



Energy Conservation and Demand Management Plan 2024-2029

LAND ACKNOWLEDGMENT

Brock University acknowledges the land on which we gather is the traditional territory of the Haudenosaunee and Anishinaabe peoples, many of whom continue to live and work here today.

This territory is covered by the Upper Canada Treaties and is within the land protected by the Dish with One Spoon Wampum Agreement.

Today this gathering place is home to many First Nations, Métis and Inuit peoples and acknowledging reminds us that our great standard of living is directly related to the resources and friendship of Indigenous people.



TABLE OF CONTENTS

Confirmation of Approval by Senior Management	4
Executive Summary.....	5
Guidance from the Institution.....	6
Overview of ECDM Plan Goals.....	7
Reporting on Results (2019-2024).....	8
Proposed Measures for 2024-2029	18
Renewable Energy Generation Facilities	25
Featured Projects and Initiatives	25
Appendix A: 2022 and 2023 Reports.....	29
Appendix B: Notes for the 2024-2029 ECDM Plan.....	32
Appendix C: Glossary of Terms.....	34





CONFIRMATION OF APPROVAL BY SENIOR MANAGEMENT

To: Ontario Ministry of Energy

With the issuance of this revised energy conservation and demand management plan (ECDM), Brock University is re-affirming our commitment to energy conservation and sustainable operations. The conservation and demand management plan will be periodically reviewed, revised and updated to meet the dynamics of energy efficiency and conservation while still providing the highest quality experience for the faculty, staff and most importantly the students of Brock University.

Lesley Rigg
President & Vice Chancellor
Brock University

EXECUTIVE SUMMARY

Brock University (Brock) has a track record of using innovative energy solutions and systems resulting in effective energy management. The institution is committed to advancing knowledge in energy management and sharing it with other organizations to accelerate the transition to low-carbon, energy-efficient operations. This approach has allowed Brock to avoid nearly \$2M in energy-related costs while saving over 18MWh and reducing carbon emissions by an estimated 16,400 Tonnes between 2019 and 2024. The measures implemented in the past five years include long-term technical programs, behavioural change initiatives and organizational adjustments to better support energy conservation and efficiency.

Brock is now recognized as a leader in energy among higher education institutions in the province, while our energy initiatives have attracted the attention of international organizations like the International District Energy Association (IDEA). Our institution remains committed to following Ontario Regulation 25/23 under the Electricity Act 1998, which requires all broader public sector (BPS) organizations to report on their annual energy consumption and greenhouse gas (GHG) emissions, as well as update their Energy Conservation and Demand Management (ECDM) plan every five years.

This plan is an update to Brock University's prior ECDM plan and will be utilized from 2024 to 2029 and it includes:

- The University's results on energy conservation and efficiency between 2019 and 2024
- The list of measures implemented to achieve those results, including their cost and lifetime of the solutions
- A list of energy-related measures and initiatives that are planned for 2024 - 2029
- Energy used in years 2022 and 2023



GUIDANCE FROM THE INSTITUTION

Brock University's new **Institutional Strategic Plan, Niagara Roots – Global Reach: Brock University Institutional Strategic Plan 2018-2025**, serves to guide the University into the future by providing a framework of values, priorities, and expectations that are to be upheld and integrated into all Institutional developments. This plan sets out four strategic priority areas to guide the institution's planning and decision making over the next seven years:

- **Providing a transformational and accessible academic and student experience;**
- **Increasing the University's research capacity;**
- **Enhancing the life and vitality of communities across the Niagara Region and beyond;**
- **Fostering a culture of inclusivity, accessibility, reconciliation and decolonization.**

These four priorities influence and contribute to the goals developed in this plan and will continue to be upheld in future versions of the ECDM. Additionally, the Strategic Plan outlines Brock's commitment to human, financial, and environmental stewardship, as it is one of Brock's eight guiding principles. This principle is a similarly strong source of guidance within this document.

The University's current strategic plan, **Niagara Roots – Global Reach**, was implemented in 2018 and was designed to guide the institution until 2025. A revitalized strategic plan aims to help the institution deliver on its mission of supporting students and faculty in the discovery of knowledge through exemplary scholarship, teaching, service and community outreach. The revitalized plan is scheduled to begin implementation to align with Brock's 60th anniversary in September 2024.



OVERVIEW OF ECDM PLAN GOALS

To align with and support Brock University's priorities outlined in its Strategic Plan, the objectives of this ECDM plan have been created and updated in accordance to our commitment to energy management and the priorities of the University.

1. **Generation:** Optimizing processes and increasing the flexibility of on-site energy generation.
2. **Operations:** Incorporating energy conservation and efficiency into all activities.
3. **Procurement:** Leveraging strategic and collaborative procurement opportunities, focusing on best value for energy and carbon related goods and services.
4. **Education:** Elevating efforts towards awareness and engagement of the Brock Community in energy conservation and efficiency.
5. **Buildings:** Improving the efficiency in building operations, modernizing systems and incorporating innovative solutions.

The following goals will guide energy and carbon conservation and efficiency measures:

- a. Demonstrate leadership in energy and GHG emissions management in the sector.
- b. Increase participation of the Brock Community in energy and emission reduction efforts.
- c. Reduce GHG emission by 75%% below 2013 baseline levels by 2030.
- d. Maintain a cost-effective, reliable, and resilient energy supply to campus that incorporates low-carbon solutions.
- e. Leverage big data and innovation throughout all energy management activities.
- f. Improve the operation of existing buildings and design new buildings to be energy efficient while incorporating alternative and low-carbon sources of energy.

The goals and objectives outlined in this plan are applicable to three types of measures—**Technical, Organizational, and Behavioural** – which will ensure that Brock maintains a holistic commitment to sustainability. Brock is committed to sustainability and is aware of its impact on the community, the Niagara Region, Canada and the world.

REPORTING ON RESULTS (2019-2024)

Brock University has implemented and tracked numerous initiatives identified in the 2019 ECDM Plan. Additional measures were also developed and implemented to adjust and better respond to the changing internal and external environments. It was not possible to deploy a renewable energy solution yet, but most of the initiatives undertaken have been successful and some have even transcended the boundaries of Brock, influencing and advancing energy management in the higher education sector.

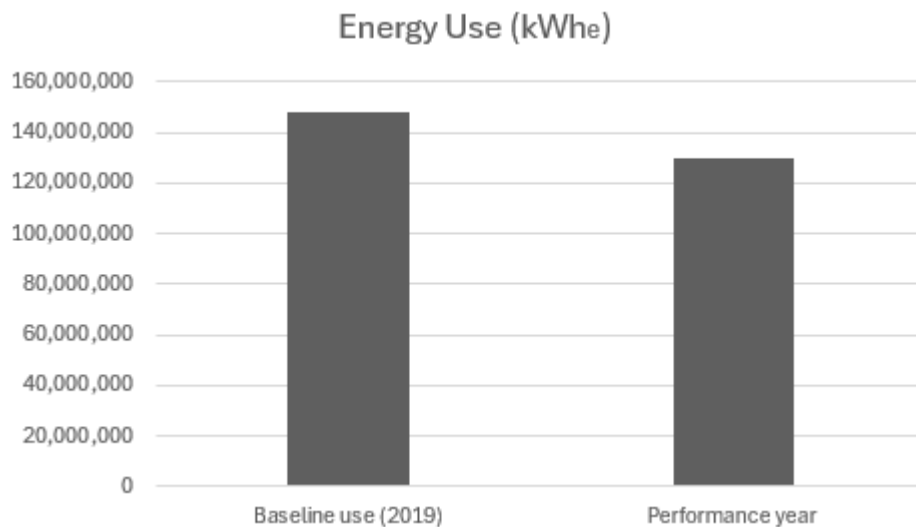


Figure 1. Portfolio-wide energy use analysis


Figure 1 showcases the energy performance of Brock University, using the most up-to-date available energy information. Based on 2019 numbers, Brock University has achieved:

- Over 18,000,000 kWh savings throughout the portfolio
- \$2,177,000 CAD in avoided energy costs
- Energy use intensity [GJ/m²] has decreased by an average of 1.7% between 2019 and 2021 alone
- GHG Emissions Intensity [TCO₂e/m²] has decreased by an average of 9.5% between 2019 and 2021

Over the past 5 years, Brock University has undertaken multiple Technical, Behavioural, and Organizational measures aimed at achieving the results outlined in the previous ECDM Plan. These measures included lighting retrofits, upgrades to mechanical and Heating, Ventilation, and Air Conditioning Systems (HVAC), building & chiller recommissioning, upgrades to the District Energy System (DES), and staff training and awareness on energy use. A summary of the measures that Brock implemented between 2019 and 2024 are outlined in the tables below, with a detailed description of each measure included in the following pages.

TECHNICAL MEASURES

Technical Measure	Lighting retrofits T8 to LED lighting upgrades in various areas across campus (e.g., Ian Beddis Gym, Bob Davis).
Actual Cost	\$35,000 CAD
Annual Savings	Over 414,000 kWh/year while improving the spaces' performance
Lifetime of measure	Estimated 50,000 hours

Technical Measure	<p>HVAC Upgrades</p> <p>Various changes made to the buildings' mechanical systems, as part of regular maintenance and specifically for energy conservation and efficiency purposes. Examples include installing an energy transfer skid in Schmon Tower and adding VFDs on fans and pumps.</p>  <p><i>An HVAC system in the Roy & Lois Cairns Health Bioscience Research Complex.</i></p>
Actual Cost	\$201,500 CAD
Annual Savings	Estimated 254,000 kWh/year
Lifetime of measure	25 years. Estimated 20 years of life for VFDs

Technical Measure	Demand Management Throughout the year Facilities Management makes operational adjustments to reduce the electrical demand from the grid. Some of the activities undertaken include: Increase temperature set points, reduce fans' speed, close outdoor dampers, increase electrical generation, discharge the Thermal Energy Storage tank to reduce chiller load.
Actual Cost	The estimated cost of implementing these adjustments are to be \$65,600 CAD/year
Annual Savings	Nearly \$400,000 CAD/year through diverse demand-related charges and reduced electricity consumption
Lifetime of measure	Permanent

Today **0.0%**
15662 ^(MW)
PEAK DEMAND

Tomorrow **0.0%**
15390 ^(MW)
PEAK DEMAND

Monday **11.8%**
16741 ^(MW)
PEAK DEMAND

Tuesday **29.8%**
17355 ^(MW)
PEAK DEMAND

Wednes... **51.9%**
17770 ^(MW)
PEAK DEMAND

Thursday **59.5%**
19653 ^(MW)
PEAK DEMAND

Friday **54.1%**
20745 ^(MW)
PEAK DEMAND

Live Power Data

Latest Update: 2024-06-08, 09:57:57

Legend: Low Probability, Medium Probability, High Probability, Facility Demand, Hourly ON Grid Demand, Forecasted ON Grid Demand, Purchased Power

Normal Mode

No Action Required

Peak Occurrence Probability **0%**
Today

Projected Peak Hours **N/a**
Today

Most Recent Hourly Grid Demand of ON **Err (MW)**
Err ET

Demand Shifted **16.38 MW**

GA Saving **\$ 111.1k**


Current Temperature **18 °C**

Current Humidity **64 %RH**

Current Wind Speed **28 km/h**

Top 10 Peak Demand Summary (from May 01, 2024, to today)

Top 10	Date	Peak Hours (EST)	Ontario Demand (MW)	Adjusted AQEW (MWh)	Facility Power Usage (MWh)	On-site Generation		
						Generators (MWh)	Solar Panels (MWh)	Batteries (MWh)
1	2024-06-04	17:00 - 18:00	20694	-	6.35	4.73	0.0033	0.0013
2	2024-05-22	18:00 - 19:00	20436	19779	6.16	4.83	0.0032	0.0012
3	2024-06-05	16:00 - 17:00	20396	-	6.62	4.89	0.0031	0.0013
4	2024-05-21	16:00 - 17:00	20229	19559	6.23	5.01	0.0031	0.0013
5	2024-06-06	17:00 - 18:00	18764	-	5.96	5.03	0.0026	0.0011

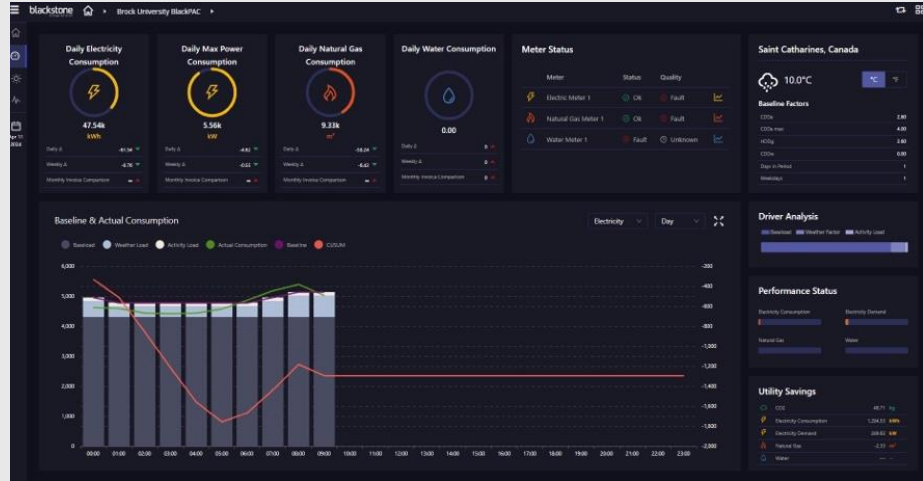
<p>Technical Measure</p>	<p>Supervisory Control And Data Acquisition System (SCADA)</p> <p>Facilities Management implemented a customized SCADA system for the DES. The system tracks and trends all the data from the different components of the DES system, allowing Brock to make informed decisions to improve the performance of energy-production operations every day. In addition, it has allowed for improvements in preventive maintenance, increased automation (e.g., automatic start/stop of engines). Use Thermal Energy Storage for demand management, reduce the number of engines running to save natural gas.</p>  <p><i>Screenshot of one of the screens on the new SCADA system.</i></p>
<p>Actual Cost</p>	<p>\$120,000 CAD</p>
<p>Annual Savings</p>	<p>Over 1,400,000 kWh/year</p>
<p>Lifetime of measure</p>	<p>Permanent</p>

<p>Technical Measure</p>	<p>Enhanced Metering</p> <p>Facilities Management has added more sub-meters to the buildings, including electrical, thermal and water meters. All the data from the meters is collected by Brock's SCADA system and used in the EMS. Staff ensures that those meters that have annual calibration requirements are properly serviced to maintain the units' accuracy.</p>
<p>Actual Cost</p>	<p>Estimated \$50,000 CAD</p>
<p>Annual Savings</p>	<p>Not applicable</p>
<p>Lifetime of measure</p>	<p>Permanent</p>

Technical Measure

Energy Management System (EMS)

Brock installed a custom-built EMS that includes multiple modules and sub-systems. The platform was co-developed with a consulting firm and it is now used by multiple higher education institutions in Ontario. The components include: Public-facing dashboards, Utilities Management Dashboards, Utilities' invoice management, RETScreen files, tracking of provincial electrical demand and Sustainability competitions.



Screenshot of the Utilities Dashboard in the BlackPac EMS.



Photograph of the District Energy System's control room.

Actual Cost	This measure was implemented over several years with a total cost of \$240,000 CAD
Annual Savings	Over 1,900,000 kWh/year
Lifetime of measure	10 years

ORGANIZATIONAL MEASURES

Organizational Measure	<p>Incorporate new design parameters in new construction projects</p> <p>Residence 8 building was designed and built with several energy efficiency measures (e.g., LED lights, VFDs) but most notable, it uses medium-temperature water (160 degC) for heating and process loads. These measure will be in place for the life of the building or until the end of the systems' life.</p>
Actual Cost	Not applicable
Annual Savings	Approximately 546,000 kWh/year in Residence 8
Lifetime of measure	Permanent

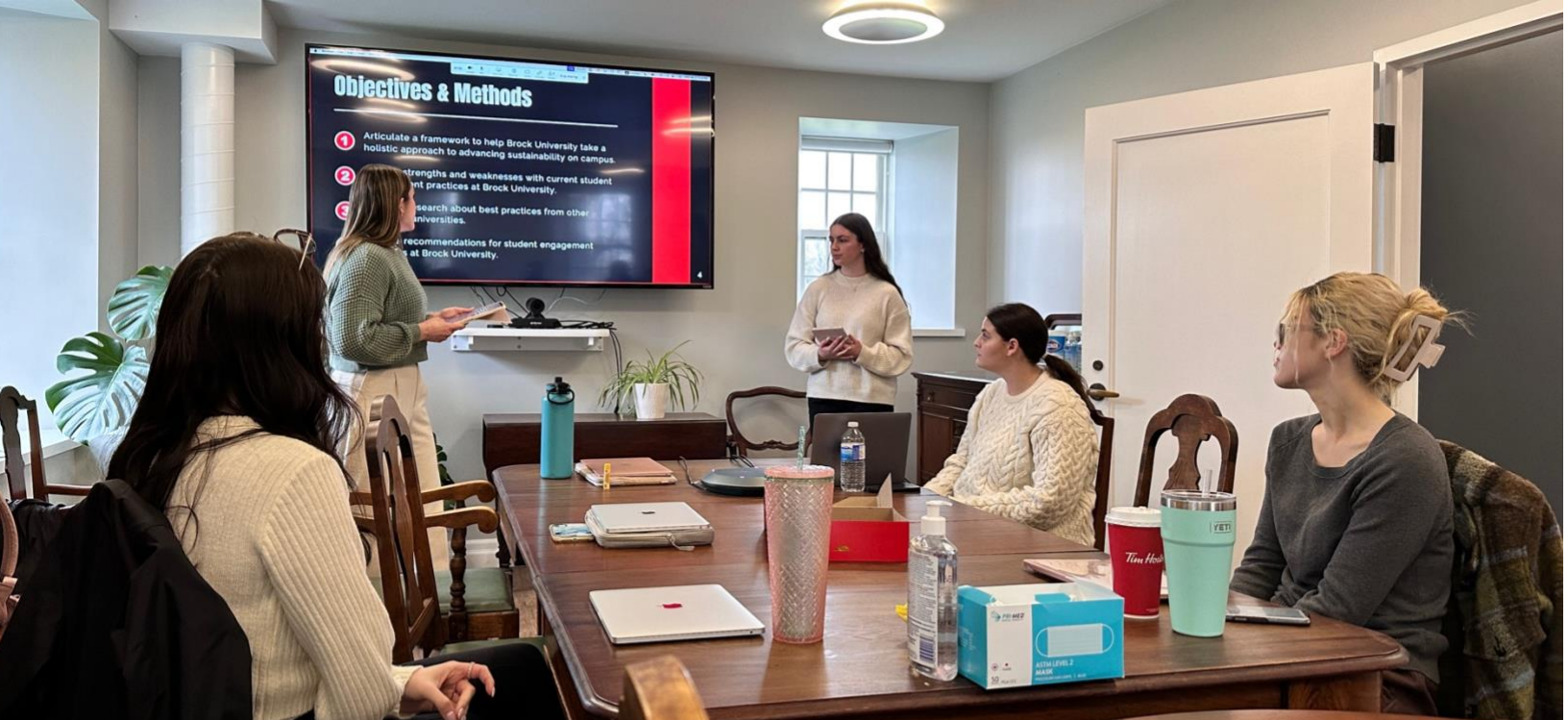
Organizational Measure	<p>Green Rating Systems</p> <p>The Marilyn I. Walker School of Fine and Performing Arts building obtained its LEED® Gold certification under the Building Operations & Maintenance system. The building is also used for teaching higher education students about sustainability.</p>
Actual Cost	The cost for the certification was \$50,200 CAD
Annual Savings	The measures implemented (e.g., constant commissioning) have saved an estimated 17,400 kWh/year
Lifetime of measure	Permanent

Organizational Measure	<p>Training of staff on energy management</p> <p>Several people in Facilities Management staff received formal training in energy-related topics (e.g., RETScreen experts certification, IESO's under their Strategic Energy Management program). In addition, regular training is provided to employees on new technologies, solutions and systems via lunch and learn and site visits.</p>
Actual Cost	Not applicable
Annual Savings	This measure has been implemented over several years, and has saved Brock over 7,000,000 kWh/year
Lifetime of measure	Permanent

Organizational Measure	Voluntary reporting on energy performance (Permanent) Brock University now reports annually to the Times Higher Education (THE) - Impact Rankings and every three years under the Association for the Advancement of Sustainability in Higher Education (AASHE)'s Sustainability Tracking And Reporting System (STARS). Both programs include numerous areas related to energy and GHGs and they have allowed third-party assurance to track progress and performance over time, as well as identifying areas needing improvement.
Actual Cost	Not applicable
Annual Savings	Not applicable
Lifetime of measure	Permanent

BEHAVIOURAL MEASURES

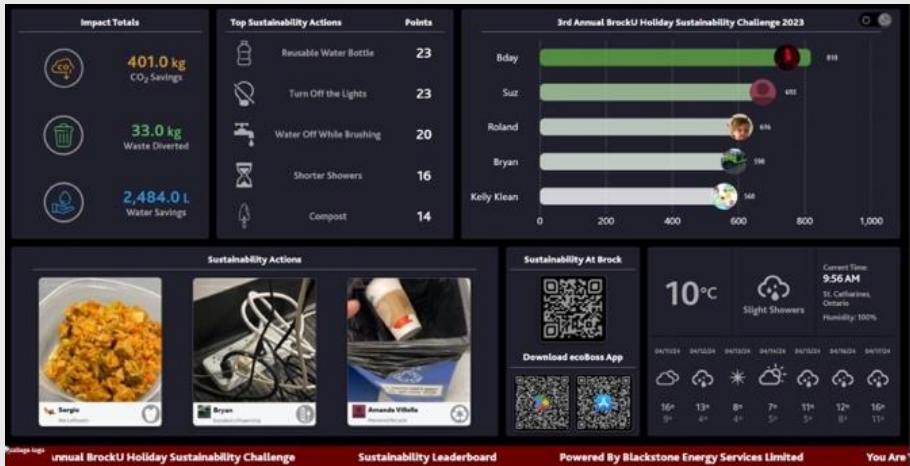
Behavioural Measure	Knowledge transfer Brock provided tours and talks for internal and external stakeholders as part of events (e.g., Wellness Day, International Development Week, etc.), courses (e.g., Masters in Sustainability), for the broader Niagara community (e.g., Niagara Region) and for other higher education institutions. Additional advocacy and awareness were done via presentations at provincial level (i.e., OAPPA) and at the International District Energy Association.
Actual Cost	Not applicable
Annual Savings	Not applicable
Lifetime of measure	Permanent



Behavioural Measure

Sustainability Competitions

One of the components of the EMS include the use of a mobile app called EcoBoss, which enables competitions between individuals or among teams. Available on Apple Store and Android, it allows people to log a wide diversity of sustainability-related actions throughout several days. Many of the actions available to log are related to energy conservation and efficiency (e.g., turning lights off, adjusting thermostats, dressing appropriately for the weather, using the dishwasher with full loads, etc.). The intent is to educate and engage the Brock Community on daily activities that can reduce environmental impacts and adopt them on campus and beyond.



Screenshot of the competition screen on the BlackPac EMS.

Actual Cost

Not applicable

Annual Savings

This measure has been implemented over several years, and has helped Brock save over 1,400,000 kWh/year

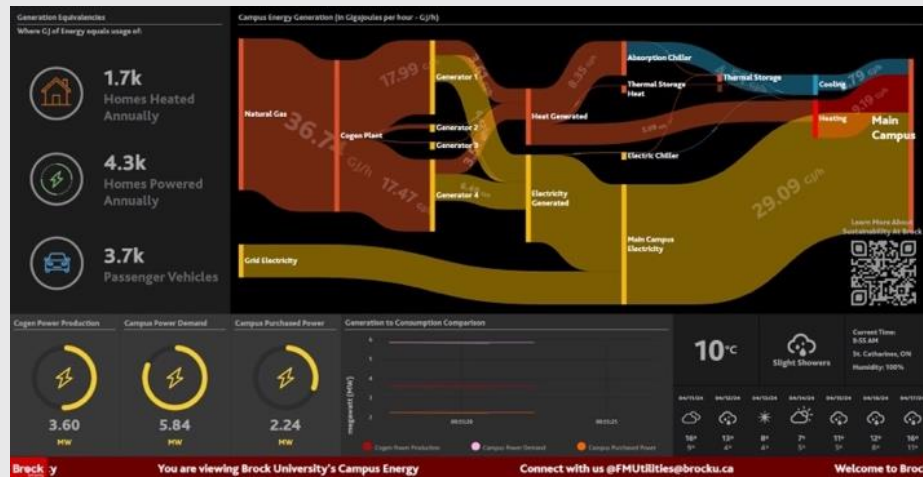
Lifetime of measure

10 years

Behavioural Measure

Public-facing Dashboards

The EMS includes a component devoted to communicating energy performance in real time. The dashboards display: Energy Use Intensity (EUI) per building, equivalencies for savings and electricity generation, a Sankey chart of energy generation at the District Energy System and all its assets, QR codes to sustainability websites and resources and a leaderboard for sustainability competitions. A screen with dashboards was installed in the Rankin Family Pavilion, the busiest area for pedestrian traffic on campus, maximizing its exposure. The moving banner and the dashboard itself has been a major contributor to increasing the number of tours, talks and other knowledge transfer activities.



Screenshot of one of the public-facing dashboards.

Actual Cost

Not applicable

Annual Savings

This measure has been implemented over several years, and has helped Brock save over 2,000,000 kWh/year

Lifetime of measure

10 years

PROPOSED MEASURES FOR 2024-2029

Based on the results from the 2019 - 2024 and their subsequent analyses, new measures have been identified under the 2024 - 2029 ECDM Plan to address the changing environment, new technologies and enhanced targets. Measures that have proven successful will be continued or enhanced while also introducing new measures that respond to technological advancements and innovation that could advance Brock's ambitious carbon and energy targets.

TECHNICAL MEASURES

Based on the results from the 2019 - 2024 and their subsequent analyses, new measures have been identified under the 2024 - 2029 ECDM Plan to address the changing environment, new technologies and enhanced targets. Measures that have proven successful will be continued or enhanced while also introducing new measures that respond to technological advancements and innovation that could advance Brock's ambitious carbon and energy targets.

Technical Measure	Lighting retrofits Lighting upgrades in various areas across campus, including controls (e.g., scheduling) and other measures (e.g., occupancy sensors, daylight harvesting) when viable.
Actual Cost	To be determined
Annual Savings	To be determined
Lifetime of measure	Estimated 50,000 hours lifetime

Technical Measure	DES Electrification This project will allow Brock to minimize the use of natural gas fueled equipment (i.e., cogeneration engines) by using electric boilers installed around campus instead. Some of the boilers are existing units while older units that are at the end of their life will be replaced. This project will also include: Improving the use of the existing Thermal Energy Storage (TES) tank and optimizing the control sequences for the DES to improve heat transfer and energy efficiency across the campus.
Actual Cost	The estimated cost of this project is \$6 million CAD.
Annual Savings	The project could reduce Brock's direct emissions by 67% while resulting in Net Annual Energy Savings of 72,000,000 kWh/year.
Lifetime of measure	Estimated 25 years

Technical Measure	<p>Install heat pumps</p> <p>In the next five years, Brock will install heat pumps in buildings where there's opportunity to recover waste heat. The first two units will be installed as part of the DES Electrification project, commencing operation in 2025. Additional locations will be evaluated to determine the economic and technical feasibility of installing low or high-temperature heat pumps.</p>
Actual Cost	To be determined
Annual Savings	To be determined
Lifetime of measure	Estimated 25 years

Technical Measure	<p>BAS Modernization</p> <p>Facilities Management will continue replacing obsolete hardware (e.g., NCMs) with new controller (e.g., JACE). Whenever needed, sensors and actuators will also be replaced. In addition to the hardware updates, we'll migrate all the buildings that remain in the old Iconics32 or Metasys platforms into Niagara Tridium, integrating all the buildings under the same BAS. When doing the migration, we'll also update the graphics for each building and make improvements on the alarm management. During the migration, we'll conduct a review of the schedules and ensure no overrides have been unnecessarily left in place.</p>
Actual Cost	To be determined
Annual Savings	To be determined
Lifetime of measure	Estimated 25 years

Technical Measure	<p>HVAC Upgrades</p> <p>As equipment reaches the end of its life and/or needs to be replaced, Brock will replace the units with new, more efficient and low-carbon alternatives. This is applicable to equipment such as water heaters, boilers, chillers, etc. and includes fuel switching (to lower-carbon alternatives) but also adding VFDs and other systems that improve the energy performance of the buildings.</p>
Actual Cost	To be determined
Annual Savings	To be determined
Lifetime of measure	Estimated 20 years

Technical Measure	<p>Energy Management System (EMS) upgrades</p> <p>Brock intends to continue using the BlackPAC EMS, building on current successes and finding opportunities for improvement. Some of the enhancement that are being considered include: Improved reporting capabilities, alarming for energy parameters outside of range (e.g., Energy Use Intensity), building-level analytics, sub-metering of loads using 10% (or more) of a building's energy, connecting water meters and tracking of water consumption.</p>
Actual Cost	To be determined
Annual Savings	To be determined
Lifetime of measure	Estimated 10 years

Technical Measure	<p>Building Retrofits</p> <p>Buildings are a crucial component in achieving energy targets: They create the demand that the DES needs to meet, while also being an integral part of the student experience at Brock. Deferred Capital Renewal and Maintenance (DCRM) is a factor that impact the buildings' energy performance. These are both significant challenges to tackle in the current fiscal environment yet both are intricately linked. Therefore, in the next five years, increased emphasis will be placed on developing projects and programs that address both in a integrative manner. In these energy retrofits, Brock will incorporate other technical, organizational and behavioural measures identified in this plan to maximize the benefits of synergies.</p>
Actual Cost	To be determined
Annual Savings	To be determined
Lifetime of measure	10 years

Technical Measure

Enhancing metering infrastructure

Additional efforts will be invested into adding meters for other utilities that are not currently submeters at the building level. These include chilled water, hot water and domestic water. All the meters installed will be connected into Brock's SCADA system and their data will then distributed for use across other systems, such as the BAS and the EMS (BlackPAC). Furthermore, large loads (e.g., commercial kitchens, chillers) will be sub-metered (electrical and/or thermal) to better track their performance and to be able to improve the tracking and analysis of the data consumption in buildings.



Screenshot of a data-intensive dashboard on SCADA system. Additional data points and screens will be added when adding metering infrastructure.

Actual Cost

To be determined

Annual Savings

To be determined

Lifetime of measure

Permanent




ORGANIZATIONAL MEASURES

Organizational Measure	<p>Incorporate new design parameters in projects</p> <p>Moving forward, Brock will not be replacing building equipment like-for-like. Consideration will be given to more energy efficiency solutions and systems using non-fossil fuels. The life cycle (operational cost, maintenance requirements, etc.) will be reviewed when choosing new equipment. This approach will be applicable to capital projects (e.g., a new building) and to maintenance/repair projects (e.g., replacing a leaking hot water heater).</p>
Actual Cost	To be determined
Annual Savings	To be determined
Lifetime of measure	Permanent

Organizational Measure	<p>Seek LEED Certification (Building Operations and Maintenance) for existing buildings</p> <p>Brock has a large number of existing buildings. In order to ensure they are operated and maintained in a sustainable and energy-efficient manner, we'll strive to get more facilities rated under LEED®: Building Operations and Maintenance. Additional benefits will be achieved on space performance and supporting the academic mission of the institution (e.g., a well lit and ventilated space is more conducive to learning).</p>
Actual Cost	To be determined
Annual Savings	To be determined
Lifetime of measure	10 years

Organizational Measure	<p>Explore new/upcoming low-carbon technologies</p> <p>Brock will consider the use of new and upcoming technologies as they become available. The stage of a technology will be considered (e.g., early stages vs. mature) but it will not be immediately ruled out based on its stage of development. When evaluating the use of new technologies, the financial feasibility and other added values (e.g., increased safety, value as a tool for teaching/learning) will also be studied. Some technologies that will be looking into are blackwater heat recovery, ground-mounted solar PV, heat pumps and Artificial Intelligence algorithms (e.g., machine learning).</p>
Actual Cost	To be determined
Annual Savings	To be determined
Lifetime of measure	Permanent

<p>Organizational Measure</p>	<p>Campus as a Living Lab</p> <p>Facilities Management will continue collaborating with faculties and departments across Brock and beyond (e.g., Niagara College) to show real-life examples to illustrate processes, showcase technologies and solve problems faced in our community. This could take the form of: Presentation in courses, students conducting research/projects on Brock's systems and operations, sharing data with researchers (e.g., machine learning), etc.</p>  <p><i>Learning about native species and biodiversity on campus.</i></p>
<p>Actual Cost</p>	<p>To be determined</p>
<p>Annual Savings</p>	<p>To be determined</p>
<p>Lifetime of measure</p>	<p>Permanent</p>

<p>Organizational Measure</p>	<p>Consider alternative/innovative methods to address capital limitations</p> <p>Energy conservation and efficiency are closely linked to Deferred Capital Renewal and Maintenance (DCRM): Obsolete infrastructure limit the integration of new technologies as much as they impact the energy efficiency of a building itself. However, the backlog of DCRM for Brock is very significant and it is difficult for the institution to tackle these under the current model. Therefore, we will assess using other funding models for building or campus-wide energy projects that address DCRM. Examples of models and methods that will be considered and/or undertaken include but are not limited to: Energy performance contracts, outcome-based projects using CCDC14 and Energy As A Service (EaaS).</p>
<p>Actual Cost</p>	<p>To be determined</p>
<p>Annual Savings</p>	<p>To be determined</p>
<p>Lifetime of measure</p>	<p>10 years</p>

BEHAVIOURAL MEASURES

Behaviorial Measure	<p>Knowledge transfer</p> <p>Brock will continue to share energy and carbon-related knowledge acquired and/or developed at the institution with internal and external stakeholders to promote the advancement of energy efficiency and conservation in the institution and beyond. This engagement will take the form of active participation in the Ontario Association of Physical Plant Administrators (OAPPA), presenting at international energy conferences and hiring of co-op students.</p>
Actual Cost	To be determined
Annual Savings	To be determined
Lifetime of measure	Permanent

Behaviorial Measure	<p>Education and engagement on energy conservation and efficiency</p> <p>Efforts will continue to educate students, faculty and staff about energy conservation and efficiency. We envision continuing with competitions that include energy-saving activities and placing increased emphasis on competitions in residences. The efforts will now expand to include energy conservation in laboratory areas where Facilities Management has no operational control. This is particularly important since laboratory equipment tends to be used intensely and is typically energy-intense.</p>
Actual Cost	To be determined
Annual Savings	To be determined
Lifetime of measure	Permanent

Behaviorial Measure	<p>Public-facing Dashboards</p> <p>The Energy Management System (EMS) will continue to evolve. We will add enhanced functionality, making them more interactive and increasingly available (e.g., sharing real-time energy information via a public website). Adding new utility meters will create opportunities for additional activities (e.g., energy treasure hunt) and will allow the creation of new, better dashboards. We will install additional monitors across campus, showcasing the public-facing dashboard, but this time focusing on locations where people spend time waiting and would be more inclined to look at the dashboard more attentively (e.g., lobbies, near elevators).</p>
Actual Cost	To be determined
Annual Savings	To be determined
Lifetime of measure	10 Years

RENEWABLE ENERGY GENERATION FACILITIES

Brock University does not currently have any renewable solution. The institution is not currently using ground source heat pump technologies, solar energy or heat pump technology. In the past five years, Facilities Management evaluated several renewable energy options, but these were ultimately not deemed suitable for Brock. Some of the options considered were: Solar thermal on the roof of Walker Complex to heat the pool and displacing natural gas with 5% hydrogen as a fuel for the cogeneration system. As technologies continue to evolve, we will revisit these solutions and will continue searching for alternatives that are applicable to Brock's operations.

FEATURED PROJECTS AND INITIATIVES

CAMPUS AS A LIVING LAB

Brock University fosters the use of the campus, including buildings, systems, District Energy System (DES) and other operations as part of the student experience. There are numerous examples of collaboration between Facilities Management, students, faculty and staff. From undergraduate students visiting the DES to learn about thermodynamic cycles and chemical reactions (e.g., heat absorption via Lithium Bromide in absorption cooling), to graduate students making strategic recommendations on advancing sustainability, the campus provides a plethora of opportunities to learn and apply knowledge via real-life activities on campus.

MARILYN I. WALKER SCHOOL OF FINE AND PERFORMING ARTS IS NOW LEED® Gold BUILDING

This building has become a staple in downtown St. Catharines. Originally housing the Canada Hair Cloth Company, the building was built in 1884, and was renovated in 1911 before been modernized by Brock in 2013. A new milestone was achieved in 2022 when the building received a Gold rating under the Leadership in Energy and Environment Design (LEED®)'s Operations & Maintenance rating system.



Some of the elements that allowed the building to achieve this target were: Preserving a large amount of the 1884 building (e.g., brick façade, wood flooring, pressed tin ceiling tiles), the addition was built on a brown site, ongoing commissioning via de Building Automation System (BAS) for energy efficiency, use of heat recovery ventilators, outstanding performance on indoor environmental quality, access to public and active transportation systems, and high water efficiency. The building is used as a living lab for teaching students about sustainability.

BROCK'S ENERGY MANAGEMENT SYSTEM (EMS)

The data collected by the SCADA system, the new meters installed, and the BAS created an opportunity to harness the power of big data analytics. In 2021, Brock installed an EMS which includes a set of comprehensive components: Public dashboards, utility management dashboards, sustainability competitions, automated bill collection, provincial peak tracking and RETScreen files for the building fleet. All the components are geared to improving energy management and promoting engagement.

The public-facing dashboards are shown on a screen at Rankin Family Pavilion, one of the highest traffic areas on campus. The dashboard has QR codes that lead to energy and sustainability websites and has fun easy-to-understand units (e.g., hours of gaming, CN Towers powered-equivalent). The utility management dashboards are more technical and are used by Facilities Management staff to track performance. The sustainability competitions are held via an app that participants download from their phones.

This measure leverages on technology and data, but at the same time it is strongly geared to raising awareness and engaging the Brock Community in energy and water conservation and efficiency, among other behavioural changes that would minimize the university's environmental footprint. We believe behavioural change and participation is of the utmost important to tackle societal challenges and while technology is part of the solution, people's actions should also be part of the solution. This measure is meant to support this approach.



DISTRICT ENERGY SYSTEM'S SUPERVISORY AND DATA ACQUISITION (SCADA) SYSTEM

The District Energy Efficiency Project (DEEP) laid the foundation for innovation and progress. The control system was vastly outgrown by the new systems and equipment, leading to the need to install an industrial grade solution to operate and monitor the District Energy System (DES). The chosen solution was a SCADA system, named Ignition.



It meets the strict operational parameters of the new equipment while also allowing Brock to exploit new functionality available because it is highly customizable. The SCADA system also collects thousands of data points and allows for increased automation (e.g., start and stop of engines, setting electricity import targets) and has resulted in reduced shut-downs, improved preventive maintenance and enhanced operations. In turn, the SCADA system also became a critical part of other data-driven initiatives undertaken at Brock University.

TRACKING PROGRESS VIA VOLUNTARY REPORTING



Brock University now voluntarily reports under the Times Higher Education (THE) - Impact Rankings Association for the Advancement of Sustainability in Higher Education (AASHE)'s Sustainability Tracking And Reporting System (STARS). While both these reporting programs include all the United Nation's Sustainable Development Goals, they require submitting data on energy consumption, energy use intensity, greenhouse gas emissions and other metrics related to energy. The results have helped identify gaps and areas needing improvement as well as providing a benchmark to track progress over time.



Brock Earns Silver STARS Rating

THURSDAY, FEBRUARY 11, 2021 | By eharper



Blog Contributor: Mikellena Nettos

Brock recently held two Focus on Learning sessions to provide an "Introduction to Sustainability at Brock" for staff and faculty on January 28 and February 3. The main purpose of these sessions was to share our recent accomplishments related to [Sustainability at Brock](#). If you have not already heard, Brock recently obtained a [Silver rating from our first-ever STARS assessment by the Association for the Advancement of Sustainability in Higher Education \(AASHE\)](#)! The Sustainability Tracking, Assessment & Rating System (STARS) is a transparent, self-reporting framework for colleges and universities to measure their sustainability performance administered by AASHE.

Times Higher Education (THE) Impact Rankings



Brock was ranked in the top 300 of nearly 1,600 universities from 112 countries around the globe in the Times Higher Education (THE) Impact Rankings!

Appendix A

2022 and 2023 Reports

2022 DATA

Portfolio Manager Property ID	Property Name	Address	Property GFA - Self-Reported (m ²)	Natural Gas Use (GJ)	Site EUI (GJ/m ²)	Total (Location-Based) GHG Emissions Intensity (kgCO ₂ e/m ²)	Electricity Use – Grid Purchase (kWh)
25466028	Hamilton Campus	1842 King Street East, Hamilton L8K 1V7	6729	7299	1.52	57.9	810327.9
25466029	John Decew School Brock Research & Innovation Centre (BRIC)	130 Lockhart Drive, St. Catharines L2S 3A1	1604	947.7	1.02	33	190975
25466030	Main Campus - 573 Glenridge	573 Glenridge Ave, St. Catharines L2S 3A1	2979	1228.8	1.07	25.9	546077.9
25466031	Main Campus - Core Campus	1812 Sir Isaac Brock Way, St. Catharines L2S 3A1	210451	436754.8	2.25	105.7	10014675.6
25466032	Main Campus - East Academic 1	460 St David's Road, St. Catharines L2S 3A1	675	293.4	0.83	25	74641
25466033	Main Campus - East Academic 2	460 St David's Road, St. Catharines L2S 3A1	675	556.5	1.13	43.8	57396
25466034	Main Campus - East Academic 3	460 St David's Road, St. Catharines L2S 3A1	675	554.8	1.34	45.4	97555
25466035	Main Campus - Gateway Suites Residence	49 John Macdonnell Street, St. Catharines L2T 4E4	3675	346.7	0.5	7.9	415700.9
25466037	Main Campus - International Complex	4 John Macdonell Street, St. Catharines L2S 3A1	4280	1363	0.8	19.7	570620.9
25466038	Main Campus - Quarryview	5 John Macdonell Street, St. Catharines L2T 4E4	10773	3163	0.43	15.8	417915
25466039	Marilyn I Walker School of Fine and Performing Arts	15 Artists Common, St. Catharines L2R 4H8	8826	7592.7	1.36	47.1	1222591.5

2023 DATA

Portfolio Manager Property ID	Property Name	Address	Property GFA - Self-Reported (m ²)	Natural Gas Use (GJ)	Site EUI (GJ/m ²)	Total (Location-Based) GHG Emissions Intensity (kgCO ₂ e/m ²)	Electricity Use – Grid Purchase (kWh)
25466028	Hamilton Campus	1842 King Street East, Hamilton L8K 1V7	6729	3352.7	0.73	26.8	431481
25466029	John Decew School Brock Research & Innovation Centre (BRIC)	130 Lockhart Drive, St. Catharines L2S 3A1	1604	748.3	0.67	25.1	92771.7
25466030	Main Campus - 573 Glenridge	573 Glenridge Ave, St. Catharines L2S 3A1	2979	1136.5	1.04	24.3	548870
25466031	Main Campus - Core Campus	1812 Sir Isaac Brock Way, St. Catharines L2S 3A1	210451	428556.5	2.2	103.7	9651927.5
25466032	Main Campus - East Academic 1	460 St David's Road, St. Catharines L2S 3A1	675	290	0.86	24.9	80652
25466033	Main Campus - East Academic 2	460 St David's Road, St. Catharines L2S 3A1	675	540.7	1.05	42.2	46299
25466034	Main Campus - East Academic 3	460 St David's Road, St. Catharines L2S 3A1	675	526.3	1.27	43	92022
25466035	Main Campus - Gateway Suites Residence	49 John Macdonnell Street, St. Catharines L2T 4E4	3675	389.1	0.46	8.1	362056
25466037	Main Campus - International Complex	4 John Macdonell Street, St. Catharines L2S 3A1	4280	1405.3	0.82	20.3	585585.6
25466038	Main Campus - Quarryview	5 John Macdonell Street, St. Catharines L2T 4E4	10773	3601.6	0.47	17.9	420724
25466039	Marilyn I Walker School of Fine and Performing Arts	15 Artists Common, St. Catharines L2R 4H8	8826	7762.7	1.39	48.2	1243675.3
25466040	Schmon Pkwy Building	3401 Schmon Pkwy Thorold, L2V 5A8	8044	2145	1.03	19.4	1712611.5

Appendix B

Notes for the 2024-2029 ECDM Plan

NOTES FOR THE 2024-2029 ECDM PLAN

The implementation and staging of any of the proposed measures is subject to change in response to resource availability, technical feasibility, institutional priorities, or needs.

Estimated Cost of Proposed Energy Measures:

- All costs presented are high-level estimates, developed by Brock University using case-studies, consultant reports, data from current or past projects, feasibility studies, and engineering best practices;
- The costs calculated remain vulnerable to error and are subject to change due to unforeseen existing conditions, inflationary factors, and variations in details of the actual project scope;
- Costs presented as a range are meant to capture typical variations directly associated with the performance requirements (e.g., targeting different levels of a LEED® rating system), which will be determined by appropriate representatives from Brock on a project-by-project basis.

Estimated Annual Savings of Proposed Energy Measures:

- Savings identified in the plan represent a high-level estimate, developed by Brock University using case-studies, consultant reports, data from current or past projects, feasibility studies and engineering best practices;
- The estimates presented remain vulnerable to error and are subject to change due to unseen existing conditions, inflationary factors and variations in details of the actual project scope;
- Staging of the measures (e.g., year occurring, buildings) will affect the estimated annual savings. The estimates presented on the plan refer to a measure once fully deployed;
- Estimated savings are not to be used in the development of measurement and verification plans. A suitable measurement and verification approach, preferably in conformance with the International Performance Measurement and Verification Protocol (IPMVP) must be determined on a project-by-project basis;
- Using this document as a guide, Brock will refer to the goals presented to aid future development and monitor progress;
- The lifetime of a measure might be revised (i.e., extended or reduced) depending on the success achieved once the measure is implemented;
- Brock's efforts toward enhanced energy conservation, efficiency, demand management, and carbon reduction will not be limited to the measures identified above. Additional and/or different measures and projects supporting our institutional energy objectives will be incorporated/undertaken whenever feasible.

Appendix C

Glossary of Terms

GLOSSARY

Baseline - A minimum or starting point used for comparisons

Charter – A written constitution or description of an organization's functions

Chiller - A machine for cooling something, especially a cold cabinet or refrigerator

Co-generation - The generation of electricity and useful heat jointly, especially the utilization of the steam left over from electricity generation for heating

DEEP – District Energy Efficiency Project

District energy loop - The Hot/Chilled water distribution system that supplies heat or cooling to the connected buildings on campus

District energy System (DES) - The systems that generate the heating and cooling for the district energy loop. Eg. Chillers, boilers, etc.

EUI – Energy Use Intensity. Can be defined as the measurement of a building's annual energy consumption relative to its gross square footage

ECDM – Energy Conservation and Demand Management

Embedded Energy Manager - A position funded through the IESO and Save on Energy program whose mandate is to conserve energy

Energy Performance Scorecard - Part of the ECDM that is updated on a yearly basis to show progress against the goals laid out in the ECDM

Energy Transfer Skid - A heat exchanger/pump package designed to transfer heating from the district energy loop to the building for heating purposes

ESRC – Environmental Sustainability Research Centre

Experiential Training – Learning involving or based on experience and observation
Feasibility study - An assessment of the practicality of a proposed plan or method
FM – Facilities Management

HVAC – Heating, Ventilation, and air conditioning

Industrial Conservation Initiative - (ICI) is a form of demand response that allows participating customers to manage their global adjustment (GA) costs by reducing demand during peak periods. Consumers with an average peak demand of above 1 MW and up to and including 5 MW are eligible to opt-in to the ICI

LED – Light-Emitting Diode

LEED Certification – Leadership in Energy and Environmental Design which shows that a building was built aimed at achieving high performance in human and environmental health, location and transportation, sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality

Low-flow technology – Toilets, shower heads, and faucets that reduce the flow rate of water and reduce water usage

Procurement - The action of obtaining or procuring something

Retrofit - Add (a component or accessory) to something that did not have it when manufactured

Sustainability – Development that meets the needs of the present without compromising the ability of future generations to meet their own needs

Variable Frequency Drive – A type of motor controller that drives an electric motor by varying the frequency and voltage supplied to the motor

Brock University

Niagara Region
1812 Sir Isaac Brock Way
St. Catharines, ON
L2S 3A1

brocku.ca/facilities-management