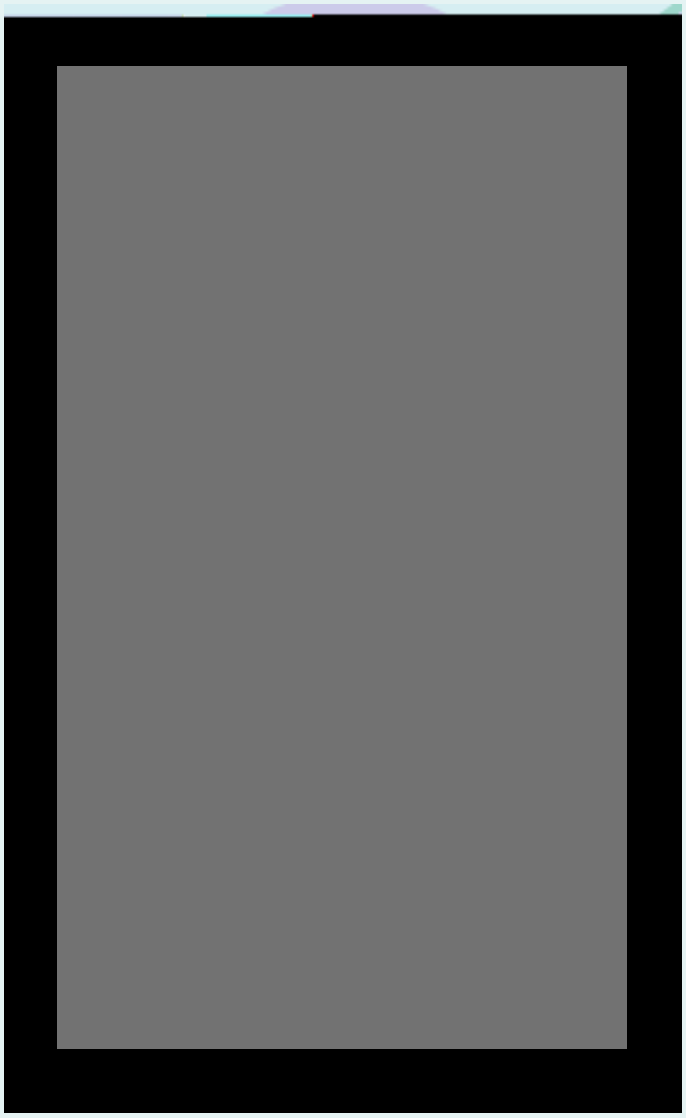
The methods used to determine GHG emissions in this report have been developed according to standard approaches. Emissions calculations are based on a standard equation, where an activity level is multiplied by a corresponding emission factor. Activity levels are derived from reports documenting the consumption of different fuels and energy. Throughout the year, invoices and metering data are collected and stored for all fuel combustion, electricity consumption, and heating of independent buildings. This information is then compiled and the 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 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, as well as heating and cooling for office spaces come from Natural Resources Canada. For both emission factor sources, there is usually a two-year lag period in the availability of these values. Thus, data from 2016 was used for this year's report, and the calculation will be updated when values for 2017 become available. This methodology is consistent with previous reports.



Scope 1 and Scope 2 emissions were calculated to demonstrate the overall carbon footprint of the University. Two fnal 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 of 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 . See Table 1 for a summary of the 2017 campus emissions.

$MTCO_2e$ 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.

	45,695	35,972
	4,670	4,670
	1.523	1.229
	6.475	5.225

Table 1. Breakdown of the 2017 Queen s University emissions by scope, population, and campus area

Scope 1 Emissions

Scope 1 emissions are those emited on site due primarily to energy generation and unintentional release from laboratory chemicals. The greatest contributor to these emissions is the Central Heating Plant (CHP), used to heat the campus in the winter. The CHP emissions represented 87% of Scope 1 emissions in 2017. The next largest emissions source is from standalone heat generation in buildings that are not connected to the CHP, contributing approximately 10% of the Scope 1 emissions in 2017. The remaining emissions are created by fuel combustion from the campus vehicle fleet, chemical emissions from laboratory chemicals, and fire suppression systems.

	31,459
	3,547
	559
	333
	24
	34
	16

Table 2. Breakdown of Scope 1 emissions in 2017

Scope 2 Emissions

Scope 2 emissions are indirectly produced by the University through electricity usage in Queen s owned and leased o f ces.

The associated emissions per kWh of electricity are calculated by the province as grid emission factors, representing an average based on all forms of electricity production contributing to the provincial grid.

	4,176
	420

Table 3. Breakdown of Scope 2 emissions in 2017

Total GHG emissions have fluctuated annually over the past 9 years, but show an overall downward trend. This is reflected in the 30% decrease in emissions from 2008 to 2017. In 2017, the total adjusted emissions were 40,643 $MTCO_2e$, a decrease from the 42,723 $MTCO_2e$ in 2016 and 42,989 $MTCO_2e$ in 2015. The decrease is a result of a combination of factors including a cool summer, decreased grid emission factors, and a variety of projects that have reduced energy usage on campus.

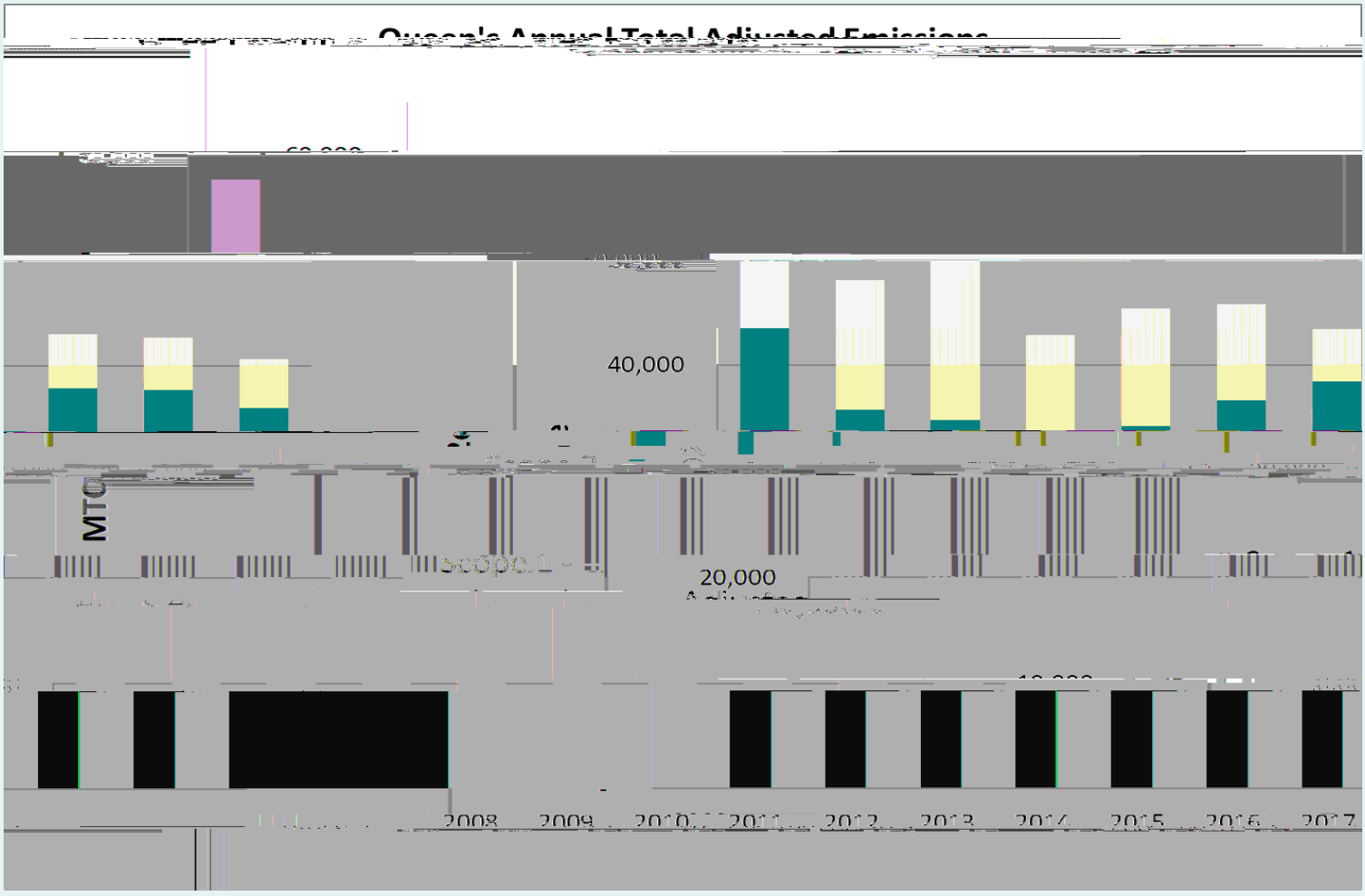


Figure 2: Total Queen's University GHG Emissions from 2008-2017

Downward Trends

Between 2016 and 2017, the overall adjusted campus GHG emissions went down by 2081 $MTCO_2e$, due largely to the following reasons.

The total adjusted emissions for Queen s University decreased from 42,723 $MTCO_2e$ in 2016 to 40,643 $MTCO_2e$ in 2017, which is the fewest emissions reported on Queen s campus since 2008. This decrease was driven primarily by energy reduction projects that reduced building level electricity loads, and fewer cooling degree days.