

QUEEN'S UNIVERSITY GREENHOUSE GAS INVENTORY REPORT 2016

December 2017

INTRODUCTION 1

In 2010, Queen's University signed the University and College Presidents' Climate Change Statement of Action for Canada, thereby committing to taking firm action in reducing its greenhouse gas (GHG) emissions. As part of this agreement, Queen's is required to track and report all GHG emissions. This is the seventh GHG Inventory Report published, and contains data from January 1, 2016 until December 31, 2016. 1 1

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In 2014, the tracking of emissions has changed from following the Queen's fiscal year (May , April) to the calendar year (January 1-December), in order to reflect the style required by the Ontario Ministry of the Environment and Climate Change (MOECC) 1 Provincial GHG 1 Report. The goal of these inventory reports is to clarify and identify opportunities to reduce the university's overall emissions. 1 1

SCOPE OF EMISSIONS

This report reviews the overall emissions associated with 1
the operations of Queen's

2016 RESULTS

Scope 1 and Scope 2 emissions were calculated to demonstrate the overall carbon footprint of the University. Two final numbers have been calculated: a total emissions value and an adjusted emissions value. This is because Queen's owns and operates a Central Heating Plant (CHP) which produces steam to heat campus buildings by burning natural gas and oil. A portion of this steam (20%) is used to heat other facilities including Kingston General Hospital and St. Mary's on the Lake Hospital. As such, some of the emissions produced by the University are not directly associated with its own facilities. Shown below are tables depicting the overall emissions of Queen's University, including energy produced for the above external facilities, and the adjusted emissions which exclude energy exported from campus. The total adjusted GHG emissions for Queen's University was 43,954 MTCO_{2e}. See Table 1 for a summary of the 2016 campus emissions.

is a metric tonne of carbon dioxide equivalents. This is a universal unit of measure that indicates the global warming potential (GWP) of each of the six greenhouse gases (CO₂, CH₄, N₂O, HFCs, PFCs and SF₆) expressed in terms of the GWP of one unit of carbon dioxide.

	2016 Total Emissions – including hospitals (MTCO _{2e})	2016 Adjusted Emissions – Queen's only (MTCO _{2e})
Scope 1	46,8451	38,9111
Scope 2	5,0421	5,0421
Total	51,888	43,954
Per Capita Emissions	1.6511	1.3991
Emissions Per 1000 SF	7.2661	6.1551

2016 RESULTS BY SCOPE

Scope 1 GHG Sources (adjusted)	2016 Totals (MTCO _{2e})
Net CHP Emissions	33,5261
Heat Generation in Buildings	3,9291
Refrigerant Leakage	1,0331
Fuel Combustion in Equipment	344 1
Laboratory Chemicals	29 1
Fire Suppression Systems	34 1
SF6 Leakage	16 1
Wood Combustion	2 1
Scope 1 Total	38,911

Upward Trends

Between 2015 and 2016, the overall campus GHG emissions rose by 965 MT CO₂e, due largely to the following carbon sources.

Electricity Loads

Electricity consumption continues to increase with campus expansion and growth, with 2016 experiencing an increase of over 2 million kWh of electricity over 2015. This translates to additional emissions of approximately 80 MTCO₂e.

Grid Emission Factor

In addition to increased electricity consumption, the provincial electric grid emission factor has also increased this year, after decreasing for the past 7 years. The provincial grid continues to get cleaner and rely on more carbon neutral sources (such as nuclear, hydro, wind, and solar), which has a direct impact on the emissions of our university. However, in 2016, without significant new renewable energy coming online to the grid, the emission factor increased roughly 7%. This resulted in an increased campus carbon footprint of over 300 MTCO₂e.

Increased Building Stock

This past year was also the first full year that the new residences, David C. Smith House and Brant House were operating throughout a full heating season and academic year. Combined, the two residences account for an increase in annual emissions of approximately 1100 MTCO₂e.

Cooling Degree Days

Cooling Degree Days (CDD) indicate the energy demand required to cool a building with air conditioning systems. The CDD value is defined as the number of degrees that a day's average temperature is above a baseline of 18°C. For example, if the average temperature is 25°C, the CDD value for that day would be 12. The total number of CDDs for 2016 was 1320, compared to the 1179 in 2015. At Queen's the carbon consumption of 1 CDD was approximately 2.5 in 2016. This translates to an increase of over 350 MTCO₂e between 2015 and 2016.

Reduction Trends

Although the university's overall emissions increased, Queen's continues to burn less oil at the Central Heating Plant (CHP). In 2016, 57,427 liters of oil was consumed compared to 2015's consumption of 123,745 liters, which was set by using more natural gas. There is an approximate 30% reduction in carbon emissions per gigajoule of energy when burning natural gas versus oil.

CONCLUSION

Although the total adjusted emissions for Queen's University increased from 142,989 MTCO₂e in 2015 to 43,954 MTCO₂e in 2016, the overall downward trend since 2008 remains promising for the school. This increase was driven primarily by an increased grid emission factor, more cooling degree days, bad increases in electricity as well as in heating and cooling due to the operation of two new residence buildings.

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It will be important to continue introducing energy reduction projects to the university over the coming years to counter balance the increasing energy demand created by new buildings and an increasing student and staff population. The Queen's Climate Action Plan aims to reduce GHG emissions by 35 percent from 2008 levels by 2020, and by 70 percent by 2030. The 2016 total is