



Brock University
Environmental Sustainability Plan 2018

Sustainability at Brock now has its own social media channels:

@BUsustainable





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PRESIDENT'S STATEMENT/ACKNOWLEDGEMENT

Brock is a comprehensive university with its main campus in a United Nations Educational, Scientific and Cultural Organization (UNESCO) Biosphere Reserve (BR). Our location informs our relationship to the environment and commitment to environmental sustainability through our transdisciplinary approach to supporting student success, regional economic growth, and community development.

Environmental sustainability is fundamental to everything we do at Brock! This report conveys our achievements regarding environmental sustainability and our balanced approach to supporting Ontario's future. As per the requirements of the Greenhouse Gas Campus Retrofit Program (GGCRP), it specifically communicates what we are doing in our efforts towards: energy conservation and GHG emission reduction; environmental sustainability management; and, education for sustainability.

Brock University is making the decisions today for a sustainable and vibrant future tomorrow. We are contributing to post-secondary education; student academic and professional development; research and innovation; regional community vitality, along with our commitment to environmental sustainability; and economic competitiveness. We look forward to building upon our current efforts. In moving forward, we will broadly engage the Brock community and thereby advance environmental sustainability across our functions in innovative and exciting ways.

A handwritten signature in blue ink, appearing to read "Gervan Fearon".

Gervan Fearon
President & Vice-Chancellor, Brock University



MISSION

Brock University is a comprehensive university, strongly rooted in the Niagara Region. Brock is committed to outstanding experiential learning and personal development for its students, discovery and innovation by its faculty and creative engagement with the development of its community partners at home and abroad.

VISION

Brock University will be recognized increasingly as an outstanding, regionally-connected, comprehensive university that provides innovative experiential learning opportunities for its students within an evolving curriculum; a growing range of high-quality graduate programs; ambitious teaching and research achievements by its faculty; and numerous community partnerships at home and abroad to enhance economic, social and cultural development.

VALUES

Brock University's draft [Strategic Plan](#) highlights a series of values that the university places in utmost regard, which include:

- Integrity and respect
- Innovation
- Unique student experience
- Freedom of thought, expression and academic responsibility
- Accountability and stewardship
- Generation and mobilization of knowledge
- Sustainability

DEFINITION OF SUSTAINABILITY

Brock's [Sustainability Policy](#) defines sustainability as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.



EXECUTIVE SUMMARY

The purpose of this report is to offer a comprehensive environmental sustainability plan as required by the GGCRP, that identifies strategies, objectives and actions that contribute to the achievement of the 37% by 2030 and 80% by 2050 provincial CCAP Green House Gas (GHG) emissions reduction targets based on 1990 emissions.

This document outlines Brock University's current environmental sustainability plan which aims to identify issues and set priorities, set overarching environmental objectives, establish environmental targets and key performance indicators, and allocate responsibility and timeframes for action, as in accordance with the GGCRP's requirements. Brock's environmental sustainability plan covers environmental performance in the following focus areas:

1. Energy Conservation & GHG Emissions Reduction
2. Environmental Sustainability Management
3. Education for Sustainability (Green Skills)/Co-benefits

Themes were developed and initiatives were grouped according to each focus area. Based on the proposed energy and GHG reduction initiatives, Brock University plans to pursue a GHG carbon intensity reduction target of 20% below 2013 baseline levels by the year of 2023. The following report outlines the current efforts towards low carbon emissions, and an overall sustainable campus.

This plan, along with all future versions, will be posted on the Brock University's [sustainability website](#). It will also be available in print form upon request.



INTRODUCTION

This report builds on the University's Sustainability Policy established in 2016 and creates a foundation for the tracking of sustainability initiatives enacted at Brock University to date. This plan, as required by the GGCRP, confirms sustainability as one of Brock's seven core values. This strategy communicates our core principles and details how we will achieve our main objectives. It is put forward amidst unprecedented environmental challenges, increasing emphasis on sustainability, and a shifting post-secondary landscape. The sustainability strategy builds upon our past strengths, and continued excellence drives our efforts in research, education, and engagement.

Creating a sustainable university requires the cooperation and dedication of faculty, staff, students, partners, and the wider community working collaboratively with each other. The Brock Sustainability Coordinating Committee was consulted in May 2018 to allow for input on ongoing campus initiatives and proposed future campus sustainability initiatives, which allowed this report to be as comprehensive as possible.

Energy

1

BASELINE YEAR IDENTIFICATION

1.1

Brock University has selected 2013 as the baseline year for its Green House Gas (GHG) reduction targets. 2013 was previously identified as the baseline year for the [Energy Conservation & Demand Management Plan](#) (ECDM) that was published in 2016. This ECDM outlined Brock's aggressive target of reducing GHG emissions by a total of 20% below the 2013 baseline. The foundation that the ECDM laid will be furthered by the release of the Brock University Sustainability Plan which will build on the 2023 goals and set new targets that will assist Canada in achieving their commitments to the 2030 and 2050 reduction targets. Brock University's target goals are outlined in the table below. The Brock University Sustainability Plan details a roadmap to GHG reduction through a combination of efficiency upgrades to existing equipment (cogeneration engines, installation of variable frequency drives, high efficiency pumps & motors, etc.), commitments to smart and efficient building operations and renewal, leveraging and strategic procurement of energy and carbon offsets, increased energy awareness and energy-efficient design, construction and renewal.

Table 1.1: 2013 Baseline Year Emissions (tonnes of CO₂)

Emission Type	GHG Emissions	Percentage Emissions
Scope 1	26,236	95.5
Scope 2	1,075	3.9
Scope 3	149	0.5
Other Sources	0	0
Total Emissions	27,460	100.0
Target Emissions Level 2030	21,968	20% Reduction
Target Emissions Level 2050	5,492	80% Reduction

GHG REDUCTION PLAN FOR YEARS 2018-2030

1.2

Brock University's GHG reduction plan is a multi-pronged approach that incorporates efficiency upgrades to existing equipment, designing and building new construction to higher efficiency standards and changing existing building operations and behaviours. The cogeneration facility accounts for roughly 85% of Brock's current GHG emissions and has been a major focus of its GHG reduction efforts. Two projects currently underway are aimed specifically at reducing the GHG emissions from the cogeneration facility. The projects, District Energy Efficiency Project (DEEP 1) and (DEEP 2) will see Brock's eight aging Caterpillar 3516 A engines replaced with four new 2 MW state of the art high efficiency, electronically controlled units with in line, active, selective, catalytic reduction (SCR) emissions control. These new engines consume 26% less natural gas per kWh produced, which directly equates to a 26% reduction in the GHG output of the facility.

Brock's GHG reduction efforts have not been limited to the Central Utilities Building (CUB) however. Equipment upgrades have been undertaken campus wide. Variable Frequency Drives (VFDs) have been installed in multiple buildings on both air handling units and pumps. Lighting upgrades were made with nearly 700 T8 or metal halide fixtures and lamps being replaced with energy efficient LED lights. The Schmon Tower had an Energy Transfer Skid (ETS) installed in its mechanical room that was designed to provide more efficient heating of the entire tower, utilizing VFD technology as well as efficient distribution of energy from Brock's district heating loop. Furthermore, behavioral and control changes were made to existing building controls, which have resulted in significant savings on campus through setbacks to building set points in the Building Automation System (BAS), changes to how stand-alone equipment is operated in sites such as DeCew Residence and Plaza, and engagement with the Brock community to conserve energy wherever possible. A summary of the GHG reduction plan for the years of 2018 – 2030 is detailed in the table below.

Table 1.2: GHG Reduction Plan 2018-2030

Proposed Strategies/ Sustainability Milestone	Total Estimated GHG Reductions (tonnes of CO ₂)	GHG Reduction by 2030 (tonnes of CO ₂)	Total Strategy Cost	Institutional Investment
DEEP Phase 1 Cogen Plant Upgrade Replacement of 4 3516 SITA CAT Engines with 2 CAT 3516 H Engines	1,423	17,076	\$10,377,528	2,594,382
DEEP Phase 2 Cogen Plant Upgrade. Replacement of 4 3516 SITA CAT Engines with 2 CAT 3516 H Engines	2,563	25,630	\$7,900,000	\$0
Schmon Tower Energy Transfer Skid Installation - installation of high efficiency pump & VFD.	13	156	\$84,783	\$84,783
Campus T8 to LED lighting retrofits. • Schmon Tower (143 fixtures) • CUB (320 lamps) • Central Utility Tunnel (200 LED wall packs) • Hamilton Campus Exterior Lighting (6 wall packs) • East Academic Exterior Lighting (24 Wall packs)	6	72	\$40,955	\$28,873
VFD pump and fan motor installations. • Taro Hall (VFD on SF1E, SF2E, RF1E & RF2E) • Schmon Tower (VFD on F10 & F12) • Thermal Storage Tank P7 & P8 VFD Install • David S. Howe Theater VFD (SF & RF VFD Install) • Welch Hall (SF & RF VFD Install)	62	747	\$72,896	\$56,646
Plaza Chiller Recommissioning. Feeding the Plaza building with chilled water from the central district energy loop. Facilitated the shutting down of the chiller in Plaza.	88	1,056	\$25,000	\$25,000
DeCew Residence boiler recommissioning. Changes to valving allowed for the building to be 100% fed from the district heating loop, and shutting down of the electric boiler and feed pumps.	152	1,824	\$30,000	\$30,000
Total	4,309	46,561	\$18,476,162	\$2,764,684

Brock University will continue to strive towards the sourcing and implementation of energy efficient technologies for both the District Energy System as well as satellite sites including Hamilton Campus, Marilyn I. Walker, Captain John DeCew and Rodman Hall. Brock also acknowledges that technology is evolving at a rapid pace and endeavors to adapt to the changing design methodology as well as equipment sourcing, procurement and implementation. Brock will look to combine current practices in sustainable design and construction and retrofitting of existing technologies with industry advances as they become commercially available. This strategy will be the catalyst to assist Brock in contributing to Canada's 2030 and 2050 emissions targets and providing a greener, more sustainable campus to its students, faculty and staff.

Table 1.3: GHG Reduction 2030-2050

Proposed Strategies/Sustainability Milestone	Total Estimated GHG Reductions (tonnes of CO ₂)	GHG Reduction by 2030-2050 (tonnes of CO ₂)	Total Strategy Cost	Institutional Investment
DEEP 1 Cogen Plant Upgrade Replacement of 4 3516 SITA CAT Engines with 2 CAT 3516 H Engines	1,423	28,460	\$10,377,528	\$2,594,382
DEEP 2 Cogen Plant Upgrade Replacement of 4 3516 SITA CAT Engines with 2 CAT 3516 H Engines	2,563	51,260	\$7,900,000	N/A
HVAC Control changes & Upgrades: Cairns Building from air-to-air to air-to-water heat exchangers & heat pumps.	3,212	64,240	\$4,075,000	\$3,846,500
Continued lighting retrofits. Replacement of T12 & T8 fluorescent fixtures with LED fixtures, trophers, wall packs and lamps.	58	1,160	\$102,500	\$22,500
Continued installation of premium efficiency motors and VFDs.	374	7,480	\$437,370	\$339,870
Total	7,630	152,600	\$22,892,398	6,803,252

Energy Conservation and Demand Management Plan

In 2016, the [Energy Conservation and Demand Management Plan](#) was published, with feasibility studies and project planning taking place in 2016 and 2017, and implementation beginning in 2018. The main goals of the plan are to improve the efficiency of on-site energy generation, commit to smart and efficient building operations and renewal, leverage strategic procurement of energy and carbon offsets, increase energy awareness and communication, and energy-efficient design, construction, and renovation. This plan also sets specific targets, with a carbon intensity reduction target of 20% below the 2013 baseline levels by 2023. To monitor progress, there is an annual review of the plan implementation and the Energy Performance Scorecard is updated. Additionally, greenhouse gas emissions and energy reduction initiatives will be evaluated and updated annually as new opportunities, funding, or technology arise. The plan will be reviewed in 2019 and re-issued and approved in 2020.

Table 1.4: **District Energy Efficiency Project**

Investment	The \$10.8 million DEEP project started 18 months ago and is replacing half of the existing natural gas-powered co-gen engines with high efficiency, electronically controlled units. DEEP 2 will upgrade and modernize the facility further, creating an energy-efficient source of electricity, cooling, and heating for campus.
In the news: March 2018 ↗	
Environmental Impacts/Justification	The completed DEEP projects will result in Brock's annual nitrogen oxide gas emissions dropping from 55 tonnes to 8 tonnes, and non-methane hydrocarbons from 15 tonnes to four. The new engines will consume 26% less fuel per kWh produced, and result in hundreds of thousands of dollars in annual utility cost savings.
Targets	This project will contribute greatly to Brock's reduction target of 20% by 2023, and lead to a 26% efficiency gain in the plant and result in saved utility and maintenance costs.
Target Date	DEEP 1 is expected to be completed during the summer of 2018. DEEP 2 will be wrapped up by March 2019.
Accountability	Facilities Management (FM)

Alternative Energy Feasibility Studies

Currently, there are several feasibility studies underway exploring the potential for diversifying the district energy portfolio. Projects under consideration include rooftop and grade level solar installations and wind turbines.

District Energy Loop Study

Brock is currently undertaking a study of its District Energy Loop. The study provides recommendations to optimize the operation and control of high-energy user buildings to ensure the district energy loop is the primary source of energy before supplementary sources are required. As Brock implements the recommendations, reductions in waste energy and supplementary energy production are expected.

Strategic initiatives for long-term energy commitments

The university aims to develop strategic policies and energy procurement practices through OECM and Energy Advisors, leveraging participation in the OAPPA Energy Committee, and reviewing opportunities for demand management in larger buildings and campus areas.

There are several energy reduction initiatives at Brock. Using a proactive approach, the university is planning and working towards future energy reduction projects.

Table 1.5: Energy Conservation

Strategy	Action Plan
LEED Silver buildings (Plaza and International Centre) Accountability: FM	There are two LEED Silver certified buildings on campus, Plaza, and the International Centre. Plaza includes landscaping that minimizes irrigation, pest control and fertilizing, rainwater collection for non-potable uses, water conserving plumbing that saves 60% of potable water, and thermal flooring. 33% of materials used to build Plaza were regionally extracted and over 75% of the construction materials were diverted from landfills.
Demand Control Ventilation Investment: \$40,000 Accountability: FM	A demand control ventilation system was installed to modulate fan speeds in kitchen hoods to reduce wasted energy. This has led to a reduction in wasted energy from 50% to 70% .
Opening and Renovation of Theal House Accountability: FM, ESRC In the news: March 2018 ↗	Theal House, the physical location of the Environmental Sustainability Research Centre(ESRC), was renovated in February 2018 to create a sustainability showcase. This includes LED lighting, reused furniture from local stores, carpet associated with 3,032 kg of carbon offsets, HVAC system to maintain control over energy use, and data acquisition on real time power usage.
LED lighting upgrades Investment: \$56,646 Accountability: FM	Older lighting fixtures around campus are being updated with the most energy-efficient lighting, including LED's and T5's. Recent projects replacing and installing new LED's in Schmon Tower, the Central Utility Tunnel, Central Utilities Building, and the exterior of Hamilton campus, have led to annual energy savings of 59,105 kWh .
Testing ecoalkaline batteries Investment: \$5,000 Accountability: FM	Brock is currently testing carbon neutral ecoalkaline batteries, to see if they can be used across campus to replace the approximately 6000 batteries used each year. If these are found to work well in preliminary testing, the target is to carry some stock by the end of the summer, and to test more across campus.
Earth Right Energy Dashboard - Marilyn I. Walker campus building Investment: \$10,000 Accountability: FM	In Fall 2017, software was installed in the Marilyn I. Walker School of Fine and Performing Arts, to monitor and provide an overview of water, gas, and electricity usage in the facility. It will be used to determine where utility consumption adjustments can be made, and as a pilot project to test the potential of implementing the software across campus.
Schmon Tower Supply Fan Investment: \$85,000 Accountability: FM	F10 and F12 variable frequency drives were installed on the return fans in Schmon Tower, to allow fan speeds to be controlled and adjusted according to demand. The project also replaced an aging 75 HP motor with a new high efficiency unit. This has led to annual energy savings of 456,000 kWh .
Schmon Tower Energy Transfer Skid Investment: \$90,000 Accountability: FM	An energy transfer skid was installed in the basement of Schmon Tower in order to increase the efficiency of hot water distribution from the district energy loop, thereby heating the building more efficiently.
Plaza Chiller Re-commissioning Investment: \$25,000 Accountability: FM	Some critical pump interlocks were removed, and valves switched in Plaza, so that the electric chiller in Plaza could be turned off. By using chilled water from the district cooling loop instead, around 435,000 kWh of energy is saved each year .

Table 1.5: **Energy Conservation cont.**

Strategy	Action Plan
DeCew Residence District Energy Optimization Investment: \$30,000 Accountability: FM	Behavioural and mechanical changes were made in DeCew residence, in order to improve the efficiency of DeCew's heating water supply. This eliminated the need for the electric boilers in DeCew, allowing the residence to be supplied from the district energy loop. This saves an annual 755,000 kWh.
Air compressor replacement Investment: \$150,000 Accountability: FM	Two existing oversized 100Hp air compressors were replaced with two new 50Hp Kaeser compressors for system air on main campus.
Smart Energy Metres Accountability: FM	Installed 18 new smart energy meters across campus.
Retrofit Older Buildings Accountability: FM	Retrofit older buildings with sensors/lighting controls, and continue to replace incandescent lighting.
Roadway and Parking Lot Lighting Accountability: FM	Parking Lot and street lights are being replaced when required. A plan is in place for larger retrofits and revamps.



Environmental Sustainability Management

2

Brock University is committed to integrating sustainability within its management and campus operations. The information below outlines strategic plans and policies, which focus on sustainability within various aspects of campus operations, procurement and development.

POLICIES AND STRATEGIC PLANS

2.1

Sustainability Policy

Brock University's [Sustainability Policy](#) was implemented on March 9th, 2016. Within the policy, sustainability is defined as the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The policy is owned by the Associate Vice-President and Facilities Management, who will monitor compliance with the Policy, with advice and/or observations provided by the Sustainability Coordinating Committee. It was authorized by the Board of Trustees and Capital Infrastructure Committee and accepted by the Senior Administrative Council. The Sustainability Policy is set to be reviewed on March 9th, 2019.



Brock Sustainability Committee

The University's Sustainability Co-ordinating Committee (SCC) was established in 2009 and held its first meeting on September 25, 2009. Participation in the Committee is open to all entities of the University, with the Committee serving as a forum for the receipt and exchange of sustainability related information, practices, actions, initiatives, education, goods and services, etc. In this manner, participants are able to link-up with one another in mutually supporting ad hoc groups to develop grass-roots initiatives or to improve on their sustainable practices. The SCC has been able to sustain and facilitate engagement and dialogue, often at the 'middle-management' level, with those in the Brock University community in regard to enhancing and promoting sustainability at the University.

ESRC Strategic Plan

The Environmental Sustainability Research Centre (ESRC) [Strategic Plan](#) outlines ongoing and future initiatives, and details how it will achieve its mission from 2018-2023. The mission of the ESRC is to advance environmental sustainability locally and globally through excellence in research and education. Three objectives outlined throughout the report are:

- A. to encourage research excellence in environmental sustainability by faculty, librarians, and students.
- B. to enable enriching educational experiences in environmental sustainability.
- C. to engage in knowledge mobilization and foster knowledge impacts.

ESRC and Facilities Management Project Charter

Facilities Management and the ESRC hold a shared vision and commitment towards a more sustainable campus. This collaboration is held together by a formal charter that shepherds and allows for a multitude of sustainability initiatives across campus, which will further engagement with sustainability campus-wide, bringing together academic and operational units. The participants will cooperate on projects of mutual benefit and collaboratively establish mechanisms that effectively communicate information with the broader Brock community about Sustainability at Brock. They will contribute resources in the form of cash and in-kind contributions over an initial five-year period to enable 'Sustainability at Brock'.

Brock University conducts an annual waste audit to record and monitor the waste that is generated across campus, in order to identify areas in need of improvement. From there, goals are identified, and initiatives created to increase diversion. In the 2016 audit, the diversion rate was determined to be approximately 67%. Brock's management team are committed to maintaining this excellent result and minimizing the amount of materials disposed to landfill.

Table 2.1: E-Waste and Hazardous Waste

Strategy	Action Plan
Battery Disposal Program Accountability: Central Receiving & Mail Services	Brock provides drop-off centres for batteries to prevent toxic waste from ending up in landfills. Pails can be ordered for departments and picked up when full. This service makes it convenient for the Brock community to recycle batteries. Overall, 90% of the battery is reclaimed , reducing waste, with 4800 lbs. of used batteries being recycled in 2017 .
Hazardous Waste Management System Accountability: Science Stores and Health, Safety & Wellness Department	Together, the Brock Health and Wellness department and Science Stores provide proper disposal of hazardous waste coming from the labs. This includes proper separation, identification, packaging, and monitoring of waste, before RPR Environmental comes weekly to pick it up.
E-waste Collection Accountability: Central Receiving & Mail Services	E-waste on campus is collected and either redeployed, sold, or recycled, ultimately keeping electronics from landfill. In the 2017/2018 fiscal year 14,000 lbs. of electronics were recycled . Collection bins are also provided to residences on move-out day, and in 2013, they collected 2,700 lbs. of electronics , keeping TV's, monitors, printers, and other small appliances from landfill.
Ink Cartridge Recycling Accountability: Central Receiving & Mail Services	Ink cartridges from departments are collected in order to reduce the millions of cartridges that enter landfill each year. Approximately 500 lbs. of ink cartridges were recycled last year.

Table 2.2: Food and Beverage Waste

Strategy	Action Plan
Coffee Cup Recycling Accountability: Custodial Services	In 2009, a coffee cup recycling program was started, to provide proper disposal for cups which cannot be disposed of in the organics or recyclable bins. There are eight marked containers across campus. The collected cups are shredded and blended with the composting material, acting as a bulk agent, while reducing the number of cups entering landfill .
Sustainability integration into Dining Services operations Accountability: Dining Services	Dining Services have taken several steps to make their every-day actions more sustainable. This includes offering biodegradable take out containers, using recyclable and biodegradable packaging, eliminating Styrofoam use, providing napkin dispensers that discourage taking stacks of napkins, and using green cleaners.
Green-2-Go reusable container program Accountability: Dining Services	In February 2017, a program was implemented where reusable take-out containers were offered to students, faculty, and staff, in order to reduce the waste associated with single-use cardboard containers. The Green-2-Go containers can be washed up to 800 times before needing to be recycled and replaced, thereby reducing waste.
In the news: February 2017	
Composting Program Accountability: Custodial Services	Organic waste is collected in 4 cafeterias for third party composting, including in SchmonTower, DeCew Residence, the Student Centre, and Lowenberger Residence. It is also collected in kitchens, staff lunch-rooms, and lounges.

dedicated to sustainable practices
supporting the local economy!
that a greener tomorrow
starts today!

5 Red Seal Chefs
you made from scratch
home-cooked meals!

Brock blend coffee is
Fairtrade & roasted
daily on site!

Famous Guernsey
homed meat is sourced
smoked in-house daily
for 9 hours!

Offer cage free eggs!

pend
dum
al

62%
of our total spend
is purchased
within 160km
of Niagara!

65%
of our total spend
is purchased here
in Ontario!

Inability Path

(Fair Trade Campus of the Year -2015).

reducing the amount of packaging & plastics we use by offering
alternatives.

products that have a reduced impact

bottle refilling stations across campus.

largest location, the Guernsey Market.

Supporting & composting everything.



Table 2.3: Reusable Items

Strategy	Action Plan
Furniture redeployment and disposal Accountability: Central Receiving & Mail Services	Brock's furniture redeployment and disposal program increases diversion on campus while supporting community organizations and providing departments with a convenient way to contribute to sustainability. The furniture not redeployed or sold supports community groups such as Habitat for Humanity and Warehouse of Hope.
Annual Swap n' Drop event Accountability: Brock Student Life & Community Experience In the news: March 2018 ↗	Each Spring, Brock Student Life and Community Experience runs an annual clothing drive where students, faculty, and staff can donate gently-used clothing. Participants can swap used clothes or purchase items for \$2 each. Money collected, and remaining clothing is directed to the RAFT and YWCA Niagara. In 2017, 10 large boxes of clothing were donated, and \$50 donated to the General Brock Food Bank.
Textile donation bins for Diabetes Association	Diabetes Association has been allowed to place textile donation bins on campus to increase diversion and reuse of textiles on campus
Textbooks for Change	There are 6 drop off boxes across campus for Textbooks for Change. 50% of the books are donated to partner campus libraries in Africa, 20% of the books are sold at affordable prices to students, and the rest are unusable books that are recycled.

There have been, and continue to be, several retrofit and installation projects conducted across different areas of campus, in order to save resources and reduce waste. Brock continues to work on successful initiatives that have a wide array of environmental and community benefits.

Table 2.4: Waste Disposal Mechanisms

Strategy	Action Plan
Waste compactors installed Investment: \$45,000 Accountability: FM	In 2012, two waste compactors were installed on campus, one in the Schmon Tower loading dock, and the other in Mackenzie Chown's G Block. The compactors reduce the frequency of trips made by the waste hauler, saving 470,000 kg of waste annually . The compactors are serviced every 1-2 weeks, compared to the daily servicing needed prior to installation.
Conveyor belt replaces garbage cans in Market Hall (main cafeteria) Accountability: Dining Services	In September 2012, a conveyor belt was installed in Market Hall to increase the efficiency of organic waste disposal . Students are asked to place their plates and all other waste, except blue bin recyclables, on the belt. Staff members then sort the organics from the garbage, ensuring proper disposal.
Pulper Installation in Market Accountability: Dining Services	Biodegradable items are separated from the waste and then pulped. The compost is then picked up by a local recycler. The pulper reduces ten bags of garbage down to one , reducing the amount of waste Brock is sending to landfills, and reducing the frequency of waste pick-ups.



Table 2.5: Water Reduction

Strategy	Action Plan
<p>Water refill stations on campus Investment: \$5,000/station Accountability: BUSU, FM In the news: June 2018 ↗</p>	<p>In 2013, Brock University's Student Union (BUSU) installed 8 water refill stations across campus to help reduce landfill waste from plastic water bottles. There are now 44 water refill stations on campus. 930,343 water bottles were saved from going to landfill in 2017 alone, with more than 3.7 million bottles being diverted from landfills since 2013.</p>
<p>Low flow toilets and urinals Investment: \$4,000 Accountability: FM</p>	<p>Existing toilets are being replaced with new low-flow technology, in order to save water. Recently, Welch Hall's units were replaced with 24 dual flush toilets, 3 low flush toilets, and 8 urinals. This has led to annual water savings of 601,000 L.</p>
<p>GE water savings Investment: \$6,500 (excl. first project) Accountability: FM</p>	<p>Several water-saving retrofits were completed in the Central Utilities Building. In 2013, the number of cycles for the Cooling Tower was increased from 3.5 to 5.0, reducing the amount of cooling water by 40% and saving 10,505 m³ annually. In 2016, filter improvements were made, saving 33,880 m³ of water and \$11,200/year. In 2017, engine cooling water was recycled to tower basins, instead of being sent to drains, saving 45,072 m³ of water and \$14,900.</p>



In 2009, Brock created its [Preliminary Bikeways Master Plan](#), which supported cycling as a sustainable and pollution-free means of transport. Since then, several initiatives have worked to create sustainable transportation programs, opportunities, and infrastructure on campus.

Table 2.6: Transportation	
Strategy	Action Plan
Car Sharing Program (Zipcar) Accountability: BUSU	In 2016, BUSU partnered with Zipcar to provide a ride share program for students, faculty, and staff. There are two vehicles available for the Brock community. This service reduces internal engine emissions and individual cars on the road.
Electric smart cars acquired and used by FM Investment: \$30,000 Accountability: FM In the news: July 2017	Facilities Management acquired three electric smart cars to replace their supervisor vehicles. The previously used vans cost more than double. This significantly reduces gas usage and associated costs. Each smart car saves approximately 1150 kg of CO ₂ emissions annually compared to a regular car, assuming 10,000 km of yearly mileage.
Active transportation (bike lines created to campus) Investment: \$325,000 Accountability: FM	In July 2017, a grant was given by the Ontario Municipal Cycling Infrastructure Program to add new cycling paths to campus, to support active transportation on campus. This project was a joint effort between the Government of Ontario, the City of Thorold, and the Niagara Region.
Electric vehicle chargers Investment: \$16,000/charger for 3 initial stations; \$75,000 from Ontario Government Accountability: FM In the news: June 2018	Brock currently has 3 electric chargers, with the first one being installed in 2013, and two more being installed in 2016. Brock recently received \$75,000 from the Ontario Government's Workplace Electric Vehicle Charging Incentive Program to install 10 new charging stations across campus, to be installed by November 2018. This will help reduce Brock's Scope 3 emissions .



GROUNDS KEEPING

[Grounds Services](#) demonstrates their commitment to sustainability through several ongoing initiatives. The first objective is to **conserve irrigation water**. This is being achieved by using automated watering systems that started being used in 2004, with scheduling being monitored and regulated as precipitation rates change. Since 2011, water is also saved by prioritizing areas such as the varsity fields, and only watering as needed, while also stopping to water some areas altogether. Rain and wind sensors that shut down the watering systems under conditions where extra water is not needed were installed in 2006 and 2008 respectively. Gray water systems have also been added to International Centre for toilets, and the Cairns Complex for irrigation.

The second objective is **maximizing natural areas and natural plants** in landscaping. There are several natural areas and long grass areas on campus, along with the Escarpment lands, that are maintained with sustainable practices. These areas are only planted with native plants. Elsewhere, plant species are chosen with native species as a first priority and only non-invasive non-native species are chosen. Furthermore, in maintaining campus landscape and sports fields, pesticides have not been used since 2002, helping to protect the biodiversity on campus.

The third objective is **reducing, reusing, and recycling materials while keeping the campus green**. One strategy to achieve this goal is using and purchasing compost for landscaping. Any landscape organic materials are composted on-site, with the finished products being used around campus. Municipal compost has also been purchased to use as a soil amendment and for top dressing turf areas since 2005. Another strategy is chipping brush from tree work on campus and using it as mulch, which suppresses weeds, reduces irrigation needs, and improves the soil.



Brock University is committed to integrating sustainability within all aspects of the university, including procurement of goods and services, and future development guidelines.

Table 2.7: Procurement	
Strategy	Action Plan
Fair trade commitment Accountability: Ancillary Services In the news: September 2015	In September 2013, Brock became Ontario's second Fair Trade Campus and was named Fair Trade Campus of the Year in 2015. Dining Services is dedicated to building mutually beneficial relationships with producers, by providing fair trade coffee, tea, dairy milk chocolate, and Camino products in campus stores and vending machines.
Purchase of sustainable raw materials Accountability: Dining Services	Dining Services integrates sustainability into its daily operations by supporting local businesses such as Locco's and St. Joe's Bakery. It proudly serves caged free eggs, buys locally, uses recyclable and biodegradable packaging, and provides biodegradable take-out containers.
Weekly Farmers' Market Accountability: Event Services In the news: May 2018	Every year, starting in the end of May and continuing throughout the summer, Brock holds a weekly farmers' market held in Jubilee Court every Thursday. The event provides easy access for students and staff to local produce, farmers, and bakeries, supporting local vendors and economy.

DEVELOPMENT

Campus Plan

An updated planning document was created in 2016, which lays out a long-term framework for the evolution and future growth of campus, creates guidelines for campus development, and strengthens Brock's image as an inspiring and beautiful place that encourages academic excellence. The Campus Plan Steering Committee and Facilities Management manage the plan, and the Office of Campus Planning and Design and Construction Services prepare the annual report and oversee the 10-year reviews.

The plan outlines sustainability as one of the five broad principles to provide direction for the plan and offer a means for evaluating future projects and amendments to the Campus Plan. This includes supporting the development of a compact, mixed-used campus, maintaining and renewing existing buildings before building new ones, pursuing reductions in energy use and emissions, considering financial opportunities and impacts, providing long-term certainty for campus lands and resources, and aligning campus development with robust and resilient utilities and infrastructure.

Best Building Practices Guideline

The Best Building Practices guideline defines guidelines for methods of designing and constructing future University buildings, which need to be a minimum of LEED silver designation. This report was issued on October 14, 2014 and was reviewed in 2017. This report is being completely enhanced and should be completed by the end of 2018. The purpose of the document is to have a set of guidelines for designing and building the "greenest building" possible by using sustainable materials etc.

Design standards for new construction and major retrofits

Brock University has developed design standards for new construction and major retrofits. The following objectives are found within the plan: implement latest technology and building systems to maximize energy efficiency gains in retrofits and new building projects whenever possible, develop retrofit plan for Schmon Tower to address maintenance requirements and to increase efficiency, design new buildings according to LEED standards, review future maintenance projects to highlight energy related building components and determine if an Energy Service Contract is feasible.

BUSU's Green Levy

The Brock University Students' Union (BUSU) has created a Green Levy. From each undergraduate student's tuition, the student union collects 1 dollar to improve environmental efficiency and to reduce BUSU's impact on the environment. Funds can be used to improve BUSU's operation, and departments on campus can make a request for funds for an event or project with environmental purpose. The funding is subject to approval from the BUSU Board of Directors and Brock University Students' Administrative Council (BUSAC).

Recent renovations to Union Station (LED lighting, automatic faucets in bathrooms, dual flushing toilets), Enviroweek (community clean-up, water bottle awareness, promotional material), the Growing Roots Summit (key note speakers, promo material, tabling), the Garden greenhouse for Brock Community Garden, reusable water bottles and refill stations across campus, and the purchase of the Green Reads used book vending machine are all examples of initiatives that were funded by BUSU's Green Levy.



Education for Sustainability

3

The Environmental Sustainability Research Centre (ESRC) is a transformative and creative transdisciplinary community dedicated to research and education advancing environmental sustainability locally and globally, which is demonstrated through its academic programming, community engagement, communications, and research.

In working towards this mission, the ESRC has three main objectives:

- To encourage research excellence in environmental sustainability by faculty, librarians and students;
- To enable enriching educational experiences in environmental sustainability;
- To engage in knowledge mobilization and foster knowledge impacts.

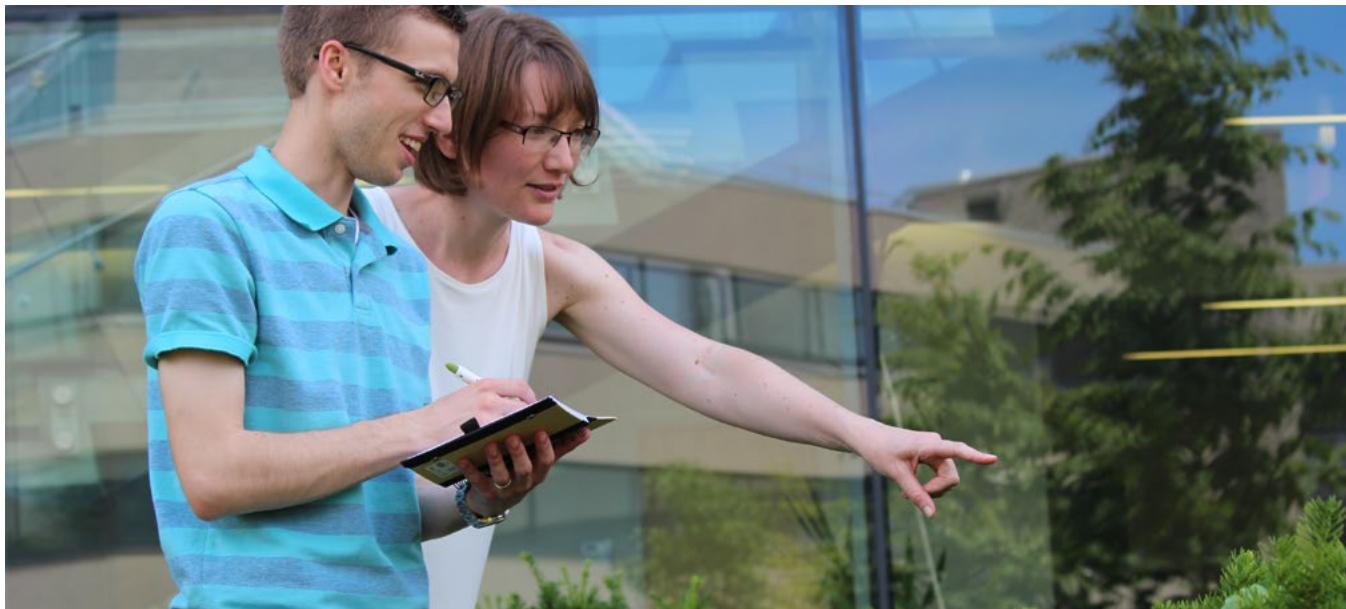
The ESRC is a research centre within the Faculty of Social Sciences as well as one of [five transdisciplinary hubs at Brock University](#).

ACADEMIC PROGRAMS

3.1

Master in Sustainability

The [Sustainability Science and Society \(SSAS\) graduate program](#), developed in 2014, aims to facilitate society's transition towards sustainability. The program is managed by the Environmental Sustainability Research Centre (ESRC). It consists of two learning paths – Scheme A (consisting of a Major Research Project and co-op work terms) and Scheme B (consisting of a thesis). Students can tailor their program to specific career and research interests through enriching classroom learning with practical experience, or intensive research experience. The program is transdisciplinary in orientation and emphasizes overcoming barriers among traditional disciplines and sectors. It provides students with enriching research and applied experiences, and problem-solving skills through innovative pedagogy. Since its inception in 2014, the program has admitted 51 students into the program.



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Minor in Environmental Sustainability

In 2017, the ESRC launched a [Minor in Environmental Sustainability](#) (ENSU). The minor enables undergraduate students across the institution to study Environmental Sustainability through courses offered in 15 units across campus and have it recognized in conjunction with their major program degree. The units include: Biological Sciences, Chemistry, Earth Sciences, Economics, Geography and Tourism Studies, Health Sciences, History, Labour Studies, Philosophy, Political Science, Recreation and Leisure Studies, Studies in Art and Culture, Visual Arts, and Women's and Gender Studies. It provides students with an opportunity to study foundational concepts and experience contemporary issues in the field of environmental sustainability, all the while educating new generations in environmental problem solving, research, and experience. The ESRC offers both online and in-person undergraduate courses.

Since 2017, 29 students have declared a Minor in Sustainability, with enrolment reaching over 500 students for ENSU course offerings in both the Fall/Winter and Spring/Summer terms.

PhD in Sustainability

Brock University has signed a Memorandum of Understanding (MoU) with the University of the Sunshine Coast in Australia to create an opportunity for students interested in pursuing a [PhD program in Sustainability](#). The partnership was established in 2016 and is enabled through a scholarship, supported by both institutions. The scholarship allows a student to study in both Canada and Australia under the supervision of researchers from both universities.

Ongoing support is contingent on new funding opportunities.



Brock-Lincoln Living Lab over five years

The Town of Lincoln and Brock University have formally launched a partnership that will help guide the town with future policy development and decision-making. This partnership offers a platform to interact with and bring together community leaders, policy-makers, researchers, and students who have a shared commitment to explore and investigate issues vital to the community and its well-being. The partnership developed in October of 2017 is for the next five years. The Brock-Lincoln Lab fosters community engagement and works to address local needs around community sustainability and assist with guiding policy development. It creates an opportunity for students to contribute to the community through experiential education, that extends the curriculum into the community, and provides more resources and research into sustainable municipal planning, research in development pressures and biodiversity.

In the news: [October 2017](#) ↗



Excellence in Environmental Stewardship Initiative

The Niagara Parks Commission (NPC) and the ESRC have identified a shared interest in collaborating on projects of mutual benefit with a focus on environmental stewardship. This partnership which was developed in April 2018 and will continue until April 2020, will advance understanding of environmental stewardship, inform and enhance practice, and improve the capacity of the NPC to make evidence-based decisions. The purpose of this partnership is to increase stewardship initiatives within NPC to navigate tension between use and conservation actions, to lead to positive ecological outcomes. Effort to engage and inform community members will be established by posting information on projects in multiple formats on the website.

In the news: [April 2018](#) ↗

Energy Awareness and Communication

Energy awareness and communication is one of the 5 objectives set within the Brock Energy Conservation and Demand Management (ECDM) 2016 plan. Brock University has set to engage the community to maximize benefits of the objectives set within the ECDM. The following initiatives are underway to provide on-going communication and seek input from all members of the Brock Community:

- Collaborating with Brock's Sustainability Committee to develop a communication plan and engagement strategy to be rolled out to entire Brock community
- Generating annual updates of the Energy Performance Scorecard, which will then be distributed to the Brock Community
- Completing annual waste audits and communicating the results and successes
- Creating and implementing Solid Waste Reduction Action Plans and a Solid Waste Management Policy
- Providing strategically located dashboards on-campus that provide information on baseline building energy consumption data and encourage the engagement of stakeholders
- Providing energy awareness and management training opportunities for Facility Management staff across all disciplines
- Providing forums for engaging the Brock Community to share energy and water conservation ideas
- Engaging Horizon Utilities to explore the opportunity for an Embedded Energy Manager (EEM)
- Conducting energy audits for Brock buildings and integrating the results into the annual Capital Planning process

Website & Social Media

The new [Sustainability at Brock website](#) launched in 2016. Social media accounts on Twitter, Facebook and Instagram platforms were created in May 2018 to share information about research, programs, news, and events. The team of student staff members hired via the [Brock University Project Charter](#) engage in writing news stories, creating videos, and social media posts. Engagement will be monitored through the number of likes, page visits, retweets, and shares received on Facebook, Twitter, and Instagram respectively.





Contest for labs in Cairns Complex

To increase energy awareness and communication, a contest was held with occupants of the various laboratories within Cairns Complex. Numerous fume hoods were consistently being left open unnecessarily by students and faculty. To modify this behaviour, the contest was held to see which lab would use the least amount of energy. The contest resulted in behaviour change, thus increasing compliance to fume hood closure requirements and significantly reducing the hours of operation for the ventilation systems and the overall energy use. This is among the many efforts to help reach Brock University's Green House Gas emissions density reduction target of 20% below 2013 baseline levels by the year 2030.

Community Education on Recycling Best Practices

As part of the Annual Swap n' Drop initiative at Brock, a new Move Out Madness component was implemented this Spring. Local organizations were in Market Hall on the day of the event, providing students with move-out education on how community organizations can help provide recycling and reuse opportunities for things like furniture, appliances, household item donations, and large item pick up.

This section outlines the major activities and achievements of the ESRC over the lifetime of the five-year Transdisciplinary (TD) Hub grant. It is imperative to recognize that the ESRC is a unit at Brock and that the TD Hub grant was a major, multi-faceted, and evolving project during this time period (2012 to 2017).

The research dollars invested via the ESRC TD Hub allowed for the creation of a highly productive research culture within the ESRC and is reflected in the research output of faculty members between 2012 and 2017. Members have published 392 peer-reviewed publications over the past 5 years, including 248 Journal articles, meaning members publish one new peer-reviewed journal article every week. 87 Books, book chapters, and edited volumes have been published. Moreover, members publish one book, book chapter, or edited volume every three weeks.

The first objective of the ESRC TD Hub was to resolve the complex environmental/social problems by fostering transdisciplinary research at Brock, cultivating academic networks with other world-class institutions, and transforming scientific thinking into action. Planning and activities undertaken toward this objective focused on deepening and expanding the research capacity of both the ESRC and its individual members. The second objective of the ESRC TD Hub was to create a vibrant learning community that enhances knowledge and develops skills through innovative pedagogies. Planning and activities undertaken toward this objective focused on the strategic design, development, and implementation of a suite of innovative educational programs in environmental and sustainability science that would meet the demands of Brock students, Faculty, and the broader community. The third objective of the ESRC TD Hub was to foster sustainable uses of our shared environments by engaging with communities of practitioners/policy makers and fostering knowledge mobilization at local through international levels.

Over the past five years members have given 488 Scholarly presentations and speaking engagements, including 319 Conference presentations, and 167 Invited speaking engagements and presentations in symposia/panels. Members make one academic conference presentation every 5.7 days and deliver one invited speaking engagement or a presentation in a symposia or panel every 10.9 days. A number of additional ESRC TD Hub activities and initiatives are described in greater detail below.



Seed Funding Grant Program

To support continued research excellence, the Seed Funding Grant Program was established in 2013. It provides seed funding for ESRC members commencing specific projects related to ESRC's research mandate, and in so doing, building ESRC's research capacity. Over five years, from 2013-2017, the program dispersed \$83,685 amongst 15 different projects, with an average grant of \$5,579.

Postdoctoral Fellowship

In addition to the SEED funding program, the ESRC's Postdoctoral Fellowship in Sustainability Science program was launched in 2013 to create opportunities for ESRC Faculty and the fellows they supervise to carry out transdisciplinary, integrative, and environmentally oriented research. There were six Post-Doctoral Fellows brought on between 2013-2017, with a total investment of \$70,340 overall.

Visiting Scholars Program

The Visiting Scholars Program (VSP) is another program offered by the ESRC that is intended to engender a stimulating and vibrant research environment by bringing high-level scholars engaged in research on environment, sustainability, and social ecological resilience into the Centre's physical space to directly interact with ESRC members and the SSAS students. The program fosters new relationships amongst members and other scholars and raises the profile of the Centre both locally and abroad. This program supported 6 individuals from 2015-2017, with a total overall investment of \$11,267.

Canada Research Chair

Julia Baird was awarded the Canada Research Chair (CRC) in Human Dimensions of Water Resources and Water Resilience in the fall of 2017. Her work focuses on the interaction of social and ecological systems of freshwater resources and emphasizes new approaches to managing and governing such systems to promote social-ecological resilience. Research Chairs provide focal points for collaboration and enable substantive, cutting-edge research programs to invigorate the work of a research centre. The recently established Canada Research Chair (CRC) shared between the ESRC and the Department of Geography builds on Brock's strength in water resources and resilience research.

In the News: November 2017 



Baseline – A minimum or starting point used for comparisons.

BUSU – Brock University Students' Union

Brock-Lincoln Living Lab – An innovative University-community partnership enabling knowledge mobilization and community-focused research.

Canada Research Chair – Title given to researchers nominated by Canadian postsecondary institutions.

Carbon neutral – Making or resulting in no net release of carbon dioxide into the atmosphere, especially as a result of carbon offsetting.

Carbon offsets – Compensating for carbon dioxide emissions arising from industrial or other human activity, by participating in schemes designed to make equivalent reductions of carbon dioxide in the atmosphere.

CFHBRC – Cairns Family Health and Bioscience Research Centre

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.

Critical pump interlocks – Temperature or pressure setpoints that force the pump to shut down when met.

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 plant – The systems that generate the heating and cooling for the district energy loop.

Eg. Chillers, boilers, etc.

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 Learning – Learning involving or based on experience and observation.

Fair trade – Trade between companies in developed countries and producers in developing countries in which fair prices are paid to the producers.

Feasibility study – An assessment of the practicality of a proposed plan or method.

FM – Facilities Management

Focus Areas – Broad overarching areas of focus that the sustainability plan is organized around.

GE – General Electric

HP motor – The rating of a motor in Horse Power.

HVAC – Heating, Ventilation, and air conditioning

Hydrocarbon – A compound of hydrogen and carbon, such as any of those which are the chief components of petroleum and natural gas.

KPI – Key Performance Indicator

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.

Levy – Fee or tax that is imposed. In the context of this document, a levy is a fee collected from every student enrolled at Brock University.

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

Memorandum of Understanding – A document recording the terms of a contract or other legal details between certain parties.

NPC – Niagara Parks Commission

OAPPA – Ontario Association of Physical Plant Administrators

OECM – Ontario Education Collaborative Marketplace

Peer-reviewed – Evaluation of scientific, academic, or professional work by others working in the same field.

Postdoctoral – Relating to or denoting research undertaken after the completion of doctoral research.

Potable – Safe to drink; drinkable.

Procurement – The action of obtaining or procuring something.

Pulper – Machine that removes pulp.

RAFT – Resource Association for Teens

Redeployment – The assignment of resources, troops or employees to a new place or task.

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

Scope 3 emissions – Greenhouse gas emissions that are the result of activities from assets not owned or controlled by the reporting organization, but that the organization indirectly impacts in its value chain.

SCR – Selective Catalytic Reduction; process of removing NO_x through the use of Urea.

SEED funding – A grant provided to researchers to kickstart their research projects.

SSAS – Sustainability Science and Society

Stewardship – The job of supervising or taking care of something, such as an organization or property.

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

Symposia – A conference or meeting to discuss a particular subject.

T5 – Fluorescent lamp that is 5/8" of an inch in diameter.

Textile – A type of cloth or woven fabric.

Theme – Specific categories of initiatives for which goals and strategies are formed.

UCS – Unified Computing System

UNESCO – The Paris-based United Nations Educational, Scientific and Cultural Organization

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

YWCA – Young Women's Christian Association

Zipcar – A membership-based car sharing program where you can reserve vehicles over a flexible period of time.

