



Brock University

Carbon Project Annual Report

2013



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Introduction

As public and private sector organizations become more conscious of environmental risks, carbon management gains a more crucial role in performance management, as well as corporate social responsibility (CSR). By tracking their carbon footprint, or the overall impact they have on the global climate in terms of the total amount of greenhouse gases produced, organizations are also making noticeable improvements to operational performance.

Partnering with Niagara Sustainability Initiative (NSI) through the Carbon Project allows companies, institutions and municipalities to recognize opportunities for emission reductions and efficiency improvements. Many organizations do not have a focused approach to carbon management. By simply viewing carbon emission data in a unified carbon management dashboard, organizations are more likely to make strides towards lowering that impact and potential business risks as they are able to identify the largest sources of their emissions. The greatest opportunities for carbon management improvements come from money-saving energy efficiency measures, making the investment in carbon management a valuable business practice.

Brock University is in a very unique position to implement sustainable practices within its operations, due to influence it has as an institution with many employees and students. The university has an opportunity to not only improve operations, but also reach out and engage with everyone on campus, to grow into a more sustainable culture. Increasing engagement and awareness provides the opportunity for students to apply the ideas they learn in school in their own lives.

In partnership with Niagara Sustainability Initiative (NSI), Brock University has undertaken the process of calculating its corporate carbon footprint. The purpose of this report is to update and inform Brock regarding the results of the 2013 reporting year under the Carbon Project.

Voluntary Reporting: The Carbon Project

The Carbon Project is a voluntary program whereby partners commit to managing and reducing their organizational carbon emissions. Through NSI's proven approach to engaging organizations in setting and achieving reduction targets partners are able to minimize their environmental impact while improving their financial bottom line: a two-fold accomplishment. The **Carbon Project** provides NSI partner organizations with services, tools and networks to facilitate a reduction in carbon (or GHG) emissions. In turn, participating organizations report their corporate carbon footprint, at a minimum, on an annual basis.

Scope of Inventory

This report describes the corporate carbon footprint of Brock University covering the time period from January 1 to December 31, 2013. International GHG accounting standards were followed to determine Brock University's carbon footprint through the use of carbon accounting software developed by e3 Solutions. According to these standards, emissions generating activities were classified under the following scopes:

Scope 1: All GHG emissions resulting from direct combustion.

Scope 2: Indirect GHG emissions from consumption of purchased electricity.



Scope 3: Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, outsourced activities, waste disposal, water usage and others.

As a participating organization in the Carbon Project, Brock U has committed to measuring and reporting emissions from the following activities:

Scope 1: Vehicle Fleet, Stationary Combustion

Scope 2: Electricity consumption

Scope 3: N/A

Inventory

The corporate carbon inventory totalled 26,500.37 tonnes of CO₂e (tCO₂e) representing a 974.82 tonne (3.8%) increase from Brock University's 2012 adjusted baseline emissions of 25,525.54 tCO₂e. The carbon footprint was predominantly comprised of scope 1 emissions, with stationary combustion (25,096.11 tCO₂e) and vehicle fleet (173.22 tCO₂e) representing the largest emissions source by scope (Table 1, Figure 1). Specifically, within Scope 1, 99% of emissions were a result of stationary combustion while the remaining 1% was a result of vehicle fleet related emissions (Figure 2). Scope 2 represented the remainder of Brock's corporate carbon emissions at 1,339.03 tCO₂e resulting from electricity consumption.

Brock University was also able to identify the amount of carbon sequestered annually by its expansive forested areas. Approximately 547,546 m² of the institution's property is covered with mostly maple and oak trees. Through resources provided by Tufts University¹ and American Forests², the amount of carbon emissions that were offset from Brock University's carbon footprint through forest carbon sequestration totalled 108 tCO₂e.

Note: This is the first year that Brock included emissions associated with Cairns Complex and Lowenberger Residence's natural gas and electricity consumption, contributing in part to the observed increase in total carbon emissions. Additionally, Brock University's baseline carbon footprint was adjusted to reflect three changes: the inclusion of carbon sequestered by campus greenery and the correction of software issues surrounding the emissions from diesel fleet vehicles and residence natural gas consumption in 2012.

Table 1. Corporate carbon footprint by scope.

Scope 1 (tCO ₂ e)		Scope 2 (tCO ₂ e)		Scope 3 (tCO ₂ e)		Offsets (tCO ₂ e)	
Fleet Vehicles	173.22	Electricity Consumption	1,339.03	Employee Commuting	--	Campus Greenery	108
Stationary Combustion	25,096.11			Business Travel	--		
Refrigerants	--			Waste	--		
				Water	--		
Total	25,269.34	Total	1,339.03	Total	0	Total	108

¹ Tufts University Office of Sustainability: Carbon Sequestration - <http://sustainability.tufts.edu/carbon-sequestration/>

² American Forests: Tree Facts: <http://www.americanforests.org/discover-forests/tree-facts/>



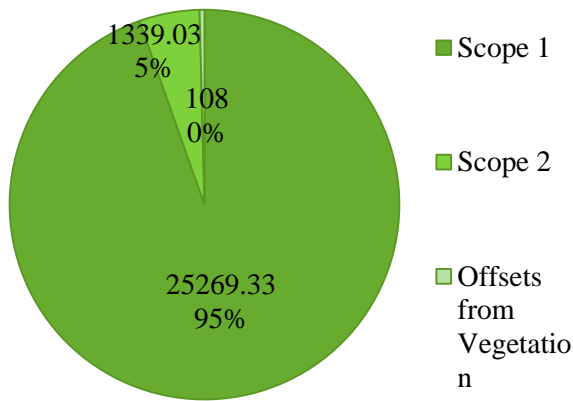


Figure 1. Illustrating Brock's 2013 corporate carbon footprint by scope (tCO₂e), including percentage by scope.

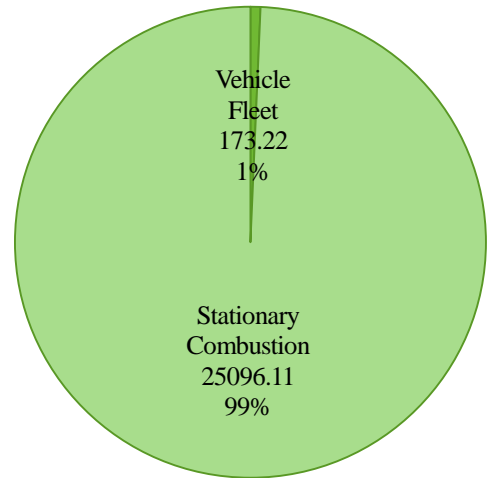


Figure 2. Illustrating the breakdown of Scope 1 emissions (tCO₂e) by source activity, including percentage.

Brock University experienced peaks in their 2013 emissions during the months of January- March and December with the highest emissions recorded in January (Figure 3). These peaks in emissions are associated with the heating of facilities. Emissions associated with electricity consumption remained generally consistent throughout the reporting year. Lower student population and consequent energy consumption during the summer months at the university may offset electricity peaks observed during this period in other organizations. Vehicle fleet use did not contribute significantly to monthly trends in the institution's carbon emissions.

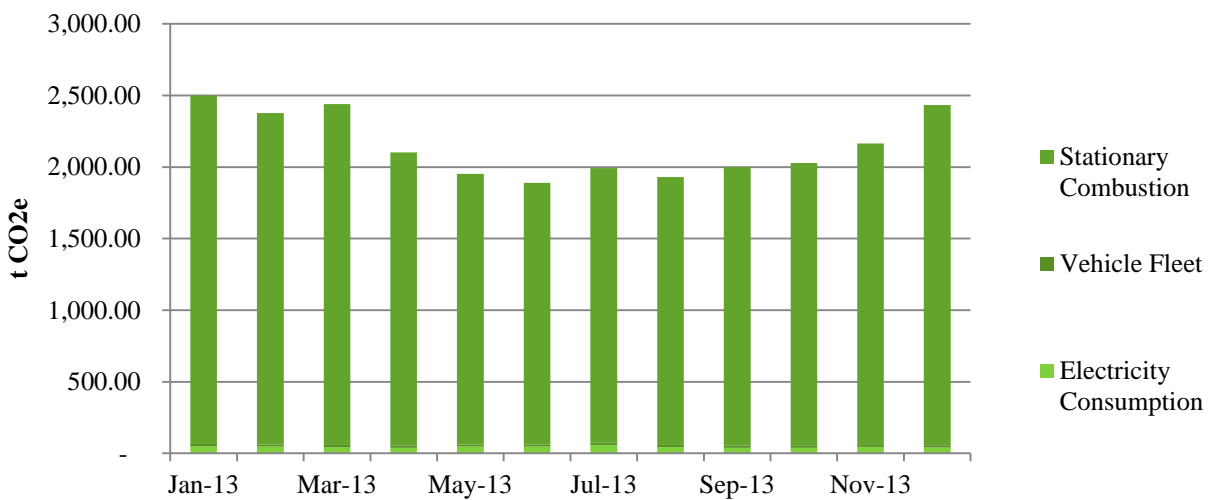


Figure 3. Brock University's 2013 carbon footprint (tCO₂e) monthly, by source activity.

As mentioned above, Brock University's total carbon emissions have grown by 3.82% (974.82 tCO₂e) since the 2012 baseline year. Although overall emissions have grown, emissions related to electricity consumption have been reduced since 2012, dropping by 183.66 tonnes or 12.1% from 2012 (Figure 4). This decrease can be attributed to the university's ambitious energy saving projects, including six lighting retrofit projects, which were incentivized through the saveONenergy program. In contrast, emissions from both scope 1 sources have increased. Specifically, vehicle fleet related emissions increased by 15.23 tonnes or 9.6% in 2013. Additionally, the number of warm days (described below) decreased between 2012 and 2013, requiring less cooling of Brock buildings and consequent electricity consumption. Stationary combustion related emissions also rose however by 1143.25 tonnes or 4.8%. Not only is this increase a result of more cold days in 2013 than 2012 (described below), but also Brock's buildings were more occupied, both in population of staff and students as well as the duration of occupancy. This year also marks the first that Lowenberger residence's and Cairns Complex natural gas consumption was reported on. Some of the increase in natural gas consumption and decrease in electricity usage can be attributed to increased use of Brock's cogeneration plant.

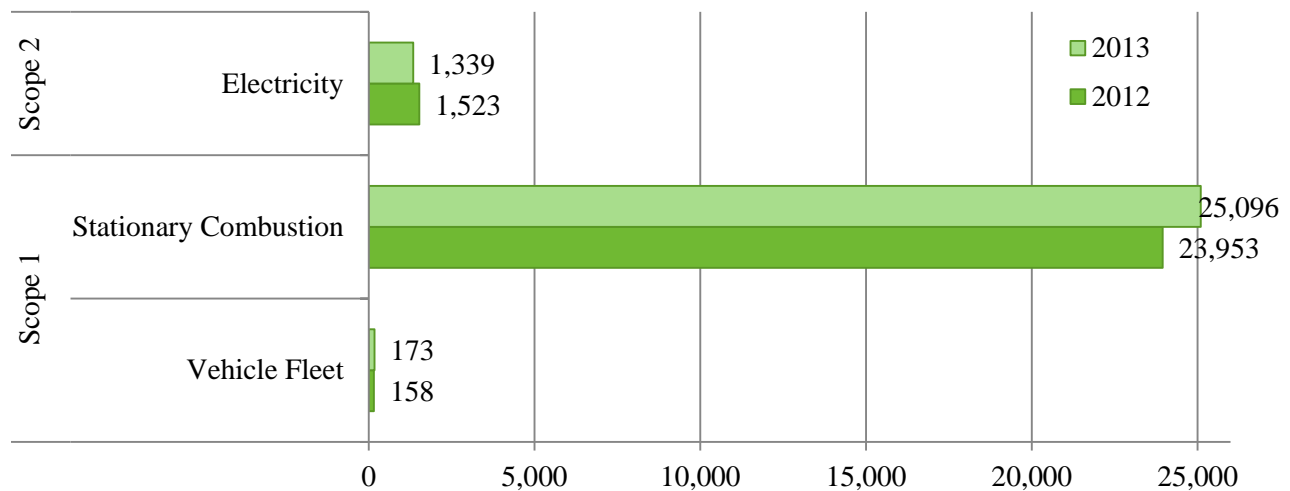


Figure 4. Comparison of Brock University's emissions (tCO₂e) from source activities between 2012 and 2013.

Brock University increased the number of buildings reported on between 2012 and 2013, to include Lowenberger residence and the Cairns Complex. As the university has chosen to make their reduction commitment on an intensity basis based on square footage, it is important to track the institution's carbon efficiency per square foot. Brock's greenhouse gas emissions per square foot reduced by 9.18% (1.21×10^{-3} tCO₂e/ft²) between 2012 and 2013. This signifies that although overall emissions increased, the emissions per unit of area fell indicating an increase in efficiency (Figures 5). Figure 6 demonstrates the total emissions with the same square footage as the baseline year (2012) using this year's emissions intensity.

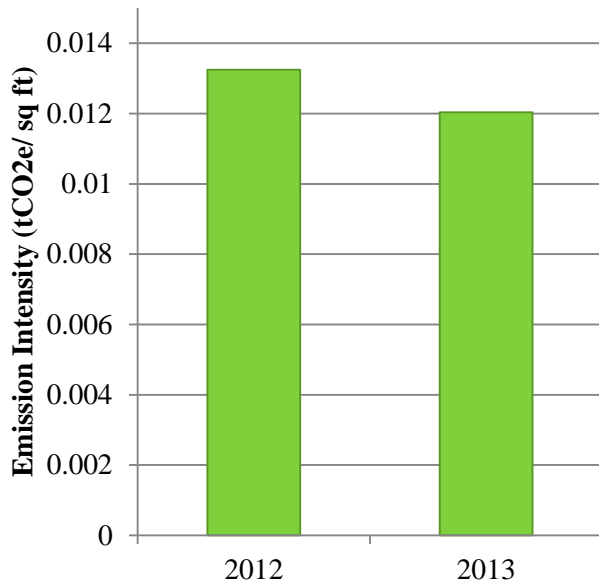


Figure 5. Brock University carbon footprint intensity (tCO₂e/ft²) based on building area (square feet), compared across the 2012 and 2013 reporting years.

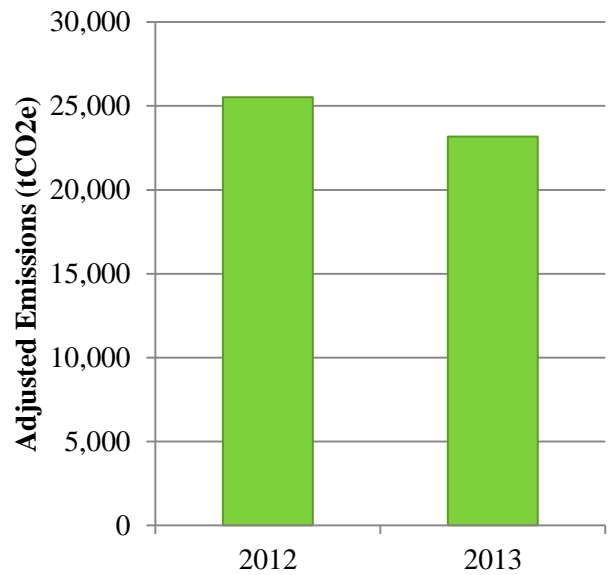


Figure 6. Comparison of Brock University's carbon footprint (tCO₂e) normalized to baseline year (2012) square footage based on intensity (tCO₂e/ft²).

The weather can have a substantial influence in the natural gas and electricity consumption. In order to incorporate weather in the analysis, heating degree days and cooling degree days were taken into consideration. Heating degree day (HDD) is a measure that reflects the demand of energy to heat a building in the winter months, based on outdoor temperature and how many degrees it would take to heat a facility to human comfort levels. The number of heating degree days increased between 2012 and 2013 by 439, or 15% from 2012 values, potentially contributing to the observed increase in emissions in stationary combustion among years.

Similarly, cooling degree day (CDD) is a measure that reflects the demand of energy to cool a building in the summer months; based on outdoor temperature and how many degrees it would take to cool the facility to human comfort levels. Between 2012 and 2013, the number of CDD decreased by 196, or 37% from the previous year. This decreased demand for cooling in the summer months may have contributed to Brock University's electricity consumption decrease. It is difficult to isolate the proportion of electricity consumption that results from building cooling as there are many additional contributing factors, whereas natural gas consumption is a direct reflection of building and water heating. Understanding the impact that weather has on consumption trends among years will create a clearer understanding of actual trends in natural gas and electricity consumption, as well as associated emissions.

Moving Forward

Measure, manage and mitigate make up the central tenets of carbon management. Following these guidelines, the NSI Carbon Team has highlighted potential paths forward for Brock University with respect to their carbon footprint.



Measure

Measuring the organizational carbon footprint is the key to determining accurate and quality data to report on. Within the voluntary reporting stationary combustion, electricity consumption, and vehicle fleet are mandatory to report. As a means to improve on the quality and accuracy of the data collection, the following recommendations are provided to allow for a more comprehensive inventory of Brock University's carbon footprint. These recommendations are given with the ultimate goal of reducing GHG emissions by 20% over the next 10 years in mind.

- **Scope Enhancement:** Brock University could consider including additional Scope 3 emissions such as employee commuting, business travel, waste and water in order to increase the transparency and completeness of its carbon footprint. It would also help to incorporate facilities which are not owned or operated by Brock but are occupied by Brock staff.
- **Improve Natural Gas Data Collection:** It is recommended that Brock identify opportunities to improve tracking of natural gas consumption (e.g., increased sub-metering) and consider installation of individual thermostats and alternative reduction strategies, especially within Cairns, the Alumni Greenhouse and Hamilton Campus. These three facilities constitute, on average, 72% of the total natural gas consumption by non-centrally heated facilities at Brock throughout the year, though comprise only 42% of their total square footage (Figure 7). During the spring/summer, this number rises as high as 86% (Figure 8). Cairns is particularly notable in this regard, consuming almost twice the amount of natural gas per square foot than the average facility.
- **Improve Fleet Vehicle Tracking.** Further, improving the tracking of fleet vehicle use will allow Brock University to identify driving trends and opportunities for reduction through routing, training, etc.



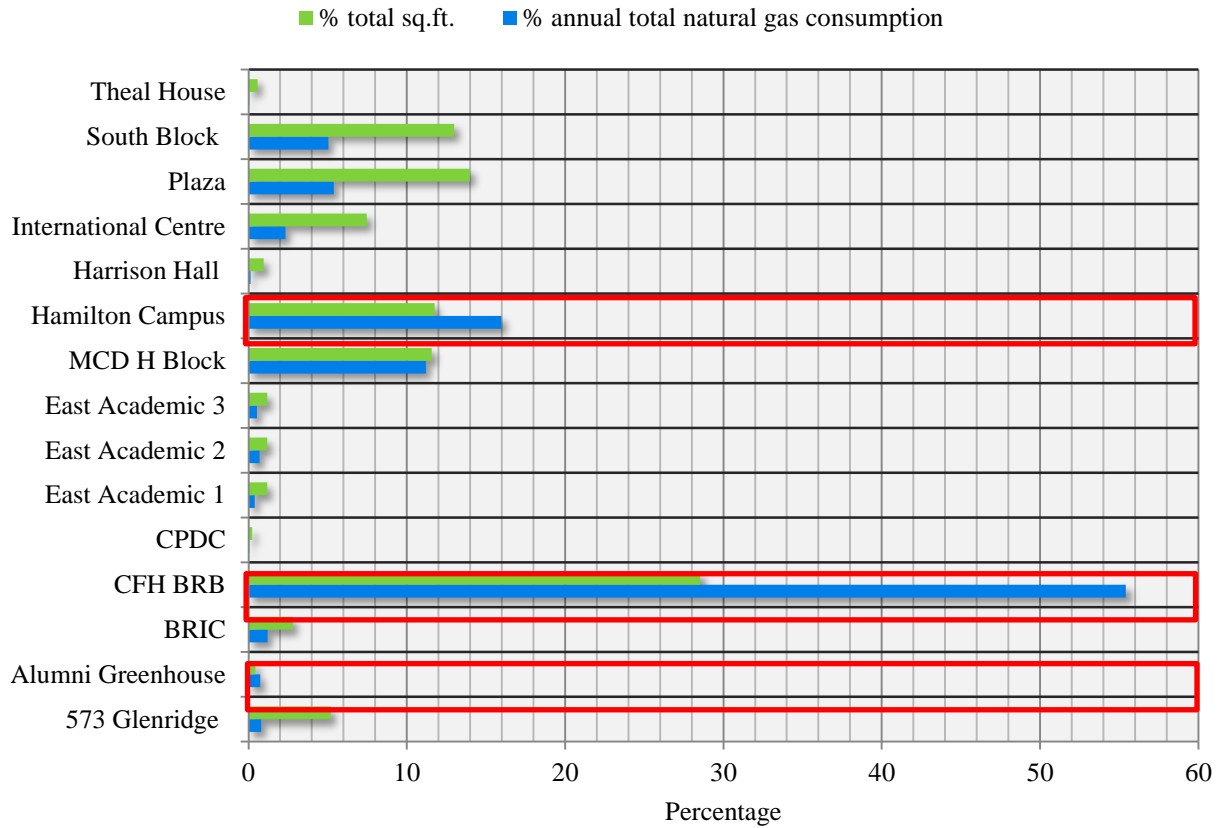


Figure 7. Percentage of total natural gas consumption by non-centrally heated facilities during the 2013 year compared to percent of total square footage. Three facilities (Cairns, Alumni Greenhouse, and Hamilton Campus) demonstrate negative net efficiencies.

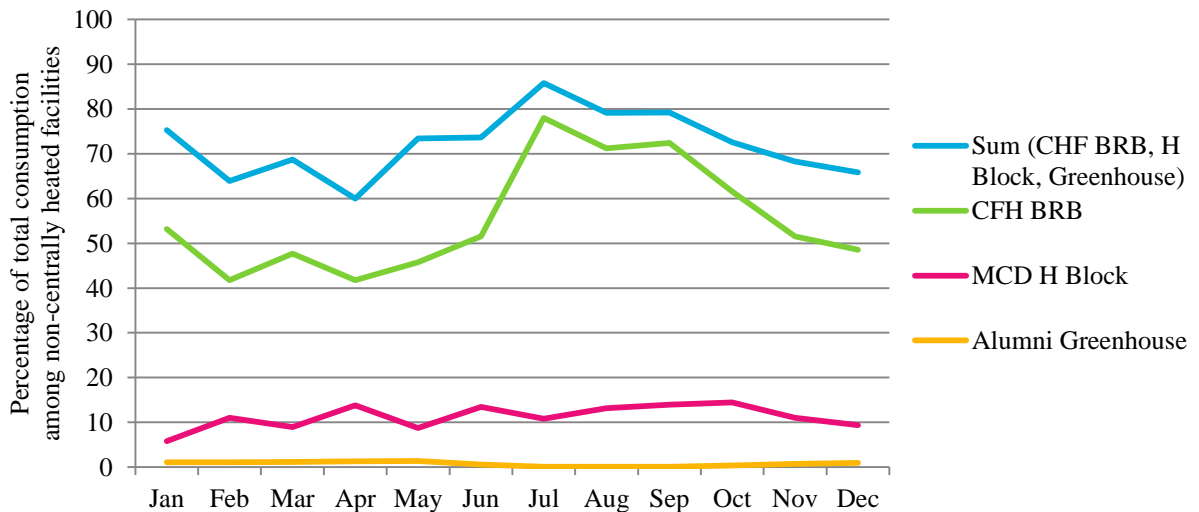


Figure 8. Percentage of total natural gas consumption among non-centrally heated facilities by buildings/units with net inefficiencies (see Figure 6) during the 2013 year.

Manage

Following measurement and quantification, the next step is carbon management of GHG emissions. This piece requires analyzing the carbon footprint and identifying significant reduction opportunities that exist within the organization. With a growing student and staff population as well as longer hours of operation, Brock must continue to find opportunities to manage their emissions, increasing efficiency as demand increases in order to meet reduction targets:

Scope 1 Reductions:

Stationary combustion within Scope 1 emissions is by far the greatest contributor to Brock's GHG emissions according to the present reporting framework.

- **Cogeneration Plant.** Given the centrality of Brock University's co-generation plant with respect to the institution's ongoing energy conservation and demand management initiatives, it is recommended that this facility undergoes a regimented cycle of upgrade proposals and reviews in order to ensure that Brock's infrastructure continues to take advantage of current technological efficiencies.
- **Heating Control.** Experimentation with simple heating reduction strategies (i.e., lowering thermostats across campus by 0.5 to 1.0 degree during the late fall/winter/early spring periods) could provide workable strategies for significant cost savings and natural gas consumption reductions with minimal disturbance to faculty, staff and students.
- **Window Film.** Window film is a cost effective way to reduce energy consumption by increasing the solar energy rejection, UV light rejection, visible light reflected and reduce the amount of glare within the buildings.

Emissions from fleet vehicles contributed 173.22 tCO₂e to Brock's carbon footprint in 2013. This may not represent a significant proportion of the total, although fleet related emissions have increased 87% from 2012 totals:

- As mentioned in last year's report, exploring alternative options such as a hybrid, diesel, or biodiesel vehicles when it comes time to upgrade vehicle fleet is recommended.
- Additionally, integrating route optimization procedures using GPS tracking and driver training to limit idling times or reduced driving days can be investigated as solutions for reduction. Assembling an initial pilot project would allow Brock University to identify the feasibility of policy and procedure changes as well as the associated consumption and emission reductions. To garner support from front-line staff, this pilot project can be executed on a senior staff member's vehicle as an example of senior level support and buy-in to sustainability initiatives.
- NSI partners have been able to limit fleet vehicle use and business travel through the installation and continued use of teleconferencing systems

Scope 2 Reductions:

Emissions from electricity consumption represent 5% of Brock University's total footprint. Although related emissions have decreased significantly from 2012, there are still potential areas for further reductions:



- **Lighting retrofits.** It is recommended that Brock continue its program of green retrofits. In particular, automated lighting systems should be considered for all floors of the Schmon Tower, and other buildings/areas that are locked nightly after closure.
- **Air Conditioning.** A Carbon Project institutional partner was able to save significant electricity through increasing the chiller set point from 6 to 12°C and reducing the operation window of their HVAC system and chiller operation.

Mitigate

The final pillar of carbon management involves mitigating the emissions that cannot be managed and reduced. Based on the data collected for year 2013, Brock's largest contributor of total carbon is Scope 1, stationary combustion. Hence, largest reduction opportunities will be achieved by focusing on this direct emission.

- **Staff and student education and engagement.** An engaged staff and student community that is aware and educated about sustainability-related goals and Brock's objective of reducing total GHG emissions by 20% can have a considerable effect on carbon reductions. It is recommended that Brock should regularly communicate and promote current and future sustainability projects to both the student body and its faculty and staff through their new Sustainability website. Additionally, educational programs for staff will assist in employee engagement. Attendance and participation in community events including NSI's events and workshops should be encouraged as it will strengthen support as the university works towards their target reductions. Carbon Project partners have seen success in exploring different themes and topics monthly, creating competitions, creating educational materials and engaging stakeholders in organizational sustainability initiatives.

Additional Opportunities

- **Waste Diversion.** Due to the high proportion (24.2%) of total waste comprised of organics that is disposed of in public areas across campus (according to Brock's 2013 annual waste audit), it is recommended that Brock expands its organics to include more public spaces. Over the long-term, a plan for on-site combustion might also be entertained and built into Brock's energy conservation and demand management strategy.
- **Commuting.** Given Brock's geographically dispersed student body, vehicle commuting is a necessary reality for many individuals residing within the Niagara Region. Exploring opportunities and providing support or endorsement of a car share program that could help to create flexible options for student commuting. Precedence has already been set in this area by numerous universities across Canada.
- Relatedly, the university might consider conducting annual transportation audits to monitor changes in how faculty/students/staff commute to campus, allowing for more targeted alternative transportation strategies.
- **Sustainability & Energy Officer.** Brock should consider the benefit to creating a full-time Campus Sustainability & Energy Officer position, whose role it would be to coordinate existing sustainability projects, direct Brock's new Energy and Conservation Demand Management (ECDM) plan and, in association with NSI, ensure the institution's compliance with O.Reg. 397/11 and future government legislated reporting and/or monitoring requirements. There are



multiple options available to help support the creation of this position at the university through the SaveONEnergy program. Firstly, the Embedded Energy Manager³ program will cover 80% of the annual salary of a hired certified energy manager as well as 80% of expenses for these managers to better identify energy efficiency opportunities at Brock. As a full time staff member, additional sustainability related tasks can be assigned to this individual. A second option is hiring a sustainability officer who could then take advantage of the Energy Manager Training Incentive⁴ available through the OPA's SaveONEnergy Program (up to \$1,600 on training and certification). The Sustainability Officer would also have a central role in promoting and publicizing Brock's sustainability efforts, and developing a pervasive community and campus-wide sustainability culture. Many leading higher-educational institutions have already set precedence for the creation of such positions, both globally and across Canada. Increasingly, such institutions are being recognized and ranked by their commitment to green initiatives, in addition to conventional metrics of academic prestige (see for example the UI Green Metric⁵).

- **Roving Energy Manager.** If Brock is not ready to take on a new full time staff to assist with energy management projects, local distribution companies will often also have roving energy managers⁶ who are a shared resource for multiple customer facilities. These managers are available on a part-time basis to assist in the development of energy management plants, implementing conservation projects and identifying additional SaveOnEnergy Incentives.
- As mentioned in last year's report, **green procurement policy** can showcase a commitment to environmental responsibility and has the potential to enhance the organization's environmental reach by asking its contractors and supply chain to limit their carbon footprint.

Summary

NSI awarded Brock University the Most Impactful Initiative award for the 2013 reporting year for their significant reduction in electricity related emissions. These reductions came as a result of many energy reduction projects the university has pursued over the last year including lighting retrofits, improvements to Cogeneration plant controls and the installation of new air handling units. Despite these significant electrical improvements, Brock's corporate carbon footprint increased by ~3.8% from the 2012 baseline, mainly as a result of an increase in natural gas consumption (4.8%), by far the largest contributor to the organization's carbon footprint. NSI therefore suggests natural gas be the focus of Brock's future sustainability initiatives in order to work towards their 20% reduction commitment over the next 10 years. Within this report, several opportunities for improving the measurement, management, and mitigation of carbon emissions have been highlighted. The NSI team is always available to discuss carbon reduction strategies and looks forward to discussing the options available to Brock University.

³ Embedded Energy Manager Program – saveONenergy: <https://saveonenergy.ca/Business/Program-Overviews/Process-and-System-Upgrades/Energy-Managers/Overview-and-Benefits.aspx>

⁴ Energy Manager Training Incentive Program – saveONenergy: [https://saveonenergy.ca/Business/Program-Overviews/TRAINING---SUPPORT/Energy-Manager-Training-Incentive-\(Industrial-comm.aspx](https://saveonenergy.ca/Business/Program-Overviews/TRAINING---SUPPORT/Energy-Manager-Training-Incentive-(Industrial-comm.aspx)

⁵ UI Green Metric: <http://greenmetric.ui.ac.id>

⁶ Roving Energy Manager Program – saveONenergy: <https://saveonenergy.ca/Business/Program-Overviews/Process-and-System-Upgrades/Energy-Managers/Overview-and-Benefits.aspx>