# Energy Efficient Arenas: It's in our Power

*Electricity is an increasingly expensive commodity; quickly outstripping a facility's other operating costs including that of machinery. The cost of electricity to run a typical industrial motor for at least 4,000 hours per year (approximately 11 hours/day year-round or 16 hours/day for 8 months) is about ten times the motor's original purchase price.*

*Proper maintenance and operation of the refrigeration equipment will result in energy conservation and reduced maintenance costs. Equipment that is not operating as long will last longer.*

With another artificial ice season underway soon ORFA members are encouraged to review their energy consumption and work towards operational efficiencies and lowering costs. Many of the ice-in procedures for our industry were developed at a time when electrical costs were not an issue and some inefficient practices have been passed along to the next generation of ice makers. Updating your operational practices will save energy and help to provide optimal ice quality.

Facility energy management requires firm commitment by all facility staff. The next few pages are a collection of known facility energy inefficiencies. It should not be perceived as a complete list of energy management techniques but rather a list of pressure points that can be addressed by most operations with little financial investment. Prior to this year's arena start-up review the following industry best practices to improve your operations.

- **Building Envelope** - Maintaining the integrity of the building envelope is one of the first steps to energy management and can be a major factor in energy efficiency. Roofs, walls, insulation, windows and doors require careful inspection to ensure the cold stays in and the heat stays out. Controlling air leakage is important because it affects the performance of the building in many different ways. For example, if you install extra insulation without first stopping all leaks it is likely to start or increase a problem of moisture accumulation in the walls and ceiling resulting in poor insulation values, decay and/or mould.

- **HVAC/R Systems** - The mechanical equipment is vital to the effective operation of your facility. Each piece of equipment should be properly maintained to ensure peak working condition. *Water flow* – condenser spray nozzles must all be working properly with leaks being repaired during the warm weather months. *Electrical panels* - must be cleaned by a licensed electrician ensuring that all connections are tight. *Mechanical failure during the start-up usually means a double hit on your energy bill as the ice may not be thick enough to hold the bond.* A lost bond means a complete start over with lost revenues and increased operational costs. Contact your refrigeration contractor to ensure you meet the **minimum** requirements of the **Operating Engineer Regulation** [more…] http://www.orfa.com/resources/TSSA%20Interview%20on%20the%20OER%20FINAL.pdf Ultimately, it is your responsibility to develop and maintain a comprehensive maintenance plan for the system.

**Planned maintenance** - The operation of mechanical systems and equipment is ultimately what uses energy. The following are energy-saving suggestions on the operation of heating and ventilation systems.
• Shut off exhaust systems during unoccupied times
• Shut off ventilation systems during unoccupied times
• Shut off spectator area heaters when there are no spectators; turn them on for games and off during practices or other times of low occupancy (heater policies



The Ontario Recreation Facilities Association T. 416-426-7062 F.416-426-7385

that guide staff on their use are vital operational tools)
• Set back heating thermostats during unoccupied times
• Set cooling thermostats as high as possible during unoccupied hours
• Install low flow shower heads to save domestic hot water and heating costs
• Insulate hot and cold water lines, as well as domestic hot water tanks, to prevent heat loss
• Insulate water lines running in unheated areas
• Provide timed shut-off shower heads to eliminate the possibility of leaving showers running, which wastes water and heat energy; infrared sensors for starting and stopping showers are also gaining popularity
• Keep room temperatures at a reasonable level; excessive room temperatures add to heat loss and energy consumption
• Set back boiler water temperatures in mild weather. Excess heat loss from pipes can cause ventilation rates to increase unnecessarily. Boilers may short cycle and wear out prematurely.

- **Paint the Ice** -Paint the ice with professional ice paint designed to be thermally conductive to reduce energy consumption and improve lighting quality. Ice paint reflects heat away from the ice sheet reducing the need for refrigeration operations.

- **Brine as a Secondary Refrigerant** – Make sure your secondary refrigerant is maintained at the proper level and recommended strength of 1.2 specific gravity with a freezing point of -10F to -15F (-23.3 to -26.1C) Too low and the equipment will need to work harder and longer to get the job done; too strong brine will increase brine horsepower requirements or reduce brine flow thus reducing the heat transfer capability of the system driving energy use up. It is recommended to maintain the brine pH level between 8.5 and 9.5. Consider insulating the brine storage tanks to reduce cooling losses and heating costs in the compressor room. Header trenches should also be insulated if ice is maintained during the spring and fall seasons.

- **Pre- Cool the Building** - If your facility has a dehumidification or air conditioning system it is recommended that you utilize these systems to lower the internal ambient air temperature before starting the plant. These systems consume less energy than the refrigeration equipment.

- **Close the Surface Doors and Keep the Lights Off** - After plant start up keep arena dasherboard doors closed. Keep surface lights off using only perimeter lighting. By keeping the cold air in the bowl and the warm air out will help to reduce refrigeration plant run time.

- **Control Lighting** - Uncontrolled lighting wastes energy and money. The first step in controlling lighting is manual switching by someone responsible for turning lights on or off as required by the facility user schedule. Replace inefficient lighting with high efficiency luminaires.

- **Check Your Demand** - Most ice arenas are identified as commercial general service users by their electrical utility supplier and are charged for two (2) basic forms of electrical service - *electrical consumption in kWh* and *electrical demand in peak kW* used calculations. The electrical demand is like the speed at which the electricity is used while the electrical energy demand charge is the total distance that the vehicle is driven. Demand is typically paid over a set period usually monthly. Buildings that are dormant for most of the month and then start putting in ice near the end of the month will significantly drive the demand calculation equipment up thus having the "demand charges" paid for the entire month. This can amount to thousands of dollars in additional charges for electricity that is not used. Work with your electrical supplier to better understand this charge and how you can reduce these costs throughout your operations.


- **Perform Ice-in Activities When the Sun Goes Down -** Heat from the sun has a significant impact on the internal ambient air temperature of the building therefore increasing refrigeration plant demand. Consider scheduling ice-in activities in the later part of the day after the sun has goes down. It will reduce energy consumption, put less stress on the HVAC-R equipment and speed up ice-in procedures.

- **Water Systems**
  - Water heaters - flush and drain the hot water storage tanks once a year to remove scale deposits (or more often in areas with very hard water.)
  - Periodically replacing the anode rods in tank will extend the life of water heaters. Check every 3-4 years or more often if water is very hard/soft. Anodes are available from plumbing supply stores.
  - Consider the benefits of a tankless water heater. In a tankless system hot water is only produced when it is being used. When the need is no longer there the units shut off and stop producing hot water.

- **Check Your Water Temperatures -** Check your flood water tank temperatures to make certain it does not exceed the recommended 140-160 degree F (60 -71C) for the water. Did you know that if you are operating water temperatures over 180 degrees and you reduce the floodwater temperature by 20% to 140-160F a 2.5% reduction in refrigeration load can be achieved? Consider the benefits of using reclaimed heat to heat resurfacing water.

- **Arena Start-up Date -** Many arenas begin their ice-in activities in late August or early September at a time when energy demand is at its peak. When setting up your annual ice-in schedule contact your local energy provider so that you may clearly appreciate the impact that your annual ice-in activities have upon the electrical grid.

- **Install Floating Head Pressure Controls - Trained refrigeration staff may be in a position to make slight adjustments to the refrigeration plant controls in response to internal and external conditions.** Floating head pressure controls adjust condensing temperatures in the refrigeration system in response to varying outdoor temperatures. These controls allow the head pressure to vary depending on the outside air conditions. Floating the pressure to reflect actual conditions reduces the operating pressure of the compressor and saves energy. When head pressure floats, the evaporative condenser fan operates continuously instead of cycling on and off. Although this consumes more condenser fan energy, it is more than compensated by the much larger decrease in compressor energy use. In addition, eliminating fan starts and stops can prolong fan belt and motor life. Since floating head pressure reduces compressor operating pressure ratios, it greatly reduces wear on compressor parts. [If unfamiliar with this type of adjustment consult with a refrigeration expert familiar with floating head pressure prior to attempting such changes.]

**Optimize Ice Thickness** - The thickness of the ice and the concrete slab beneath it are critical factors in refrigeration efficiency. Both the ice and the concrete act as insulators, resisting the transfer of heat to the refrigeration system. Excessive ice thickness will increase compressor load and energy costs. The thicker the ice and concrete, the harder it is for the refrigeration system to maintain a desired ice surface temperature. The amount of energy required to maintain ice surface temperature for each additional 1 inch (25.4 mm) of ice is approximately 10,000 kWh/yr. Vigorous skating during a typical hockey practice will damage ice that is too thin. It will also require more resurfacings. On the other hand, thick ice is inefficient because it increases the energy requirements of the refrigeration system. *Most rink facilities maintain ice thickness of between 1" to 11/2" (25.4 mm to 38.1 mm) considered to be an industry accepted standard.*

**Energy Consumption**

**Ontario's recreation facilities are high energy users – let's make every effort possible to reduce our carbon imprint.**

Your local electrical supplier can assist in determining the daily energy profile of your facility and further identify what is contributing to peak demand charges by:
• monitoring the facility's electrical demand,
• explaining the impact of power demand charges on the total billing, and
• determining what equipment is creating the peak demand.

Facility operators can then implement one or more of the following changes to reduce heat load and energy consumption,
• Install low-emissivity ceilings to reduce refrigeration and lighting loads and to allow compressors to operate at a higher saturated suction temperature.
• Reclaim refrigerant superheat to preheat shower water, heat ice resurfacing water, melt ice shavings, heat the subfloor, etc.
• Insulate the subfloor and header piping.
• Control temperature and humidity in the arena to reduce sensible and latent heat gain to the ice.
• Install high-efficiency luminaries.
• Use demineralized or very-low-mineral-content water for ice and resurfacing.
• Do not operate the underfloor heating system more than necessary to prevent frost formation.
• Maintain the secondary coolant temperature no lower than necessary to maintain the desired ice quality.
• Maintain high suction pressure and low discharge pressure.
• Reschedule operations to avoid running equipment at the same time, including "overlooked" demand contributors such as kitchen equipment, coffee makers, computers, printers and office lights.
• Install automatic timers to ensure staggered operation of equipment.
• Replace older inefficient motors with new high efficiency motors that use less energy at the same horsepower rating and load.
• Install programmable electronic load controllers to "load shed" – shut down non-essential or deferrable equipment if the total kilowatt load exceeds a set amount and "load cycle" – control the operating time and duration of operation of each piece of equipment. Refrigeration and dehumidification equipment are good candidates to participate in this form of power demand optimization.
• Shut off exhaust systems during unoccupied times
• Shut off ventilation systems during unoccupied times
• Shut off spectator area heaters when there are no spectators; turn them on for games and off during practices and other low occupancy times. Set back heating thermostats during unoccupied times
• Employ hot and cold storage systems as a cost effective way to reduce equipment operation without penalizing the supply of services in the

facility. This option is of great interest in areas where demand charges are costly.

- Provide timed shower heads to save domestic hot water and heating costs.