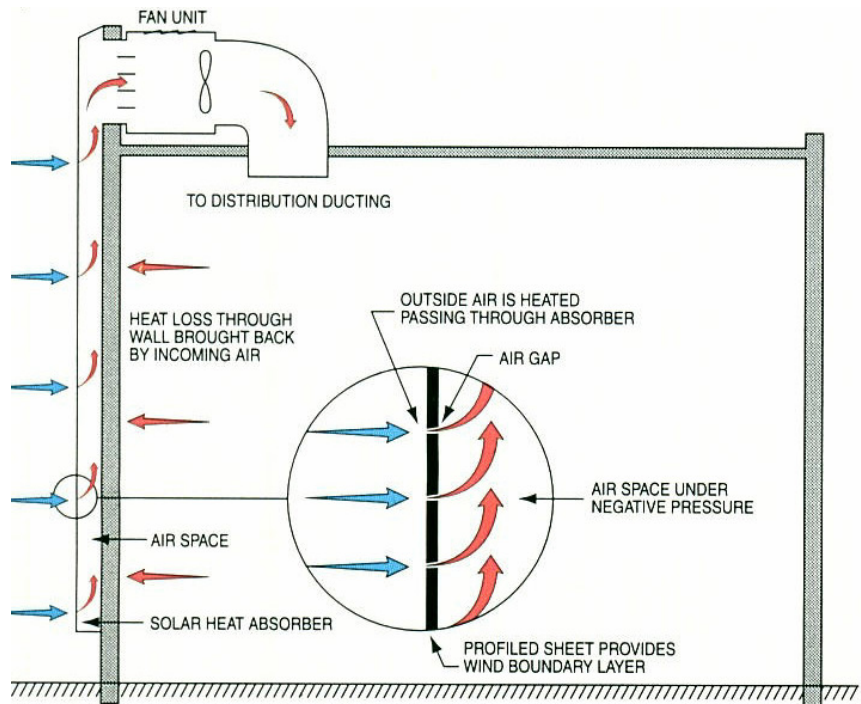
The City of Toronto uses a unique solar air heating technology for the first time at its Central Maintenance Garage at 843 Eastern Avenue. The garage is a single-storey, flat-roof facility and serves as a vehicle repair workshop. The building area is 7,887 square metres with concrete walls and a steel structure.

The SOLARWALL™ system utilizes metal cladding, installed on the south side of the garage, to provide economical and environmentally benign solar energy to the garage. Solar-heated ventilation air supplements the existing natural gas heating system. The result is a reduction in fossil fuel use and the associated greenhouse gas emissions by approximately 160 tonnes a year.

How it works

The SOLARWALL™ consists of over 600 square metres of a solar air heating perforated-plate collectors mounted on the south wall facing Lakeshore Boulevard (see photo). Ventilation fans draw in outside air, which then circulates through the collectors and is heated by the metal panels. The warm air passes through ducts to fans and warm, fresh air is distributed throughout the building.

The SOLARWALL™ will increase the R-values (thermal resistance) of the south wall and utilize any heat losses here to heat the incoming fresh air.



Improved indoor air quality

Before installation of the SOLARWALL™, there was negative pressure in the building. Negative pressure occurs when less air enters the building than is expelled. The deficiency of air is responsible for the negative air pressure. It is expected that the solar heated make-up air distribution by fans and ducts will balance the air pressure in the building and alleviate the negative air pressure. There will be an overall improvement in the indoor air quality of the facility.

Savings

The forecasted savings are approximately \$30,000 per year and 85,000 cubic metres of natural gas or equivalent to 879,000 kWh of renewable energy.

