OPTIMIZING REFRIGERATION CONDENSING TEMPERATURE

BACKGROUND

Reference conditions

Air-cooled refrigeration systems use pressure controllers to maintain refrigeration-condensing temperature at or above 35°C regardless of the outside air temperature.
The main purpose of maintaining the condensing temperature higher than 35°C is to ensure that the refrigeration system will start-up reliably in cold weather and to ensure good heat recovery for space heating needs.

Proposed improvements

To reduce energy consumption:

- Install a cooling system that will vary the refrigeration condensing temperature according to outside temperature and space heating demand.
- Ensure that waste heat exchangers have high thermodynamic efficiency (at least 75%).

BENEFITS

Direct impacts

If the system is run at a 24°C condensation temperature:

- The refrigeration system capacity increases by more than 10%.
- Its energy consumption falls by 170,000 kWh/yr (-25%).
- However, lowering the condensation temperature does reduce the heat recovery performance.

Indirect impact

- A moderate refrigeration system condensing temperature will extend the refrigeration compressor life and reduce the opportunity for refrigerant leaks for open type refrigeration system.

REFRIGERATION SPECIALIST'S REMARKS

Figure 2 (over) indicates the effect of the refrigeration condensing temperature on the energy consumption for heating the stands, the refrigeration system and the combination of both applications. The refrigeration system's consumption increases with an increase of the condensing temperature; whereas energy consumption for heating decreases because of energy recovery. However, for condensing temperatures between 24° and 27°C, the total energy consumption of the two is minimized. This concludes that for the reference arena the maximum total energy efficiency is not necessarily achieved at conditions that produce the greatest heat recovery, or at the lowest condensing temperature. While the methods described appear simple, the services of a skilled refrigeration specialist are required to ensure that the refrigeration system performs well and reliably.

ARENA'S ANNUAL GREENHOUSE GAS (GHG) EMISSIONS

	Total emissions* Tonnes CO_2-eq./yr
Variable condensation temperature	*249 (-11%)*
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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http://cetc-varennes.nrcan.gc.ca/fr/publication/2003-066-3f.html.

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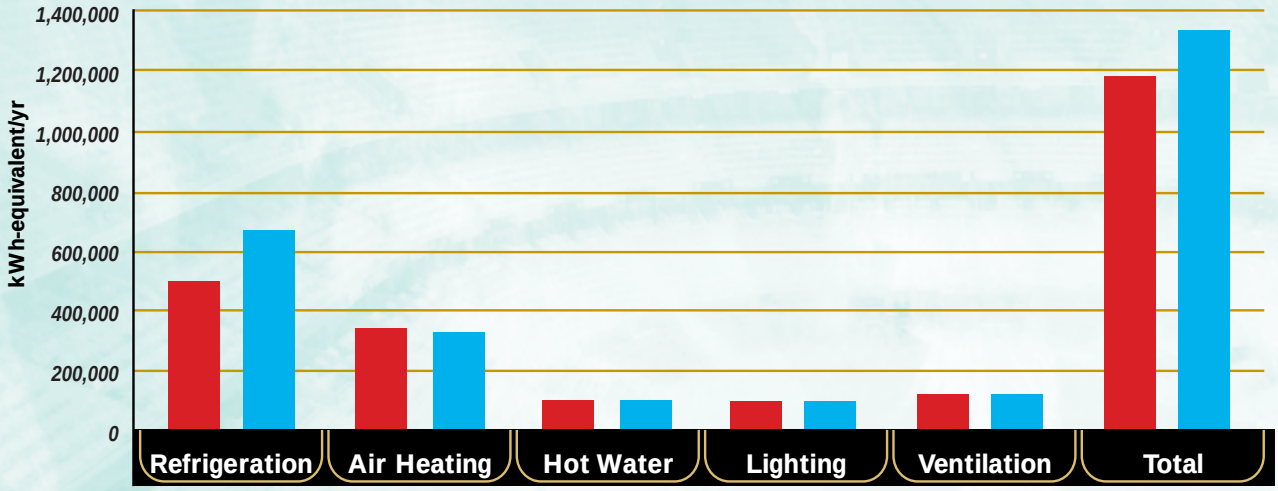
Arena's Energy Consumption



Condensation T°: 24°C	501,136 (-25%)	346,000 (5%)	105,000	102,000	124,000	1,178,136 (-11%)
Reference Arena	670,000 (Ref.)	330,000 (Ref.)	105,000	102,000	124,000	1,331,000 (Réf.)

Figure 1

Impact of the condensing temperature on the heating and refrigeration loads

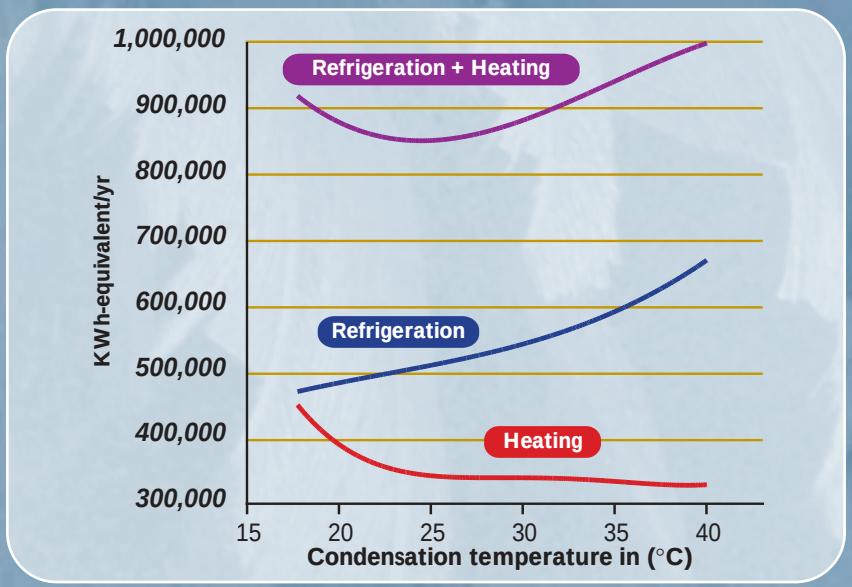


Figure 2

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