

Building Operator Training in First Nations Communities Delivers Infrastructure Improvements, Energy Savings and Enhanced Technical Skills



The Weeneebayko General Hospital in Moose Factory Ontario has undergone extensive energy auditing and facility upgrades including the additional of a high-efficiency summer boiler, energy-efficient windows and doors, and a conversion to LED lighting.

INVESTING IN PEOPLE

The decision by senior leaders at the Weeneebayko Area Health Authority (WAHA) to invest in technical training for their First Nations facility management staff has started to pay huge dividends for the remote health authority on the western shore of James Bay which include significant ongoing energy savings, improved health care facility infrastructure, reduced greenhouse gas emissions and greatly increased local energy management capacity in the remote northern First Nations communities of Attawapiskat, Kashechewan, Fort Albany, Moose Factory and Moosonee.

Under a training initiative carried out by the Canadian Coalition for Green Health Care (the Coalition), with financial support from Ontario's Independent Electricity System Operator's (IESO) Education and Capacity Building Program, specialized building operator training was offered to those First Nation's staff responsible for the operation of WAHA's 19

major health facilities including hospitals, clinics, ambulance bases and multiple residential housing units. This has led to a behaviour change mindset developing throughout the WAHA organisation with other staff members embracing the potential to reduce utility costs while improving infrastructure and the environment of care for residents.

The six graduates of the Building Operator Certification (BOC) program are now taking charge of project design and implementation which has led to a new sense of pride and ownership in the projects completed to date and an enthusiasm to tackle a multiplicity of new energy retrofit projects which will see WAHA realizing energy savings for years to come.

According to the Coalition's HealthCare Energy Leaders Ontario (HELO) lead, and BOC instructor JJ Knott, "WAHA's First Nations facility staff are now confident to tackle a much broader spectrum of building maintenance and retrofit tasks. Their previous reliance upon expensive fly-in technical support has been replaced by enthusiasm, competence and a newfound determination to make their buildings more energy efficient and climate change ready while ensuring the best possible treatment facilities for First Nation's residents."

"WAHA's leadership was key to the success of the training initiative," says Knott, "ensuring flexibility of work schedules, travel logistics, and internal support was in place to permit staff the time necessary for the training which occurred over two one-week periods in 2017 and 2018."

The competency-based BOC training, offered under an agreement with the Canadian Institute for Energy Training (CIET), provided the opportunity for participants to improve their technical expertise and job skills in a number of core areas including Energy Efficiency Operation of Building HVAC Systems, Measuring and Benchmarking Energy Performance, Efficient Lighting and HVAC Controls Fundamentals, Indoor Environmental Quality, Common Opportunities for Low-cost Operational Improvements, Facility Electrical Systems, and Operation and Maintenance Practices for Sustainable Buildings

“The BOC training has helped make me more aware of possible [energy] savings to be had and helped develop better maintenance strategies.”

PROJECTS

As part of the Coalition’s multi-year energy management and training initiative with WAHA, the HELO Team conducted building energy audits on all major WAHA structures with the intent of developing viable building envelope and facility upgrade initiatives that would result in energy savings and improved patient care environments. Three projects, including window replacements at the Weeneebayko General Hospital (WGH), the installation of a summer boiler, and lighting upgrades, are showing very tangible results.

WINDOW REPLACEMENT

WGH’s aged and drafty single-glazed aluminum- and vinyl-framed windows were in drastic need of upgrading with modern energy-efficient units. Existing windows were not equipped with a thermal break so their construction and installation characteristics meant that excessive air infiltration around the sash and frame, and the single-glazed nature of the glass, were contributing to heat loss during the winter months and heat gains during summer thereby drastically increasing the heating and cooling costs.

Replacement windows were chosen that utilized fibreglass sills, sash and frames providing superior thermal break qualities and modern thermal pane glazing, rendering them equal to, or above, the minimum ENERGY STAR® rating requirements for James Bay’s climate zone.

During the investigative process to determine the best possible solution, historic energy data was used to establish average Heating Degree Day (HDD) and Cooling Degree Day (CDD) values for the region. These were then used to determine heat gain and heat loss numbers through established engineering and architectural practices, as well as to calculate cubic feet per minute air infiltration.

Using the HDD and CDD data, the average difference in radiant heat loss for single glazed windows versus double glazed, for windows of various exposures, were then calculated on an annualized basis.

Based on measurements taken on site, the average glazed window area was 17.5 ft². The number of windows replaced was 398 with total area of new glazing calculated at 6,965 ft², plus seven doors of 147 ft² to bring the total to 7,112 ft².



The high-efficiency windows installed in the Weeneebayko General Hospital in Moose Factory are expected to save the Weeneebayko Area Health Authority over \$3,154,000 over the 25-year life of the windows. Note that some unnecessary windows have been closed in to help reduce heating costs.

Additional calculations determined a potential savings of 405,234,648 Btu/year in avoided heat loss and annual savings of approximately 10,964 litres of fuel.

Final calculations allowed for such additional elements as percentage of windows facing the prevailing wind direction, difference in coefficient for infiltration of old weatherstrip vs. new, and air infiltration rate of old versus new. Assumptions also included average operational hours of the hospital’s HVAC equipment, average wind velocity, boiler efficiency and savings to be derived from in-filling 65 windows no longer required which resulted in an additional savings of 75, 557.67 litres of fuel.

Taking all findings into consideration, and based on a construction cost of \$1.4 million, simple payback was determined to be 11.09 years and return on investment (ROI) of 9.01%

Window Project Summary

1. Replacement window and door project cost: \$1,400,000
2. Average lifespan of new windows and doors: 25 years
3. Total projected annual savings: \$126,187.38
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5. Total 25 Year Lifetime Savings: \$3,154,684.50
6. Return on Investment (ROI): 9.01% without incentives
7. Projected fuel oil savings: 75,557.67 litres
8. Avoided CO₂ emissions: 206,650.23 kg

For more details on WAHA’s window replacement initiative, please see the Coalition’s Energy Management Best Practice Case Study #1, *Assessment of Window Replacement Project* available at www.greenhealthcare.ca



The installation of LED lamps and fixtures in the laundry department has improved the staff work environment, and has reduced WAHA's demand for electricity.

LIGHTING UPGRADE

Facility staff were very well aware the lighting at the Weeneebayko General Hospital was outdated and expensive to operate so they developed a business case to replace all inefficient outdoor and indoor lighting fixtures and bulbs with modern, energy-efficient LED lighting technology. Implemented over the calendar years 2016 and 2017, WAHA staff systematically combed the facility and grounds removing energy-intensive lamping such as exit lights and other incandescent lamps, MR16 lamping, two-lamp T8 and four-lamp T12 fixtures, high pressure sodium street lighting, metal halide and par 30 exterior lamp units.

2016 Upgrade

During the 2016 retrofit, a total of 22 street lights and 72 additional exterior lighting fixtures were swapped to LED as were 139 interior fixtures for a total of 233. Total cost of the upgrade was \$85,831.58 including \$16,956.94 for street lighting, \$24,866.14 for outdoor lighting, and \$44,008.50 for indoor lighting.

Table 1 shows total annual kWh savings realized through the three lighting project initiatives and the corresponding annual dollar savings based on an all-in cost of \$0.15 per kWh of electrical consumption. It is important to note that sites outside Moosonee and Moose Factory will realize far greater savings due to their higher kWh costs.

2016 Savings

Project	kWh Savings/Yr	\$ Savings/Yr
Outdoor Lighting	46,699	\$ 7,005
Street Lighting	18,480	\$ 2,772
Indoor Lighting	83,723	\$12,558
Annual Savings	148,902	\$22,335

Table 1: Annual kWh and dollar savings 2016

Incentives

Incentives from Ontario's Independent Electricity System Operator (IESO) totaled \$15,924.65 helping to reduce the project costs as follows:

Outdoor Lighting Incentive:	\$6,880.90
Street Lighting Incentive:	\$2,772.00
Interior Lighting Incentive:	\$6,271.75

Using a simple payback method, which ignores interest rates and other variables, it will take WAHA 3.13 years to recover their initial capital investment:

Outdoor Lighting:	2.6 years
Street Lighting:	5.1 years
Indoor Lighting:	3.0 years

Overall LED Project Savings

The LED lighting replacements have an average life expectancy of 50,000 hours, at which time, typically, their lumen output will have degraded to approximately 70% of their original output prompting consideration of replacement to retain optimal lighting levels.

If lamps and fixtures are used an average of 12 hours per day, they are assumed to be illuminated 4,380 hours per year. This gives the average lifetime of a lamp or fixture of 50,000 hours/4380 hours per year, or 11.42 years of service life. At 11.42 years, total savings over their lifetime is as follows:

Outdoor Lighting:	\$ 79,997
Street Lighting:	\$ 31,656
Indoor Lighting:	\$143,412
Total Lifetime Savings:	\$255,065

2016 Lighting Project Summary

1. Initial LED upgrade project cost: \$85,831.58
2. saveONenergy® incentive received: \$15,924.65,
3. Overall project cost: \$69,906.93
4. Projected annual savings: \$22,335.00
5. Overall payback period of 3.13 years including incentives
6. ROI for project is 26.02% excluding incentives
7. ROI for project is 31.95% including incentives

“Overall project savings from the 2016 LED lamp replacement project exceeds \$255,000”

2017 Upgrade

During the 2017 lighting upgrade, a total of 26 exterior lighting fixtures were replaced, 338 interior fixtures were either retrofit or replaced and 2,487 T8 lamps were removed and replaced with LED lamping. The cost to upgrade outdoor lighting was \$6,143.33, indoor lighting \$55,387.70 for a total upgrade cost of \$61,531.03.

Table 2 shows total annual kWh savings realized through the three lighting project initiatives and the corresponding annual dollar savings based on an all-in cost of \$0.15 per kWh of electrical consumption. Note that sites outside of Moosonee and Moose Factory will realize greater savings potential due to higher kWh costs.

2017 Savings

Project	kWh Savings/Yr	\$ Savings/Yr
Outdoor Lighting	16,401	\$ 2,460
Indoor Lighting	453,720	\$68,058
Annual Savings	470,121	\$70,518

Table 2: Annual kWh and dollar savings 2017

Incentives

Incentives from Ontario's Independent Electricity System Operator (IESO) totaled \$25,134.62 helping to reduce project costs as follows:

Outdoor Lighting Incentive: \$ 1,445.00
Interior Lighting Incentive: \$23,689.62

Overall LED Project Savings

As noted above, the average life expectancy of an LED lamp is 50,000 hours, at which time, typically, their lumen output will have degraded to approximately 70% of their original output prompting consideration of replacement to retain optimal lighting levels. Following the same logic as above, with the average lamp operating 12 hours per day or 4,380 hours per year, the average lifetime of a lamp is 50,000 hours yearly or 11.42 years of service. Total anticipated savings are as follows:

Outdoor Lighting: \$ 28,094.91
Indoor Lighting: \$777,227.50
Total Lifetime Savings: \$805,322.41



2017 Lighting Project Summary

1. Initial LED upgrade project costs: \$61,531.03
2. saveONenergy® incentive received: \$25,134.62
3. Overall project cost: \$36,396.41
4. Projected annual savings: \$70,518.60
5. Overall payback period of .52 years or 6.2 months (including incentives)
6. ROI for project is 114.60% excluding incentives
7. ROI for project is 193.80% including incentives

BOILER REPLACEMENT

The summer boiler replacement project at the Weeneebayko General Hospital is showing positive results having reduced fuel consumption by five percent overall.

The hospital was equipped with multiple boilers with minimum low-fire capability and efficiency. Each boiler was oversized to the point of being four times the required capacity to supply the summer peak steam demand for the facility. Such demand was driven by Laundry, Kitchen, and sterilization processes.

Steam trap audits were also conducted and corrections were made where necessary to improve performance. The steam trap audit not only aided the facility staff in identifying and cataloguing all of the steam traps, but also identified traps that were not correct for the application they were serving and those in need of repair or replacement. This portion of

the project resulted in paybacks of less than 1.5 years and continues to deliver savings to the organisation as well as helping to establish new preventative maintenance routines for staff.

In addition to the new boiler, condensate return lines from the community housing steam distribution systems were re-designed, re-constructed, steam traced and re-insulated, contributing to a 40% gain in condensate return to the boiler systems permitting the boilers to operate more efficiently and consume less energy. Continued loss of condensate return would have meant ongoing costs for water supply, treatment, and the passive loss of hot water which contributed to energy waste. This project has a calculated payback of two years and has freed up a lot of maintenance staff time in system repair and replacement, which typically occurred on an annual basis.

OPPORTUNITIES

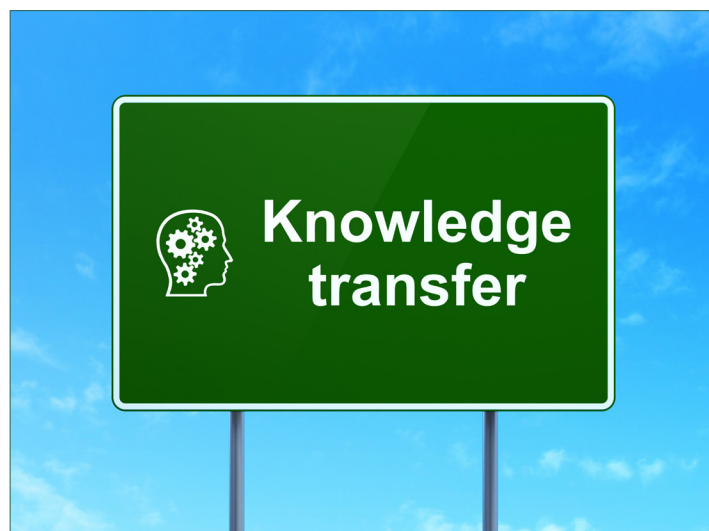
Thanks to enhanced support from WAHA's senior leaders and a newfound conservator mentality that is permeating the organisation, facility managers and staff feel empowered to embrace technical challenges and find solutions that previously may have gone unaddressed. Armed with the knowledge gained from the BOC training course, and the enthusiasm that has developed, the list of energy and building envelope retrofits is growing. Currently, WAHA facility staff are looking to replicate these same types of projects in all their facilities along the west coast of James Bay.

Other types of projects being investigated cover a broad spectrum and include a heating ventilation and air conditioning (HVAC) retrofit in the Medical Devices Reprocessing Department (MDRD) of the Weeneebayko Hospital, for which saveONenergy® funding will be requested. Other projects include more efficient heating systems for WAHA's many social housing facilities.

Staff are also considering an application for High Performance New Construction incentives for the new hospital being planned for Moosonee and for which the provincial government announced funding May 25, 2017.

The Coalition is interested in replicating the success of this energy management and skills transfer project in other First Nations communities across Canada. We encourages those interested in energy efficiency, climate change sustainability and increasing local technical capacity to contact us at info@greenhealthcare.ca

This initiative was made possible in part through the financial support of the Independent Electricity System Operator's (IESO) Education and Capacity Building Program. The Canadian Coalition for Green Health Care is solely responsible for implementation of, and the content of any materials produced by, this initiative, and the IESO has no responsibility or liability whatsoever in the event that any person suffers any losses or damages of any kind as a result of the initiative.



Credits

We would like to thank the senior leadership team and the facility management staff at the Weeneebayko Area Health Authority for assisting us in the development of this Case Study and for their dedication to ongoing development and completion of Energy Conservation Measures (ECMs) at the Weeneebayko Area Health Authority.

The Canadian Coalition for Green Health Care is Canada's premier green health care resource network and is leading the evolution of green in Canada's health sector as a national voice and catalyst for environmental change. Collaboratively we strive to reduce health care's ecological impact from compassionate care delivery while providing a nurturing platform upon which to discuss and promote best practices, innovation, environmental responsibility and climate change resiliency.

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