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MUNICIPAL ICE RINK PROGRAM

YOU'VE GOT THE POWER TO SAVE

Rinks are often the centre of the community, but they are also expensive to operate. Let us help you lower your energy costs with our Municipal Ice Rink Program.

Eligibility

- Existing Saskatchewan artificial ice rink facilities
- Yearly power bill of at least $12,000

What You Will Receive

- No cost Walk Through of facility to assess equipment and operating practices
- Information about power-saving opportunities in both low-cost and capital-intensive categories
- Prescriptive financial incentives on common energy-efficient equipment and installations
- Custom incentives for more comprehensive energy saving opportunities resulting in >15% savings of annual power bill
- Advice and support when it comes to energy-related projects

How To Apply

For prescriptive incentive:

1. *Print and complete the application form that can be found at saskpower.com/savebusiness under Municipal Ice Rink Program.*
2. *Submit application by email, fax or mail to the address noted in the application.*
3. *We will contact you to confirm we received your application and discuss next steps.*

For Custom Incentive and all other information:

saskpower.com/savebusiness or email DSMCommercialPrograms@saskpower.com

Benefit

- Save money on your power bills annually
- Incentives can be customized to your facility

SaskPower
Powering the future®

MIRP Ice Rink Energy Efficiency Audit

For Artificial Ice Rinks operating in Saskatchewan SaskPower will provide an opportunity identification (ASHRAE level 1) audit free of charge.

The audit will consist of collecting energy consumption data, a site visit by an auditor or team, analysis of findings, production of a draft report, presentation of that draft report to Ice rink staff and officials and ultimately the provision of a finall report.

The report will consider the following:

- The rink and all facilities associated or connected to the rink
- Control systems and ice plant efficiency
- Ice tempartures
- Brine loop circulating systems
- Lighting over ice and throguhout the facility (indoors and out)
- Heating in rink loby, change rooms and attached facilities
- Kitchen/canteen equipment and plug loads
- All energy efficinecy questions posed by operators and owners

The Audit will provide:

- An overview of facility energy use (both gas and electric) and a high level assessment of water use
- Education-Demand charges, energy charges, minimum charges
- Benchmarking of your rink to others in Saskatchewan
- Lighing intensity and ice temperature assessment
- All system assessements
- Three low cost Energy Efficiency measures for consideration
- Three larger capitol cost Energy Efficiency measures for consideration
- Direction to incentives that may be available.

Technical Assistance

For artificial ice rinks operating in Saskatchewan contemplating energy efficinecy improvements of any sort the MIRP will provide technical assistance to rink operators to help them understand the costs/benefits of proposed changes.

Simply contact the MIRP program leader as instructed onpage 1 to request this service.

If in agreement SaskPower will allot a few hours of engineering resources to the rink at no cost.

The engineers providing the service will be the same as those conducting audits on behalf of Saskpower and will have no vested interest in the conclusions reached outside of the energy efficinecy and best inteterest of the ice rink.

Prescriptive Incentive Program

For artificial ice rinks operating in Saskatchewan contemplating energy efficinecy improvements the Perscriptive Incentive Program provides rebates for a list of preconsidered improvement (See page 4).

If an ice rink underakes any of the improvements listed they can apply to receive a rebate after the project is completed.

The customer will have to submit an applicaion along with an invoice and a few details regarding the changes made but so long as those itemss are provided a rebate will be provided to the customer.

There is a timeline of 90 days from invoiceing of the work to be able to submit for a rebate. It is also rcomended that the customer who wishes to obtain a rebate review the application prior to the work being performed as they may have to request some informoation from their refrigeration trades workers to complete the application

To obtain your rebate application or to review it in advance please return to the MIRP main page and click on the apply button. Complete the table protionof the application on line and then print, sign and forward to SaskPower as instructed on the document.

If there are any questions do not hesitate to contact us at SaskPower via the communication link indicated on page 1.

Qualifying Products and Services

Products or Service (Measures)	Approximate amount of Incentive	$ of Incentive	Eligibility Requirements
Ice Plant Measures			
Ice plant Equipment Performance Improvement (i.e. Tune up)	15%	$13/HP	Must include the following: inspection of compressor valves, bearings, seals, impellers and chiller tube flow; replacement of broken or damaged valves, suction screens; vibration analysis of compressor and brine pumps; clean system brine and; oil and lubricant changes as prescribed.
Brine pump Replacement	20%	$70/HP	Must be a single speed pump running 24/7 replaced with on demand or variable speed pump
Brine Pump motor Replacement (Incremental cost)	20%	$10/HP	Purchase and installation of a new high or premium efficiency motor for brine pump
Conversion to IR temp sensor from brine loop or slab sensor	20%	$460 each	New IR sensor system must include at least 2 sensors for control of compressor cycling where brine loop sensor or slab sensor were used previously
Conversion to slab sensor from brine loop sensor	20%	$400 each	New slab sensor system must include at least 2 sensors- for control of compressor cycling where brine loop sensor used previously
Install Programmable Controller	20%	$560 each	New controller must be capable and set to allow 3^{o}F increase in temperature during non-use times (eg. at night, or over holidays) and must replace a controller not capable of time of day setback
Cycling Brine pump with compressor	n/a	$200 each	If changes made from 24/7 brine pump operation to on demand brine pump operation either independently or in conjunction with any of the above measures.
Non Ice Plant Measures			
Demand Control of Ventilation	20%	$300 each	HP of system being converted must be greater than 750W or 1 HP and no automated control.
Kitchen Hood Exhaust fan timers	20%	$50 each	No automated exhaust fan control on current system

Custom Incentive Program

For artificial ice rinks operating in Saskatchewan contemplating material, energy efficinecy improvements that they anticipate will provide savings creater than 15% of their current bill (this usually involves modifications to multiple systems or the ice plant) SaskPower offers a Custom Incentive program.

Through this program the rink is invited to make a proposal to SaskPower. A proposal will identify and describe the systems intended to be modified, a description of the changes proposed and an estimate of the demand, energy and cost savings. If the customer is eligible and SaskPower will benefit from the changes, then SaskPower will be willing to work with the customer to develop their proposal from the opportunity stage to a complete business case. Through the Development Incentive portion of the program SaskPower will pay half the costs of that develoment up to $3200. If a viable business case results form the development then SaskPower will be willing to pay half the costs of the implementation to a maximum of $10,000.

To be eligible the modification has to be made to a functioning system primarily for the purpose of energy savings. If a system must be replaced as an emergency replacement or the system is new, SaskPower may consider the incremental cost of base line equipment versus more energy eficient equipment for an incentive.

All proposals will be considered on their own merit and SaskPower reserves the right to enter into an incentive agreement or not accordign to the benefit SaskPower will receive from the project when it is proposed.

Simply contact the MIRP program leader as instructed on page 1 to make a proposal or to learn more about the MIRP Custom Incentive Program.

Operating Efficient Ice Rinks

The following document while becoming a bit old provides many good tips and ideas for minimizing energy use in Ice Rinks in Saskatchewan. . While energy price information is not current the beauty of working with energy units is they are timeless.and provide insight on how a system is functioning and what it will cost.

Operating efficient

ICE RINKS

Across Saskatchewan, hockey arenas and curling rinks are often the hub of the community; however, they are also expensive facilities to operate.

SaskPower is committed to helping you reduce your rink operating costs. Within this handbook, we provide valuable power-saving information to help Saskatchewan municipalities make their facilities more cost efficient to operate. You'll find:

- Best practices to operate your rink in the most energy efficient way;
- Tips for prioritizing energy management opportunities; and
- Information about energy saving opportunities in both low-cost and capital-intensive categories.

For more power saving tips, visit **saskpower.com/efficiency**

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BEST PRACTICES FOR REFRIGERATION AND ICE PLANT SYSTEMS

This section includes information on best practices for refrigeration and ice plant systems, including how you can optimize your brine pumping system, how to optimize the temperature of the ice slab, and how a heat recovery system can be used in your facility.

Brine pump control

In the early days of artificial ice surfaces, compressor plants cooled refrigerant and pumped this refrigerant directly into pipes underneath the ice surface. As time passed, this method was deemed dangerous due to potential refrigerant leaks into the ice rink as well as expensive due to the large amount of refrigerant required. Modern ice rinks now use a heat exchanger in the compressor room that transfers heat from a brine solution circulated underneath the ice surface. While this is much safer, this type of system requires a pump to circulate the brine under the ice surface. There are several different methods for operating the brine pump and this section details these control types, the costs associated, and recommendations for making modifications to your brine pump and circulating systems.

Methods of control

There are four primary methods of brine pump control:

1. **Constant operation**

   This method is exactly as it sounds; the brine pump operates 24 hours per day throughout the entire ice season. This is regarded as the least efficient option and is not recommended unless there is a reason you can't or shouldn't shut the pump off.

2. **Cycling with compressor plant**

   This method operates the brine pump only when the compressor plant operates. This is the most common control option and because it avoids circulating brine when there is no source of cooling operating, it carries significantly lower costs than constant operation.

3. **Two-speed motor**

   This method employs a two-speed motor and can operate at two different loads based on the ice plant needs determined either through compressor load or brine temperature. Since two-speed pumps only cost a little more than one-speed pumps but significantly less than variable speed pumps, this is the most cost-effective method.

4. **Variable speed drive**

   This method employs a variable speed drive to speed up or slow down the brine pump based on the brine temperature itself. Because this method matches pump operation with the ice surface needs, this is the most efficient means of operation. This method is rarely seen in practice since variable speed pumps are relatively expensive as compared to a two-speed pump, which can achieve similar results.

Typical operating costs

The savings potential from modifying your system is highly dependent on what type of system you're currently working with. The table below shows estimated savings from switching control methods in a curling and skating rink. For both cases, a six-month season is assumed – your costs may vary based on how you operate your rink.

	Typical skating rink – 25 HP brine pump		Typical curling rink – 15 HP brine pump	
Operation type	**Consumption**	**Operating cost**	**Consumption**	**Operating cost**
Constant operation	81,654 kWh	$6,419	48,992 kWh	$3,851
Cycling with compressor plant	48,992 kWh	$4,382	29,385 kWh	$1,838
Two-speed motor	41,644 kWh	$3,724	24,996 kWh	$1,559
Variable speed drive	34,295 kWh	$3,067	20,577 kWh	$1,284

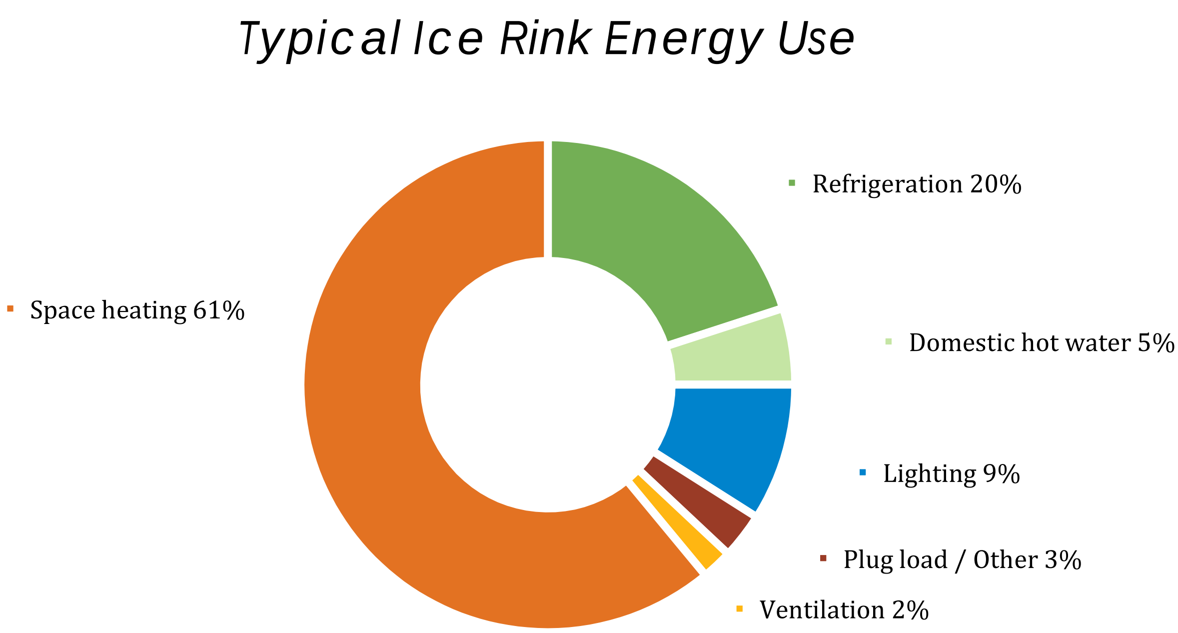
Recommended changes

Similarly to savings levels, recommendations vary based on the existing system. The table below shows the recommended course of action. As always, when considering spending large amounts of money, you should not only contact your preferred/existing service provider but also attempt to obtain quotes from other contractors to ensure you're getting the best value for your money.

Existing System	**Recommended Course of Action**
1-speed pump in constant operation	Recommission to cycle pump with compressor activity. If concerned about compressor heat, allow pump to run for a period of time after the compressor shuts down.
1-speed pump cycled with brine pump	No immediate actions – when pump nears replacement age, consider two-speed or variable speed pumping system.
2-speed motor	No immediate action recommended.
All scenarios where the existing equipment is near end of life	Request pricing for both a two-speed motor and variable speed pumping system and use operating costs shown above to evaluate the decision.

Ice slab temperature optimization

Refrigeration is the largest electricity load after space heating in the typical ice rink; due to the cost difference between natural gas and electricity, it tends to be the costliest section of the ice rink to operate.



Why overcooling the ice slab is a problem

Refrigeration makes up roughly 20 per cent of an ice rink's energy use. A key component of refrigeration load is maintaining the ice slab temperature. In order to ensure ice slab integrity, temperature controls are often set at a conservatively low value that will maintain ice slab quality under the most adverse conditions. Because the ice slab is subjected to adverse conditions only during business hours, a conservative slab temperature set point keeps the ice colder than it really needs to be for a majority of the time. As outlined in Table 1, optimizing the slab temperature for different activities and increasing slab temperature during long unoccupied periods (overnight and mornings) can result in significant energy and cost savings. In addition warming the ice will also relieve the ice of built-up stresses during past freezing cycles and prevent brittle ice formation.

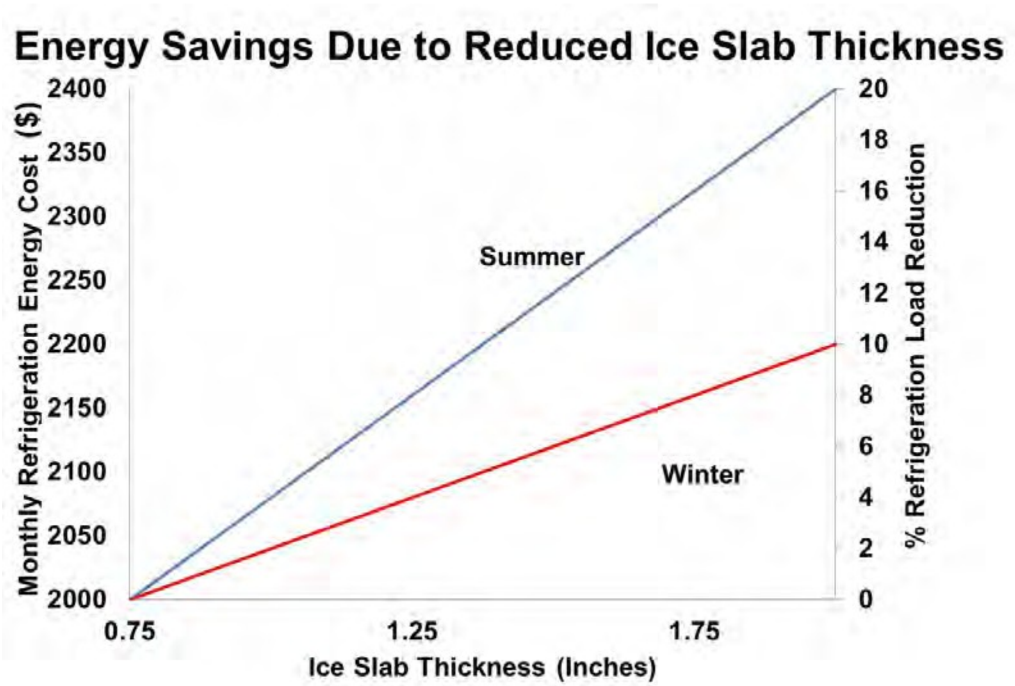
Slab temperature for maintaining slab integrity during various activities and potential energy savings

Activity	Ice slab temperature	Brine temperature (1" thick ice)	% Energy savings
Typical Ice Rink	**22 °F (-5.5 °C)**	**20 °F (-6.5 °C)**	–
Adult Hockey	23 °F **(-5.0 °C)**	21 °F **(-6.0 °C)**	2%
Curling	24 °F **(-4.5 °C)**	22 °F **(-5.5 °C)**	4%
Figure Skating	25 °F **(-4.0 °C)**	23 °F **(-5.0 °C)**	6%
Public Skating	27 °F **(-3.0 °C)**	25 °F **(-4.0 °C)**	10%
Ice Maintenance	29 °F **(-1.5 °C)**	27 °F **(-3.0 °C)**	14%

How to optimize your ice slab temperature

Most ice rinks use a brine solution to cool the floor under the ice slab. The temperature of the ice slab is either directly monitored using an infra-red sensor, or indirectly monitored through the brine temperature entering the refrigeration system. The following steps can be taken to optimize the ice slab temperature:

- Reduce the ice slab thickness from 2 inches (50.8 mm) to 1 inch (25.4mm). In addition to water savings, this increases the brine temperature requirements by 2 °F (1.0 °C), resulting in refrigeration energy savings of $150-$300 per month as outlined in the chart below.



- Increase the slab temperature to an "Ice Maintenance" setting of 29 °F (-1.5 °C) at night when the ice rink is not in use. As outlined in the above table, this will likely result in overall energy savings of two per cent to five per cent depending on hours of operation.

- Since it is possible to increase/decrease ice slab temperature by 1 °F (0.5 °C) every hour while maintaining ice integrity, install a simple programmable ice temperature controller to control the slab temperature based on a schedule of events. A sample schedule is provided in the table below resulting in four per cent to six per cent overall energy savings.

Sample daily schedule of ice slab temperature

Time of day	Activity	Slab temperature
Midnight – 6 am	Night setback	29 ^{o}F (-1.5 ^{o}C)
6 am – 8 am	Ice maintenance	27 ^{o}F (-3.0 ^{o}C)
8 am – 4 pm	Skating	25 ^{o}F (-4.0 ^{o}C)
4 pm – 6 pm	Curling	24 ^{o}F (-4.5 ^{o}C)
6 pm – Midnight	Hockey	23 ^{o}F (-5.0 ^{o}C)

- Alternatively, you can install a fully automated controller that monitors the ice temperature using infrared sensors in real time, and automatically regulates all aspects of the refrigeration system to maximize efficiency. These are typically more expensive than the simpler systems and are suitable for new construction or significant retrofits.

Cost savings from optimizing ice slab temperature

Optimization strategy	Estimated cost ($)	Estimated payback period
Reduce Ice Slab Thickness	None	Immediate
Manually Increase Slab Temperature at Nights	None	Immediate
Install Simple Programmable Controller	\$250 - \$500 Installed and Programmed	0.2 – 0.5 years
Install Automated Control System	\$3500 - \$5000 Installed and Programmed	1.7 – 2.3 years

Refrigeration plant heat recovery

Anyone who has entered a compressor room during a big game can tell you that when working hard to keep the ice nice and cold, the plant itself creates heat – lots of it. To get rid of this heat, ice rinks typically have either a cooling tower or a fan coil outside the building. Systems built to harvest this heat for a useful purpose are becoming commonplace in new construction and are beginning to take hold in the retrofit market, with packaged products available through most refrigeration contractors. Heat recovery also saves on two fronts – on saving heating input as well as saving electricity from reduced cooling tower/fan coil use.

By the end of this section, you should know how a desuperheater works, what you can use the recovered heat for, as well as the keys to a successful heat recovery installation.

How is heat recovery done?

Heat recovery is typically performed using a desuperheater, which routes the hot refrigerant exiting the compressor plant through a heat exchanger before the heat rejection system (cooling tower or fan coil) outside the building. These are usually packaged pieces of equipment sized specifically for your compressor plant and can also include water storage tanks to increase heat recovery capacity.

Uses of waste heat

There are three primary uses of waste heat:

1. **Domestic hot water preheat**

   The most common use of recovered heat is to preheat cold water entering the domestic hot water heater tasked with providing either showers or flood water. This is efficient because the heating load usually coincides with the availability of waste heat (the compressors work their hardest right after the flood, generating the most heat when the tanks are refilling or players are showering).

2. **Space heating**

   Another frequent use of recovered heat is to provide space heating to either the stands or the locker room. While using recovered heat for space heating can and has been done successfully, it's typically more complex and in most cases is limited to new construction.

3. **Snow melting**

   Facilities that melt snow indoors will often use compressor waste heat to speed up the process without paying for additional heating. While melting snow indoors is an inherently inefficient process and not recommended, the melting pit is usually adjacent to the compressor plant and heat recovery can be a good way to prevent using energy to melt ice.

Keys to success

In theory, heat recovery is a great idea for all ice rinks. However, applying heat recovery successfully depends highly on two major factors:

Usage

The more a building is used, the more compressor waste heat that is available. Rinks that have low use are generally poor candidates for heat recovery due to excessive payback periods. Highly-used ice rinks, however, can provide excellent heat recovery opportunities at minimal cost.

Distance

If the compressor plant is not directly adjacent to or at least near the space where heat is required, it is unlikely that heat recovery will be financially attractive. However, short distances create simple heat recovery systems that can be very lucrative.

If these two key factors exist in your facility, you should contact your preferred refrigeration contractor to better examine the costs and savings available from such a project. Since these typically involve spending significant sums of money, proper design and collecting bids from multiple service providers is recommended to help maximize your rink budget.

BEST PRACTICES FOR LIGHTING

After the refrigeration system, lighting is usually an ice rink's next-largest electricity consumer. Fortunately, there are many great options to reduce lighting costs. Here are some important considerations when considering lighting changes:

- Lighting generates heat – and heat must be removed by the refrigeration system to keep the ice in good condition. Reducing your lighting energy consumption will also reduce the load on the ice plant.
- Lighting affects how users perceive your facility. Is the ice surface adequately illuminated? Are there dark or bright spots that make it harder to see the hockey puck or curling rock? You may wish to consider hiring a lighting designer to determine the exact lights and appropriate placements for your facility.
- Lighting contributes to demand charges – an older lighting system over a hockey rink may draw 45 kVA – using new technology, this could be cut in half, lowering your demand charge and saving you money.

What makes good ice rink lighting? In general:

- The ice surface is illuminated uniformly.
- The light fixtures can easily be switched on and off to match the rink schedule.
- The light fixtures are energy efficient.
- The light fixtures are durable and can resist occasional impacts from hockey pucks.
- The light sources are low-maintenance and will not require repairs during a rink season.

Lighting technologies

There are two main types of lighting in common use above ice surfaces: metal halide and fluorescent. This section will explain the differences and advantages of each.

All types of lighting emit heat as a byproduct of producing light. In an ice rink, all heat must be removed by the ice plant to keep the ice hard. Therefore, by increasing the efficiency of the lights (reducing the amount of heat produced), the load on the refrigeration system is reduced. Improving the efficiency of ice rink lighting consequently has a two-fold effect: both in the direct savings from having more efficient lights, as well as the indirect savings of lowering the load on the ice plant.

Metal halide

Metal halide (MH) fixtures are the traditional method of providing light over an ice surface. These fixtures are widely used, but with the arrival of new technologies over the past 5 years, they are no longer considered best practice for arenas. The downsides of metal halide lamps are:

- Their light output decreases dramatically over their usable life.
- They require a magnetic ballast that consumes a lot of energy.
- If the power is interrupted, they are not able to turn back on immediately (known as restrike).
- The colour of their light output can vary over the life of the lamp.
- They are not as energy efficient as other technologies.

Pulse-start metal halide

The latest generation of metal halide lighting, called "pulse-start" metal halide, addresses some of the downsides of standard metal halide fixtures. Pulse-start MH fixtures have better colour and are more efficient than their predecessors. They also maintain more of their light output as they age. The downside of pulse-start lamps is that they require a special ballast – pulse-start lamps will not work on legacy metal halide ballasts.

T5 high output fluorescent

T5 high output (T5HO) fluorescent lighting is the current best practice for illuminating most ice surfaces. A T5HO lamp is a type of fluorescent tube that is much thinner than older T12 or T8 tubes. T5HO lamps also output much more light than T8 lamps. They use electronic ballasts and have been in common use for at least 10 years. The advantages of T5HO, as compared to mercury-vapour or metal halide lamps, are:

- High lumen maintenance: T5HO lights continue to output high levels of light (lumens) throughout their lifetime, unlike metal halide lamps, which degrade over time.
- Instant-on: T5HO lights turn on instantly and come up to full brightness almost immediately.
- Energy efficiency: T5HO consume around half the energy of typical metal halide lamps.
- Long lifetime: T5HO fixtures last for a long time – typically 20,000 or 30,000 hours of operation time. That translates into approximately 10 rink seasons.

Other types of lighting

There are several other types of less-common lighting technologies in use today:

Compact fluorescent high-bay

These fixtures are composed of many compact fluorescent (CFL) lamps arranged in a single fixture. Typically featuring four or more lamps per fixture, they have the appearance of a traditional metal halide fixture. However, CFL lamps are not as efficient as current T5HO technologies, so these fixtures are not recommended as a best practice for retrofits.

Induction lighting

Induction lighting is a specialized form of fluorescent lighting. Since it typically outlasts most other types of lighting, it's particularly well-suited for installation in areas that make changing burnt-out lamps difficult. However, its benefits must be weighed against its costs. For this reason, T5HO fixtures usually perform best in a cost-benefit analysis.

LED lighting

LEDs (light-emitting diodes) are a relatively new type of lighting that is becoming more commonly available. While LEDs are becoming good candidates to replace incandescent and halogen lights, their high initial cost and the cost-effectiveness of other technologies requires a through cost-benefit analysis be performed before proceeding to install these for illuminating an ice surface.

BEST PRACTICES FOR ICE RESURFACING AND WATER USE

This section will explore the best practices for ice resurfacing as well as water use in ice rinks, an often overlooked expense at many rinks. It will also explore setting proper flood temperature and volume as well as best practices in discarding shavings. **Please note that this section applies to skating rinks, not curling facilities.**

Ice resurfacing

In all skating rinks, resurfacing the ice pad is a routine event that is often overlooked form an energy efficiency standpoint. Most rink operators go above and beyond what is required in an attempt to provide the best ice quality for their users – filling the resurfacer with too much hot water at too high of a temperature when the intent of the flood is to melt the top layer of ice and freeze it quickly afterwards. Using too much water or water that's too hot will result in excessive pooling on the ice, which affects ice quality. Perhaps the greatest benefit of ice resurfacing best practices is that when implemented, they have the ability to both increase ice quality and save money.

This section will provide some best practices for ice resurfacing and how to optimize the process, creating the best ice at the lowest cost. We've segmented ice resurfacing into three main issues: flood volume, flood temperature, and ice shaving disposal. While the maintenance of overall ice thickness is also important, this is dealt with in the Ice Slab Temperature Optimization section found earlier in this handbook.

Flood volume best practices

The ideal flood volume is the lowest amount of water needed – any water left in the resurfacer will be tepid by the time the next flood occurs and is typically emptied. A typical flood requires between 100 and 120 US gallons (380 to 450 litres) but the tank on a resurfacer (including the wash and ice-making tanks where applicable) can be from 200 to 300 US gallons (760 to 1140 litres). If the current practice is to just fill the tanks, this may not only be wasteful but also detrimental to ice quality because it can leave puddles that don't fully freeze until well into the rental period. The following methods can be used:

- **Using a water flow meter** – this is accurate but can be expensive.
- **Timing the fill** – not very accurate but can help in reducing flood water.
- **Use existing equipment** – some resurfacers are equipped with a gauge; if one exists, this is most certainly the easiest and most efficient method.

The best solution is what you can implement most easily at your facility and within your budget – the intent of this section is to provoke thought about how and why things are done the way they are.

Flood temperature

Many operators currently produce hot water at a temperature of 140-150 ^{o}F (60-66 ^{o}C), which is the typical factory setting on most domestic hot water heaters. While this is a great practice for professional arenas, those ice surfaces typically have very large compressor plants and have more time to refreeze than a typical regional rink, where skaters are often on the ice surface immediately after the resurfacer doors close. For the immediate-use application, a lower temperature that freezes more quickly and leaves fewer puddles creates the best ice surface for the end users. The following table provides recommendations surrounding setting an ideal flood temperature:

Existing system	Recommended best practice
DHW tank used exclusively for flooding purposes	Lower temperature set point to 120 ^{o}F (49 ^{o}C)
DHW tank shared for showers/other uses	Maintain water temperature of 150 ^{o}F (66 ^{o}C) and use a mixing valve to reduce the output temperature of the flood water to 120 ^{o}F (49 ^{o}C)

Keep in mind that this is a general guideline – every rink is a little different and there may be limiting factors. You may be able to be even more aggressive; remember reducing water temperature reduces both the energy to heat the water and to refreeze it once it is on the ice slab. To find the limits of what you can do, try to experiment with the water temperature during maintenance periods where it won't affect the user experience.

Ice shavings

If at all possible, ice shavings should be dumped outside. Melting snow is a wasteful process at any time, including when using recovered heat. It is likely that a better use for the recovered heat can be found if the shavings are discarded outside.

Ongoing rink optimization

Like many other ice quality-related aspects of running an ice rink, optimizing the resurfacing process often means experimenting with different flood volumes and temperatures to make great ice at the lowest possible cost. Furthermore, requirements can change based on exterior conditions – what may work during a warmer month like October or March may not be necessary during a colder month like January. Ice rink optimization in general is an ongoing process.

Water use in rinks

Water is an often overlooked expense at many ice rinks. While some rural areas either charge flat water rates or include water costs within property taxes, many jurisdictions are converting to full cost recovery water systems, which attempt to recover all operating costs through direct consumption rates. This generally leads to higher water rates and unexpected arena operating costs. It's important to note that the area in which you operate your ice rink is a very big factor – in some areas, completing water conservation projects will have no payback at all and in others it will be very attractive.

This section will help you identify when it's a good idea to undertake water conservation projects to get the best benefit for your facility.

How to reduce water consumption

There are three common methods to reduce non-arena related water consumption in an ice rink:

1. **Low-flow faucets**

   Most faucets found in arenas either have no faucet aerator at all or use an aerator that limits flow to 8.3 litres per minute (LPM). Low-flow aerators are screw-on devices that fit on most modern faucets and reduce the flow by half or more for a cost of less than $5. This is an inexpensive and effective way to reduce water and domestic hot water-related energy use.

2. **Low-flow shower heads**

   If your shower heads are easily replaceable, low-flow alternatives are available at a relatively low cost of $20-50, depending on the type of shower head you need. Depending on the previous flow rate, water flow can be cut in half, reducing both water consumption as well as domestic hot water-related energy use.

3. **Low-flow toilets**

   A typical older toilet will use anywhere between 13 and 18 litres per flush whereas a new toilet at approximately $500 installed will use no more than 6 litres per flush, reducing consumption by between 53 per cent and 66 per cent respectively.

Replacement guidelines

As with most retrofit projects, replacement guidelines vary based on equipment usage and costs. This section provides an overview of replacement guidelines to give you the information you need to make equipment replacement decisions.

Shower heads and faucet aerators

The payback period for replacing shower heads and faucet aerators typically lies within a single ice season. Even in jurisdictions where water is not billed, the natural gas savings will easily cover the small investment. Please note that low-flow faucet aerators should be avoided where faucets are used to fill bottles – this is a poor use of the equipment and will not generate savings.

Toilets

Deciding whether or not to replace a toilet depends highly on the jurisdiction and what it charges for water combined with the amount a toilet is used. You can easily obtain the utility cost from bills or by checking with your town or city, it is usually posted on the internet. Estimates on toilet use can be made through various methods from check off sheets by users to monitoring bathroom traffic at certain times and during different events.

BEST PRACTICES FOR HEATING, VENTILATION AND AIR CONDITIONING

Using the heating, ventilation, and air conditioning systems to achieve the optimal temperature in your rink operation can have a great impact on your operating costs. This section explores the different HVAC equipment typically found in arenas and the control methods associated with each. Here we provide best practices in controlling your equipment so that you're providing top quality service to the community while reducing your costs.

Temperature control

Since ice rinks are built to provide a frozen surface, many are surprised to see that 61 per cent of energy and approximately 20 per cent of costs are actually spent on space heating. While some of this amount is operational and required to keep a comfortable space, much of the space heating energy is spent heating unoccupied spaces. When assessing energy consumption related to space heating, the ultimate goal is twofold:

- Reduce the amount of fresh air in the building to the minimum required for occupant safety and comfort.
- Reduce all space heating during unoccupied periods.

This section aims to describe the different ways you heat your space and to provide best practice for controlling and reducing unnecessary waste.

Typical system types

There are four distinct types of space heating typically seen in ice rinks. Note that the equipment efficiency can vary; this list is segmented by control types.

1. **Local heating**

   This system type is a catch-all that collects baseboard heaters, unit heaters, radiant heaters, or any other heating system that supplies heat to a limited space. These are typically controlled using electric thermostats and unless physically turned down at the end of the day, they maintain comfortable space temperatures 24/7.

2. **Central furnace**

   Furnace systems distribute heat through air ducts. These are used very frequently, often providing heat to the lobby or a set of changing rooms. For the purposes of this document, this refers to all air-based systems that do not use fresh air intake. These systems tend to use a mix of programmable and electric thermostats.

3. **Fresh air system**

These are similar to furnaces in that they distribute heat through air but these use damper systems to provide fresh air. Due to the fresh air intake, these are the most expensive systems to operate. These systems tend to use a mix of programmable and electric thermostats.

4. **Hot water circulation**

This is a distributed heating system that supplies heat to multiple spaces using hot water radiators. These systems usually use boiler controllers that monitor return water temperature, increasing boiler output to maintain sufficient loop temperature.

Best practices

The table below lists the best practices for each of the system types along with typical costs and paybacks associated with conversion. Since the investments involve controlling existing systems and not installing any new capital equipment, the costs are usually relatively low and paybacks short. These paybacks and investments assume that the existing systems do not currently use heating setbacks. If you have programmable thermostats with unsuitable or no settings, you may be able to achieve considerable savings at little to no cost.

Typical heating system	Recommended best practice	Typical cost ($)	Typical payback period
Local heating	Where the heat source is large enough (more than a single baseboard heater), a programmable thermostat is the best control option.	$250-$500 installed and programmed.	1.5 years
Furnace	The use of a programmable thermostat is the most cost-effective way of operating a furnace. If an automation system exists, all furnaces should be included.	$250-$500 installed and programmed.	1 year

Typical Heating System	Recommended Best Practice	Typical Cost ($)	Typical Payback Period
Fresh air system	Best practice for these systems is occupancy control using carbon dioxide sensors. However, simply closing the outdoor air damper during unoccupied periods will also generate significant savings.	Depends on the complexity of the system - an HVAC contractor will be able to quickly assess the system.	Depends on existing system but if fresh air intake can be limited during unoccupied periods, payback usually occurs within first heating season.
Hot water distribution	Most boiler controllers have time-of-day and day-of-week programming capability	Aside from very complex systems, these should cost no more than $1,000 installed.	1.5 - 2 years

POWER SAVING CHECKLISTS FOR ICE RINKS

10 No-cost ways to reduce your rink's utility bill

We put together a list of no-cost changes you can make at your rink to reduce the charges on your utility bill.

- ☐ Post reminders by each light switch to encourage users to turn off lights. Ensure outdoor lights are turned off during daylight hours.
- ☐ If there is no scheduled activity for half an hour or more, turn off the lights above the ice pad.
- ☐ Turn off the breaker that controls the parking lot plug-ins when the temperature is warmer than -15°C.
- ☐ Post the rink's monthly utility bill totals on a bulletin board for all to see! Understanding what it costs to operate the rink can encourage everyone to take steps to conserve resources.
- ☐ Avoid demand charges for one month in the fall by not starting the refrigeration plant until after the meter has been read. Similarly, avoid one month's demand charges by not running the refrigeration plant once the meter has been read in the shutdown month of the season.
- ☐ Ensure that any programmable thermostats installed at your facility are set to the correct date and time, and that they are programmed to the desired schedule. You can check them monthly or even weekly.
- ☐ If your community allows, dump ice shavings outdoors.
- ☐ Ensure that the surface of the concrete slab is clean before making ice.
- ☐ Mark a one-inch ice thickness line on the rink boards to help maintain ideal ice thickness.
- ☐ Reduce the flood water temperature to 120 °F (49 °C) or lower when you have a dedicated hot water heater for flood water.

For more power saving tips, visit **saskpower.com/efficiency**

10 Low-cost ways you can reduce your rink's utility bill

We put together a list of low-cost changes you can make at your rink that will help to reduce the charges on your utility bill.

- ☐ Install programmable thermostats capable of temperature setback in places like the lobby, dressing rooms, and other common spaces. If programmable thermostats are already installed at your facility, ensure that they are set to the correct time and desired setback schedule. Add a note to avoid forgetting Zamboni rooms and other smaller spaces.
- ☐ Replace incandescent bulbs with equivalent compact fluorescent bulbs. For example, a 60W incandescent bulb can be replaced with a 13W CFL or LED bulb.
- ☐ Replace incandescent exit signs with LED equivalents.
- ☐ Install low-flow shower heads in locker and change rooms.
- ☐ Install occupancy sensors to control lights in low traffic areas, washrooms and change rooms.
- ☐ Caulk and weather-strip your facility's walls, floors, windows, roof and doors to seal air leaks. Seal doors and windows between the rink lobby and arena space.
- ☐ Insulate hot water tanks and pipes in unheated areas.
- ☐ Change the air filters on ventilation and heating equipment regularly.
- ☐ Your brine or slab temperatures are usually set based on what works at the warmest part of the season, usually at the very start and very end. For most of the season, you can turn your compressor set point up a degree or two without impacting the ice quality.
- ☐ Make best use of your existing controls by shutting the brine pump off when the compressors are off. If you need additional controls to accomplish method of operation, the cost should be built into your planning processes.

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