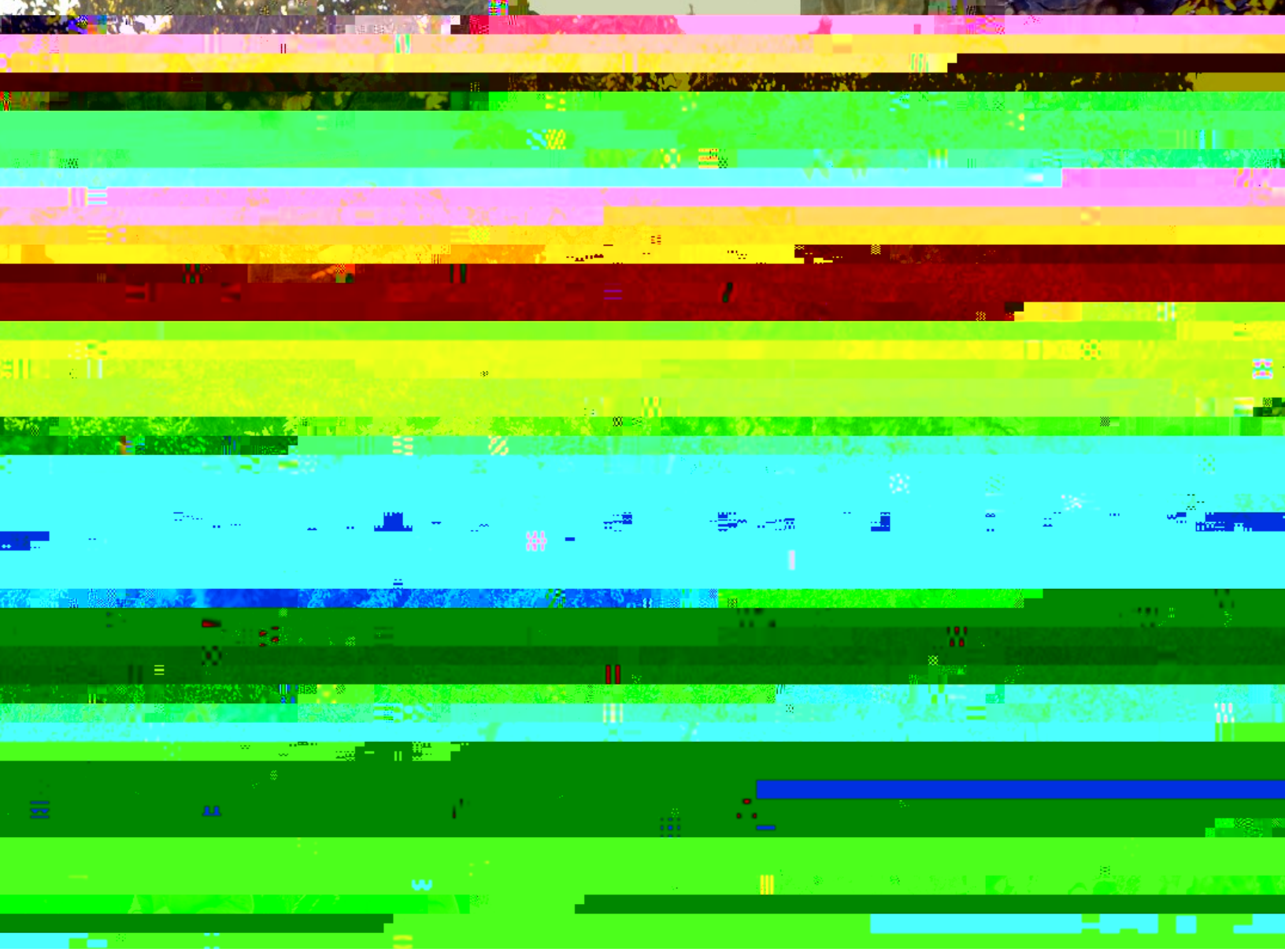

INTRODUCTION

In 2010, Queen's University signed onto the *University and College Presidents' Climate Change Statement of Action for Canada*, thereby committing to taking firm action to reduce its greenhouse gas (GHG) emissions. As part of this agreement, Queen's is required to track all GHG emissions and report on them. This is the sixth GHG Inventory Report published, and contains data from January 1, 2015 until December 31, 2015.

The emissions data is separated by years and the year over year total emissions is compared from 2008 until 2015 (Figure 1). The tracking of the emissions has changed from following the Queen's fiscal year (May-April) to the calendar year, in order to reflect the style of the required provincial greenhouse gas report. The goal of analyses such as these is to

SCOPE OF EMISSIONS

This report reviews the overall emissions associated with the operations of Queen's University, including the direct (Scope 1) and indirect (Scope 2) emissions of all Queen's facilities and operations within the province of Ontario. This encompasses leased and

METHOD

The GHG quantification methodologies used in this report have been developed according to standard quantification approaches. Emission calculations are based on a standard equation, where an activity level is multiplied by a corresponding emission factor. Activity levels are derived from reports documenting consumption for fuels and energy. Throughout the year, invoices and metering data is collected and stored for all fuel combustion, electricity consumption, and heating of independent buildings. This information is then compiled and its associated greenhouse gas emissions are calculated. The calculations represent approximately 97% of all Queen's University emissions. The final 3% is calculated based on assumptions and includes elements such as fugitive emissions from laboratory chemicals and fire suppression units, leased space, and some small fuel-consuming equipment.

The Grid Emission Factor

The Grid Emission Factor is a measure of the Provincial Electricity Grid's carbon intensity, or the average output of carbon dioxide per unit of electrical output.

Different types of electricity generation have their own carbon intensities. Output from fossil fuel plants have varying levels of carbon intensity depending on the fuel, which in Ontario is natural gas. Carbon-neutral sources such as nuclear, hydro, wind, and solar are generally viewed as having no carbon emissions and so their carbon intensities are zero. The transmission infrastructure also adds to carbon intensity when accounting for line losses. A weighted calculation of these elements within the grid is equal to the annual Grid Emission Factor.

The emission factors used in the calculator are based on national industry standards that tend to remain static for most fuels. However, the grid emission factors used for electricity calculations come from Environment Canada's National Inventory Report. Additionally, data for lighting energy use, and heating and cooling for office spaces come from Natural Resources Canada. For both emission factor sources, there is usually a two-year lag in the availability of these values. Thus, data from 2014 was used for this year's report, and the calculation will be updated when values for 2015 become available. This methodology is consistent with previous reports.

RESULTS BY SCOPE

Campus emissions are divided into two categories: Scope 1 and Scope 2. Scope 1 emissions are those emitted on site due primarily to energy generation and unintentional release from laboratory chemicals.

The greatest contributor to these emissions come from the central

RESULTS IN CONTEXT

Total emissions have remained relatively stable since 2009, fluctuating annually but showing an overall downward trend. This is reflected in the 2% decrease in emissions from last year. In 2014, the total adjusted emissions were 44,433 MT CO_2e, as

Heating Degree Days (HDD) are a form of measurement designed to indicate the energy demand required to heat a building. The greater the number of HDD over a period of time, the greater the required energy is to heat a building. One HDD is equivalent to one degree below 18°C, which has been set as the baseline temperature. As a result, if the temperature is -10°C, the HDD value for that day would be 28. At Queen's, the impact of a single HDD on campus is on average approximately 8.5 MT CO_2e, as opposed to a cooling degree day which is 7.5 MT CO_2e. There were 4184 HDD in 2015. This was a decrease from last year where there were 4,277 HDD in 2014. The impact of 93 fewer HDD than the previous year is approximately equivalent to 790 MT CO_2e.

The university's emissions also decreased due to the impact of burning less oil at the Central Heating Plant (CHP). In 2015 111,000 liters of oil was consumed compared to 2014's consumption of 1 M liters. There is an approximate 30% reduction in carbon emissions per gigajoule of energy when burning natural gas versus oil. Fuel choice at the plant matters, as using natural gas leads to far less emissions.

As mentioned earlier, the provincial grid emission factor has continued to decrease, impacting last year's GHG inventory as well as the current year's GHG inventory. The provincial grid continues to get cleaner and uses more carbon-neutral sources (such as nuclear, hydro, wind, and solar), this has a direct impact on the emissions of our university. There was a reduction in the value from 2013 to 2014 of roughly 38%. This reduction translates directly into a carbon reduction for Queen's, however is partially offset by steady incremental increases to campus electricity consumption.

CONCLUSION

Although the scope for the GHG inventory increased from 2014 to 2015 with the addition of two new residence buildings, there was nevertheless a decrease in campus emissions. Driving this trend was the reduced heating demand at the CHP, as indicated by fewer Heating Degree Days in 2015 and the reduction in oil consumption. The downward trend can also be attributed to the lower Provincial Grid Emission Factor.

Although the gross carbon footprint has decreased, as can be seen (Figure 2), the GHG emissions relative to area and population have remained relatively stable since 2011. This would suggest that despite the positive effects of outside forces such as HDD values and grid emission factors, our energy consumption continues to grow. More effort to internally reduce emission will be necessary to achieve our carbon footprint