



Brock University

Carbon Project  
Annual  
Report



June 2015

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## Introduction

Through NSI's proven approach to engaging organizations in setting and achieving reduction targets, member are able to minimize their environmental impact while improving their financial bottom line: a two-fold accomplishment. Brock University is currently a **Committing Member** of the Carbon Project and has set a 10-year intensity based reduction target of 20% below 2013 levels (Milestone 4).

Brock University is uniquely positioned as an educational institution to exemplify sustainability practices through their facilities, both old and new. The university has the opportunity to demonstrate both community engagement and building innovation as it continues to develop and grow. Brock has put sustainability into practice through their cogeneration system and chiller projects; these initiatives significantly decrease peak energy use. The university's leadership in sustainable management influences students, faculty and community partners to apply these same principles outside of the institution.

As a member of NSI's Carbon Project, Brock University has undertaken the process of calculating its corporate carbon footprint and measuring its progress. The purpose of this report is to update and inform the organization regarding the results of 2014's greenhouse gas (GHG) inventory.

## Scope of Inventory

This report describes the corporate carbon footprint of Brock University covering the time period from January 1 to December 31, 2014. International GHG accounting standards were followed to determine Brock University's carbon footprint. According to these standards, emissions generating activities were classified under three scopes. Brock University reports on the following:

**Scope 1:** All GHG emissions resulting from direct combustion.

- Gas & Stationary Combustion
- Fleet & Mobile Combustion

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

- Purchased Electricity

**Scope 3:** Other indirect emissions, such as the extraction and production of purchased materials and fuels, and others. Brock University currently does not report any Scope 3 emissions.



## Inventory

The total corporate carbon inventory totalled 28,599.57 tonnes of CO<sub>2</sub>e (tCO<sub>2</sub>e) representing an increase of 2964.22 tonnes (11.56%) from Brock University's 2013 baseline emissions of 25,635.35 tCO<sub>2</sub>e. The university's baseline year was moved to 2013 from 2012 due to addition of the CAIRNS building and updated residence consumption values taken from actual meter readings during the latter year. The carbon footprint was predominantly comprised of Scope 1 emissions, with stationary combustion (27,449.03 tCO<sub>2</sub>e) and vehicle fleet (251.63 tCO<sub>2</sub>e) 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 898.91 tCO<sub>2</sub>e resulting from electricity consumption.

Additionally, Brock University was able to increase its carbon offsets this year through their expansive forested areas. Approximately 547,546 m<sup>2</sup> of the institution's property is covered with mostly maple and oak trees. Through resources provided by Tufts University<sup>1</sup> and American Forests<sup>2</sup>, the amount of carbon emissions that were offset from Brock University's carbon footprint through forest carbon sequestration totalled 201.5 tCO<sub>2</sub>e in 2014. The total sequestered carbon from Brock's greenery increases by 1.7 tons per hecter each year as a result of forest growth.

Brock University has set an intensity based reduction target using square footage growth. Brock's area of heated space from 2013 and 2014 is 2,627,225 square feet. The carbon emissions intensity per square foot is 0.011tCO<sub>2</sub>e. Last year's emissions intensity was 0.010tCO<sub>2</sub>e per square foot, a 5% increase (Figure 5).

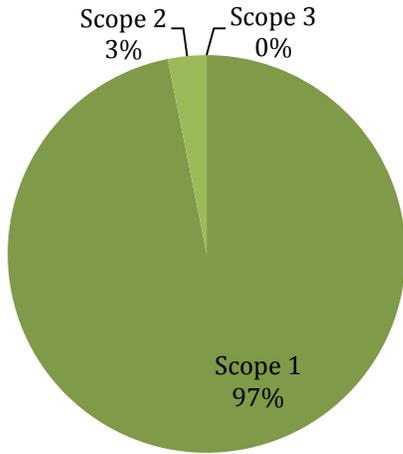
**Table 1. Actual corporate carbon footprint by scope.**

Scope 1 (tCO <sub>2</sub> e)		Scope 2 (tCO <sub>2</sub> e)		Scope 3 (tCO <sub>2</sub> e)		Offsets (tCO <sub>2</sub> e)	
Fleet Vehicles	251.63	Purchased Electricity	898.91	Employee Commuting	--	Campus Greenery	-201.5
Stationary Combustion	27449.03			Business Travel	--		
Refrigerants	--			Waste	--		
				Water	--		
<b>Total</b>	<b>27700.66</b>	<b>Total</b>	<b>898.91</b>	<b>Total</b>	<b>0</b>	<b>Total</b>	<b>-201.5</b>

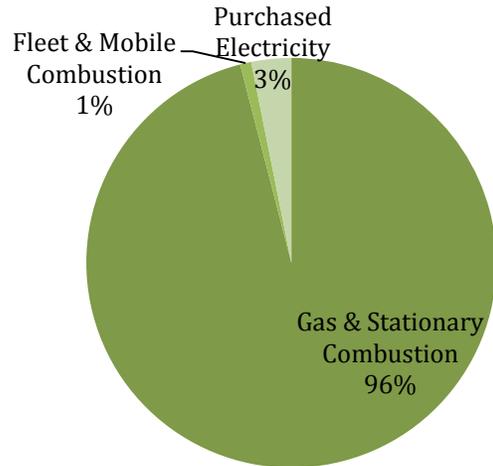
<sup>1</sup> Tufts University Office of Sustainability: Carbon Sequestration - <http://sustainability.tufts.edu/carbon-sequestration/>

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



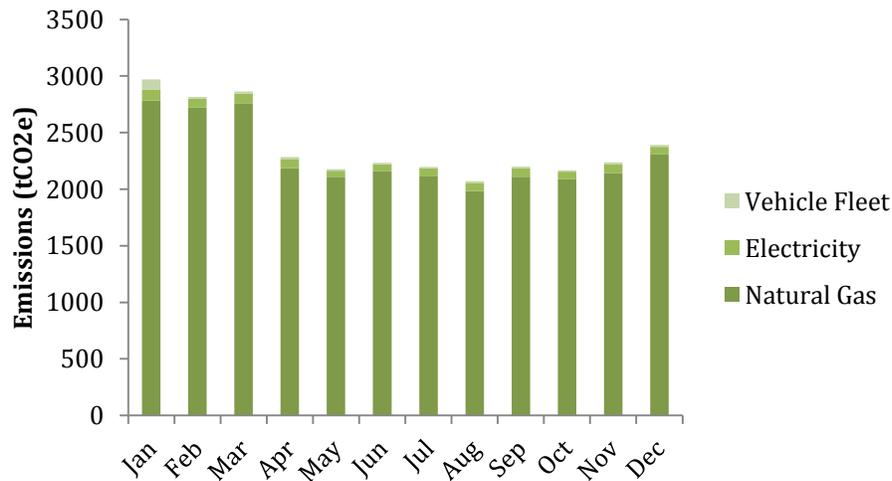


**Figure 1: Illustrating Brock's 2014 corporate carbon footprint by scope (tCO<sub>2</sub>e), including percentage by scope.**



**Figure 2: Illustrating the breakdown of scope emissions (tCO<sub>2</sub>e) by source activity type, including percentage.**

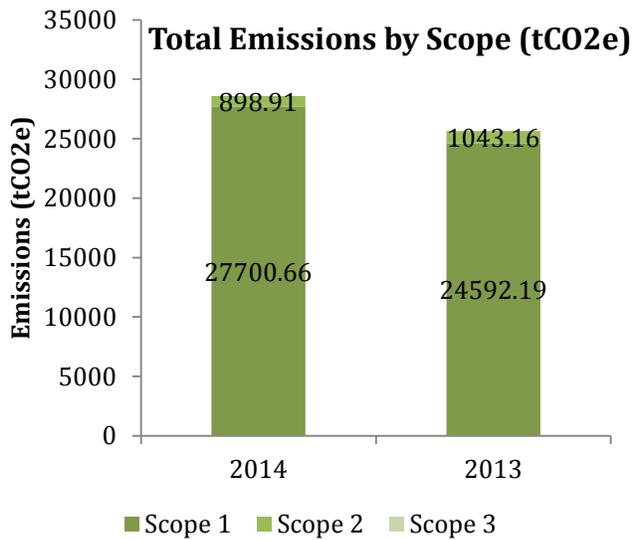
Similar to previous years, Brock University experienced peaks in their 2014 emissions during the months of January through March with the highest recorded monthly emissions of 2969.56 tCO<sub>2</sub>e in January (Figure 3). These peaks in emissions are associated with the heating of facilities during the cold winter months. Emissions associated with electricity consumption remained generally consistent throughout the reporting year. The college residences already reduce energy use in the summer months while the facilities house no student by shutting down all cooling to these buildings. Vehicle fleet emissions also peak during the winter months from January to March, however they have little impact on the monthly trends.



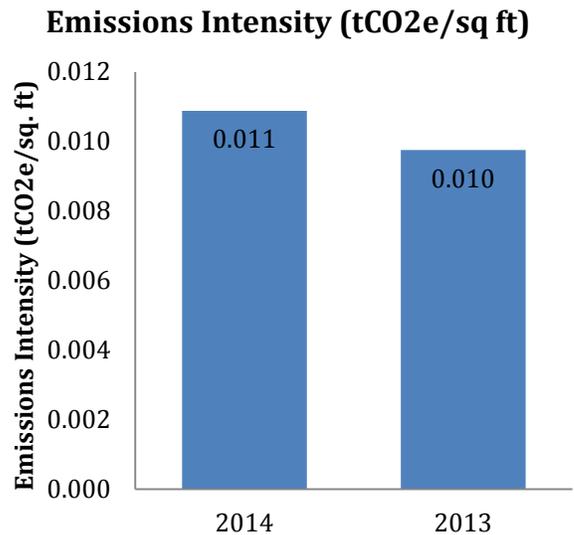
**Figure 2: Brock University's 2014 carbon footprint (tCO<sub>2</sub>e) monthly by activity type.**

## Comparison by Year

Since baseline the carbon emissions produced by Brock University's reported activities has grown. The increase in emissions from the past year is largely due to the observed increased use of the Central Utilities Cogeneration Plant (Figure 3). The intensity of carbon emitted per square foot of heated spaces has also increased from 0.010tCO<sub>2</sub>e to 0.011 tCO<sub>2</sub>e. This is a 5% increase in intensity. Consequently, the reduction target for the year 2023 is 25% below 2014 levels or 0.008 tCO<sub>2</sub>e per square foot.



**Figure 3: Comparison of Brock University's year-by-year actual carbon footprint (tCO<sub>2</sub>e).**



**Figure 4: Comparison of Brock University's year-by-year carbon intensity (tCO<sub>2</sub>e/ft<sup>2</sup>).**

Conversely, during the winter of 2013-2014 Brock University implemented an electricity reduction project that transferred chilling load from an inefficient older model to the #1 process chiller in the new CAIRNS complex. The program was estimated to reduce 2514kWh/day or 392 tCO<sub>2</sub>e in a year. The University's focus on electricity reduction to support its Energy Conservation and Demand Management Plan has resulted in decreased Scope 2 carbon emissions of 13.82%(144.25 tCO<sub>2</sub>e) since baseline. Electricity related emissions represent 3.1 percent of the institutions total inventory.

## Moving Forward

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

### Measure

This is the third year that Brock University has reported on its carbon footprint through the Carbon Project. Data quality assurance is integral to ensuring reliability. Improving data collection methods aid quality assurance and enhance transparency. To improve data collection and measurement methods, the following recommendations have been made. These recommendations are given with the ultimate goal of reducing GHG emissions by 20% over the next 10 years in mind:

- **Scope Enhancement:** Consider including Scope 3 emissions such as employee commuting, water consumption and waste production in order to increase the transparency and completeness of the carbon footprint. NSI highly recommends the inclusion of the following two activities for the main campus:
  - **Water Consumption:** With the implementation of water conservation projects during the past year in the form of low flow and dual flush toilets, Brock estimated a savings of 601,000 L of water per year. NSI recommends that additional metres be installed within Brock's facilities to more accurately measure water consumption and then begin to report those numbers for the carbon inventory.
  - **Waste Production:** One of greatest successes of the Brock Sustainability Committee in 2014 was the extensive waste diversion program. In total 898,700 kg of waste was recycled and 327,200 kg of organic waste was composted. Special waste such as Oil & Grease, Batteries, E-waste and Yard Waste were also diverted from landfill. Access to the waste information would allow NSI to measure and report on the emissions reductions resulting from these successes.
- **Improve Natural Gas Data Collection with a focus on the Cogeneration Plant:** Natural gas accounts for 96 percent of the University's carbon inventory. The Central Utilities Cogeneration Plant represent 83 percent of the total natural gas emissions (See Table 2). Regularly measuring and reporting the utility data for the Cogeneration Plant will ensure that there is adequate time to perform data quality assurance. It is integral to the results

of the carbon inventory that natural gas data from this source is as complete and correct as possible.

### Top Emitters

The organizational facilities of Brock University have been arranged in NSI's carbon accounting software in the breakdown that follows in Table 2. Each campus is measured separately. Moreover, the institution has the ability to measure significant equipment or buildings' carbon footprint independently of the total inventory. Units such as the Cairns Family Health & Bioscience Research Complex (CFH and BRB), Central Utilities Cogeneration Plant and Diesel or Gasoline vehicle fleets have been separated for this purpose.

The Main Campus contributes the largest proportion of the institution's total emissions (90%) and within the Main Campus the Cogeneration Plant represents 23,201 tCO<sub>2</sub>e of the 25,606.08 tCO<sub>2</sub>e emissions. A distant second emissions generator is CFH and BRB at 2472.58 tCO<sub>2</sub>e. East Campus and all other Satellite Campus buildings are third and fourth ranked respectively.

**Table 2: Brock University facility emissions inventory - top emitter ranking.**

Rank	Facility/ Sub-facility	Major Emissions Activity Type	Annual Emissions (tCO <sub>2</sub> e)
<b>1</b>	Main Campus	Natural Gas Combustion	<b>25,606.08</b>
1.1	<i>Central Utilities Cogeneration Plant</i>	Natural Gas Combustion	23,201.84
1.2	<i>Campus Buildings</i>	Natural Gas Combustion	2117.26
1.3	<i>Diesel Vehicles</i>	Diesel Fuel Combustion	165.07
1.4	<i>Gasoline Vehicles</i>	Gasoline Fuel Combustion	86.56
1.5	<i>Central Utilities</i>	Purchased Electricity	35.34
<b>2</b>	CFH and BRB	Natural Gas Combustion	<b>2474.58</b>
<b>3</b>	East Campus	Natural Gas Combustion	<b>373.99</b>
<b>4</b>	Satellite Campus Buildings	Natural Gas Combustion	<b>144.63</b>
Total Emissions			<b>28599.28</b>

## Manage

By understanding the GHG emissions from business operations, NSI can identify opportunities for improvement within the organization. There are opportunities to better manage carbon reductions through analyzing structural and behavioural tendencies within the facilities. **Recommendations made with regards to each scope include:**

### 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.

- **Natural Gas Reduction:**
  - **Cogeneration Plant:** It is recommended that this facility continues to undergoes a regular reviews, maintenance procedures and upgrades in order to ensure that Brock's infrastructure continues to take advantage of current technological efficiencies.
  - **Energy Awareness Event:** During the winter months, employees and student can be encouraged to participate in campus wide events such as a sweater days. On these days the sustainability committee and the facilities management department can work together to encourage occupants to layer up while the campus turns down the heat. An event such as this will improve the University's awareness and engagement in energy savings tactics while not compromising occupant comfort.
  
- **Fleet Vehicle Management:**
  - **Upgrading Vehicles:** Reductions to emissions could be made through the replacement of fleet vehicles at the end of their life cycle with hybrid, diesel or electric vehicles.
  - **Training & Education:** Seasonally or during orientation, the staff who operate fleet vehicles that travel between buildings on campus can be trained and reminded to practice fuel efficiency while on the job. A module on non-idling and route optimization could be developed and added to annual health and safety or environmental training schedules.

### Scope 2 Reductions:

Through energy saving projects such as the winter chilling load transfer Brock University have experienced net decreases in electricity related emissions. It is recommended that the institution continue to find and put into practice opportunities to better manage electricity consumption on all campuses.



## Mitigate

The final pillar of carbon management involves mitigating the emissions that cannot be managed and reduced. A meaningful carbon reduction plan helps you to meet your business objectives. This first requires a thorough understanding of your current situation, from which you can find opportunities for improvement and commit to mitigation strategies. Based on the data collected for year 2014, Brock's largest contributor of total carbon is Scope 1, stationary combustion. Hence, the largest reduction can be achieved by focusing on this direct emission scope.

- **Energy Awareness Program:** located in the Member's Portal, this document provides comprehensive resources to help engage employees, students and clients on an organization's energy initiatives. Key areas that the program will assist in are:
  - **Behavioural adaptations:** Education and awareness regarding the issues and impacts of energy consumption. The Energy Awareness Program provides a template that members' can adapt to their own needs. Some staff and student engagement tactics include: creating friendly competition (gamification) and participation in international sustainability events.
  - **Communication:** Visual pieces such as posters can be placed near energy consuming areas in the workplace to serve as reminders to use less electricity, natural gas or fuel. The Awareness Program has sample posters, which can be adjusted and branded to each organization.
- **Carbon Offsetting:** significant efforts have been made in order to reduce emissions since baseline. In order to assist in reaching the 20 percent intensity based reduction objective and future goals of carbon neutrality; it is recommended that the purchase of carbon offsetting be considered.

## Additional Opportunities

- **Commuting:** Given Brock's geographically dispersed student body, vehicle commuting is a necessary reality for many individuals residing within Niagara. Exploring opportunities and providing support or endorsement of a car share program that could help to create flexible options for student commuting would be worthwhile considerations. Precedence has already been set in this area by numerous universities across Canada.
- **Roving Energy Manager:** If Brock is not ready to take on a new full time staff such as an Energy Demand Manager to assist with energy conservation



projects, local distribution companies will often also have roving energy managers<sup>3</sup> 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 plans, implementing conservation projects and identifying additional SaveOnEnergy incentives.

## Summary

The organization continues to demonstrate a downward trend in purchased electricity due to increased on-site production at the cogeneration plant. Additionally, sustainability projects such as waste diversion and water conservation have seen great success at Brock University. Expanding the boundaries of carbon inventory to include employee commute, water consumption and waste production should be considered. This would provide a more accurate representation of Scope 3 emissions and account for any reductions resulting from the above-mentioned projects.

Despite these substantial environmental management measures, Brock's corporate carbon footprint continues to climb, rising by 9.22% from 2013's Annual Report. The largest contributor to the carbon footprint is natural gas combustion by the Central Utilities Cogeneration Plant. In order to achieve the 20% intensity based reduction target set for 2022, focus should be given to reduction of natural gas emissions in future sustainability initiatives. NSI has presented several targeted strategies to enhance measurement, management and mitigation of carbon emission at the University.

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