City of Peterborough

To:	**Members of the General Committee**
From:	**Blair Nelson, Commissioner, Infrastructure, Planning and Growth Management**
Meeting Date:	**June 17, 2024**
Report:	**Community Building Retrofit Feasibility Study, Report IPGACP24-012**

Subject

A report to provide Council information about the completed Community Buildings Retrofit Feasibility Study conducted at nine corporate facilities.

Recommendations

That Council approve the recommendations outlined in Report IPGACP24-012, dated June 17, 2024, of the Commissioner, Infrastructure, Planning and Growth Management as follows:

a) That the presentation from Efficiency Engineering Inc. be received for information;

b) That the Community Building Retrofit Feasibility Study be used to inform future budget requests for energy efficiency projects;

c) That Council authorize City staff to seek funding opportunities from external agencies or other levels of government to supplement approved budgets in support of priority initiatives; and

d) That Council authorize the use of the Climate Change Reserve as a source of eligible funding, under the delegated authority of the Director of Asset Management and Capital Planning, for energy conservation measures to decarbonize corporate facilities.

Executive Summary

- The Community Buildings Retrofit Feasibility Study evaluated nine corporate facilities to determine the energy conservation measures best suited to mitigate facility greenhouse gas emissions by 80 percent over a 20-year time horizon.

- The evaluation conducted by Efficiency Engineering Inc. ascertained that the nine facilities cumulatively could reduce emissions by 2,444 tCO_2e with total project implementation costs of $56,494,291, incremental life cycle costs of $20,390,145, and annual utility savings of $110,515 by 2045 (see facility breakdown in Table 1).

- Grants and loans are presently available from the Green Municipal Fund to fund facility energy renovations for municipalities that have completed the Community Buildings Retrofit Feasibility Study.

Background

Greenhouse gases (GHG) originating from utilizing fossil fuels to power and heat buildings is a substantial source of corporate emissions. The most recent corporate GHG inventory report determined that buildings generated 3,305 tCO_2e, contributing 18 percent to total corporate emissions in 2021. The largest GHG emitting class of buildings in the inventory is attributed to arenas that produced 1,704 tCO_2e or 6 percent of total corporate emissions. The GHG inventory report concluded that building energy retrofits would be needed in part to support reducing total corporate emissions to reach the 45 percent target by 2030.

To assist in achieving the corporate GHG reduction targets in 2030 and 2050, as mandated by the Climate Emergency Declaration, an improved understanding of facility mitigation opportunities was needed. In 2021, City Council approved recommendations in IPSIM21-019 that authorized City staff to apply to the Federation of Canadian Municipalities' Community Building Retrofit Feasibility Study ('Study'). In 2022, the City was successful in its application which provided 80 percent in grant funding to assess a portfolio of buildings to identify the practicality of various energy conservation measures to mitigate GHG emissions by 50 percent in 10-years and 80 percent in 20-years. The Study afforded the City the ability to investigate the associated costs of energy conservation measures that included detailed project costs, annual utility savings, avoided costs, incremental life cycle costs, and net present value of individual measures. In addition, the Study required three decarbonization scenario models to be developed that projected the impact of various energy conservation measures to achieve the 50 and 80 percent goals as well as accomplishing 80 percent reduction in 5 years.

In 2023, Efficiency Engineering Inc. ('Efficiency Engineering') was hired to conduct the Study. The consultant undertook several tasks to complete the project that included the following:

- Analyzing facility energy consumption data for multiple years and reviewing site drawings,
- Performing detailed site investigations and interviewing on-site facility staff,
- Hosting design and decision-making workshops with the City technical team composed of Facility Management, Recreation Facility Services, and Asset Management & Capital Planning, to select energy conservation measures to model,
- Conducting financial and emission modelling to ascertain individual and interactive effects of energy conservation measures,
- Developing GHG reduction pathway scenarios that align with mitigation of 50 percent in 10-years, 80 percent in 20-years, and 80 percent in 5-years,
- Presenting key findings to the Peterborough Environmental Advisory Committee and senior leadership team; and
- Completing final reports for all nine facilities.

Individual facility technical reports that contain detailed project methodology, site investigation results, model calculations and assumptions, energy conservation measure analysis, and GHG reduction pathways are located in the Appendix of this report.

Study Findings

Total GHG Emissions and Financial Costs

Efficiency Engineering determined that the total projected GHG emission reduction for the suite of energy conservation measures at all facilities was 2,444 tCO_2e (Table 1). The total emission abatement projected aligned to within the 80 percent reduction target with some facilities exceeding the goal. Project costs to realize the emission savings was estimated to amount to $56,494,291 if all measures are implemented by Year 20. The avoided cost of implementing the various energy conservation measures when compared to the cost of business-as-usual replacement for like-for-like or like-for-similar measures was found to be $7,006,379.

Table 1. Facility GHG Emission and Financial Cost Projections

Facility	GHG Reduced (tCO_2e)	Total Project Costs	Annual Utility Saving	Avoided Costs	Incremental Life Cycle Costs	Incremental Cost of Carbon per tonne	Potential GMF Grant
Memorial Centre	567	$8,342,631	-$17,050	$1,200,209	$3,105,422	$274	$1,668,526
Kinsmen Arena	536	$5,769,524	$78,008	$391,140	$1,611,712	$150	$1,153,905
Municipal Operations Centre	451	$12,480,917	-$11,375	$584,300	$5,126,088	$568	$2,496,183
Healthy Planet Arena	328	$10,301,934	$13,837	$1,581,695	$3,721,933	$568	$2,060,387
Sports & Wellness Centre	273	$5,178,567	-$35,129	$903,882	$2,324,873	$426	$1,035,713
City Hall	163	$6,878,362	$15,981	$1,538,862	$2,189,661	$672	$1,375,672
Bus Terminal	57	$3,202,232	$41,378	$494,347	$945,735	$835	$640,446
Art Gallery	45	$2,396,900	$6,125	$239,087	$825,045	$910	$479,380
Airport Terminal	24	$1,943,223	$18,740	$72,856	$539,675	$1,102	$388,645
TOTAL	**2,444**	**$56,494,291**	**$110,515**	**$7,006,379**	**$20,390,145**	**$417**	**$11,298,858**

The Study concluded that the 80 percent reduction pathway scenario achieved over 20 years was the best suited pathway for the City to achieve its GHG goal. The 80 percent reduction pathway is the best opportunity to reduce emissions without stranding assets prematurely once the end-of-life of the equipment or asset is reached by replacing with the proposed energy conservation measure. Thereby avoiding the higher financial costs inherent in the 5-year pathway which arise from the removal of assets before end-of-life and paying for added electricity utility consumption sooner than in the 20-year pathway.

Financial modelling calculated the net incremental life cycle cost which is the expected cost that considers the energy conservation measure's project cost, annual operational costs, and expected inflation over 20 years. Furthermore, the incremental life cycle cost deducts external funding from currently available Green Municipal Fund grants and the avoided costs from not pursuing a business-as-usual energy project once end-of-life for the equipment or asset has been reached. The net incremental life cycle cost is the best financial indicator to reflect the impact of energy renovations over a 20-year period. To note, long-term financial modelling is limited in some accuracy due to the variable future costs of utilities, equipment, and labour that will likely impact financial estimations.

The incremental cost of carbon per tonne allows for comparison of different reduction pathways as well as between facilities. A lower number represents a cost-effective outlook for implementation of the suite of energy conservation measures per facility.

Lastly, the Green Municipal Fund is presently offering municipalities that have completed the Community Building Retrofit Feasibility Study an opportunity to apply for dedicated capital financing stream. The Community Building Retrofit GHG Reduction Pathway Capital Project provides $5 million per project, covering up to 80 percent of eligible costs with an 20 percent of grant funding component. Municipalities can re-enter the Capital Project stream once a project has been completed for future retrofits.

Modelling Considerations

Efficiency Engineering proposed energy conservation measures after completing the facility site investigations. Individual measures were presented to the City's technical team and selected for measure analysis modeling. Once the financial and GHG impact for each energy conservation measure was determined, the City technical team nominated the measures that were the best opportunity for each facility. Efficiency Engineering then completed the scenario level analysis that identified which GHG reduction pathway, the 50 percent or 80 percent pathway, each energy conservation measure should be placed.

To note, the scenario level analysis typically differs in the sum total of the financial and GHG projections of the individual measure analysis due to the interactive effects of the bundled energy conservation measures. The measure analysis affords the ability to determine project costs per energy conservation measure but does not consider the ramifications of other proposed measures per facility. At the facility level, the scenario level's financial and GHG analysis is the best representation of the anticipated impact of the suite of renovations over 20 years.

An example is the impact of converting non-LED to LED lighting fixtures. Individually, LED lighting reduces electricity consumption and associated electricity GHG emissions. However, when included in a scenario level analysis, LED lighting contributes to the rise in space heating demand as a result of less heat generated that the inefficient non-LED lighting would have provided to warm the indoor air. This interactive effect impacts the financial and GHG outcome at the facility. Several other individual measures have pronounced interactive effects which is why the sum of electricity and natural gas usage may not equal the scenario level financial and GHG analysis presented in Table 1.

Proposed Facility Energy Conservation Measures

Airport Terminal

The investigation at the Airport Terminal revealed that the building uses more energy than other airport terminals. The top three energy end uses at the Airport Terminal are space heating (42%), lighting (31%), and air distribution (14%). The top three utility costs per end use were lighting, air distribution, and space heating, respectively.

Nine energy conservation measures were proposed by Efficiency Engineering to lower the Airport Terminal's GHG emissions by 31 tCO_2e by 2042 (Table 2). Four measures were found to have no capital payback but generated a combined GHG emission abatement of 25 tCO_2e. Combined annual utility savings was determined to be $18,740 for the suite of measures. A potential GMF grant of $388,645 is currently available to cover up to 20 percent of the project costs.

Table 2. Proposed Measures and Estimated Financial Costing at the Airport Terminal

Energy Conservation Measures	Utilities		GHG Emissions	Financials				Timeline
Proposed Opportunities	**Electricity (kWh)**	**Natural Gas (m^3)**	**GHG Reduced (tCO_2e)**	**Utility Savings**	**Project Costs**	**Net Present Value**	**Capital Payback**	**Year**
Low flow water faucets	0	-151	0.3	$118	$1,389	$352	9.5	2024
LED fixtures	-72,920	3,569	-3.1	$13,631	$30,191	$183,189	2.1	2024
Building automation system	-170	-2,160	4.1	$903	$40,533	-$26,047	23.4	2025
ASHP MUA	10,300	-2,172	3.6	-$894	$200,312	-$191,673	No Payback	2028
40-kW solar PV system	-49,915	0	2.5	$8,586	$158,318	-$17,995	12.8	2029
Hybrid ASHP water tank heater	7,440	-1,931	3.3	-$499	$32,689	-$38,630	No Payback	2030
AHU & electric backup	47,640	-10,112	16.8	-$4,107	$288,419	-$330,428	No Payback	2031
Triple pane windows	-2,150	-1,161	2.3	$839	$169,624	-$156,050	47.9	2040
Insulation	340	-547	1.0	$163	$1,021,748	-$1,019,156	No Payback	2042
Total	**59,435**	**14,666**	**31**	**$18,740**	**$1,943,223**	GMF funding available: $388,645		

Note: Air handling unit (AHU), air source heat pump (ASHP), light emitting diode (LED), make up air (MUA), photovoltaic (PV)

Art Gallery

The investigation at the Art Gallery revealed that the building is more energy efficient than other public sector art galleries due to existing electric hot water heaters, high efficiency condensing boilers, and LED lighting. The top three energy end uses at the Art Gallery are space heating (66%), lighting (15%), and air distribution (8%). Correspondingly, the top three utility costs per end use were also space heating, lighting, and air distribution.

Six energy conservation measures were proposed by Efficiency Engineering to lower the Art Gallery's GHG emissions by 45 tCO_2e by 2038 (Table 3). Three measures were found to have no capital payback but generated a combined GHG emission abatement of 44 tCO_2e. Combined annual utility savings was determined to be $6,125 for the suite of measures. A potential GMF grant of $479,380 is currently available to cover up to 20 percent of the project costs.

Table 3. Proposed Measures and Estimated Financial Costing at the Art Gallery

Energy Conservation Measures	Utilities		GHG Emissions	Financials				Timeline
Proposed Opportunities	**Electricity (kWh)**	**Natural Gas (m^3)**	**GHG Reduced (tCO_2e)**	**Annual Utility Savings**	**Project Costs**	**Net Present Value**	**Capital Payback**	**Year**
Low flow water fixtures	-1,310	0	0.1	$296	$2,643	$1,799	7.5	2024
LED fixtures	-18,740	923	-0.8	$1,985	$59,538	-$26,994	17.9	2024
38-kW solar PV system	-44,731	0	2.2	$5,510	$148,779	-$58,735	16.7	2028
Triple pane windows	-130	-749	1.4	$278	$168,986	-$106,430	24.0	2032
ASHP w electric backup	90,535	-19,396	32.3	-$4,363	$562,946	-$548,129	No Payback	2035
Insulation	-4,920	-5,179	10.1	$2,419	$1,454,008	-$1,415,028	68.9	2038
Total	**20,704.1**	**-24,400.9**	**45**	**$6,125**	**$2,396,900**	GMF funding available: $479,380		

Note: Air source heat pump (ASHP), light emitting diode (LED), photovoltaic (PV)

City Hall

The investigation at City Hall revealed that the facility uses slightly less energy than other public sector administration buildings. The top three energy end uses at City Hall are space heating (64%), air distribution (19%), and plug loads (7%). The top three utility costs per end use were air distribution, space heating, and plug loads, respectively.

Eight energy conservation measures were proposed by Efficiency Engineering to lower City Hall's GHG emissions by 171 tCO_2e by 2040 (Table 4). Four measures were found to have no capital payback but generated a combined GHG emission abatement of 143 tCO_2e. Combined annual utility savings was determined to be $15,251 for the suite of measures. A potential GMF grant of $1,375,672 is currently available to cover up to 20 percent of the project costs. It is anticipated that City Hall will require an electrical service upgrade to support the electrification of the facility which is estimated to cost an additional $1,047,435.

Table 4. Proposed Measures and Estimated Financial Costing at City Hall

Energy Conservation Measures	Utilities		GHG Emissions	Financials				Timeline
Proposed Opportunities	**Electricity (kWh)**	**Natural Gas (m^3)**	**GHG Reduced (tCO_2e)**	**Annual Utility Savings**	**Project Costs**	**Net Present Value**	**Capital Payback**	**Year**
Install Low Flow (0.5 gpm) Washroom Faucets	0	-789	1.5	$640	$6,252	$3,065	8.2	2,024
Upgrade to LED Lighting	-40,660	3,115	-3.9	$4,526	$136,242	-$61,935	17.9	2,024
Replace DHW Heaters with Electric	10,730	-1,422	2.2	-$978	$39,529	-$28,736	No Payback	2,029

Energy Conservation Measures	Utilities		GHG Emissions	Financials				Timeline
Proposed Opportunities	**Electricity (kWh)**	**Natural Gas (m^3)**	**GHG Reduced (tCO_2e)**	**Annual Utility Savings**	**Project Costs**	**Net Present Value**	**Capital Payback**	**Year**
Install a 210 kW Solar PV Canopy over South Parking Area	-203,336	0	10.2	$28,246	$1,480,220	-$1,018,618	25.2	2,026
Install a 2-Stage Heat Pump System to Offset Heating Boilers	121,838	-35,965	62.2	-$3,970	$739,898	-$808,686	No Payback	2,038
Replace RTUs with ASHP RTUs & Electric Backup	244,890	-47,842	78.6	-$16,785	$2,642,974	-$1,918,820	No Payback	2,031
Install Triple Pane Windows	2,140	-10,741	20.3	$3,572	$785,812	-$728,609	50.1	2,040
Electrical Service Upgrade	0	0	0.0	$0	$1,047,435	-$1,047,435	No Payback	2,036
Total	**135,602.4**	**-93,645.7**	**171**	**$15,251**	**$6,878,362**	GMF funding available: $1,375,672		

Note: Air source heat pump (ASHP), heat pump (HP), light emitting diode (LED), photovoltaic (PV), roof top unit (RTU)

Healthy Planet Arena

The investigation at the Healthy Planet Arena revealed that the facility uses slightly more energy than other municipal arenas. The top three energy end uses at the arena are process loads (45%), space heating (33%), and hot water (7%). The top three utility costs per end use were process loads, domestic water, and space heating, respectively.

Nine energy conservation measures were proposed by Efficiency Engineering to lower Healthy Planet Arena's GHG emissions by 324 tCO_2e by 2035 (Table 5). Six measures were found to have no capital payback but generated a combined GHG emission abatement of 272 tCO_2e. Combined annual utility savings was determined to be $13,837 for the suite of measures. A potential GMF grant of $2,060,387 is currently available to cover up to 20 percent of the project costs. It is anticipated that Healthy Planet Arena will require an electrical service upgrade to support the electrification of the facility which is estimated to cost an additional $653,291.

Table 5. Proposed Measures and Estimated Financial Costing at Healthy Planet Arena

Energy Conservation Measures	Utilities		GHG Emissions	Financials				Timeline
Proposed Opportunities	**Electricity (kWh)**	**Natural Gas (m^3)**	**GHG Reduced (tCO_2e)**	**Annual Utility Savings**	**Project Costs**	**Net Present Value**	**Capital Payback**	**Year**
Low flow showerheads	0	-4,259	8.1	$1,099	$4,226	$13,398	3.4	2024
LED fixtures	-53,500	3,691	-4.3	$6,518	$379,696	-$272,880	26.7	2024
Electric ice resurfacers	58,800	-5,679	7.8	-$6,746	$231,205	-$341,891	No Payback	2025
Cold water arena ice flooding	-200	-5,395	10.3	$1,420	$87,524	-$64,744	28.1	2025
600-kW solar PV system	-682,066	0	34.1	$95,243	$2,121,138	-$564,631	14.6	2026
HRV w electric backup	50,800	-11,641	19.6	-$4,091	$557,728	-$625,484	No Payback	2028
HE refrigeration plant compressors	-90,400	0	4.5	$12,623	$2,263,750	-$2,057,453	45.1	2028
ASHP w electric backup	186,400	-43,189	72.7	-$14,887	$1,003,420	-$1,250,077	No Payback	2034
Parallel condenser w HP & electric boiler	757,724	-110,337	171.6	-$77,343	$2,999,958	-$4,272,539	No Payback	2035
Electrical service upgrade	0	0	0.0	$0	$653,291	-$653,291	No Payback	2035
Total	**227,558**	**-176,808**	**324**	**$13,837**	**$10,301,934**	GMF funding available: $2,060,387		

Note: Air source heat pump (ASHP), heat pump (HP), heat recovery ventilator (HRV), high efficiency (HE), light emitting diode (LED), photovoltaic (PV)

Kinsmen Arena

The investigation at the Kinsmen Arena revealed that the facility uses significantly more energy than other benchmarked municipal arenas. The top three energy end uses at the arena are space heating (60%), plug loads (28%), and hot water (5%). The top three utility costs per end use were process loads, space heating, and domestic water, respectively.

Seven energy conservation measures were proposed by Efficiency Engineering to lower Kinsmen Arena's GHG emissions by 534 tCO_2e by 2035 (Table 6). Five measures were found to have no capital payback but generated a combined GHG emission abatement of 503 tCO_2e. Combined annual utility savings was determined to be $78,008 for the suite of measures. A potential GMF grant of $1,153,905 is currently available to cover up to 20 percent of the project costs. It is anticipated that Kinsmen Arena will require an electrical service upgrade to support the electrification of the facility which is estimated to cost an additional $733,025.

Table 6. Proposed Measures and Estimated Financial Costing at Kinsmen Arena

Energy Conservation Measures	Utilities		GHG Emissions	Financials				Timeline
Proposed Opportunities	**Electricity (kWh)**	**Natural Gas (m^3)**	**GHG Reduced (tCO_2e)**	**Annual Utility Savings**	**Project Costs**	**Net Present Value**	**Capital Payback**	**Year**
Low flow shower heads	3,120	-4,259	8	$1,235	$3,458	$16,227	2.6	2024
LED fixtures	-9,760	1,136	-2	$881	$216,321	-$201,793	50.2	2024
Electric ice resurfacers	69,920	-6,530	9	-$6,935	$231,205	-$345,312	No Payback	2024
430-kW solar PV system	-468,869	0	23	$63,555	$1,182,500	-$143,858	12.9	2025
MUA w HRV	11,680	-10,221	19	$2,396	$431,259	-$393,303	47.1	2025
ASHP w gas backup	44,750	-9,654	16	-$2,308	$490,098	-$528,944	No Payback	2025
Parallel condenser w HP & electric boiler	600,462	-258,341	461	$19,184	$2,481,659	-$2,198,544	No Payback	2027
Electrical service upgrade	0	0	0	$0	$733,025	-$733,025	No Payback	2027
Total	**251,303**	**-287,870**	**534**	**$78,008**	**$5,769,524**	GMF funding available: $1,153,905		

Note: Air source heat pump (ASHP), heat pump (HP), heat recovery ventilator (HRV), light emitting diode (LED), make up air (MUA), photovoltaic (PV)

Municipal Operations Centre

The investigation at the Municipal Operations Centre revealed that the facility uses slightly more energy than other benchmarked municipal operation centres. The top three energy end uses at the Municipal Operations Centre are spacing heating (70%), air distribution (21%), and plug loads (3%). The top three utility costs per end use were space heating, air distribution, and domestic water, respectively.

Ten energy conservation measures were proposed by Efficiency Engineering to lower the Municipal Operation Centre's GHG emissions by 456 tCO_2e by 2040 (Table 7). Eight measures were found to have no capital payback but generated a combined GHG emission abatement of 441 tCO_2e. Combined annual utility savings was determined to be cumulatively a negative value, costing an extra $11,375 for the suite of measures. A potential GMF grant of $2,496,183 is currently available to cover up to 20 percent of the project costs. It is anticipated that the Municipal Operations Centre will require an electrical service upgrade to support the electrification of the facility which is estimated to cost an additional $1,112,267.

Table 7. Proposed Measures and Estimated Financial Costing at the Municipal Operations Centre

Energy Conservation Measures	Utilities		GHG Emissions	Financials				Timeline
Proposed Opportunities	**Electricity (kWh)**	**Natural Gas (m^3)**	**GHG Reduced (tCO_2e)**	**Annual Utility Savings**	**Project Costs**	**Net Present Value**	**Capital Payback**	**Year**
Wash bay controls	-36,240	0	2	$4,633	$10,411	$65,303	2.1	2024
Electric pressure washer	82,310	-13,913	22	-$4,184	$35,247	-$74,149	No Payback	2027
Electric unit heaters	1,520	-284	0	-$65	$99,323	-$74,281	No Payback	2027
ASHP MUA & electric backup	364,110	-72,970	120	-$13,304	$1,339,372	-$1,512,500	No Payback	2027
236-kW solar PV system	-273,563	0	14	$37,635	$936,468	-$318,011	15.8	2030
Hot water w ASHP & electric backup	39,379	-10,221	17	-$761	$666,879	-$675,468	No Payback	2032
Electric HRU	636,610	-91,993	143	-$39,474	$89,623	-$698,392	No Payback	2037
ASHP RTU w electric backup	65,010	-12,209	20	-$2,749	$1,755,050	-$1,745,507	No Payback	2038
ASHP w gas backup	186,109	-63,605	111	$5,185	$3,486,480	-$3,348,671	672.4	2040
Insulation	-3,250	-2,839	6	$1,709	$2,949,797	-$2,922,258	No Payback	2040
Electrical service upgrade	0	0	0	$0	$1,112,267	-$1,112,267	No Payback	2040
Total	**1,061,995**	**-268,035**	**456**	**-$11,375**	**$12,480,917**	GMF funding available: $2,496,183		

Note: Air source heat pump (ASHP), heat recovery unit (HRU), make up air (MUA), photovoltaic (PV), roof top unit (RTU)

Peterborough Memorial Centre

The investigation at the Memorial Centre revealed that the facility uses more energy than other benchmarked municipal arenas. The top three energy end uses at the arena are space heating (35%), refrigeration (23%), and process loads (22%). The top three utility costs per end use were refrigeration, process loads, and air distribution, respectively.

Seven energy conservation measures were proposed by Efficiency Engineering to lower the Memorial Centre's GHG emissions by 566 tCO_2e by 2040 (Table 8). Four measures were found to have no capital payback but generated a combined GHG emission abatement of 262 tCO_2e. Combined annual utility savings was determined to be cumulatively a negative value, costing an extra $1,627 for the suite of measures. A potential GMF grant of $1,668,526 is currently available to cover up to 20 percent of the project costs. It is anticipated that the Memorial Centre will require an electrical service

upgrade to support the electrification of the facility which is estimated to cost an additional $681,511.

Table 8. Proposed Measures and Estimated Financial Costing at the Memorial Centre

Energy Conservation Measures	Utilities		GHG Emissions	Financials				Timeline
Proposed Opportunities	**Electricity (kWh)**	**Natural Gas (m^3)**	**GHG Reduced (tCO_2e)**	**Annual Utility Savings**	**Project Costs**	**Net Present Value**	**Capital Payback**	**Year**
Low flow showerheads	0	-5,395	10	$1,989	$3,073	$28,824	1.4	2024
Cold water arena ice flooding	-2,100	-47,700	91	$17,868	$68,400	$218,290	3.4	2024
LED lighting	-114,500	7,098	-8	$12,893	$483,104	-$271,603	20.6	2025
Electric ice resurfacers	0	-7,666	15	$2,826	$231,205	-$185,877	32.6	2025
ASHP RTU w electric backup	252,500	-50,539	83	-$15,573	$1,997,980	-$2,258,116	No Payback	2028
Parallel condenser w HP & electric boiler	920,042	-217,337	367	-$44,512	$4,333,714	-$5,085,365	No Payback	2035
155-kW solar PV system	-168,924	0	8	$22,882	$543,644	-$169,693	15.3	2040
Electrical service upgrade	0	0	0	$0	$681,511	-$681,511	No Payback	2035
Total	**887,018**	**-321,539**	**566**	**-$1,627**	**$8,342,631**	GMF funding available: $1,668,526		

Note: Air source heat pump (ASHP), heat pump (HP), light emitting diode (LED), photovoltaic (PV), roof top unit (RTU)

Peterborough Sports & Wellness Centre

The investigation at the Peterborough Sports & Wellness Centre revealed that the facility uses less energy than other benchmarked municipal aquatic centres. The top three energy end uses at the arena are miscellaneous equipment (39%), space heating (17%), and ventilation fans (16%). The top three utility costs per end use were ventilation fans, miscellaneous equipment, and domestic hot water, respectively.

Nine energy conservation measures were proposed by Efficiency Engineering to lower the Sports & Wellness Centre's GHG emissions by 300 tCO_2e by 2035 (Table 9). Three measures were found to have no capital payback but generated a combined GHG emission abatement of 239 tCO_2e. Combined annual utility savings was determined to be cumulatively a negative value, costing an extra $35,129 for the suite of measures. A potential GMF grant of $1,035,713 is currently available to cover up to 20 percent of the project costs. It is anticipated that the Sports & Wellness Centre will require an electrical service upgrade to support the electrification of the facility which is estimated to cost an additional $733,619.

Table 9. Proposed Measures and Estimated Financial Costing at the Peterborough Sports & Wellness Centre

Energy Conservation Measures	Utilities		GHG Emissions	Financials				Timeline
Proposed Opportunities	**Electricity (kWh)**	**Natural Gas (m^3)**	**GHG Reduced (tCO_2e)**	**Annual Utility Savings**	**Project Costs**	**Net Present Value**	**Capital Payback**	**Year**
Implement Demand Control Ventilation	-44,040	-5,758	13	$8,592	$6,760	$132,983	0.7	2024
Install Low-Flow Showerheads	0	-5,707	11	$2,211	$5,121	$30,351	2.1	2024
Install a Wastewater Heat Recovery System	0	-5,523	10	$2,140	$58,521	-$24,195	17.1	2025
Retrofit Exterior Lighting to LED	-5,600	0	0	$809	$23,433	-$10,215	17.5	2025
Install a 155 kW Solar PV System	-169,413	0	8	$24,469	$620,458	-$220,575	16.0	2026
Install Lead Electric Boiler	1,178,500	-142,760	212	-$114,895	$224,218	-$2,118,605	No Payback	2028
Replace RTUs with ASHP RTUs and Electric Backup	121,500	-17,405	27	-$10,804	$3,065,793	-$3,244,399	No Payback	2030
Install an Air Source Heat Pump to Offset Pool Heating (Roadmap 2)	-362,444	0	18	$52,349	$440,645	$414,868	6.9	2035
Electrical Service Upgrade	0	0	0	$0	$733,619	-$733,619	No Payback	2035
Total	**718,503**	**-177,152**	**300**	**-$35,129**	**$5,178,567**	GMF funding available: $1,035,713		

Note: Air source heat pump (ASHP), light emitting diode (LED), photovoltaic (PV), roof top unit (RTU)

Simcoe Bus Terminal

The investigation at the Simcoe Bus Terminal revealed that the facility uses similar energy than other benchmarked municipal transportation terminals. The top three energy end uses at the arena are space heating (48%), lighting (26%), and air distribution (14%). The top three utility costs per end use were lighting, space heating, and air distribution, respectively.

Seven energy conservation measures were proposed by Efficiency Engineering to lower the Simcoe Bus Terminal's GHG emissions by 55 tCO_2e by 2035 (Table 10). Four measures were found to have no capital payback but generated a combined GHG emission abatement of 36 tCO_2e. Combined annual utility savings was determined to be

$41,378 for the suite of measures. A potential GMF grant of $640,446 is currently available to cover up to 20 percent of the project costs.

Table 10. Proposed Measures and Estimated Financial Costing at the Simcoe Bus Terminal

Energy Conservation Measures	Utilities		GHG Emissions	Financials				Timeline
Proposed Opportunities	**Electricity (kWh)**	**Natural Gas (m^3)**	**GHG Reduced (tCO_2e)**	**Annual Utility Savings**	**Project Costs**	**Net Present Value**	**Capital Payback**	**Year**
Low flow faucets	0	-145	0.3	$142	$115	$1,936	0.8	2024
Building automated system	-2,859	-1,293	2.6	$894	$159,872	-$145,419	45.7	2024
Electric heater	3,210	-945	1.6	-$34	$7,140	-$5,162	No Payback	2026
300-kW solar PV canopy	-318,819	0	15.9	$41,388	$1,993,348	-$1,316,961	24.0	2028
Hybrid ASHP water heaters	2,751	-378	0.6	-$205	$59,585	-$45,510	No Payback	2030
ASHP RTU w gas backup	24,827	-7,428	12.9	-$220	$541,528	-$310,878	No Payback	2032
ASHP for boilers	42,064	-12,054	20.8	-$588	$440,645	-$397,681	No Payback	2035
Total	**-248,825**	**-22,244**	**55**	**$41,378**	**$3,202,232**	GMF funding available: $640,446		

Note: Air source heat pump (ASHP), photovoltaic (PV), roof top unit (RTU)

Strategic Plan

Strategic Pillar: Infrastructure

Strategic Priority: Continue to invest in lower carbon footprint initiatives which support the City's unique biodiversity to ensure the sustainability of our future.

The Community Buildings Retrofit Feasibility Study provides City staff with valuable insight into how GHG emissions can be mitigated at facilities. The energy conservation measures recommended by Efficiency Engineering will directly lower the carbon intensity of selected facilities to achieve 80 percent reduction in 20 years. The estimated costs and expected timeline for implementing each energy conservation measure affords City staff the ability to develop capital budgets accordingly. Lastly, prior to the Study commencing, City staff had limited understanding of which energy conservation measure should be pursued, the mitigation potential of the measure, and overall financial ramification of the measure to achieve 80 percent GHG emission reductions.

Engagement and Consultation

Project engagement with key City staff was integral for the completion of the Study. The City technical team was composed of Facility Management, Recreation Facility

Services, and Asset Management & Capital Planning staff formed at project launch to provide crucial input to support Efficiency Engineering during the measure level and scenario level analyses. Additional City facility staff were met with during the site investigation segment of the project that offered Efficiency Engineering key insight into mechanical and operational attributes of each Study facility. Lastly, Asset Management and Capital Planning staff worked with Efficiency Engineering throughout the Study to enable project delivery.

Initial study findings were presented to the Peterborough Environmental Advisory Committee (PEAC) to update the Committee on the goals of the Study and preliminary financial and GHG projects. In October 2023, PEAC passed a motion regarding the early findings of the project:

“That the Committee advises City Council on the merit of reducing greenhouse gas emissions from facilities despite the financial burden of inherent renovation and operating costs to ensure that the City adheres to the Climate Emergency Declaration to achieve 2030 and 2050 mitigation targets.”

In February 2024, Efficiency Engineering presented the final study reports to Commissioners for feedback that was incorporated into the final body of work.

Budget and Financial Implications

There are no budgetary or financial implications associated with these recommendations at this time.

Conclusion

The City completed the Community Buildings Retrofit Feasibility Study to ascertain the GHG emission reduction potential of energy conservation measures and the financial cost of implementation. Efficiency Engineering undertook the investigation at nine facilities and determined that 2,444 tCO_2e from a suite of measures could be reduced. Project costs for recommended measures total an estimated $56,494,291. Grants and avoided project costs total $18,305,237 with a resulting incremental project cost of $20,390,145. The City will review the Study results and consider implementing energy conservation measures dependent on annual capital budgets.

Attachments

Appendix A: Airport Terminal
Appendix B: Art Gallery
Appendix C: City Hall
Appendix D: Healthy Planet Arena
Appendix E: Kinsmen Arena
Appendix F: Municipal Operations Centre

Appendix G: Peterborough Memorial Centre
Appendix H: Peterborough Sports & Wellness Centre
Appendix I: Simcoe Bus Terminal

Submitted by,

Blair Nelson, P. Eng.
Commissioner, Infrastructure, Planning and Growth Management

Contact Name:
Michael Papadacos, M.A., P.Eng.
Director, Asset Management & Capital Planning
Phone: 705-742-7777 Ext. 1756
Toll Free: 1-855-738-3755
Email: mpapadacos@peterborough.ca

James Byrne, M.CC.
Climate Change Coordinator
Phone: 705-742-7777 Ext. 1882
Email: jbyrne@peterborough.ca