Managing Energy Costs in Ice Rinks

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Ice rinks are highly energy-intensive businesses that can greatly benefit from energy-saving strategies. "Skating" into energy savings can boost your bottom line and, if desired, help your ice rink attain a greener image. The energy-saving measures described below are generally among the most effective options, yielding substantial energy savings with short simple-payback periods.

How Ice Rinks Use Energy

Most electricity consumption in ice rinks generally goes toward refrigeration, lighting, pumps, and fans, and most thermal energy goes toward heating (**Figure 1**). Because these facilities require simultaneous heating and cooling, measures that can reduce either load individually will affect the energy consumption of both. For example, a reduction in air temperature, which lowers the amount of energy required for space heating, will also cause the ice to melt at a slower rate, thereby reducing the refrigeration load.

Ways to Save Energy

Many ice rinks can realize substantial savings quickly and easily by making basic changes to existing equipment. Operational measures frequently offer the largest potential for saving energy, followed by maintenance and retrofits/upgrades.

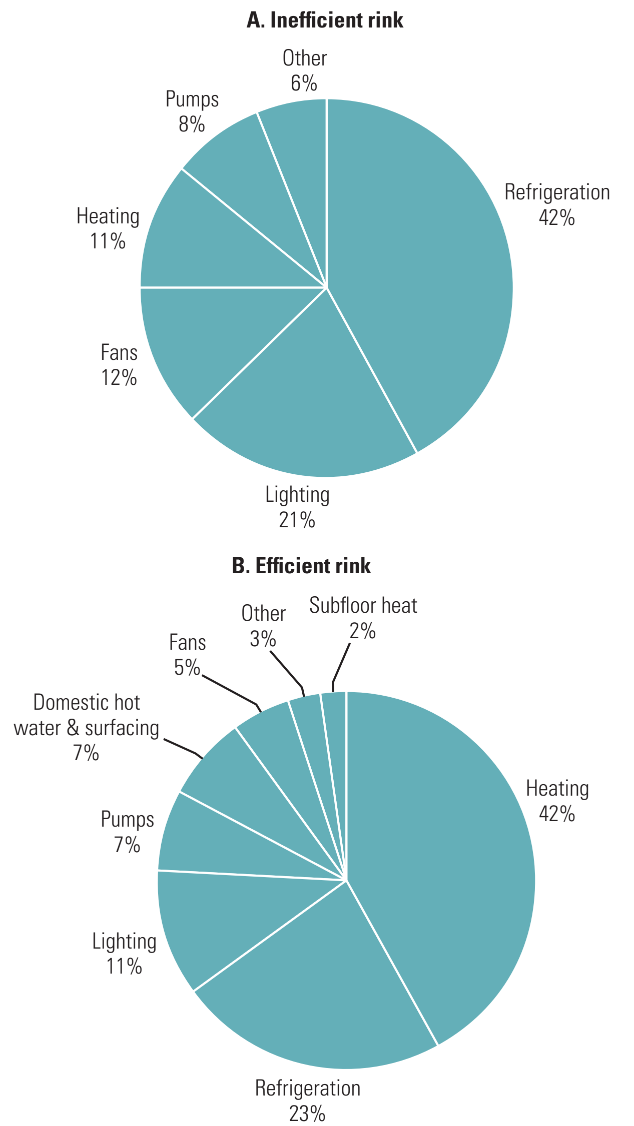
Heating

Although heating systems can represent the largest single source of energy consumption in ice rinks, they are also one of the areas with the greatest potential for energy reductions.

Adjust air temperature. In many ice rinks, air temperature is set to between 55° and 60° Fahrenheit (F) to ensure that spectators are comfortable. However, because air temperature affects both the amount of energy used by the rink's heater and the amount of energy consumed by the ice plant (because the ice will melt faster at higher ambient temperatures), something as simple as turning down the heat when there aren't many spectators can have a drastic influence on energy use. In Canada, ice rinks that have reduced air temperature from 60°F to about 40°F have realized overall energy savings of 25 to 50 percent.

FIGURE 1: Energy use in a Canadian ice rink

Heating generally represents one of the largest sources of energy consumption in ice rinks, and it can be drastically reduced through a variety of measures. A breakdown of end-use energy consumption is shown for a typical inefficient ice rink (A) as well as a highly efficient ice rink utilizing heat recovery and other energy-saving measures (B).



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Add heat recovery. On average, as much as 7.2 million Btu, or more than 2,000 kilowatt-hours, of heat are generated each day by the ice plant—more than enough to satisfy the entire daily heating load of the ice rink while having excess thermal energy left over for other purposes. By implementing heat recovery systems, ice rinks can realize overall heating savings of over 75 percent. Though most available waste heat comes from the refrigeration condenser, some heat can be also recovered from building exhaust air. In addition to space heating, recovered heat can be used in a variety of other applications, including domestic water heating, subfloor heating, floodwater heating, ice melting, and preheating cold outdoor air for ventilation.

Ice Plants

Because the refrigeration and pumping systems in ice plants comprise the majority of electricity consumption in ice rinks, they are great applications for efficiency measures.

Optimize ice thickness. Although the layer of ice in the rink needs to be thick enough to support skaters, the refrigeration equipment will end up working harder than necessary if it is too thick, resulting in wasted energy. Check the thickness of the ice sheet in your rink to ensure that it is between 1.0 and 1.5 inches.

Add head-pressure controls. Many refrigeration systems are designed for outdoor conditions of 86°F and, as a result, often have higher head pressures than needed, resulting in high condensing temperatures and increased electrical consumption. Particularly in areas with cold climates, modulating head pressure based on outdoor air temperature can yield refrigeration savings as high as 25 percent.

Install variable-frequency drives (VFDs). VFDs match motor output to real-time load and can be an effective way to save energy in condenser and brine pumps, used for chiling the ice. By reducing pump speed when possible, not only can VFDs reduce the energy consumption of the pumps themselves, but they can also reduce the amount of heat added to the brine (which increases cooling loads).

Improve water quality. The more impurities water contains, the colder it needs to be before it will freeze. Depending on the condition of the water used for making ice in your rink, purifying your water can help reduce the load on your ice plant, thereby saving energy.

Install low-emissivity ceilings. Nearly 30 percent of the total refrigeration load in heated rinks is radiated from the arena ceiling. By adding reflective paint or ceiling curtains, ice rinks can realize significant energy savings, particularly when they are located in warm, humid climates. Low-emissivity ceilings can also help to boost illumination levels and reduce ceiling condensation.

Get rid of the ice. When planning new construction or major retrofits, consider installing synthetic ice. Although you'll need to evaluate the performance of the synthetic ice product with respect to your facility's needs, this measure can effectively eliminate almost all major sources of energy consumption in ice rinks.

Lighting

Improving the efficiency of your lighting systems can be straightforward and inexpensive and is an easy way to save energy.

Change light intensity. Consider adapting the level of lighting to the activity taking place. Although some events, such as hockey games, may require high-intensity lighting, many activities will be unaffected by reduced light levels. You will save electricity by shrinking your lighting load and also help to reduce the cooling load for the ice rink.

Upgrade fluorescent lamps. High-performance T8 lamp systems (also referred to as super T8s) can improve lighting performance by 70 to 81 percent compared to T12 systems, and 23 to 31 percent when compared with conventional T8 systems.

Install occupancy sensors. Areas that are not consistently occupied—such as storage rooms, restrooms, back offices, and hallways—are ideal places for occupancy sensors. They can save 30 to 75 percent in lighting-energy consumption and typically yield simple payback periods of one to three years.

The Bottom Line

All of the measures discussed above represent good investments. Not only will they save you money and pay for themselves quickly, but they can also help your ice rink establish a greener image.

Resources

Energy Management Manual for Arena and Rink Operators (PDF), http://www.saskpower.com/wp-content/uploads/rink_operation_manual.pdf. SaskPower's ice rink manual is a great resource for ice rink–related measures and includes examples of how to analyze and catalog energy use for your facility.

Improving Efficiency in Ice Hockey Arenas (PDF), https://www.ashrae.org/File%20Library/docLib/eNewsletters/nichols-062009--feature.pdf. This short article by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) provides a great overview of energy use in ice rinks and includes specific examples of how much energy different measures can save.