USING A NETWORK OF HEAT PUMPS

BACKGROUND

Reference conditions

The current reference arena does not use heat pumps. A portion of the heat energy contained in the refrigeration compressor discharge superheated gas is recovered to produce domestic hot water and for space heating in the stands. To maximize heat recovery, the refrigeration condensing temperature is maintained above 40°C, which reduces the refrigeration system capacity and increases its energy consumption. This condensing temperature is maintained even when heating demand decreases. The areas around the rink, such as the main entrance, offices and locker rooms, do not use any recovered heat from the refrigeration system.

Proposed improvements

To reduce energy consumption:

- Use a refrigeration condensing system that utilizes a secondary coolant, which is utilized as a heat supply for a network of heat pumps. This will provide thermal energy for space heating of the stands, offices, locker rooms and other areas; preheating domestic hot water, and preheating the water for the ice resurfacing machine.

BENEFITS

Direct impacts

- Heat pumps allow refrigeration system operation at 24°C condensing temperature, thereby increasing the system capacity by more than 10%.
- The refrigeration system energy consumption falls by 170,000 kWh/yr (-25%).
- The network of heat pumps will satisfy the heating demand of all arena spaces, when the refrigeration system is in operation.
- The heat provided by using an electricity driven network of heating pumps replaces all other types of energy supply for space heating.
- The total energy consumption of the arena is reduced by 360,000 kWh (-27%).

Indirect impact

- The lower refrigeration system condensing temperature will extend the life of the compressors.
- The use of heat pumps may increase the arena's electricity demand.

REFRIGERATION SPECIALIST'S REMARKS

Integration of the refrigeration system with a heat pump network reduces total energy consumption by more than 27 % compared to the reference arena. This major reduction in energy consumption results from the recovery of refrigeration heat from condensation to meet the heating needs of the stands and other arena spaces. The use of an evaporative fluid cooler for rejection of excess energy can further reduce the refrigeration system energy consumption while maintaining heat recovery.

ARENA'S ANNUAL GREENHOUSE GAS (GHG) EMISSIONS

	Total emissions* Tonnes CO_2-eq./yr
Arena with a heat pump network	*166 (-40%)*
Reference arena	*278 (Ref.)*

NOTE* Calculations of GHG emissions include electricity, fossil-fuel energy and refrigerant leaks.

NOTE: Energy consumption and energy savings were estimated on the basis of Montréal's 1996 climatic profile. Readers may refer to the technical fact sheet "Reference Arena".

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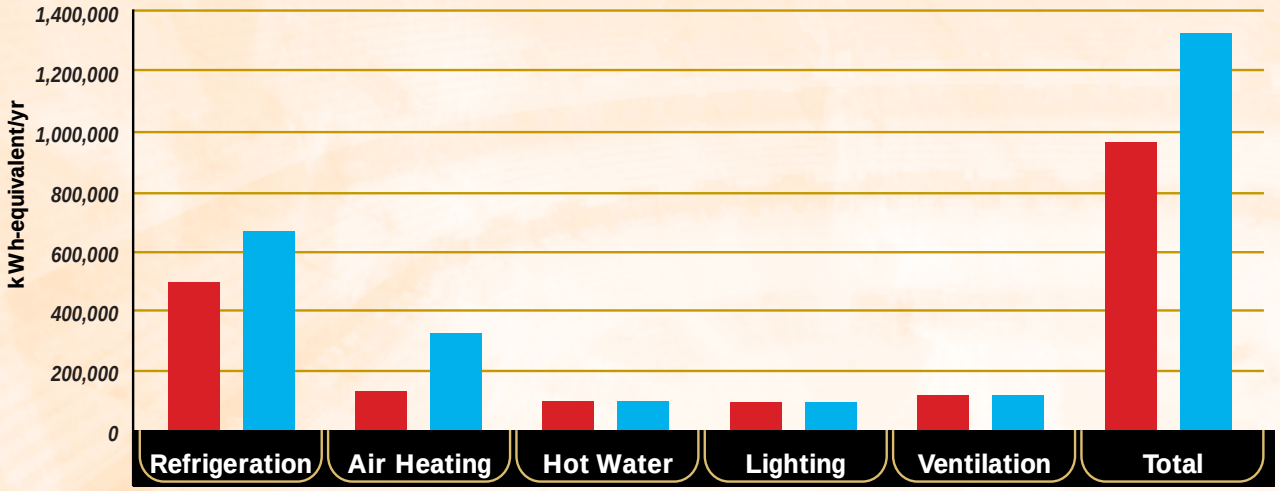
The original version of this fact sheet (in French) may be downloaded from the website:
http://cetc-varennes.nrcan.gc.ca/fr/publication/2003-066-7f.html.

Arena's Energy Consumption



	Refrigeration	Air Heating	Hot Water	Lighting	Ventilation	Total
Heat Pump Network	501,000 (-25%)	136,000 (-25%)	105,000	102,000	124,000	968,000 (-27%)
Reference Arena	670,000 (Ref.)	330,000 (Ref.)	105,000	102,000	124,000	1,331,000 (Ref.)

Figure 1

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