Niagara College Canada

APPLIED DREAMS.

Niagara College

Carbon Project Annual Report

2014

NIAGARA SUSTAINABILITY INITIATIVE

The CarbonProject

July 2015

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Introduction

Through Niagara Sustainability Initiative's (NSI) proven approach that engages organizations in setting and achieving reduction targets, members of the Carbon Project are able to minimize their environmental impact while improving their financial bottom line; a two-fold accomplishment. Niagara College is currently a **Committing Member** of the Carbon Project and has set a 10 year absolute reduction target of 20 percent below 2009-2010 levels (Milestone 4).

As an educational institution, Niagara College is a unique Carbon Project member, as they are able to engage students and staff in both horizontal and vertical decision making on sustainability. The Niagara College Sustainability Committee has made great strides in energy reduction projects in this past year:

- A window film retrofit for the Wine Visitor and Education Centre (WVEC) that was funded by TD Friends of the Environment Foundation (TDFEF).
- Recognized for their efforts by the Ontario Power Authority, Niagara College was awarded the Energy Manager Excellence Award for the greatest electricity load reduction.
- Recognized by Canadian Network for Environmental Education and Communication, the College was awarded the Outstanding Postsecondary Institution Award for environmental education.
- Recognized by Niagara Region for their leadership, the College was awarded the Green Business Award.

As one of NSI's original members Niagara College has committed to calculate and measure its corporate carbon footprint and invest in emission reduction strategies. The purpose of this report is to present the College's 2014-2015 greenhouse gas (GHG) inventory.

Scope of Inventory

This report describes the corporate carbon footprint of Niagara College between April 1, 2014 and March 31, 2015. Standards set out in the International Greenhouse Gas Protocol were followed to determine Niagara College's carbon footprint. According to these standards, emission generating activities are classified under three scopes. Of all the members within the Carbon Project, the College reports on the widest range of carbon emitting activities within the three scopes of emissions, including:

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.

- Waste (excluded for this report)
- Water
- Business Travel

Inventory

Niagara College's 2014-2015 carbon inventory was calculated using NSI's new carbon accounting software, HARA. Data from the previous year was also recalculated using the emission factors from HARA to increase the accuracy for comparison purposes (See Figure 3 and 4). The waste emissions have been excluded from this report due to inaccuracy of waste emission factors, to be corrected and included in a later report.

The corporate carbon inventory totals 5,627.62 tonnes of CO_2e (tCO_2e) representing an increase of 941.14 tonnes (20.0%) from Niagara College's 2009- 2010 baseline emissions. The largest contributor to the total inventory was Scope 1 (59%), with stationary combustion emitting 3,536.08tCO_2e and vehicle fleet emitting 28.58tCO_2e (Table 1, Figure 1). Electricity consumption is the second highest emissions source (32%) and contributes all of Scope 2 emissions, adding 1,893.81tCO_2e to the inventory. A significant portion of the College's carbon inventory is also derived from Scope 3 emissions (9%) with business travel and water contributing 513.57tCO_2e and 5.58tCO_2e respectively (Figure 1). Within business travel, flights accounted for 83% of emissions. Additionally, emissions from waste which are yet to be determined, will add to Scope 3 emissions.

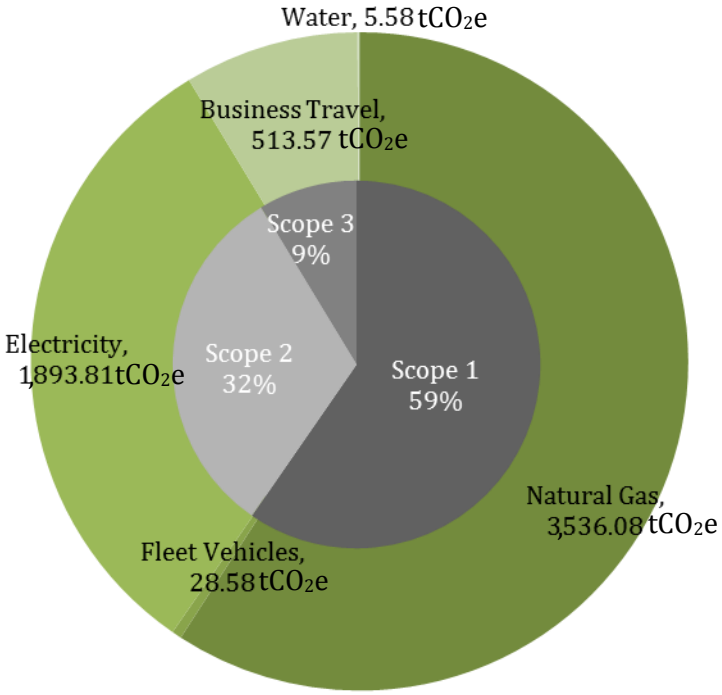
Table 1: Niagara College's Corporate Carbon Footprint 2014-2015.

Scope 1		Scope 2		Scope 3		Carbon Offsets	
Fleet Vehicles (tCO_2e)	28.58	Electricity Consumption (tCO_2e)	1,893.81	Employee Commuting (tCO_2e)	.....	Purchased Carbon Offsets	350.00
Stationary Combustion (tCO_2e)	3,536.08			Business Travel (tCO_2e)	513.57		
				Waste (tCO_2e)	TBD		
Refrigerants (tCO_2e)	.....			Water (tCO_2e)	5.58		
Total (tCO_2e)	3,564.66	Total (tCO_2e)	1,893.81	Total (tCO_2e)	519.15*	Total ($tCO2e$)	350.00

*Scope 3 emissions incomplete due to omission of waste emission totals.

Note: The Wine Visitor and Education Centre and the Rankin Technology Centre are certified carbon neutral buildings on the CSA Clean Projects Registry. To maintain the carbon neutral status 350.00tCO_2e were purchased through ISO 14064-2 Verified Emission Reductions from Walker Environmental Group in 2014. The purchased offsets reduce their total 2014-2015 inventory by 5.86% (Figure 4).

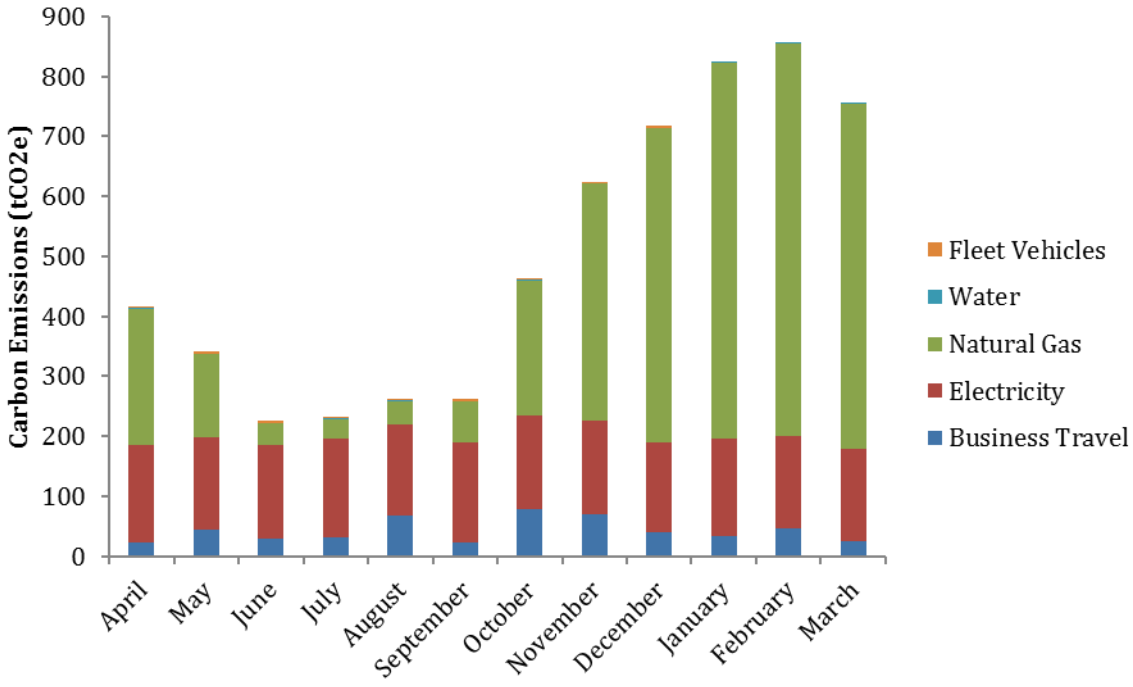
Figure 1: Niagara College's total 2014-2015 emissions (tCO2e) by activity type and scope (percentage).



Similar to many other Carbon Project members, Niagara College experiences peaks in their annual emissions during the months of January and February. January reported the highest monthly emissions at 827.94$tC0_2e$ (Figure 2). These peaks in emissions are associated with the heating of facilities during the cold winter months. Emissions associated with electricity consumption remained very consistent throughout the reporting year, peaking at 165.118tCO2e in July, hitting a low of 151.188tCO_2e for December of 2014, and averaging 157.8tCO_2e.

Niagara College is working to manage and minimize energy use in the summer months while there are fewer individuals on site. The monthly emissions are 73.15% lower in June than in February. Vehicle fleet emissions are consistent year round and average 3.17tCO_2e. Business travel is greatest in August, October and November due to increased air travel. Water use is highest in April and October, coinciding with horticultural and harvesting activities.

Figure 2: Niagara College's 2014-2015 monthly carbon foot print (tCO2e) by activity type.



Year by Year Comparison

All of Niagara College's raw utility and travel data was reentered into the new carbon accounting software during this past reporting period in order to ensure consistent emission factors were used for year by year comparison. As a result, totals from previous years have been slightly adjusted from the numbers reporting in the original annual reports. The previously reported annual totals, excluding waste are shown in Figure 3.

Figure 4 shows total emissions prior to subtracting Niagara College's purchased offsets. In the latest inventory, the institution's emissions have grown by 10.72% from 5,336.61tCO2e to 5,977.62tCO2e since the 2013-2014 year. Figure 5 depicts the official carbon inventory including purchased offsets, showing a net reduction from 2010-2011 of 382.03 tCO2e.

In 2012, the college achieved a 27.9 percent reduction since baseline; surpassing their commitment target of 20% absolute reductions. Unfortunately, maintaining this level is challenging and carbon emissions have been steadily climbing in the past three reporting years (Figure 5). The goal for Niagara College is to cap emissions at 3,749.18tCO_2e by 2019-2020.

Figure 3: Total inventory emissions by year 2009-2010 to 2013-2014 excluding purchased offsets as calculated by previous e3 carbon accounting software program.

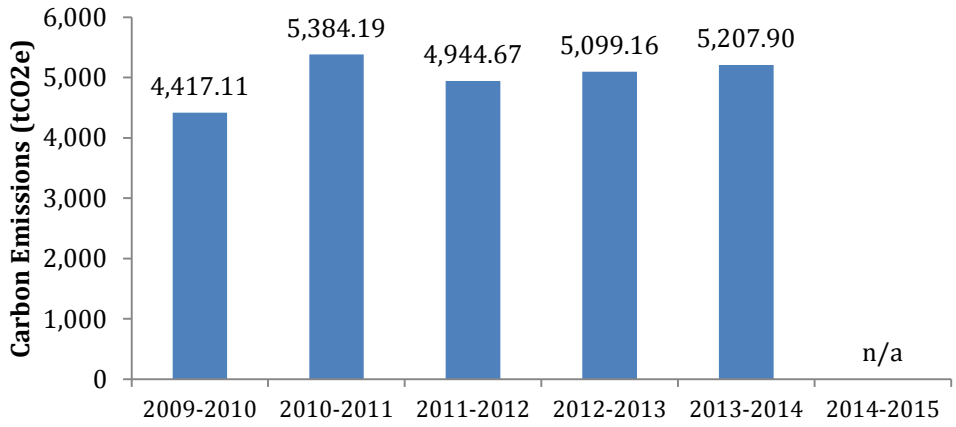


Figure 4: Total Emissions by year from 2009-2010 to 2014-2015 excluding purchased carbon offsets.

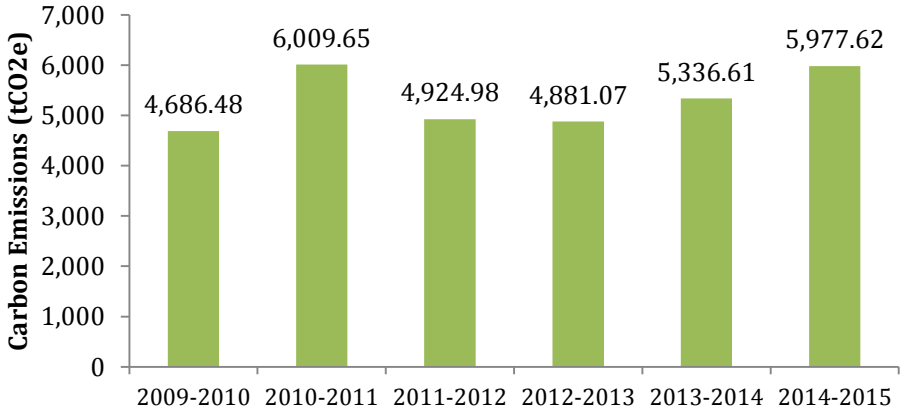
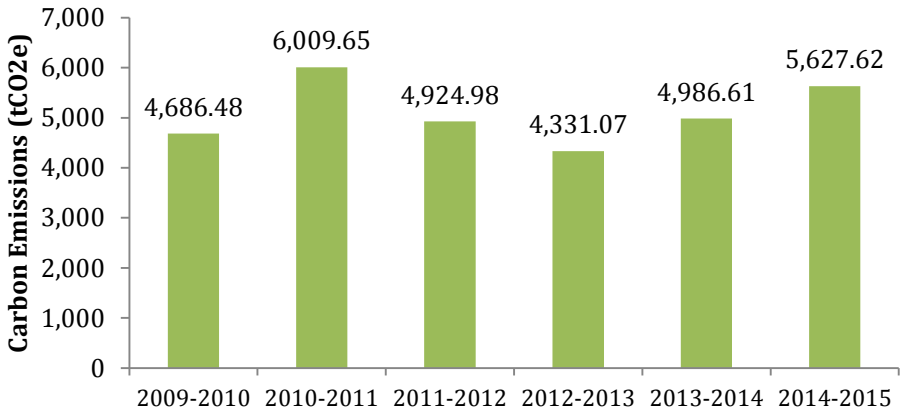
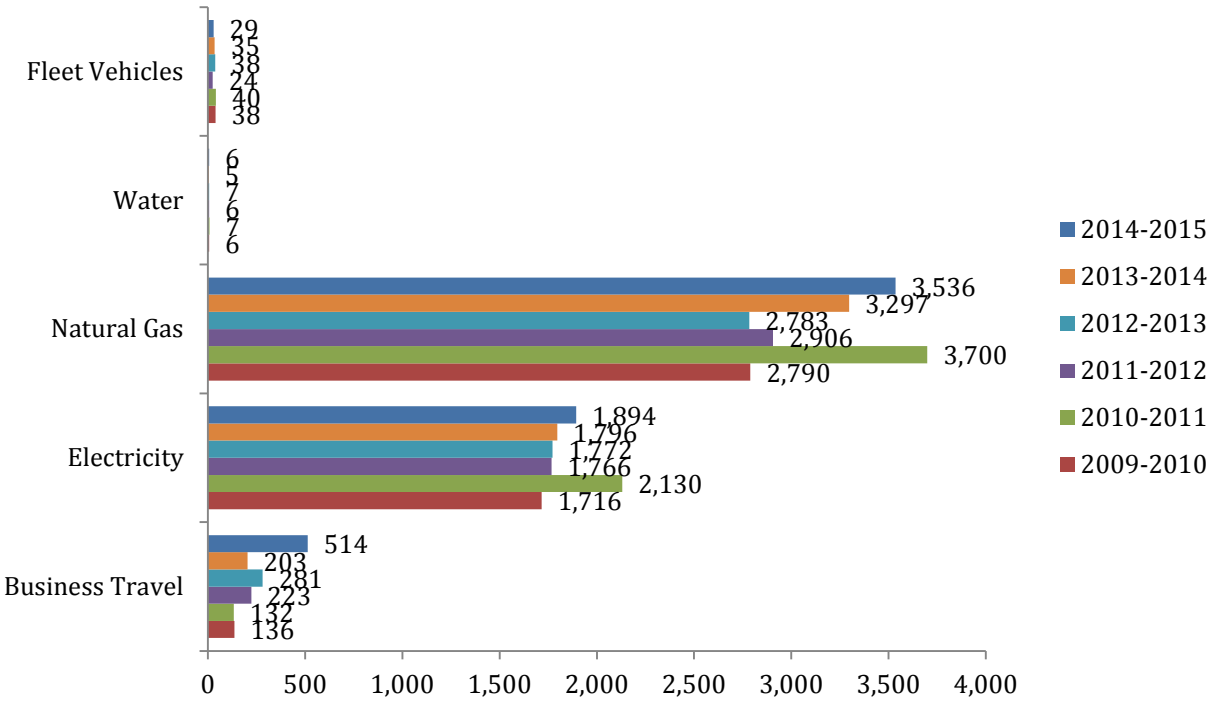


Figure 5: Total inventory emissions by year from 2010-2011 to 2014-2015 including purchased offsets.



Carbon emitting activities that experienced increases from the previous year were business travel, natural gas and electricity growing by 310.71tCO2e, 238.74tCO2e and 97.5tCO2e respectively. Due to the opening of three Niagara College campuses in Saudi Arabia, drastic increases in air travel were observed from 2013-2014 to 2014-2015. Air emissions rose 202.86 tonnes to 513.57 tonnes which is a 153% growth, as shown in Figure 6.

Figure 6: Emissions by activity type from 2010-2011 to 2014-2015. Excluding purchased carbon offsets.



Weather and Energy Use

A linear regression analysis was performed for both the Niagara-on-the-Lake campus and Welland campus, in order to compare monthly emissions associated with facility heating and locally observed Heating Degree Days (HDD). The weather can have a substantial influence on natural gas and electricity consumption of an operation. Heating Degree Days is a measure of how many degrees and for how many days a building requires heating, based on outdoor temperatures. In order to calculated HDD, a chosen balance point temperature must be determined, this the temperature at which the building requires no heating or cooling in order to maintain human comfort levels[2]. Monthly HDD at the set point of 16.5°C at both the Welland Weather Station and St. Catharines Airport were collected and compared with the Welland campus and Niagara-on-the-Lake (NOTL) campus natural gas emissions.

The results show that natural gas usage closely follows the trend of HDDs. The College effectively manages their heating use to weather patterns with a few outliers in April for NOTL and March for Welland. The Welland campus in particular manages facility heating well in the summer months, minimizing emissions during July and August. The R^2 value indicates the strength of the correlation between HDD and natural gas emissions; the closer this value is to 1 the more efficient the energy management system. Niagara College's Welland and Niagara-on-the-lake campuses both achieved an R^2 score of 0.92 (Figure 7 and Figure 8), indicated a highly efficient energy management system. The equation of the trend line can be used to calculate the expected energy use from HDD for a given period per facility.[3]

Figure 7: NOTL natural gas and HDD linear regression graph.

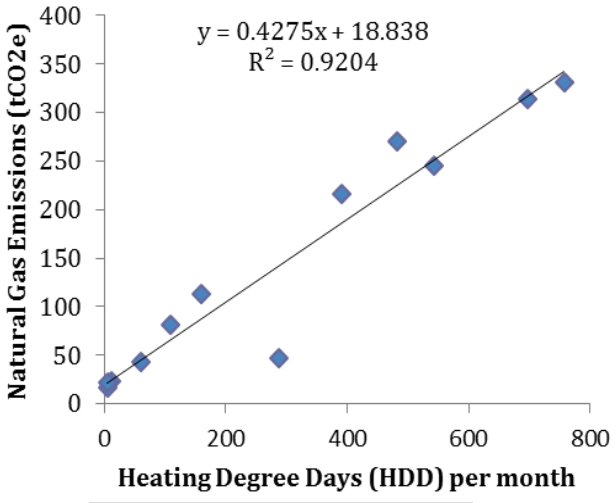
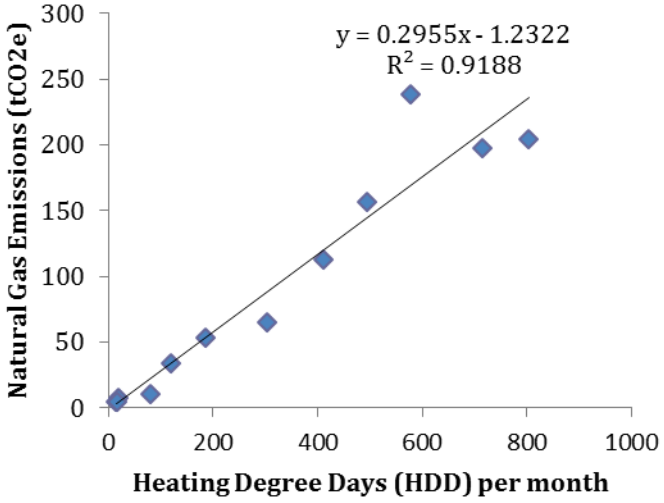


Figure 8: Welland natural gas and HDD linear regression.



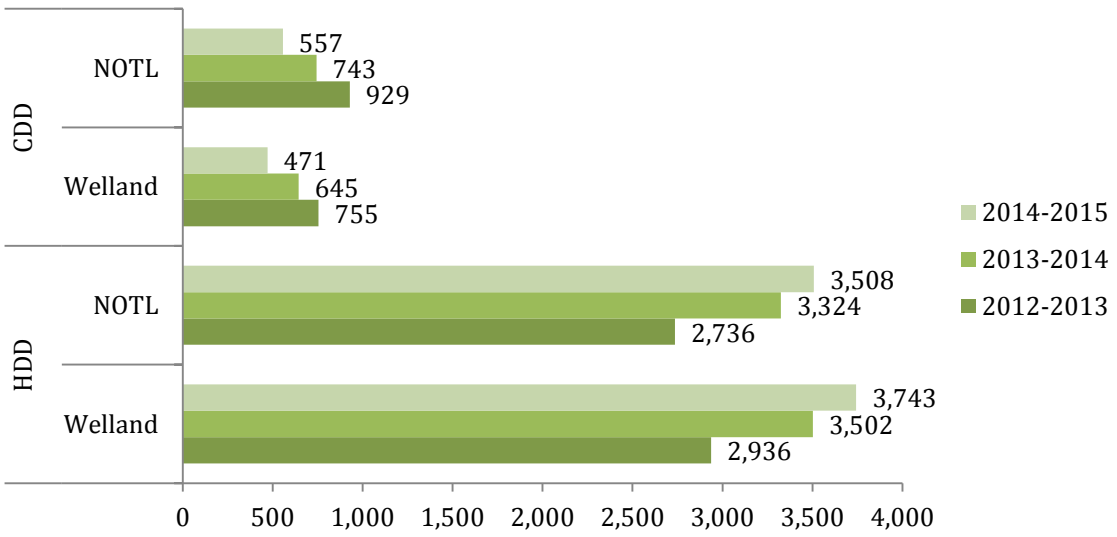
[2] C.D Ahrends, (1985). "Degree Days"

[3] BizEE Degree Days, (2015), "Linear Regression of Energy Consumption Data"

Similar to Heating Degree Days, Cooling Degree Days (CDD) refers to the demand for energy needed to cool indoor air to human comfort levels.[4] CDDs were not compared in the linear regression against electricity emissions at either campus because the College's electricity use trend is relatively flat all year. There is little to no correlation between weather and electricity use on a monthly basis due to the fact that electricity is not exclusively used for building cooling.

Continuing the observed pattern from last year, HDDs have increased in number and CDD have decreased in number since the 2013-2014 reporting year. On average, among the two locations, the number of HDDs increased from 6,827 to 7,351 or 6.3%, accounting for a proportion of the observed increase in natural gas consumption (Figure 9). The number of CDDs between the last two reporting years is shown in Figure 9) both at Welland Weather Station and St. Catharines Airport. Between the 2013-2014 and 2014-2015 reporting years, the average number of cooling degree days fell by 26.15% from the 16.5°C set point; however, in contrast electricity consumption has increased.

Figure 9: Total annual HDD and CDD from 2012-2013 to 2014-2015.



Although linear regression is a useful tool to analyze the relationship of heating and cooling energy use and weather, it is important to be cautious of the limitations, which include:

- Results are most accurate when the period of time is constant in length such as a day or week. Months, which have varying number of days can cause inaccuracies.

[4] C.D Ahrends, (1985). "Degree Days"

- Additionally, the analysis above estimates static 24/7 set-point of 16.5°C for simplicity, while in reality building heating and cooling is not constant, rather intermittently set to meet occupancy hours. The more irregular the consumption data, the greater inaccuracies become. [5]

Moving Forward

Measuring, managing and mitigating make up the central pillars of carbon management. Following these guidelines, the NSI Carbon Services Support Team has highlighted potential paths forward for Niagara College with respect to their carbon footprint. These recommendations are given with the ultimate goal of reducing GHG emissions by 20% by the reporting year 2019-2020.

Measure

Over the six years Niagara College has been reporting under the Carbon Project, they continue to improve data collection. To further advance data collection and measurement methods, the following recommendations have been made:

- **Enhance Data Accuracy:** Due to the large number of facilities and emissions activities that Niagara College reports on as part of their carbon footprint, it is important that Niagara College work with NSI to update reporting timelines and categories as the capacity of the software improves.
    - **Waste:** further breakdown the reporting of sorted waste streams to more accurately reflect carbon sinks from recycling and composting.
    - **Timing**: In order to provide time for data to be configured and included in NSI's Annual Report, it is suggested that Niagara College enter all available data into the software by January and the remaining data in April.
- **Intern to assists with carbon accounting**: during the upcoming year select an intern which will work concurrently with Niagara College, Walker Industries and Niagara Sustainability Initiative to measure carbon sequestration, assist creating the carbon inventory and report significant structural and operational changes and observed areas of improvement.

[5] BizEE Energy Lens, (2015). "Degree Days – Handle with Care".

Manage

By understanding the greenhouse gas 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 Recommendations

Stationary combustion within Scope 1 emissions is the greatest contributor to Niagara College's GHG emissions according to the present reporting framework. Within Scope 1, 99% is derived from natural gas. Managing building heat should be a key focus for future sustainability initiatives. Some recommendations include:

- **Improve building envelope**: As part of the building maintenance be sure to check and seal cracks and other areas where heat can easily escape. This can be very beneficial in older buildings. Ensure effective weather stripping is in place around windows and doors to the building. This not only reduces the heat loss in the winter but also cool air loss in the summer.
- **Optimize Boiler Loading:** Identify the low load period and where possible shut down the selected boilers during that time, so that the remaining boilers can operate at higher and more efficient firing rates.
- **Awareness Event:** energy saving best practice is not always top of mind for many employees. Find ways to motivate and engage staff and students on natural gas reduction by prompting events such as sweater days. During these days the sustainability committee can work with facilities management to turn down heat while participants layer up.

Scope 2 Recommendations

Over the past few years, Niagara College has managed to slow the growth of electricity related emissions through lighting retrofits and the use of natural lighting. Ontario's electricity costs are estimated to increase by 33% over the next 3 years[6].

Niagara College' initiatives have produced significant savings and will continue to do so as the cost of electricity rises. NSI encourages Niagara College to continue to find opportunities to manage electricity use at all facilities:

- **Timed or motion sensor lighting controls**: installing and pre-programing the most efficient lighting schedules, especially in the area used at predictable times each day.

[6] Ontario, (2014). "Ontario Long Term Energy Plan"

- **Holiday cooling schedules**: identify areas not in use seasonally and during holidays and ensure that electricity is not being wasted to cool space unnecessarily.
- **Consider electricity use during construction**: As with previous and on-going projects, train and remind workers to insulate areas and unplug equipment wherever possible as they progress through the project to reduce phantom power and the loss of cooled air.

Scope 3 Reductions

The largest proportional growth in emissions during the 2014-2015 reporting year came from business travel. Table 2 shows the breakdown of business travel related activities and emissions. Air travel contributes 83% of total business travel related emissions. The major contributing factor to air emissions in the past year was staff flights to the newly built Saudi Arabia campuses. Management strategies for Scope 3 include:

- **Increase potential for remote work**: technology provides the opportunity to introduce telecommuting, where employees do not need to travel long distances to meetings or work related training, which decreases business travel.
- **Offsetting Flight Travel:** the flights taken by Niagara College staff to the new campuses are a necessary part of operating the facilities in Saudi Arabia. Although these unavoidable emissions are acknowledged by the college and additional efforts are being made to reduce carbon in other areas of operation carbon offsets can be considered as another option.
- **Encourage and incentivize alternative transportation**: alternative travel options including carpooling, public transit and car sharing can help reduce travel related emissions. To start this initiative individuals can take part in the Commuter Challenge or Bike Month in May.

Table 2: Niagara College 2014-2015 breakdown of business travel related emissions and percentage.

Category	Transport Type	Emissions (tCO_2e)	Percent of Total
Vehicle Travel	Mid Sized (Diesel)	0.36	0.07%
	Compact (Gasoline)	0.24	0.05%
	Mid Sized (Gasoline)	86.41	16.82%
	Full Sized (Gasoline)	0.06	0.01%
Flights	Short Flights	5.55	1.08%
	Medium Flights	4.32	0.85%
	Long Flights	272.06	52.97%
	Unknown Haul Flights	144.55	28.14%

Note: Waste recommendations withheld until results of waste emissions finalized.

Mitigate

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. Niagara College has done an excellent job at external communication of their sustainability success. They have received several awards for their efforts this past year. The College's challenge is in communication the importance of energy conservation internally to staff and students that will translate to practice.

- **Energy Awareness Strategy**: NSI recommends that the college make use of the Energy Awareness Program resource 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 changes**: Education and awareness regarding the issues and impacts of energy consumption. The 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 posted in the workplace or via internal communication portals 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.
- **Quantify Carbon Sinks:** The College has inventoried over 210 acres of tree cover. As a next step, it is recommended that the carbon sequestration rate of these trees be calculated and added to the carbon emissions inventory.

Summary

Niagara College is an inspiring leader in sustainability within the Carbon Project. This past year the college introduced many new projects to reduce emissions and have seen results in building efficiency and cost savings. As the College continues to grow so are their demands on energy, as seen in the increased emissions from natural gas, electricity and business travel. Consequently, they must continue to seek reduction strategies in order to achieve their 20% absolute reduction target. Within this report, several opportunities for improving the measurement, management, and mitigation of carbon emissions have been presented. We encourage Niagara College to take even more ambitious steps to reduce emissions now and in the future.

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