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Energy Audit

Westmeath Recreation Centre

119 Synton Street, Westmeath, Ontario

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1 Proposal

This audit will explore the possible energy savings and operational improvements along with operational cost benefits for the existing recreation centre located in Westmeath, Ontario.

2 Project Background / Requirement

2.1 Asset Description

Westmeath Recreation Centre is an existing complex consisting of a single ice pad arena with locker rooms & shower facilities and a small community hall with a commercial kitchen and bar area.

The arena operates from the first week in October to the last week in March. The community hall is used year round for social events.

The building is a pre-engineered structure fabricated from corrugated galvanized steel (Behlen building). The main steel structure has no insulation, only two inches of spray-on acoustic insulation above the arena board height. The community hall is above the main entrance & locker rooms and has stud walls with insulation installed within the main steel structure. The Ice Plant and Resurfacer room is located on the opposite side of the rink in a block building.

Existing Building Systems – *Community Hall*:

Plumbing:
Domestic cold water is provided via a series of wells. Domestic hot water is supplied to both the *community hall* and *locker rooms* & *showers* by two electric hot water heaters with water storage tanks.

HVAC:
The *community hall* is heated and cooled by a geothermal heat pump located in an adjacent service room. Ventilation air is supplied by a heat recovery ventilator (HRV) connected to the heat pump. Both units are in good repair.

Lighting:
The *community hall* uses 2 bulb fluorescent T8 light fixtures in the suspended ceiling. The *kitchen* has surface mounted T-8 fixtures.

Existing Building Systems – *Rink* & *Resurfacer Room*:

Plumbing:
Water is provided via a series of wells. Hot water is supplied to the ice surfacer by an interconnected system of one fuel oil hot water heater and two electric water heaters. During regular use, the electric heaters are de-energized and simply being used as insulated water storage tanks.

HVAC:
Both the *Resurfacer room* and the *Ice Plant* are heated by a fan coil with a heating water coil connected to the resurfacer water heater tanks. Back-up heat is provided by a pair of wall mounted electric resistance heaters.

There is no heating system in the *Rink*. Ventilation is provided through a series of permanently open louvres by natural ventilation. There is no carbon monoxide or propane detection system in either the *rink* or *resurfacer room*. There is no power ventilation system in the *rink*.

The *Rink* has two inches of acoustic spray-on insulation installed above the board height and in the ceiling space above the rink only. A fair amount of this insulation has detached from the structure. There is no other thermal insulation in this space.

A low-e membrane has been installed below the existing ceiling inside the *Rink*.

Lighting*:*
The *Ice plant* and *Resurfacer Room* has suspended, two bulb T8 fluorescent fixtures for lighting. There are high pressure sodium (HPS) fixtures outside the Ice plant to provide exterior lighting.

The *Rink* is lit by high intensity discharge metal halide fixtures. The bulbs are replaced every two years to reduce the effects of colour shift & light output degradation.

2.2 Project Background / Issue

The general condition and operation of the Recreation Centre exceeds expectations for a building of this age. However, there are a few areas where improvements in energy efficiency and operation can be accomplished. The main items are:

- Ice Plant heat reclaim
- Humidity Control in Rink
- Lighting upgrade in Rink
- Energy management of Ice Plant

3 Analysis of Options

3.1 OPTION 1 – Heat Reclaim

Currently, all the waste heat generated by the *Ice Plant* is rejected to the cooling tower. A double wall heating coil & insulated water storage tank should be installed in the *Resurfacer room*. This would allow some of the rejected heat to be captured for the preheat of the water required for the heating of the *Resurfacer* room & used in the flooding of the rink. Actual reclaim heat available capacity varies based upon the ice plant's compressor load. Even so, it is expected that this option would supply all the hot water requirements for both the ice resurfacer as well as the heating of the *Resurfacer room*. This would allow for the complete removal of the fuel oil system, with the electric hot water heaters used strictly as back-up when the refrigeration plant should require servicing.

Energy Savings:	35,000 kWh
Greenhouse Gas Reduction	16,900 kg
Expected Payback	Less than 2 years
Maintenance Requirements	Slight increase
Occupancy Comfort Level	None

Estimated Construction Cost: $25,000

3.2 OPTION 2 – Insulating of Existing Building

The current building is not insulated. To reduce the effect of weather changes and the effect of solar heat gain on the metal room, insulation should be placed within the attic cavity of the existing steel building. This would reduce the temperature swings within the building.

Insulating of the exterior walls would prove to be difficult. The walls should be sprayed with urathane insulation and a fire proofing layer, but would not be very abuse resistant. An interior wall should be built to a height of 8 feet to provide abuse resistance for the insulation.

Energy Savings:	Minor
Expected Payback	None
Maintenance Requirements	None
Occupancy Comfort Level	Great improvement

Estimated Construction Cost: $75,000

3.3 OPTION 3 – Humidity & Ventilation Improvements

Since the existing building is not insulated, it is especially susceptible to temperature swings based on the ambient conditions. The current ventilation system inside the rink consist of permanently open louvres that allow for moisture migration into the rink. The combined temperature and humidity fluxuations above the rink surface allows the air to exceed it's dew point, forming fog above the ice. This has a detrimental effect on both the building and contents as it promotes corrosion and the growth of mold/mildew. This is especially of concern during the fall and spring.

The absence of a CO monitoring system and powered ventilation system not only impacts the humidity, but also raises indoor air quality concerns. The ice resurfacer is propane fueled with all the products of combustion being released inside the rink. Since there is no active ventilation system within the rink, this can allow for the build-up of carbon monoxide and other toxic substances to unexceptable limits. A monitoring system must be installed along with a fan assisted ventilation system with dampers to prevent the migration of moisture when outside air is not required.

A propane fired desiccant dehumidifier should be installed. This would eliminate the formation of fog inside the rink. The lower humidity levels would hinder the growth of mold/mildew & formation of corrosion. In addition to the building condition and occupant comfort improvements, the reduction in relative humidity would also reduce the run time on the chiller in the *ice plant* required to maintain ice surface temperature.

Energy Savings:	neutral
Expected Payback	None
Maintenance Requirements	Reduction of future repair to building structure
Occupancy Comfort Level	Great improvement

Estimated Construction Cost: $15,000 (CO monitoring system & fans)
$30,000 (dehumidifier)

3.4 OPTION 4 – Update of Lighting system

The lighting system in the Rink currently consist of suspended metal halide fixtures. Great care is taken of these fixtures to maximize their efficiency and operation, however both energy efficiency and maintenance requirements can be improved with the use of T5HO fluorescent fixtures. It should be noted that the ballast for the T5 fixtures will not be able to energize the lamps when the temperature inside the rink is below -17˚C, hence careful attention should be paid to the expected temperatures within the space. The fluorescent fixtures would be approximately 30% more efficient than the metal halide units with a very even distribution of light over the entire ice surface.

Energy Savings:	2,300 kWh
Greenhouse Gas Reduction	2,300 kg GHG
Expected Payback	4 years
Maintenance Requirements	20% reduction
Occupancy Comfort Level	Great improvement

Estimated Construction Cost: $24,000

3.5 OPTION 5 – Ice Plant Control System

Provide a control and energy management system for the *ice plant*, including an infrared camera to measure ice surface temperature. This would allow for temperature reset of the ice plant systems during period of time that the rink is not in use and allow for scheduling of the compressors based upon brine temperature return. This would have a great impact on the energy consumption of the rink, as there are large periods of time when the rink is not in use (weekdays from 12 a.m. to 4 p.m.) A reduction of 10% in energy consumption for the ice plant is expected.

Energy Savings:	11,500 kWh
Greenhouse Gas Reduction	11,500 kg GHG
Expected Payback	>2 years
Maintenance Requirements	Improved
Occupancy Comfort Level	Negligible

Estimated Construction Cost: $11,000

3.6 OPTION 6 – Rink Spectator Heating System

Currently there is no heating system for the seating area within the rink. Since the building is not insulated, the temperature within the rink is very low during the winter months. A pair of propane fired infrared radiant heaters should be installed above the seating area in the rink.

Energy Savings	180 MBH increase
Greenhouse Gas Reduction	1512 kg increase
Expected Payback	None
Maintenance Requirements	Slight increase
Occupancy Comfort Level	Great improvement

Estimated Construction Cost: $7,500

4 Recommendations

It is recommended that the Heat Reclaim, Lighting Upgrade and Ice Plant Monitoring options (Options 3.1, 3.4 & 3.5) be implemented as they have the greatest reduction in energy consumption. With these three options implemented, the arena would reduce it's annual greenhouse gas emissions by approximately 30,700 kg (30.7 tons). Estimated construction cost for these options is $60,000 The other options would improve occupant comfort & building integrity.

Regardless of energy improvements, an air monitoring system should be installed in the rink to allow for effective evacuation of contaminants from the rink caused by the ice resurfacer. If this is not an option, the ice resurfacer should be modified to an electric only unit.

END OF REPORT

Jim Gordon, P.Eng.,

Appendix A - Photos

Recreation Centre Entrace

Right Wall

Left Wall

Ice Plant and Resurfacer Room Exterior

Community Hall Entrance

Community Hall Interior

Kitchen Area

Community Hall & Locker room Domestic Water Heaters

Rink

Resurfacer Room & Ice Plant Fuel Oil & Electric Water Heaters

Appendix B – Energy Consumption