Community Energy Management In A Box

This guidebook provided a summary of best practices and easy wins in facility maintenance and energy management for Community Leagues in Edmonton.

Edmonton Federation of Community Leagues

2019

EFCL Green Leagues

Table of Contents

Introduction

This document was created with several goals in mind:

1) Encourage Community Leagues and their facility managers to incorporate sustainability within community halls. As this guidebook outlines potential upgrades and easy wins, it is a resource that can be used by Community Leagues to increase the performance of their facilities. This can result in reduced energy consumption, reduced operating and maintenance costs, increased thermal comfort, and a reduced environmental footprint.
2) Incorporating sustainability at a larger scope. Efforts to improve the building are the first step of a larger strategy to adopt sustainability. Community leagues may be inspired to cement sustainability into their bylaws, mission statements, and visions.
3) Sharing best practices with Community Leagues members creates a more sustainable neighbourhood. By creating conversation about sustainability and conservation, residents will be encouraged and inspired to adopt these practices within their own homes.

Throughout this document, best practices and easy wins will be outlined. These suggestions are based upon 14 energy audits that were completed by Generate Energy on Community League facilities. These facilities received an ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Level II commercial building energy assessments, which includes a walkthrough of the building, review of the utility bills, interviews with facility managers, and detailed energy and financial calculations of proposed energy efficiency measures. A summary report was also created by Generate Energy, to review the major findings of the Community League energy assessments.

This report is designed to assist Community League volunteers, specifically facility managers, in reducing their building's energy use and make decisions about energy efficiency upgrades. Conversation measures outlined are also complied into a List of Upgrades for a simple checklist to have. Suggestions made are not specific to any one facility but rather conventional guidelines for the implementation of energy conservation measures. This report does not replace the information that can be obtained from a detailed energy audit completed by a qualified energy auditor.

The majority of the content is based on the Green Leagues Energy Assessment Summary Report, prepared by Generate Energy. Any use which a third party makes of this report, or any reliance on or decisions to be based on it, is the responsibility of such third parties. Generate Energy accepts no responsibility for damages, if any, suffered by a third a party as a result of decisions made, or actions taken, based on this report.

The material in this report reflects Generate Energy's best judgement based on the information available at the time of preparation. Project implementation cost estimates are in 2017 dollars and were developed using limited visual observations of EFCL facilities. Actual implementation costs may vary due to market-driven price fluctuations and conditions not observable during site visits.

Every reasonable effort was made to ensure the accuracy of estimated energy savings, cost savings, and equipment life expectancies. Energy use of facilities, and equipment contained within them, was estimated based on past historical billing data, interviews with site representatives, and observed conditions at the time of site visits. Generate Energy cannot guarantee the energy savings nor cost savings of recommended energy conservation measures due to, but not limited to, factors outside of its control such as future changes in building occupancy and energy use patterns, changes in utility prices, weather conditions, and any incorrect information received during the interview process. This report was compiled by Ronak Patel, Energy Transition Officer for the Edmonton Federation of Community Leagues.

Acknowledgements

- Generate Energy
- Change for Climate, City of Edmonton
- Government of Alberta

List of Upgrades

Utility Saving Opportunities

- □ Late Payment Fees
- □ High Fixed Energy Rates
- □ Oversized Indoor Water Use Meter
- □ Indoor Water Service Used To Flood Outdoor Ice

Energy Conservation Measures

- Interior Lighting
- □ Replace Incandescent And Halogen Lamps With Led Lamps
- □ Replace Incandescent Exit Signs With Led Signs
- □ Replace T8 Fluorescent Lamps With T8 Direct Install Linear Led Lamps
- □ Upgrade T12 Fluorescent Lighting To Led Fixtures
- Exterior Lighting
- □ Replace Exterior Building Hid Lighting With Led Light Fixtures
- □ Replace Exterior Metal Halide Rink Lights With Led Light Fixtures
- Appliances
- □ Upgrade Old Refrigeration Appliances To Energy Star Certified Models
- HVAC
- □ Upgrade Furnaces To High-Efficiency Condensing Units
- □ Upgrade Air Conditioner Condensers To High-Efficiency Units

Controls And Low-Cost Measures

- □ Install Occupancy Sensors To Control Washroom Lighting
- □ Install Smart Thermostats And Improve Control Of Facility Hvac System
- □ Install Power Bars On Commercial Refrigerators And Reduce Their Operation
- □ Install Programmable Timers On Circulation Pumps And Water Coolers
- □ Install Low Flow Aerators On Sink Faucets
- □ Reduce Or Eliminate The Use Of Electric Unit Heaters

Maintenance And Behavioural Practices

- □ Replace Degraded Exterior Door Weather Seals And Sweeps
- □ Replace Damaged Window Seals And Window Panes
- □ Seal Air Gaps In Walls And Ceiling
- □ Perform Regular Maintenance On Furnaces
- □ Clear Obstructions From Ventilation Registers
- □ Tension Loose Drive Belts On Rooftop Exhaust Fan Motors
- □ Perform Regular Maintenance On Ac And Refrigeration Equipment
- □ Replace Degraded Insulation On Air Conditioner Refrigerant Piping
- □ Reduce Phantom Loads
- □ Repair Leaky Faucets And Toilets
- □ Turn Off Fans And Lights
- □ Program And Check Thermostat Settings
- □ Set Energy Efficiency Goals

Common Facility Characteristics & Usage

Each Community League is unique, but community facilities are typically found to consist of an assembly hall, kitchen, multi-user washroom, office/meeting rooms, mechanical/electrical rooms, and/or storage rooms. Most facilities have a skate shack (attached or detached) with outdoor hockey rinks / skating areas.

From the Community Leagues assessed under the Generate Energy evaluation, facilities were constructed ranging from the late 1920s to 1996, with most of the buildings being constructed in the 1980s. Of these halls, most Community Leagues have undergone further work, either partial renovations or new additions.

Occupancy of facilities can be quite varied, as some Community Leagues host preschools, daycares, and non-profit organizations on irregular year-round schedules. Weekend and evening occupancy are typically sporadic as Community Leagues can host a variety of events including various classes, exercise groups, children's programs, cooking groups, weddings, anniversaries, birthday parties and memorials. Community Leagues with skating facilities are typically used in the winter months (November to March).

Energy Use

Understanding how building use energy is key in identifying where upgrades can be made. For an in-depth analysis on building energy performance, it is recommended that an energy audit be completed by a qualified professional. Each facility will have its own unique end-use breakdown, but a general breakdown of Community League facilities is shown in Figure 1. Generate Energy found that space heating was the largest portion of energy and is primarily provided by natural gas furnaces. Facility lighting and domestic hot water uses make up the next largest portions. In general, the major appliances, space cooling, plug loads, and ventilation represents low percentages of overall energy use in Community League buildings.

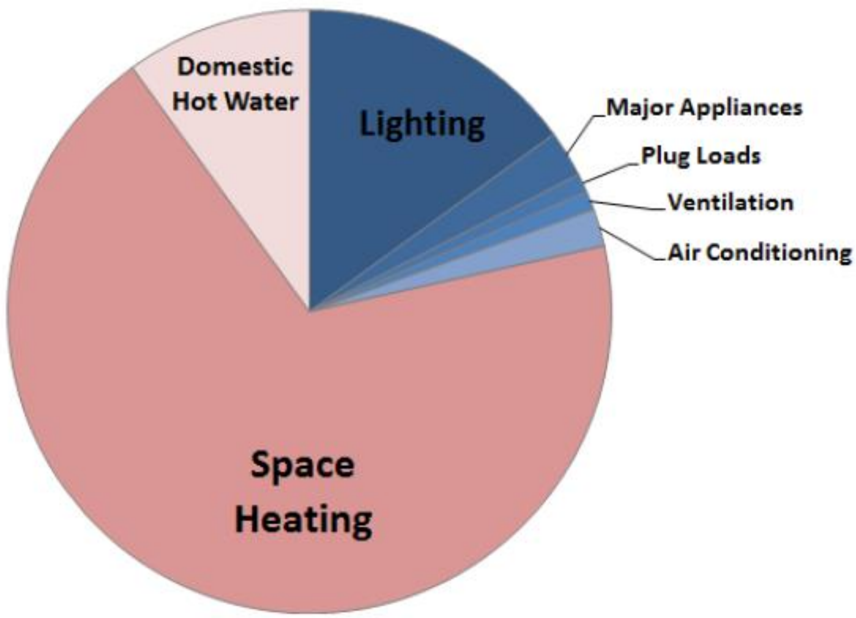

FIGURE 1: TYPICAL ANNUAL ENERGY BREAKDOWN BY END-USE CATEGORIES

To understand the seasonal variation of electricity, natural gas, and water consumption, annual use profiles were created, demonstrating frequently observed trends.

Electricity

The spring and fall often provide the best estimates for baseline electrical load. Community Leagues with outdoor hockey rinks and high-intensity discharge (HID) exterior lighting generally have higher electricity consumption during the winter months. The effect of space cooling in the summer months is often apparent on the annual electricity use profile.

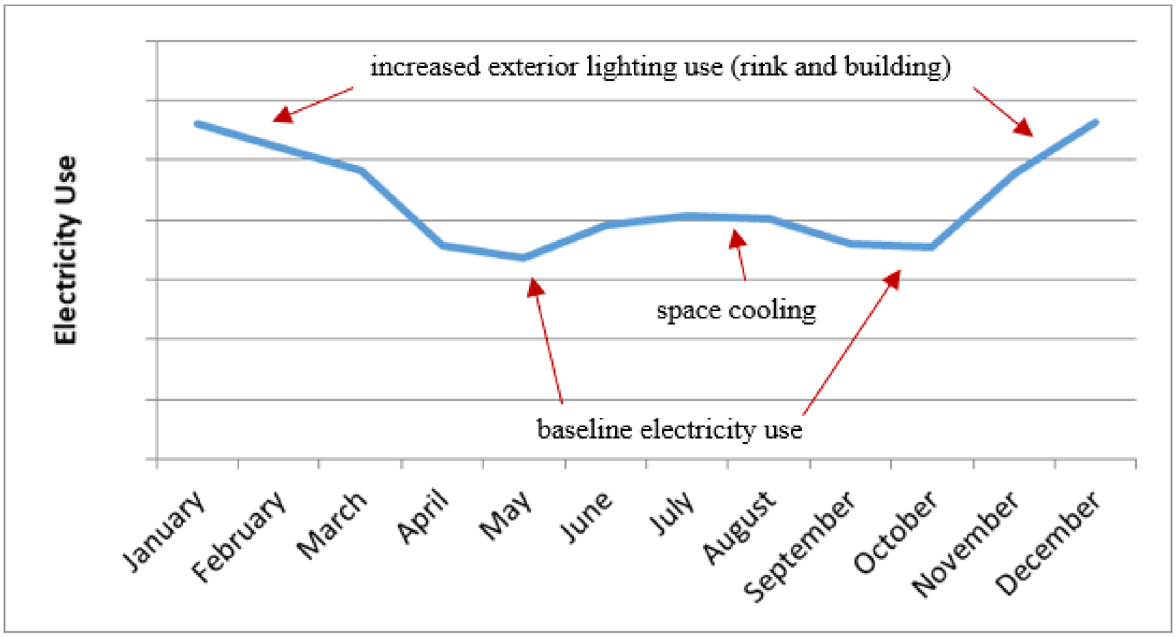

FIGURE 2: TYPICAL ANNUAL ELECTRICITY USE PROFILE

Natural gas

Space heating provided by natural gas furnaces is responsible for increased use during winter months. In the summer, natural gas consumption falls as it is only used for hot water heating and occasional cooking by natural gas appliances, if present. The summer consumption can be used to estimate annual energy use of the domestic hot water system and natural gas appliances.

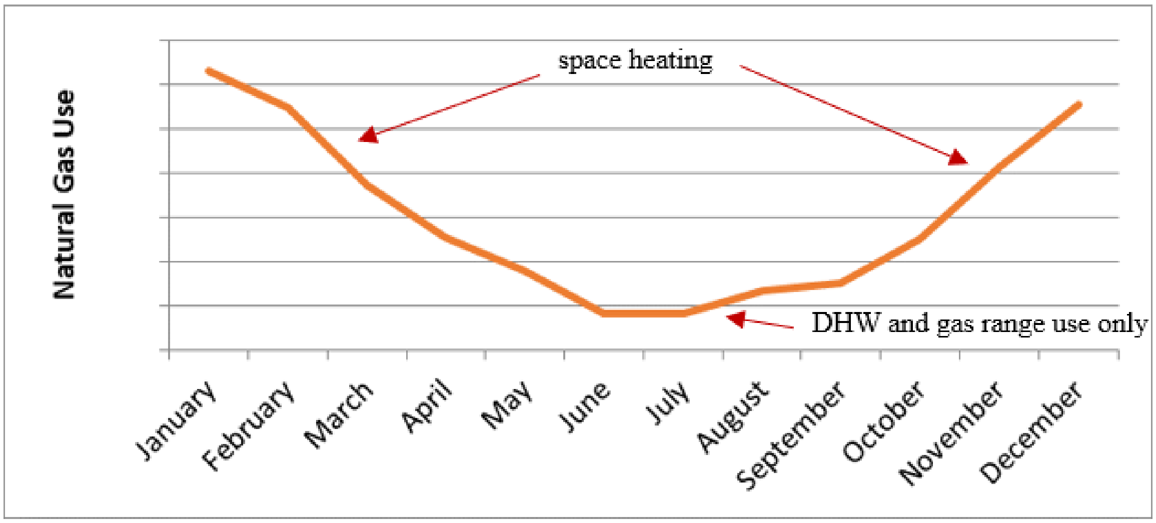

FIGURE 3: TYPICAL ANNUAL NATURAL GAS USE PROFILE

Water

Baseline water use can generally be estimated during periods of low occupancy. Water use will typically peak during the early winter months for facilities that flood their outdoor ice surfaces.

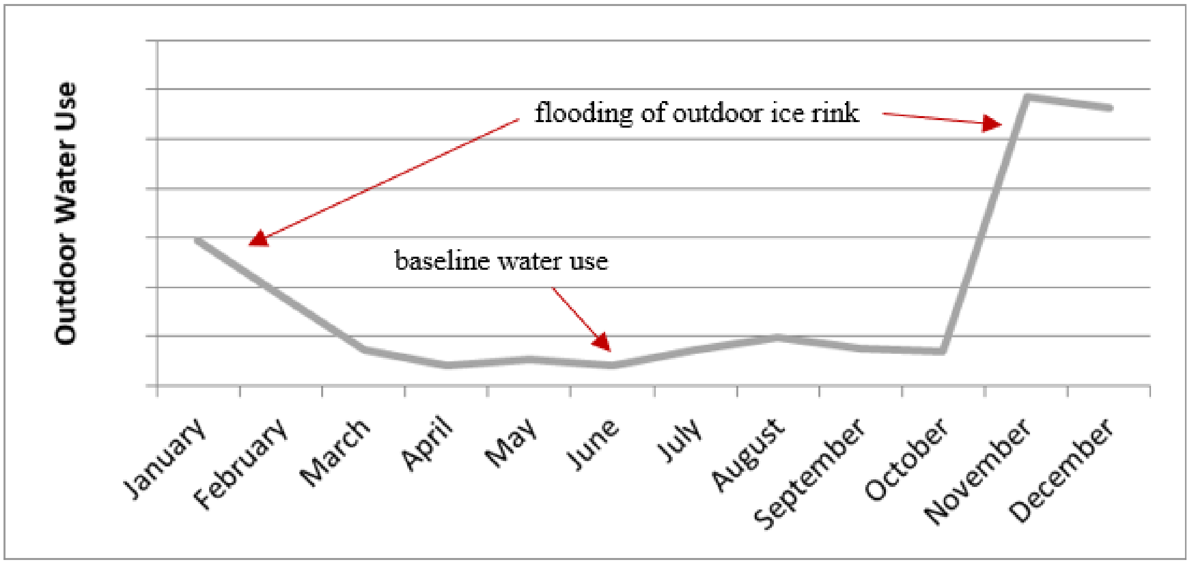

FIGURE 4: TYPICAL ANNUAL WATER USE PROFILE

Energy Use and Cost

Energy bills for 14 Community Leagues were analyzed as part of the Green Leagues energy assessments. The average facility annual energy use was found to be 606 GJ. On average, 82% of the energy used was from natural gas and the remaining 18% was electricity.

The average annual cost of energy for a Community League facility was $6,968. On average, natural gas accounted for 45% of the energy cost and electricity represented 55%. The disparity between energy use and cost is explained by the fact that during the analyzed billing period, the price of electricity was over five times higher than natural gas per unit of energy consumed. Figure 5 depicts the breakdown of annual energy use and cost for the average facility.

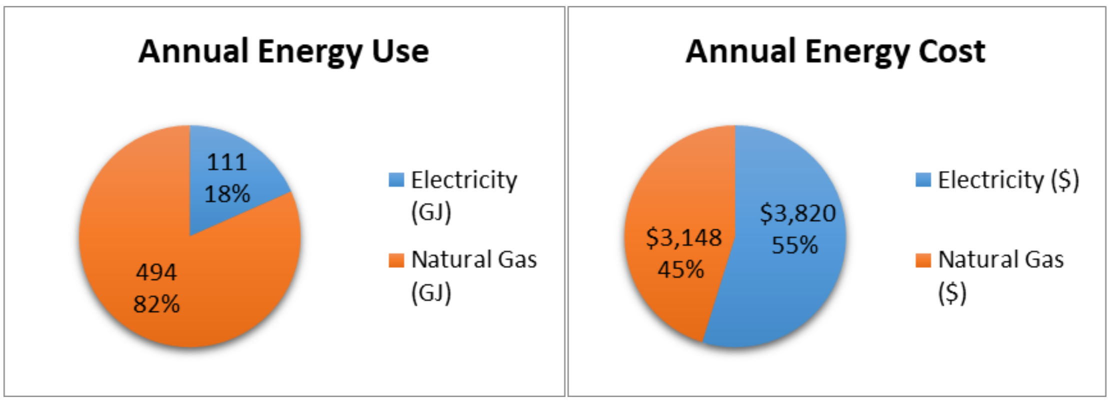

FIGURE 5: AVERAGE FACILITY ANNUAL ENERGY USE AND COST

The Energy Use Intensity (EUI) is a measurement used to evaluate a building's energy performance. It is calculated as a building's annual energy consumption per unit area. The EUI is expressed in units of GJ/m^2 and allow for the comparison of the energy performance of a building to itself over time. This means that is can be used to set and track energy efficiency targets for the building and see how effective the upgrades are. The EUI of a building can also be compared to other buildings of different sizes so that energy performances can be evaluated against a group of buildings with similar use characteristics.

According to the building and energy use data acquired, the average Community League facility has an EUI of 0.91 GJ/m^2. However, energy use intensity varied significantly across the 14 community facilities for both electricity and natural gas usage.

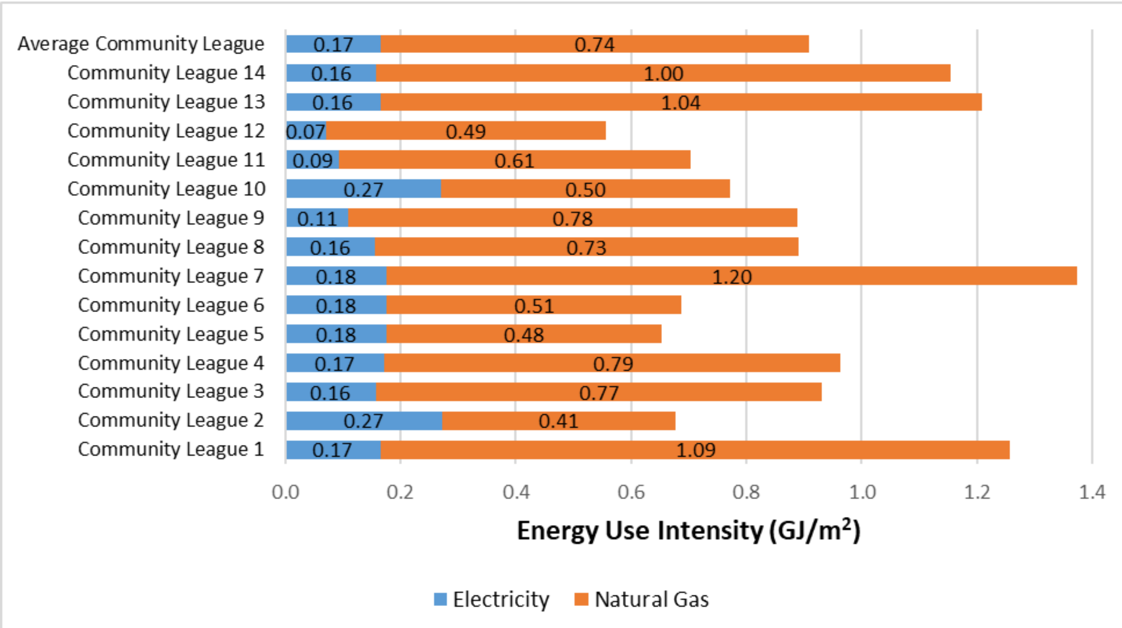

FIGURE 6: COMMUNITY LEAGUE ENERGY USE INTENSITY (EUI) BY ENERGY SOURCE

Community Leagues in Edmonton can also be compared to other property types in Canada for reference purposes (Table 1).

TABLE 1. ENERGY UTILIZATION INDEX FOR VARIOUS PROPERTY TYPES

Property Type	Site EUI (GJ/m2)
Worship Facility	0.86
Mixed Use	0.90
Average Edmonton Community League	**0.91**
Preschool/Daycare	0.92
Recreation	1.11

Source: Canadian Energy Use Intensity by Property Type, ENERGY STAR Portfolio Manager

Energy Assessment Outcomes

Each energy assessment conducted provided facility-specific energy conservation measures (ECMs) that detailed expected energy savings, emission reductions, cost savings, and financial paybacks. The following section provides a summary of the anticipated benefits and cost, assuming all energy conservation recommendations were to be followed and implemented. This information may prove useful to facility managers who are considering energy efficiency upgrades for their Community League buildings.

Average Community League results

As described in the previous section of the report, the energy use intensity (EUI) of the average Community League facility prior to energy efficiency upgrades/retrofits was determined to be 0.91 GJ/m^2. If implementation of all ECMs are assumed to be carried out, it is estimated that the average facility EUI will be lowered to 0.59 GJ/m^2. This amounts to a 35% reduction in annual energy use.

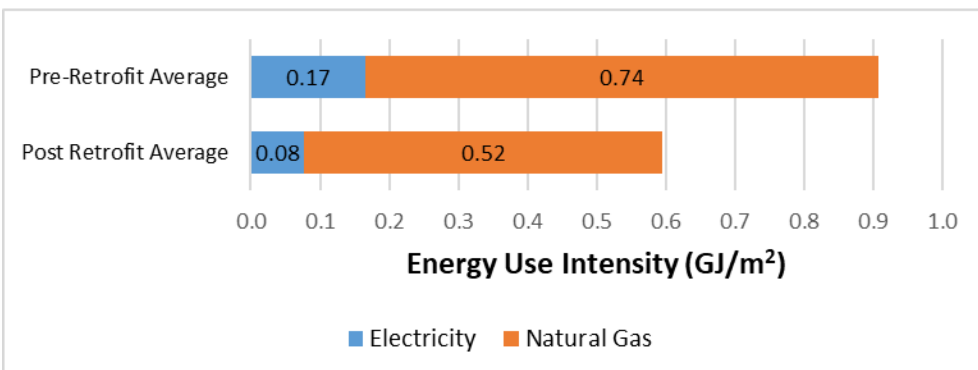

FIGURE 7. AVERAGE FACILITY EUI BEFORE AND AFTER ECM IMPLEMENTATION

The average cost of ECM implementation (retrofit cost) for Community League facilities that received an energy assessment was $45,298. Average annual cost savings associated with reduced energy use was $2,586 which amounts to a 17.5 year simple payback. The retrofit cost does account for incentives or grant funding available to Community Leagues. Information on grants, incentives or other funding opportunities is available through Green Leagues, either on the Green Leagues website or direct email contact (Greenleagues@efcl.org). The average reduction in greenhouse gas (GHG) emissions over the lifetime of the energy efficiency upgrades was determined to be 391.6 tCO_2e.

TABLE 2. ANALYSIS RESULTS (AVERAGE OF 14 COMMUNITY LEAGUE FACILITIES)

Item	Value	Unit
Pre-Retrofit Average EUI	0.91	GJ/m2
Post-Retrofit Average EUI	0.59	GJ/m2
Average Annual Reduction in Energy Use	35%	
Average Retrofit Cost	$45,298	
Average Annual Cost Savings	$2,586	
Average Simple Payback	17.5	years
Average Annual Reduction in GHG Emissions	39%	
Average Lifetime Reduction in GHG Emissions	391.6	tCO2e

Program-wide results

The combined effect of all 14 Green Leagues program energy assessments is shown in Table 3. In total, the recommended ECMs will lower utility costs by $36,211 per year and reduce greenhouse gas emissions by 5,482 tCO_2e over their expected lifetime.

TABLE 3. ANALYSIS RESULTS (COMBINES ALL 14 COMMUNITY LEAGUE FACILITIES)

Item	Value	Unit
Combined Retrofit Cost	$634,166	
Annual Cost Savings	$36,211	
Annual Electricity Savings	228,504	kWh
Annual Natural Gas Savings	1,954	GJ
Annual GHG Emissions Reduction	244	tCO2e
Lifetime GHG Emissions Reduction	5,482	tCO2e

Utility Saving Opportunities

The following section identifies opportunities to reduce the cost of utility services without affecting the amount of energy or water being used.

☐ *Late payment fees*

Several Community League facilities were found to incur late payment fees in addition to monthly utility costs. In some cases, these fees amounted to hundreds of dollars annually. It is recommended that pre-authorized payments be set up on Community League utility accounts to avoid late payment fees.

☐ *High fixed energy rates*

During the period of time that the Green Leagues energy assessments were carried out, energy rates were relatively low compared to historical averages. Some leagues were on fixed energy rate plans and were paying higher rates than currently available through their retailer. It is recommended that Community Leagues evaluate their utility rates on an annual basis and renegotiate their energy rates if necessary. Some retailers allow for early exit from fixed term contracts without penalty. The Utilities Consumer Advocate website is an excellent resource for comparing energy rates between retailers and between fixed, variable, and regulated rate options. Historical utility rate data is also available here. https://ucahelps.alberta.ca

☐ *Oversized indoor water use meter*

An oversized, 1 1/2-inch, water meter for supplying indoor water use was found in one of the visited Community League facilities. Typically, Community Leagues require a 5/8-inch, 3/4 inch, or 1-inch meter for their indoor water service depending on the facility’s size and water system requirements (water meters used for flooding ice rinks are usually 1 1/2 inch). Downsizing this particular service to a 1-inch meter was found to save the Community League approximately $400 per year in water and drainage service charges. It is recommended to consult with EPCOR Water Services and a qualified plumber if you think that your Community League’s water service meter could be reduced in size.

□ *Indoor water service used to flood outdoor ice*

Several Community League facilities were found to be using the same, 1 1/2-inch, water service for both indoor facility use and to flood outdoor ice surfaces in the winter. Water services that supply the building’s indoor water incur monthly wastewater treatment and drainage fees; however, services for exclusively outdoor use are spared from these fees because they do not drain into municipal sewer lines.

In these situations, annual water bill savings can be realized by separately metering the facility’s indoor and outdoor water use. This will typically require the installation of a new, smaller meter for the building’s indoor water use and for the existing 1 1/2-inch water service to be designated as outdoor-use only. It is recommended to consult with EPCOR Water Services and a qualified plumber to determine if your facility could benefit from metering its indoor and outdoor water use separately.

Table 4 shows an example of the estimated annual savings from separate metering of indoor and outdoor water use in one Community League facility. These estimations are based on an annual outdoor water use of 130 m^3. Annual savings is positively correlated with the volume of outdoor water use of a facility.

Table 4. Example of estimated utility bill savings from separate metering of water services

Reduced Annual Fees on Existing 1.5-inch Service	
Wastewater Treatment Service Charge Savings	$50
Wastewater Treatment Charge Savings Based on Outdoor Water Usage*	$103
Drainage Service Charge Savings	$606
Drainage Charge Savings Based on Outdoor Water Usage*	$124
Total Annual Savings	$883

* Based on estimated annual outdoor water usage of 130 m3

Increased Annual Fees for New 5/8-inch Service	
Water Service Charge	$87
Wastewater Treatment Service Charge	$50
Drainage Service Charge	$112
Total Increased Annual Fees	$249

Net Annual Savings	
Annual Savings - Increased Annual Fees	$633

Energy Conservation Measures

The Energy Conservation Measures (ECMs) identified in the 14 Energy Audits were compiled and selected based on their relevance to Community Leagues, frequency of application, low implementation sots, short payback periods, or ease of installation.

Recommended energy conservation measures (ECMs) have been detailed in three steps:

1. **Existing Condition** - Description of identified energy inefficiency commonly found in community league facilities
2. **Recommendation** - Proposed corrective action for the above condition
3. **Implementation** - Required actions to carry out the recommendation

The estimated simple payback for higher cost ECMs has been provided in the recommendation step. Estimates are based on ECMs that were developed for specific community league facilities participating in the Green Leagues energy assessment program. Actual financial paybacks will vary based on the unique billing, occupancy, equipment, and building characteristics of the community league being considered. Certain upgrades, such as window replacements or insulation improvements to the building envelope, are effective strategies for reducing energy use but were not included in this report due to their extremely long financial paybacks.

The cost of some ECMs can be estimated without having detailed information of the community league facility or equipment. The estimated cost for these measures has been included in the implementation step. Other ECMs simply rely too much on specific facility characteristics to provide an estimated cost. Provided implementation costs were developed from actual contractor quotes received during the period of time that the energy assessments were conducted. It is recommended that community league facilities interested in pursuing energy efficiency upgrades receive their own quotes from local contractors to determine the financial and technical feasibility of such upgrades.

For the purposes of transparency and consistency, ECM financial calculations only consider the total cost of implementation and the anticipated energy cost savings. They do not account for any incentives or grant funding available to community leagues or the fact that certain existing equipment has reached its theoretical end of life and is due for replacement in the near future. It is recommended that these additional factors be considered when determining project feasibility

Interior Lighting

- ☐ *Replace incandescent and halogen lamps with LED lamps*

Existing Condition: Inefficient incandescent and halogen lamps were found to comprise a portion of the interior lighting in many community league facilities. Some of these lamps encounter regular use as a result of being in high occupancy areas such as assembly halls.

Recommendation: It is recommended that incandescent and halogen lamps be replaced with LED lamps of roughly equivalent lumen output. Any dimmer switches used to control these lights will likely need to be upgraded to LED compatible dimmers. To achieve a colour temperature comparable to the existing incandescent lamps, it is recommended to select LED lamps with a colour temperature of 2700 - 3000 K. These bulbs are usually indicated as “soft white” or “warm white” on their packaging. Upgrading incandescent and halogen lamps to LEDs will reduce the electricity consumption of these lights by 75 to 85%. The simple payback for this measure depends on the hours of operation of the lighting but was found to range between 1 and 5 years in community league facilities.

Implementation: Implementing this recommendation requires removing existing incandescent and halogen bulbs, replacing them with the LED lamps, and installing LED dimmer switches where required. Lamp replacement can be performed by a facility manager or maintenance volunteer. LED lamps and dimmer switches are readily available at local home improvement stores. LED lamp costs range from $5 to $30 depending on the lamp type.

□ *Replace incandescent exit signs with LED signs*

Existing Condition: Several community league facilities were found to utilize incandescent exit sign lighting, with each sign containing two 15 W incandescent lamps. Exit sign light fixtures operate 24 hours per day for the entire year which causes unnecessarily high electricity use within the facility. Additionally, the incandescent T6 bulbs used in these fixtures have a short life expectancy and require replacement every three to six months. This contributes to a high life-cycle cost and many hours of bulb-replacement maintenance.

FIGURE 8. INCANDESCENT EXIT SIGN FIXTURE

Recommendation: It is recommended that the incandescent exit signs be replaced with 2.5 W LED models. These LED fixtures will use 90% less energy than incandescent signs. The simple payback for the installation of new LED exit signs is approximately 7 years. Additional safety, convenience, and financial savings will be realized by eliminating the requirement for frequent bulb replacement.

Implementation: Installation of LED exit sign fixtures can be performed by a qualified electrical contractor for an estimated cost of $150 per fixture.

□ *Replace T8 fluorescent lamps with T8 direct install linear LED lamps*

Existing Condition: Some community leagues have T8 fluorescent lamp fixtures installed in their facility. This is especially common in buildings that have undergone renovations since their original construction. The 4 ft T8 lamps usually have a rated power of 32 W and are operated on instant-start electronic ballasts.

FIGURE 9. T8 INSTANT-START ELECTRONIC BALLAST (LEFT) AND T8 FLUORESCENT LAMPS (RIGHT)

Recommendation: It is recommended that existing 32 W T8 fluorescent lamps be replaced with 15 W T8 direct install linear LED lamps. These LED lamps are designed to work with instant-start electronic ballasts and reduce the power consumption of the fixtures by 40 to 50%. The LED lamps have an average rated life of 50,000 hours compared to 30,000 hours for standard fluorescent lamps. The simple payback for this upgrade depends on the hours of operation of the lighting but was found to range between 8 and 15 years in community league facilities.

Implementation: Implementing this recommendation will require replacing the existing T8 fluorescent lamps with LED lamps. Lamp replacement can be performed by a facility manager or maintenance volunteer. It is recommended to confirm the compatibility of existing ballasts with the new LED lamps prior to installation and to ensure that old fluorescent tubes are disposed of at an appropriate waste management facility. The replacement T8 LED tubes can be purchased from local lighting specialty stores for approximately $15 per tube. Old fluorescent lamps will incur a disposal fee of $1 per tube at Edmonton Eco Stations.

□ *Upgrade T12 fluorescent lighting to LED*

Existing Condition: Fluorescent light fixtures equipped with T12 lamps and magnetic ballasts were the most commonly observed form of interior lighting in community league facilities. In addition to being inefficient and noisy, the flicker generated by magnetic ballasts can cause eye strain in certain individuals.


FIGURE 10. T12 FLUORESCENT LAMPS (LEFT) AND MAGNETIC BALLAST (RIGHT)

Recommendation: It is recommended that T12 fluorescent light fixtures be replaced with LED fixtures of comparable lumen output. Upgrading the T12 fluorescent light fixtures to LED fixtures will reduce the annual electricity consumption of these lights by 50 to 60%. The simple payback for this measure depends on the hours of operation of the lighting but was found to range between 15 and 25 years in community league facilities.

Implementation: Replacement of fluorescent light fixtures with new LED fixtures should be performed by a qualified electrical contractor.

Exterior Lighting

☐ *Replace exterior building HID lighting with LED fixtures*

Existing Condition: Many community league facilities have high intensity discharge (HID) light fixtures for their exterior security lighting. These HID lights are usually high-pressure sodium or metal halide fixtures and range from 70 to 250 W each. They are controlled by photo sensors to turn on when the sun sets. This results in high hours of operation for these exterior lights. HID lights are more efficient than incandescent or halogen lighting, but less efficient than LEDs.

FIGURE 11. 100 W METAL HALIDE (LEFT) AND 250 W HIGH PRESSURE SODIUM FIXTURES

Recommendation: It is recommended that existing HID exterior light fixtures be replaced with LED lighting. This will reduce the annual electricity consumption of the outdoor light fixtures by approximately 70% while maintaining or enhancing lighting quality and levels. The simple payback for this measure ranges from 7 to 12 years.

Implementation: Implementing this recommendation involves replacing existing exterior fixtures with LED units. Replacement of the HID light fixtures should be completed by a qualified electrical contractor.

◻ *Replace exterior metal halide rink lights with LED light fixtures*

Existing Condition: Community leagues with outdoor hockey rinks commonly had pole-mounted 1,000 W metal halide flood lights for illuminating ice surfaces. Accounting for the power consumption of the lamp and ballast, these light fixtures use approximately 1,080 W each when operating. Hours of operation for the rink lighting varied among community leagues but typically ranged between 400 and 700 hours per year.

FIGURE 12. 1,000 W METAL HALIDE OUTDOOR RINK LIGHTS

Recommendation: It is recommended that 1,000 W metal halide fixtures be replaced by 300 W LED flood lights with a light output of greater than 30,000 lumens each. Estimated life for these flood lights are generally 100,000 hours. LED flood lights will reduce the electricity use of the outdoor rink lighting by approximately 70%. The simple payback for this measure was found to be quite high (approximately 30 years), largely due to the relatively low operational hours of the rink lighting.

Implementation: Upgrading the rink lighting to LED will require replacing the existing metal halide fixtures with LED flood light fixtures. This can be completed by a qualified electrical contractor for an estimated cost of $1,600 per light fixture.

Appliances

- ☐ *Upgrade old refrigeration appliances to ENERGY STAR certified models*

Existing Condition: Several community league facilities were found to contain old (early 1990s) refrigerators and chest freezers. These units have aged door seals, poor insulation, and utilize inefficient refrigeration technology. This results in significantly higher electricity use than that of new models.

FIGURE 13. OLD CHEST FREEZERS

Recommendation: It is recommended that refrigeration appliances with a manufacturing date older than 1993 be replaced with ENERGY STAR certified models of equivalent storage capacity. Electricity use of refrigeration equipment decreased significantly in the 1990s due to improvements in compressor design. Replacing old units with high-efficiency models will reduce the annual electricity use of the appliance by over 60%.

Implementation: ENERGY STAR certified refrigerators and freezers can be purchased from a local home improvement store. Ensure that old appliances are taken to an Edmonton Eco Station or other appropriate waste facility as the refrigerant must be safely disposed of.

HVAC

☐ *Upgrade furnaces to high-efficiency condensing units*

Existing Condition: Medium efficiency furnaces are still commonly found in community league facilities. These furnaces are typically non-condensing, single stage units with an AFUE of approximately 80%. They have inefficient single speed blower motors and are nearing the end of their usable life.

FIGURE 14. MEDIUM EFFICIENCY, NON-CONDENSING FURNACES

Recommendation: It is recommended that these mid-efficiency units be upgraded to high-efficiency, two-stage, condensing furnaces of comparable heating capacity with multi-speed blower fan motors. Unlike the existing furnaces, condensing furnaces utilize a secondary heat exchanger to extract useful heat from the exiting combustion exhaust gases. Two-stage burners and multi-speed fan motors more efficiently meet a building's heating demand.

Simple payback for this measure varies significantly based on the unique characteristics of a building and its heating system; however, 30 to 35-year paybacks were commonly observed. Long paybacks are largely due to the low cost of natural gas. It is worth noting, however, that the existing heating equipment is near its end of life and will require replacement soon whether this recommendation is followed or not.

Implementation: Implementing this measure requires that the old furnaces be removed, and the combustion intake and exhaust piping be renovated to accommodate the high-efficiency units.

Condensate piping also must be run from each furnace to a floor drain pipe. This work should be completed by a qualified heating and ventilation contractor.

□ *Upgrade air conditioner condensers to high-efficiency units*

Existing Condition: Several old air conditioner condenser units were observed at community league facilities. These units have an estimated SEER rating of 6 to 8 and are nearing the end of their usable life. Refrigerant piping on these systems is typically degraded or non-existent causing further reduced system efficiency. This can lead to high electricity use in the summer months for leagues that rely heavily on their cooling system.

FIGURE 15. OLD ROOFTOP AIR CONDITIONER CONDENSER UNIT

Recommendation: It is recommended that these condenser units be upgraded to high-efficiency (16 SEER) models and that refrigerant piping be insulated with closed-cell foam pipe insulation that has a UV resistant PVC jacket to protect it from environmental degradation.

Simple payback for this measure was found to be over 35 years due to the short cooling season and low occupancy of the facilities. It is worth noting, however, that the existing cooling equipment is near its end of life and will require replacement soon whether this recommendation is followed or not.

Implementation: Replacement of condensing units will require the use of a lift or crane if it they are located on the roof of the building. Installation of the recommended equipment, disposal of the old condensers, and insulation of the refrigerant piping can be completed by a qualified heating and ventilation contractor.

Controls and Low-Cost Measures

□ *Install occupancy sensors to control washroom lighting*

Existing Condition: Manual switches are typically used to control the lighting in community league washrooms. During energy assessment site visits, washroom lights were commonly found to be left on.

Recommendation: It is proposed that where practical, the washroom lighting controls be upgraded to incorporate occupancy sensors (motion sensors) for effective lighting management. Lighting electricity consumption is typically reduced by 40% once occupancy sensors are installed.

FIGURE 16. WALL SWITCH OCCUPANCY SENSOR

Implementation: Implementing this recommendation will require installing wall switch occupancy sensors in place of the existing manual switches. The cost of an occupancy sensor is approximately $30. It is recommended that installation be performed by a qualified electrical contractor.

- *Install smart thermostats and improve control of facility HVAC system*

Existing Condition: Community league facilities were commonly found to contain non-programmable thermostats for controlling heating and cooling equipment. When present, programmable thermostats were rarely set to follow the building's occupancy schedule. This is causing excessive energy consumption by the heating and cooling systems.

FIGURE 17. ANALOG (LEFT) AND DIGITAL (RIGHT) NON-PROGRAMMABLE THERMOSTATS

Recommendation: It is recommended that non-programmable thermostats be replaced with smart thermostats and that they be programed to operate according to the building's occupancy schedule. Programing a 4 ºC temperature setback during unoccupied hours is recommended to reduce annual heating energy consumption. Smart thermostats are also capable of sensing the occupancy of a zone and automatically overriding the set schedule if the zone is occupied. These web-enabled thermostats allow for remote monitoring and adjustment of all the facility's thermostats on a single account. This provides an effective means of controlling the temperature in community leagues even if building occupancy is infrequent and sporadic.

FIGURE 18. SMART THERMOSTAT WITH REMOTE TEMPERATURE/OCCUPANCY SENSOR

Implementation: Implementing this measure will require that the current thermostats be removed, and programmable smart thermostats be installed in appropriate locations with wireless occupancy/temperature sensors. The smart thermostats can be installed by a qualified heating and ventilation contractor for an estimated cost of $450 per thermostat. Ensure that the thermostats are properly programmed by the contractor, guided by a community league representative with knowledge of the facility's regular occupancy schedule.

□ *Install power bars on commercial refrigerators and reduce their operation*

Existing Condition: Most community league facilities have commercial refrigerator units that operate continuously. These refrigerators are often only needed for weekend events and remain empty on weekdays. Annual electricity consumption of these large refrigerators was measured to be between 1,500 and 2,000 kWh per year in most cases. This electricity consumption is higher than necessary because the units operate for a significant amount of time without drinks or food inside.

FIGURE 19. COMMERCIAL GLASS-DOOR REFRIGERATORS

Recommendation: It is recommended that an easily-accessible power bar be installed to allow refrigerator units to be turned off when not in use. The power bar must have an on-off switch and should be mounted in an easy-to-reach location. The refrigerator door should be left slightly open when the unit is off to prevent odor and mold growth.

Implementation: The cost for a power bar is approximately $20 and can be easily installed by a community league volunteer. The power bar could be attached to the side of a refrigerator unit with Velcro adhesive. Easy access to the on/off switch is important to encourage people to turn off the refrigerator when not in use. Signage should be installed next to the power bar to notify occupants to turn the power on once drinks and food are placed inside and to leave the refrigerator door open when the appliance is turned off.

☐ *Install programmable timers on circulation pumps and water coolers*

Existing Condition: Certain equipment, such as circulation pumps and water coolers, operate continuously even though their use is only required during occupied hours. This results in unnecessary electricity consumption during unoccupied hours.

Recommendation: It is recommended that programmable timers be utilized to reduce the operating hours of circulation pumps and water coolers. Timers should be programmed to operate equipment during the scheduled occupancy hours.

FIGURE 20. CIRCULATION PUMP TIMER (LEFT) AND PLUG-IN PROGRAMMABLE TIMER (RIGHT)

Implementation: Various types of programmable timers are available to control electrical equipment. A plug-in programmable timer is suitable for controlling appliances such as a water cooler. This type of timer can be purchased from a local home improvement store for approximately $30. Programmable timers designed specifically for circulation pumps can be purchased from a local plumbing supplier and installed by a qualified contractor for an estimated cost of $250.

□ *Install low flow aerators on sink faucets*

Existing Condition: Sink faucets were found to be lacking low flow faucet aerators in many community league facilities. Measured flow rates on these faucets ranged from 3 to 10 gpm.

Recommendation: It is recommended that WaterSense certified faucet aerators with a flow rate of 1.5 gpm be installed on the identified sink faucets. This will reduce both water use and natural gas consumption for hot water heating. The simple payback for this measure is usually under two years.

FIGURE 21. LOW FLOW FAUCET AERATOR

Implementation: Faucet aerators can be purchased from a local plumbing supply store for approximately $10 each and installed by a facility manager or maintenance volunteer.

□ *Reduce or eliminate the use of electric unit heaters*

Existing Condition: Fan forced and convection electric unit heaters were often found in stairwells, vestibules, and mechanical rooms. These heaters ranged from 1,000 to 3,000 W in capacity. Some of these electric heaters were found to be constantly running, which is an expensive method for heating conditioned space.

 

FIGURE 22. FAN FORCED (LEFT) AND CONVECTION (RIGHT) ELECTRIC UNIT HEATERS

Recommendation: It is recommended that unnecessary use of electric heat be eliminated in community league facilities. The cost of heating with electricity is approximately five times more expensive than heating with natural gas furnaces. Where the use of electric heat is critical for thermal comfort or preventing freezing water pipes, it is proposed that programmable thermostats be installed to control and reduce the temperature set points accordingly.

Implementation: Installation of programmable thermostats can be completed by a qualified heating and ventilation contractor for an estimated cost of $250 per unit

Maintenance and behavioural practices

The following section identifies recommended maintenance and behavioural practices for reducing energy and water use in community league facilities. These recommendations are informed by observations made during community league energy assessments. An energy efficiency maintenance schedule is also included to assist facility managers with planning for periodic maintenance items.

Infrared (IR) thermal images were taken during the site visits and are included with some of the recommendations. Infrared cameras detect IR energy emitted from objects, convert it to temperature, and display the temperature distribution as an image. This allows for areas of heat loss or infiltration to be identified. In the thermal images that follow, areas of relatively higher temperature appear as warm colours (red, orange, and yellow) while areas of lower temperature appear as cool colours (green and blue). Spot temperature readings in degrees Celsius are also included in some of the thermal images.

□ *Replace degraded exterior door weather seals and sweeps*

Damaged weather stripping around door sealing areas and door sweeps results in outdoor air infiltration and building thermal losses. Additionally, misalignment of the doors or damaged door closers can cause exterior doors to remain partially open for long periods of time. This reduces thermal comfort of the building and leads to increased energy consumption by its heating and cooling systems. It is recommended that exterior door seals and sweeps be inspected annually and replaced as required. Ensure proper functioning of the door closers and sealing around the door edges; door adjustments may be required to gain a positive seal.

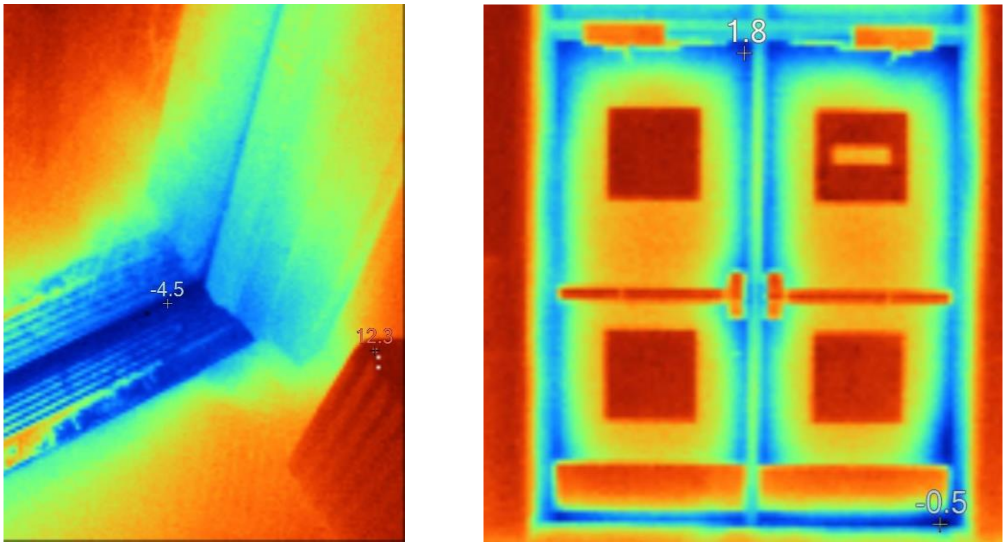

FIGURE 23. THERMAL IMAGES SHOWING COLD AIR INFILTRATION IN BLUE

□ *Replace damaged window seals and window panes*

Damaged window seals and window panes cause increased outdoor air infiltration. This reduces thermal comfort of the building and leads to increased energy consumption by its heating and cooling systems. It is recommended that windows be inspected annually, and that damaged weather seals and broken window panes be replaced accordingly.

□ *Seal air gaps in walls and ceiling*

Air leaks can cause buildings to feel drafty and increase the energy use of the heating and cooling systems. Plumping penetrations, attic access hatches, and gaps in concrete masonry (cinderblock) walls are common culprits. It is recommended that exterior walls and ceilings be inspected for air leaks and sealed using an appropriate weather seal or caulk.

□ *Perform regular maintenance on furnaces*

Dirty air filters result in increased electricity consumption of furnace blower fan motors and reduce indoor air quality. It is recommended that furnaces have scheduled air filter changes every three months, or as specified by the equipment manufacturer, and be inspected and serviced annually by a qualified HVAC contractor.

□ *Clear obstructions from ventilation registers*

Obstructed ventilation registers restrict the distribution of heated or cooled air causing blower fans to use more electricity. It is recommended that obstructions blocking ventilation registers be moved so that air can efficiently enter at the designed flow rate.

FIGURE 24. OBSTRUCTED VENTILATION REGISTERS

☐ *Tension loose drive belts on rooftop exhaust fan motors*

Rooftop exhaust fans are not easily accessed and therefore often neglected when it comes to regular maintenance and inspection. In addition to negatively affecting the operation of the motor, a loose fan motor drive belt will cause increased electricity use. It is recommended that fan motor drive belts be inspected annually and tensioned to the manufacturer's specifications.

☐ *Perform regular maintenance on AC and refrigeration equipment*

Air conditioners and refrigeration equipment require regular maintenance to ensure their efficient operation. The condenser cooling fins on these units can accumulate debris that restricts the cooling fan's airflow and decreases the ability to cool the refrigerant. This results in increased compressor cycling and electricity consumption. It is recommended that the condenser cooling fins on AC and refrigeration condensers be cleaned regularly and that cooling fans and refrigerant levels be checked periodically by a qualified technician.

FIGURE 25. DEBRIS ACCUMULATION ON REFRIGERATOR CONDENSER

□ *Replace degraded insulation on air conditioner refrigerant piping*

Degraded insulation on refrigerant piping causes low pressure refrigerant lines to absorb heat from the exterior air resulting in lower system efficiency, more frequent compressor cycling, and increased air conditioning operation costs. It is recommended that new closed-cell foam pipe insulation be installed with UV-resistant PVC jacketing to protect it from environmental degradation.

FIGURE 26. DEGRADED FOAM INSULATION ON AIR CONDITIONER REFRIGERANT LINES (LEFT) AND UV-RESISTANT PVC JACKETING FOR PIPE INSULATION (RIGHT)

□ *Reduce phantom loads*

A phantom load is any device that uses electricity when it is off but still plugged into an outlet. Individually, a phantom load may appear to be insignificant, but a building full of phantom loads can lead to considerable electricity waste. It is recommended that electronic devices, such as computers, monitors, printers, televisions, coffee makers, and microwaves, be disconnected from the electrical system when not in use. This can be accomplished by unplugging the device or by using another device to control its operation such as a smart power bar or programmable timer. Consider using an energy usage monitor, such as the one shown below, to identify phantom loads in your facility.

FIGURE 27. ENERGY USAGE METER (LEFT) AND SMART POWER BAR (RIGHT)

☐ *Repair leaky faucets and toilets*

Leaky plumbing fixtures causes excessive water use and lead to expensive water bills. It is recommended that plumbing fixtures be inspected, and monthly water bills be monitored to identify any plumbing issues and that leaky faucets and toilets be repaired promptly.

☐ *Turn off fans and lights*

Fans and lights controlled by manual switches are prone to be left on when the building is vacant. Posting signs that remind occupants to turn off lights and fans can reduce unnecessary operation of this equipment. Consider installing occupancy sensors in areas such as washrooms, change rooms, and hallways to further reduce their operation.

☐ *Program and check thermostat settings*

One of the simplest and most effective energy conservation strategies is to utilize a temperature setback strategy to decrease the heating or cooling requirements during unoccupied hours. This is accomplished by programming thermostats to a lower temperature at night during winter and a higher temperature at night during summer. Typical setback temperatures are 18 ºC for heating and 27 ºC for cooling. It is recommended that thermostats be checked periodically to ensure that their settings continue to fit the requirements and occupancy pattern of the building.

□ *Set energy efficiency goals*

Setting energy efficiency goals for your community league facility demonstrates leadership that can inspire community members to prioritize energy efficiency in their own homes. It is important to involve key individuals such as facility managers, hall managers, and treasurers in the planning process. Reach out to the EFCL with any questions as they have resources and personnel to assist your community league with its energy efficiency initiatives.

Energy Efficiency Maintenance Schedule Example

Task	Frequency		
	3 Months	**6 Months**	**Annually**
Building Envelope			
Inspect exterior door seals, closers, and alignment. Repair or replace as needed.			x
Inspect window seals and look for broken panes. Replace as needed.			x
Inspect walls and ceilings for air gaps. Seal gaps as needed.			x
Heating			
Replace furnace filters.	x		
Professional furnace inspection and servicing.			x
Ventilation			
Check for proper functioning of air dampers.		x	
Inspect ventilation registers to make sure they are clear of obstructions.		x	
Inspect fan belts on rooftop exhaust fans. Tighten or replace as needed.			x
Inspect and clean exhaust fans.			x
Cooling			
Inspect and clean condensing coil fins on AC and refrigeration units.		x	
Professional AC inspection and servicing.			x
Plumbing			
Inspect plumbing fixtures for leaks. Repair as needed.		x	
Controls			
Check programmable thermostat schedule. Adjust as needed.	x		
Confirm that photocells for exterior lighting are functioning properly.			x

ENERGY BENCHMARKING AND MONITORING

Measurement and verification (M&V) is the process of monitoring and recording energy use within a facility in order to quantify the savings delivered by energy efficiency upgrades. In its most basic form, M&V can be accomplished by tracking monthly energy billing information. ENERGY STAR Portfolio Manager is a free online program that can be used to track energy and water consumption, monitor building greenhouse gas emissions, and benchmark the performance of a facility.

Property profiles were created in Portfolio Manager for each of the facilities that received an energy assessment under the Green League program. The provided energy and water bills were also inputted into the program. The historical energy bills and calculated energy use intensity (EUI) form a baseline to which future energy performance can be compared. If a community league is interested in pursuing energy efficiency improvements, it is highly recommended that a league representative be appointed to create an account in Portfolio Manager and input monthly energy billing information.

More detailed M&V can be accomplished by installing monitoring equipment at an electrical breaker panel or near a gas utility meter to record and display real-time energy use data for the facility. This is commonly referred to as submetering and can be applied to monitor the energy use of a whole facility, part of a facility, or individual equipment.

Submeters measure and log building energy consumption data and make it visible remotely through an online monitoring platform. This makes tracking energy use simple and helps to identify sources of energy waste as well as opportunities for energy savings. Additionally, dashboards can be set up in lobby areas to display facility energy use and targets and to encourage occupants to participate in meeting annual energy goals. Figure shows an example of an energy use dashboard displaying hours of high electricity use.

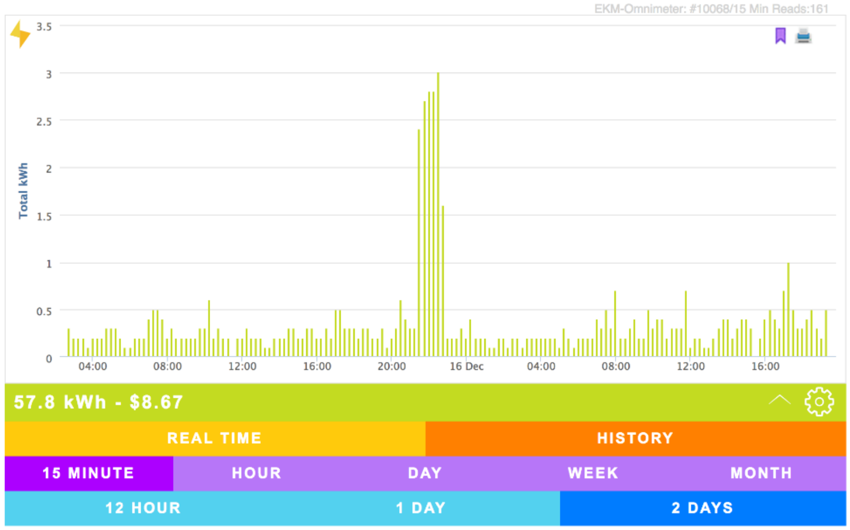

FIGURE 28. DASHBOARD DISPLAYING ELECTRICAL ENERGY USE

It is recommended that community leagues interested in improving the energy efficiency of their facility install electrical submeters with a web-based monitoring system on their main electrical panel feed conductors. This will allow the facility's electricity use to be monitored on-site or remotely by an appointed community league member using his or her smartphone, tablet, or computer. This type of monitoring system would benefit the league by:

1. Providing a simple method of ensuring all non-essential systems are off when the building is unoccupied to avoid unnecessary energy use and cost.
2. Logging historical energy use data to verify and quantify the effects of implemented ECMs.
3. Allowing malfunctioning building equipment to be identified before failure occurs.
4. Monitoring energy production from any existing or future renewable energy systems installed on the facility.

Managing the energy use of a community league building may seem like a daunting task, especially considering the time constraints of league volunteers. However, once they are set up, the tools mentioned above are simple to use, require minimal time commitment, and provide an effective means to reduce energy costs and communicate the value of energy conservation to members of the community.

APPENDICES

List of Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
A	amp
AC	air conditioning
AFUE	annual fuel utilization efficiency
AHU	air handling unit
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BMS	building management system
btu	British thermal unit
cap	capacity
CFL	compact fluorescent lamp
COE	City of Edmonton
comp	compressor
cu ft	cubic foot
DHW	domestic hot water
ECI	energy cost intensity
ECM	energy conservation measure
EFCL	Edmonton Federation of Community Leagues
eff	efficiency
EPS	expanded polystyrene
equip	equipment
EUI	energy use intensity
ft	foot
gal	gallon
GHG	greenhouse gas
GJ	gigajoule
gpm	gallon per minute
h	hour
HDD	heating degree days

HID	high-intensity discharge
hp	horsepower
HPS	high pressure sodium
HVAC	heating, ventilation, and air conditioning
in	inch
incand	incandescent
IR	infrared
K	Kelvin
kVA	kilovolt-amp
kW	kilowatt
kWh	kilowatt hour
LED	light-emitting diode
l	litre
lm	lumen
lpf	litre per flush
m	meter
M&V	measurement and verification
MAU	make-up air unit
min	minute
NG	natural gas
O&M	operation and maintenance measure
OSB	oriented strand board
oz	ounce
PEA	preliminary energy-use analysis
PVC	polyvinyl chloride
qty	quantity
RRO	Regulated Rate Option
SEER	seasonal energy efficiency ratio
tCO2e	tonne of carbon dioxide equivalent
UV	ultraviolet
V	volt
VA	volt-amp
W	watt