

## FCM Sustainable Communities Awards 2012 Winner — Energy

City of Montréal, Quebec  
Population: 1,621,000

Montréal 



Exterior view of the Montréal Biodôme  
Credit: Maxime Harvey-Carrière

### *A Space for Life — Energy Efficiency Program*

#### Summary

The City of Montréal created the A Space for Life (Espace pour la vie) program as a way of using energy more efficiently for its Insectarium, Botanical Garden and Biodôme while at the same time ensuring a healthy and comfortable environment for the flora and fauna living there. As part of this sustainable development project, the city replaced obsolete systems for all three facilities with renewable energy sources such as geothermal and solar energy.

The results were impressive: the three museums reduced their annual energy consumption by 40 per cent and their greenhouse gas (GHG) emissions by 30 per cent; saving the city \$2 million.

#### Background

Located at the confluence of the St. Lawrence and Ottawa Rivers, the Island of Montréal covers 483 square kilometres. It is endowed with a number of green spaces, and its major urban parks take up six per cent of the island.

Home to over 1.5 million people, the city is divided into 19 boroughs and 15 suburban cities. It is governed by a city council composed of a mayor (also the mayor of the Borough of Ville-Marie) and 65 elected councillors. The city council, the primary decision-making body, is assisted by an executive committee made up of 11 members and the mayor, and a regional council as well as borough councils with local responsibilities.

In April 2005, the city administration took on its first strategic sustainable development plan. Members reconfirmed their commitment to it in 2007 and again in 2009 by developing a new plan. The city's goal was to reduce GHG emissions by 20 per cent from 2002 levels, and A Space for Life became part of this initiative. The project also offered a chance to educate the public about the importance of nature within the favourable environment offered by Montréal's three nature museums — the Insectarium, the Botanical Garden and the Biodôme.

#### Project Development and Implementation

At the beginning of the project, the city, instead of using a conventional model in which the plans and specifications are developed by professionals before work is carried out, decided to issue a call for tenders. The bidders — energy-efficiency companies — would propose a turnkey project offering every guarantee. The firm hired (Ecosystem) guaranteed the project cost, the projected savings, funding to be obtained, work to be completed and ensured the project's overall performance

(\$1 million per year), including its profitability. Ecosystem developed concept details as well as plans and specifications. The firm also validated the project's feasibility and oversaw the work, under the city's supervision.

Montréal used several tools to promote the project: press conferences, data sheets and presentations aimed at media, public posters and bilingual panels posted in the Biodôme, as well as a video on YouTube and the city's website. The city also organized visits to the museums' mechanical rooms in collaboration with the Association québécoise pour la maîtrise de l'énergie (AQME) and the American Society of Heating, Refrigerating and Air Conditioning Engineers. These visits were aimed at students — the future engineers and technicians in energy efficiency.

This project is based on geothermal energy; the energy used by all three museums is provided by heat gathered below ground. Both open and closed geothermal energy systems were used. At the Insectarium, two wells were drilled for two continuous 500-foot pipes to pump out or shed energy into the ground. In this closed geothermal system, the fluid running through the pipes is heated by the constant temperature of the earth (10 °C), before returning to the heat pump and then on to the rest of the building. This technology completely replaced the building's old electric baseboard heaters. The water table beneath the Biodôme made it possible to build one of the largest open geothermal systems in Canada. Only one well was needed with a capacity of 1,000 tonnes in order to make the project cost effective.

The Biodôme consists of four ecosystems: the warm tropical rainforest of South America; the cold sub-Antarctic Islands; and the Laurentian maple forest and the Gulf of St. Lawrence, both four-season climates. Before this project was undertaken, these four systems operated independently. Now they are linked together to allow for energy to be exchanged among them. For example, heat removed from the sub-Arctic ecosystem is transmitted to the tropical rainforest. The heating and cooling of the other sectors of the building, including offices, is also integrated into this exchange system to form a recovery loop that transfers energy and uses it where it is needed. The equilibrium in the recovery loop is maintained as long as the external temperature does not fall below 0 °C. When the heat transferred is insufficient, the geothermal system kicks in to compensate for the total heating needs and a good part of the cooling needs.

As part of A Space for Life, all the old equipment from the mechanical room at the Biodôme's sub-Antarctic world was replaced by four new heat pumps that are used to transfer energy between the different ecosystems to heat or cool them as needed.

The project also included systematically refurbishing the lighting so that it is better positioned, more efficient and consumes less energy. Remote ballasts last longer and are easier to service, and cut down on noise pollution — now birdsong can be heard throughout the Biodôme. And since the overall lighting efficiency of the three buildings has improved, energy consumption has decreased by 45 per cent.

The environmental results were compared to data gathered for over 10 years, which gives a fairly accurate picture of GHG emissions before the project. As part of the follow-up, the project's performance will be evaluated for at least five years.

The project was financed with subsidies totalling \$1.6 million and an \$8 million loan from the City of Montréal. The loan is being repaid through the annual energy savings. Furthermore, obsolete equipment was replaced with the same budget as the project, which made for major savings.

This initiative – chosen as a finalist by AQME – has been highly popular among other institutions and municipalites already aware of the costs involved in such a project, especially those involving geothermal energy. Representatives from hospitals, universities, the Government of Quebec and others have come to see the installations.

## Results

- Once the project was up and running, GHG emissions decreased by 30 per cent, the equivalent of taking 766 vehicles, each travelling 15,000 kilometres per year, off the road.
- Natural gas consumption was reduced 21 per cent, chilled water by 100 per cent, steam by 100 per cent and electricity by 13 per cent.
- Overall energy consumption decreased 40 per cent, dropping from 246,522 GJ to 146,541 GJ last year.
- Since project completion, energy costs have been reduced 37 per cent.
- By modernizing all heating, ventilation and lighting systems, the lifecycle has been prolonged for all three facilities.

## Lessons Learned

- **START WITH A GOOD PLAN.** The objectives of Montréal’s sustainable development plan, combined with political will, played a major role in the success of this initiative.
- **WORK WITH EXPERTS IN THE FIELD.** Energy service companies (ESCO) offer a pool of efficiency experts with specialists in every field. They are well positioned to provide accurate evaluations and to find the best qualified contractors. “Turning to an ESCo after a call for tenders for a turnkey project delivered good ideas and helped us complete the project quickly, with a minimum of management. This makes procedures a lot shorter, and the city no doubt saved a lot over a few years, thanks to the guarantees provided by the firm it went with,” said Jean Bouvrette, head of the City of Montréal’s Technical services department.
- **DOLLARS AND SENSE.** “This project model, which does not require direct financing, can be realized even by small municipalities with limited resources,” he added. “In addition, they can replace their obsolete equipment without assuming a heavy debt load.”

## Related and Future Initiatives

The A Space for Life team expects to repay the loan from the city in 5.33 years. After the debt is paid, ongoing savings will be reinvested in other sustainable development projects at the three museums. Two projects are already under consideration: replacing obsolete equipment in the Botanical Garden, which will significantly reduce greenhouse gas emissions; and reducing water consumption in all three facilities by using rainwater for watering plants. The team has several other ideas in mind and will consider implementing them over the next six years.

## Partners and Collaboration

This project is the work of A Space for Life Technical Services, a City of Montréal initiative. Ecosystem developed the plans and specifications, made the grant applications, carried out all the work, and will also conduct the project follow-up and prepare the annual report.

## Contact

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