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Tour Aimia/Altoria: A mixed-use complex with a unique design

A modern mixed-use complex that opened in June 2014, the Tour Aimia/Altoria includes both commercial and residential areas, each taking up several floors. Elegant, and with a mostly glass exterior, the tower also boasts the energy efficiency of a LEED project. The commercial portion of the tower obtained LEED Canada NE Gold certification, while the residential portion qualified for LEED Canada NC Silver certification. The project ranked third in Category VI –Residential buildings – in the prestigious international **ASHRAE Technology Award 2015**.

A building with many energy challenges

The project called for the design of a 35-storey tower, totalling 48,588 m^2, of which 21,368 m^2 was intended as office space, occupying 10 floors. The residential portion occupied the 25 upper floors. A 5-storey underground garage completed the building.

From the outset, the mechanical design engineers faced some major challenges: how to obtain LEED certification for each portion of a glass curtain wall building in Montréal, where heating degree-days total about 8,000°F a year?

A vision of the whole was needed to combine the comfort of the occupants with the energy efficiency of the complex. To successfully address local issues, it was necessary to think globally. The following approach was therefore proposed to the client.

Lobby

Interdependent energy zones

In a mixed-use residential/commercial project of this kind, synergies had to be optimized between office space that gives off heat (exothermic) and residential space that has 24/7 energy needs.

To do so, hybrid heat pumps, shared between the condos and the office space, recovered the heat exhausted from some parts of the building and returned it to the sectors that needed it.

The energy recovered from the toilets, dryers and other sources was used to heat:

- the perimeter of the office space;
- the thermal water loop for the condos;
- the preheating of domestic hot water;
- the outdoor pool (from May to October);
- the garage.

The surplus energy was stored directly in the ground using a geothermal system with 15 vertical 152 m wells, adding a further challenge by creating a geothermal network in downtown Montréal, where the footprint is severely limited.

When all energy needs have been met and the ground is saturated, any surplus heat is then exhausted through an outdoor chilling tower. When demand during heating periods exceeds the energy recovered, the deficiency is met first by the energy stored underground. Then, when demand exceeds the geothermal system (usually when the temperature is below -5°C), two natural gas condensing boilers meet the building's needs.

Lastly, the design of the Tour Aimia/Altoria meets ASHRAE Standards 62.1-2010 and 55.2010. The fresh air supply for the building is either preheated by the excess from the aluminum regenerative heat recovery system, or from the thermal loop with its active heat recovery. The nominal recovery rating is 89%, making it a very efficient system. As well, the demand for fresh air in the garage is modulated to maintain a low level of CO.

A very high-level of energy efficiency

The optimized design has allowed reaching the energy efficiency level targeted by the overall operational concept for the building (Table 1), namely 42% and 35% respectively in energy savings that will be achieved at maturity in the office and condo portions compared with a typical building. From a savings point of view, this corresponds, respectively, to a 30% and a-38% reduction in the energy bill.

TABLE 1: PROJECTIONS OF ENERGY EFFICIENCY AND SAVINGS FROM THE TWO PORTIONS OF THE TOWER

		Proposed building		Reference building		Savings (in %)	
		Energy (MJ)	Costs ($)	Energy (MJ)	Costs ($)	Energy (MJ)	Costs ($)
OFFICE TOWER	Electricity	10,075,679	241,283	12,518,028	292,796	20%	18%
	Natural gas	1,286,852	14,947	6,948,282	73,211	81%	80%
	TOTAL	**11,362,531**	**256,230**	**19,466,310**	**366,007**	**42%**	**30%**
CONDO TOWER	Electricity	7,274,928	141,491	11,087,478	223,902	34%	37%
	Natural gas	2,077,722	24,188	3,238,072	42,159	36%	43%
	TOTAL	**9,352,650**	**165,679**	**14,325,550**	**266,061**	**35%**	**38%**

On the international scene, there are many building construction projects that rely on imagination to increase both comfort and energy efficiency. The Tour Aimia/Altoria might be described as a city within a city, an innovative project that shows how to exploit all the energy aspects of a building to provide impressive operational flexibility.

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