Ottawa Community Housing Case Study

Solar Wall Uses Renewable Energy to Heat Building, Saving Natural Gas

PROPERTY

Built in 1973, Clementine Towers (figure 1) is a 17-storey, 258-unit residential rental apartment building, primarily occupied by seniors. The original cladding consisted of a brick veneer assembly with insulation and a drainage cavity. By 2011, the nearly 40-year-old original cladding was deteriorating, with loose mortar joints, corroding shelf angles and missing blocks, and required replacement. The building's south-facing wall provided approximately 8,500 square feet of wall space and is optimally oriented toward the sun.

Figure 1 Clementine Towers
(credit: OCH)

OPPORTUNITY

The brick cladding at Clementine Towers (1455 Clementine Ave.) required replacement to address deficiencies and deterioration. This offered an opportunity for Ottawa Community Housing (OCH) to install an innovative "solar wall" to preheat air supplied to its mechanical systems. The project reduced energy consumption and operating costs, while showcasing green building practices.

PROCESS

The cladding replacement project included an optional price to provide a solar wall cladding assembly on the south elevation. This enabled OCH to obtain competitive pricing for the solar wall in order to assess if the cost and benefits aligned. In the end, the project was financially feasible. OCH chose a system manufactured by a company with proven experience and expertise. Prior to the solar wall installation, all of the old brick was removed and any deficiencies in the concrete structure were fixed before a sealing membrane was applied.

HOW THE SOLAR WALL WORKS

The solar wall at Clementine Towers consists of a dark, perforated panel assembly with a six-inch plenum space over insulation directly installed on the structural wall. The cladding was installed in a similar manner to conventional panelized cladding assemblies.

The sun's radiant energy is absorbed and warms the building's south-facing, dark colored panels. Exterior air penetrates perforations in the cladding panels and, as it is warmed by the cladding, the air rises through the plenum space (cavity) behind the panels. The warm air rises to the top of the plenum space and is then directed to the rooftop makeup air unit (MAU). Typically, the MAU burns natural gas to heat cold outdoor air before delivering it into the building (figure 2). Having the air preheated by the passive solar plenum reduces the amount of heating required using natural gas, thereby saving energy.

The solar wall passive heating system provides the greatest potential for energy savings during the spring and fall seasons, when outdoor temperatures are neither too cold nor too hot. There are also significant energy saving benefits during the winter when the exterior air is cold and the cladding is exposed to the sun. When the exterior ambient temperature rises above 15°C, mechanical dampers in the solar wall supply ductwork are closed, preventing overheating of the building.

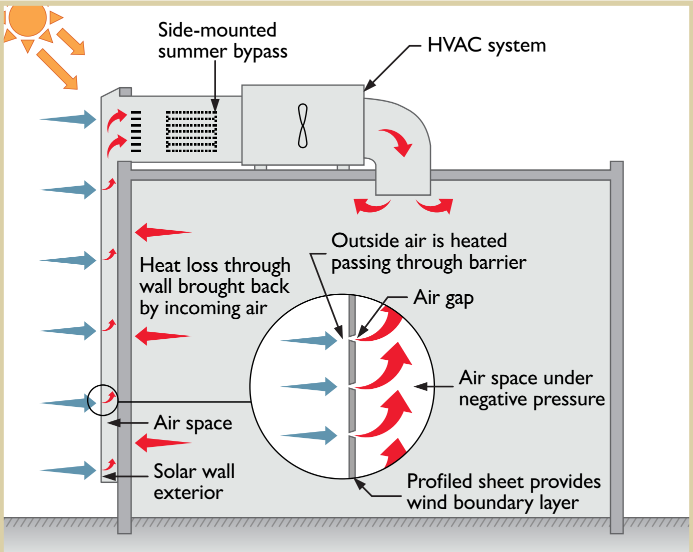

Figure 2 Solar wall with rooftop HVAC

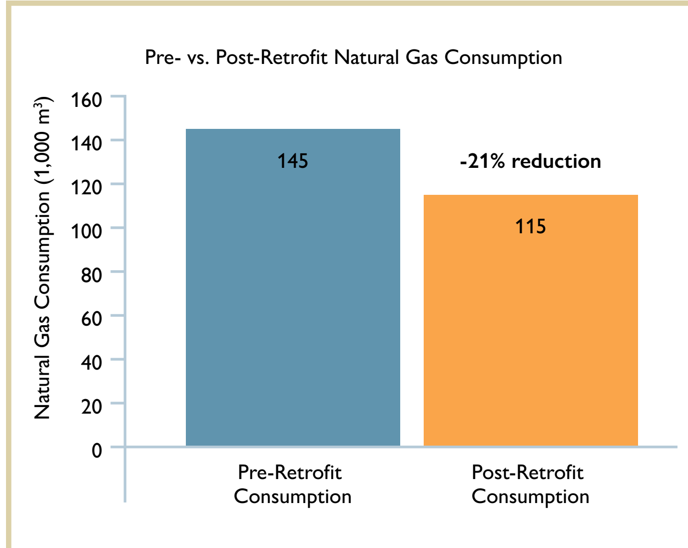

Figure 3 Pre- vs. post-retrofit natural gas consumption

RESULTS

In the 12 months prior to the solar wall retrofit, the building consumed approximately 145,000 cubic metres of natural gas per year,[1] some of which was used by the MAU to heat air in the common areas of the building. In the 12 months after the solar wall was installed, annual natural gas consumption decreased to 115,000 cubic metres per year, saving approximately 30,000 cubic metres of natural gas per year (figure 3).[2]

This represents a 21-per-cent reduction in natural gas consumption and estimated cost savings of approximately $11,000.[3]

These savings correspond exactly with estimates and performance modelling done using RETScreen during the design of the project.

LESSONS LEARNED

Installing the solar wall during the recladding project required approximately $100,000 in additional capital costs for the supplemental materials and engineering. This cost was offset entirely by a federal government grant supporting renewable energy initiatives in social housing. Without the grant, the solar wall would have paid for itself through natural gas cost savings in approximately 10 years.

During the retrofit, there was minimal tenant disruption because the retrofit took place on exterior building walls abutting a stairwell space. OCH presented information about the solar wall at a tenant meeting. Preliminary feedback indicates tenants see the solar wall as an improved esthetic feature of the building.

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[1] Based on September 1, 2010, to August 31, 2011, data, normalized for weather.

[2] Based on October 1, 2013, to September 30, 2014, data, normalized for weather.

[3] Cost savings were based on an average 2014 natural gas rate of $0.36/m^3.

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ALTERNATIVE TEXT AND DATA FOR FIGURES

Figure 3: Pre- vs. Post-Retrofit Natural Gas Consumption

	Natural Gas Consumption (1000m^3)
Pre-Retrofit Consumption	145
Post-Retrofit Consumption	115