Brock University

Carbon Project Annual Report

2014

June 2015

Table of Contents

Introduction 1
Scope of Inventory 1
Inventory 2
Adjusted Emissions 4
Moving Forward 5
- Measure 5
- Top Emitters 6
- Manage 7
- Mitigate 7

Additional Opportunities 8
Summary 9

Introduction

Through the Niagara Sustainability Initiative's (NSI) proven approach that engages organizations in setting and achieving reduction targets, members of Carbon Project 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 2012 levels (Milestone 4).

As an educational institution, Brock University is a unique Carbon Project member, as they are able 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 puts 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 undertakes 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 between January 1, 2014 and December 31, 2014. International GHG accounting standards are followed to determine Brock University's carbon footprint. According to these standards, emissions generating activities are 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 totals 28,944.27 tonnes of CO_2e (tCO_2e) representing an increase of 3418.73 tonnes (13.39%) from Brock University's 2012 baseline emissions of 25,525.54 tCO_2e. The carbon footprint is predominantly comprised of Scope 1 emissions, with stationary combustion (27988.82 tCO_2e) and vehicle fleet (251.63 tCO_2e) representing the largest emissions source by scope (Table 1, Figure 1). Specifically, within Scope 1, 99% of emissions are a result of stationary combustion while the remaining 1% is a result of vehicle fleet related emissions (Figure 2). Scope 2 represents the remainder of Brock's corporate carbon emissions at 905.32 tCO_2e resulting from electricity consumption.

Additionally, Brock University is able to increase its carbon offset this year through their expansive forested areas. Approximately 547,546 m^2 of the institution's property is covered predominantly with maple and oak trees. Through resources provided by Tufts University[1] and American Forests[2], the amount of carbon emissions that were offset from Brock University's carbon footprint through forest carbon sequestration totals 201.5 tCO_2e in 2014. The total sequestered carbon from Brock's greenery increases by 1.7 tons per hector each year as a result of forest growth.

Brock University has set an intensity based reduction target using square footage growth. The adjusted total carbon emissions for 2014 is 25,760.33 tonnes of CO_2e. This is the inventory total reported on NSI's Annual Report (See Figure 4).

Table 1. Actual corporate carbon footprint by scope.

Scope 1 (tCO_2e)		**Scope 2 (tCO_2e)**		**Scope 3 (tCO_2e)**		**Offsets (tCO_2e)**	
Fleet Vehicles	251.63	Purchased Electricity	905.32	Employee Commuting	--	Campus Greenery	-201.5
Stationary Combustion	27988.82			Business Travel	--		
				Waste	--		
Refrigerants	--			Water	--		
	28,240.45	**Total**	**905.32**	**Total**	**0**	**Total**	**-201.5**

[1] (Tufts University, 2015)

[2] (American Forests, 2015)

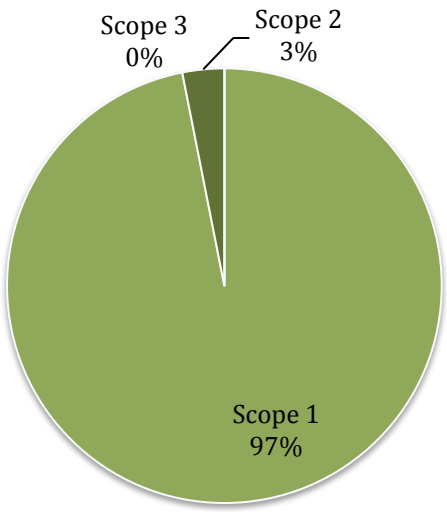

Figure 1: Illustrating Brock's 20134 corporate carbon footprint by scope (tCO_2e), including percentage by scope.

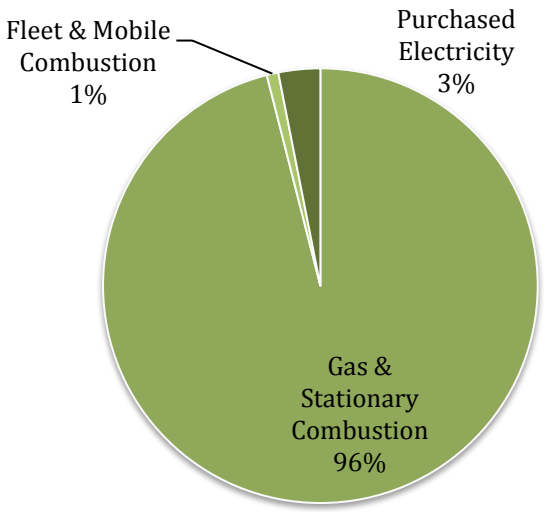

Figure 2: Illustrating the breakdown of scope emissions (tCO_2e) by source activity type, including percentage.

Similar to previous years, Brock University experiences peaks in their annual emissions during the months of January through March, with the highest recorded monthly emissions of 3061.83 tCO2e 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. There is additional potential to decrease energy use in the summer months while the facilities have fewer student populations. Vehicle fleet emissions also peak during the winter months from January to March, however they have little impact on the monthly trends.

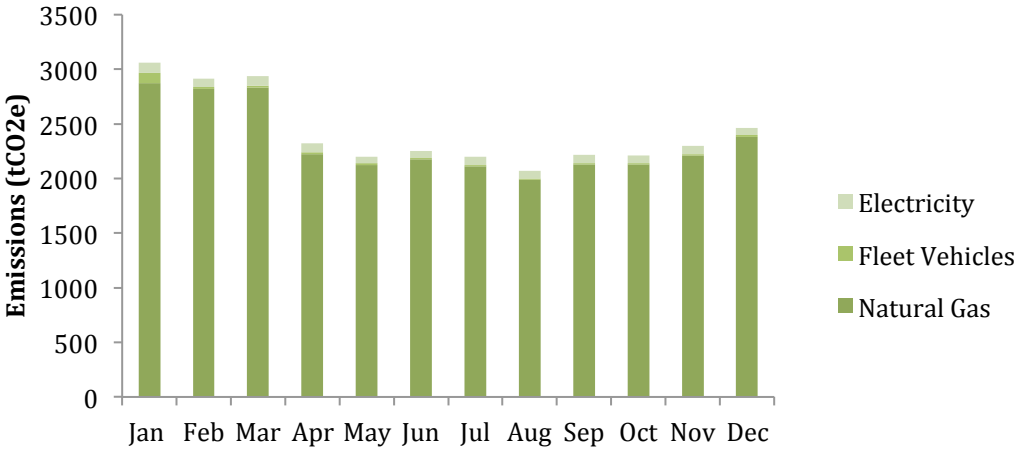

Figure 2: Brock University's 2014 carbon footprint (tCO2e) monthly by activity type.

Adjusted Emissions

Each year since baseline, the actual carbon emissions produced by Brock University's reported activities have grown. The increase observed in 2012 to 2013 can be attributed to the addition of the Lowenberger residence and the CAIRNS Family Health and Bioscience Research Complex. As a result, total heated space from 2012 to 2013 increased from 2,248,689 square feet to 2,524,467 square feet. The area of heated space remained consistent from 2013 to 2014. The increase in emissions from the past year is largely due to the observed increased use of the Central Utilities Cogeneration Plant (Figure 3).

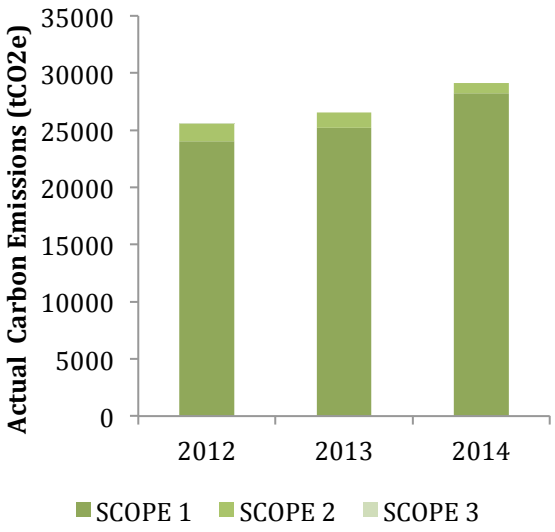

Figure 3: Comparison of Brock University's year-by-year actual carbon footprint (tCO2e) before adjusting for intensity by square feet.

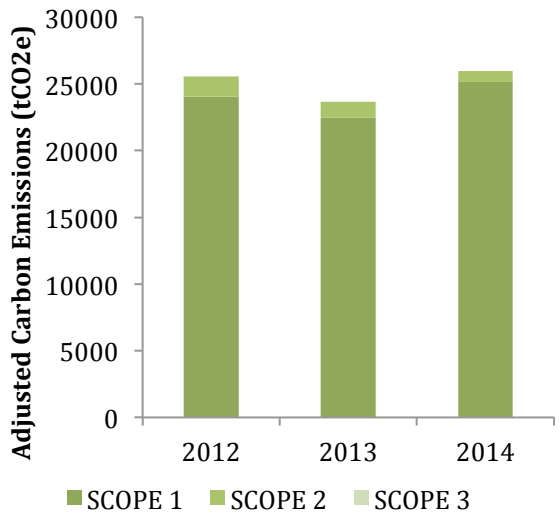

Figure 4: Comparison of Brock University's adjusted carbon footprint normalized to 2012 square footage based on intensity (tCO_2e/ft^2).

The 2014 adjusted corporate carbon inventory totals 25,760.33 tCO_2e, representing a 234.79 tCO_2e (0.99%) increase from Brock University's 2012 adjusted baseline emissions of 25,525.54 tCO_2e. However, it is a 2316.28 tCO_2e (9.07%) increase from last year's adjusted total emissions, reversing the progress witnessed in the previous inventory report. Figure 4 illustrates the total emissions normalized to the same square footage as the baseline year (2012) using this year's emissions intensity.

Conversely, during the winter of 2013-2014 Brock University implemented an electricity reduction project that transferred the 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 tCO2e 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 40.42 percent (614.38

tCO_2e) since baseline. Electricity related emissions represent 3.2 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, business travel, waste production and water consumption in order to increase the transparency and comprehensiveness 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. Water consumption totals should be measured and added to the carbon inventory to determine the emissions savings.
    - **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 Plan plant represents 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 (see Table 2). Each campus is measured separately. Moreover, the institution has the ability to measure significant equipment and/or building carbon footprints 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 (88%) and the Cogeneration Plant within the Main Campus represents 23,201 tCO_2e of the 25,606.08 tCO_2e emissions. A distant second emissions generator is CFH and BRB at 2472.58 tCO2e. Hamilton Campus, East Campus and all other Satellite Campus buildings are third, fourth and fifth, ranked respectively.

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

Rank	Facility/ Sub-facility	Major Emissions Activity Type	Annual Emissions (tCO2e)
1	Main Campus	Natural Gas Combustion	**25,606.08**
1.1	*Central Utilities Cogeneration Plant*	Natural Gas Combustion	23,201.84
1.2	*Campus Buildings*	Natural Gas Combustion	2117.26
1.3	*Diesel Vehicles*	Diesel Fuel Combustion	165.07
1.4	*Gasoline Vehicles*	Gasoline Fuel Combustion	86.56
1.5	*Central Utilities*	Purchased Electricity	35.34
2	CFH and BRB	Natural Gas Combustion	**2474.58**
3	Hamilton Campus	Natural Gas Combustion	**546.20**
4	East Campus	Natural Gas Combustion	**373.99**
5	Satellite Campus Buildings	Natural Gas Combustion	**144.63**
Total Emissions			**29,145.77**

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 undergo regular reviews, maintenance procedures and upgrades in order to ensure that Brock's infrastructure continues to take advantage of current technological efficiencies.
  - **Temperature Set Point:** Adjusting the temperature set point in your buildings depending on the season can greatly impact energy consumption. The organization should continue to find opportunities to identify the optimal low set point for its furnace that will allow savings in natural gas and expenses while maintaining a comfortable working environment.

- **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.
  - Route Optimization: Minimizing driving through the use of a Route Optimizer will find the most efficient route for your service vehicles. A smart phone fleet management application such as FleetMatics would allow the organization to track total mileage and route efficiency.

Scope 2 Reductions:

Through energy saving projects such as the winter chilling load transfer, Brock University has experienced net decreases in electricity-related emissions. It is recommended that the institution continues to find and operationalize 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' cab 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 for 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 necessity 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 a worthwhile consideration. 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[3] who are a shared resource for multiple customer facilities. These

[3] (Independent Electricity System Operator (IESO), 2015)

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.

Summary

The organization continues to demonstrate a downward trend in electricity consumption (40.42% since 2012) due to many energy reduction projects focused on electricity improvements. Additionally, sustainability projects such as waste diversion and water conservation have seen great success at Brock University. NSI commends Brock on these significant effects and recommends that the University continue to pursue these initiatives in line with the Energy Demand Management Plan[4]. 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.

[4] (Brock University, 2015)

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