Conservation and Demand Management Plan

2019-2024

Introduction

Ontario Regulation 507/18 under the Electricity Act 1998 requires public agencies—municipalities, municipal service boards, school boards, universities, colleges and hospitals—to report on their energy consumption and greenhouse gas (GHG) emissions annually and to update energy Conservation and Demand Management (CDM) plans every 5 years starting in 2019.

Sections

1 - Results

2 - Current and Proposed Measures

3 - Renewable Energy Generation

4 - Confirmation of Approval by Senior Management

Appendices

Section 1: Results

Annual Energy Consumption 2017

Please refer to:

Appendix A
2017 Reg. 397/11 Campus Data

Appendix B
Queen's Carbon Footprint Report

Energy Conservation Goals

Queen's is preparing for several strategic energy conservation projects over the next 5 years. Technical measures such as a campus-wide real-time utility metering suite with reporting capability will be used to facilitate behavioural measures including improved departmental utility cost allocation, outreach programs for students and staff, and HVAC scheduling. Setting specific targets before the results and opportunities are quantified will be avoided. Instead these targets will be updated within an amendment to the plan when appropriate. Queen's current goals and targets are summarized below.

- Reduce energy use intensity [GJ/m^2]
- Reduce overall energy use
- Reduce water use intensity [m^3/m^2] and consumption

Results

During the period covered by the first CDM plan (2014-2019) Queen's was able to keep total energy costs stable despite increasing enrollment and a significant increase in square footage. Cost control was achieved through a combination of energy conservation projects, behavioural measures, and strategic energy procurement.

Electrical peak demand shaving has been the cornerstone of utility cost control. Over the last several years an integrated system has been developed by the Energy and Sustainability team which alerts controls technicians, refrigeration mechanics, and building occupants that a peak day is expected. This notification is coordinated days in advance to give staff and users time to plan for and react to the coordinated shutdown of large equipment such as chillers during these provincial electricity grid critical peaks. These shutdowns contribute to GHG emissions reductions at the grid level by reducing load on GHG intensive generation such as natural gas peaking plants.

Projects

Since 2014 over $20m has been spent on conservation projects. Of the 8 technical measures included in the 2014 CDM plan, 5 have been implemented or are in progress. Below is a list of measures implemented from 2014-2019.

Electricity Conservation Projects
A variety of electricity conservation projects were completed including LED lighting upgrades, adding VFDs to air handlers, and enhancements to HVAC direct digital control systems. Across over 30 buildings, 63 total electricity conservation projects were implemented saving over 3.3 million kWh/year.

Water Conservation Projects

In 52 buildings a total of 59 water conservation projects were completed. The largest single project was an upgrade to re-use the bearing cooling water at the central heating plant as boiler makeup water, saving 25,000 m^3/year. A campus-wide effort was made to perform leak detection and repair, and install low-flush toilets as well as faucet aerators and low-flow showerheads. Total annual water savings are estimated at over 215,000 m^3/year.

Natural Gas Conservation Projects

Most natural gas savings were achieved through upgrades to steam based heating systems, resulting in reduced demand on the central steam heating plant. The largest project involved severing the aging steam line serving the Queen's West Campus from the central heating plant, replacing it with an efficient local heating system, resulting in an annual savings of over 400,000 m^3 per year. A second large project saw the addition of heat recovery coils to the fume hood exhaust system at the main chemistry lab building, Chernoff Hall. This single project is now saving 250,000 m^3 of natural gas per year.

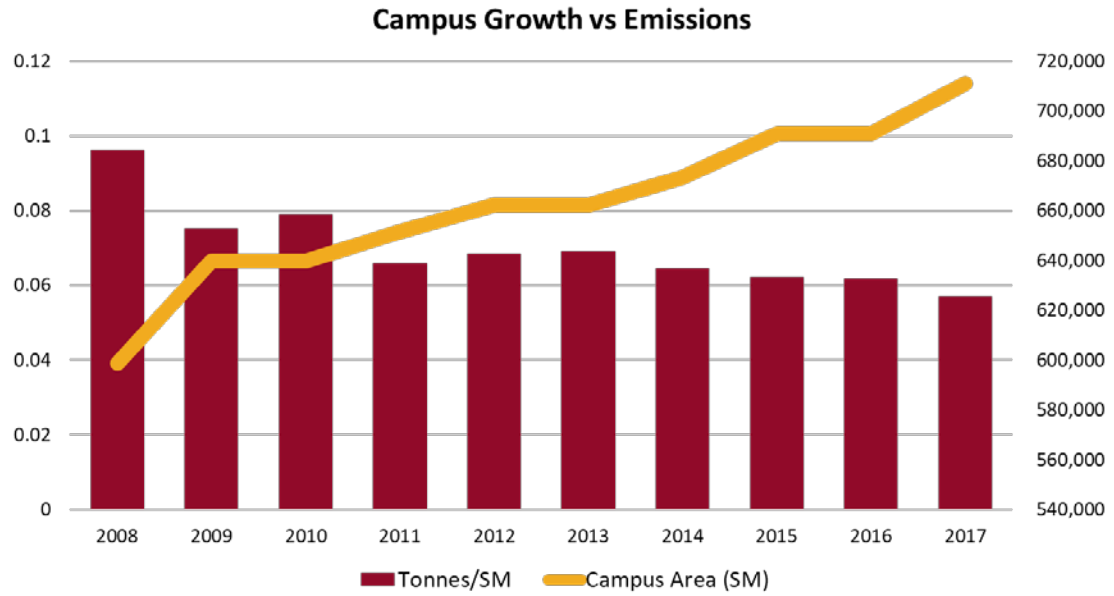
Other projects included upgrades to HVAC controls, replacement of boilers and hot water tanks in a residence building, more precise scheduling of HVAC systems to building occupancy, weatherstripping of leaky building envelopes, and repairs to failed steam traps. Total savings for all natural gas conservation projects are approximately 1.3 million m^3 per year.

Upgrade to Cogeneration Plant

To increase the operational availability of the district energy system an upgrade was made in 2016 that allows the cogeneration unit to operate under a wider set of conditions. Through this upgrade Queen's was able to increase utilization of the cogeneration units, assisting in the mitigation of over $3.5 m/year in energy costs.

Greenhouse Gas (GHG) Intensity Reduction

In February 2010, Principal Woolf signed the University and College Presidents' Climate Change Statement of Action for Canada. This pledge commits the university to engage in activities aimed at reducing GHG emissions and enhancing research and curriculum in the areas of climate change and sustainability. It also required the development of a comprehensive Climate Action Plan (CAP), which was published in March 2016 and set an institutional target of net-zero by 2040. Energy conservation projects have helped Queen's total greenhouse gas emissions per square meter (SM) decline year over year since 2013.



Section 2: Current and Proposed Measures

Through investments in energy conservation, and strategic energy procurement, Queen's has had success containing utility costs, seeing no increase in spending despite significant organizational growth and utility rate changes. While new measures are proposed in this plan, the key elements of the conservation strategy are to maintain and refine our demand management program, and continue the financial momentum of retrofit project implementation.

Proposed utility conservation measures and the business case to support them will be reviewed on a continuous basis by the Energy and Sustainability Team. The following list of measures has been identified by Queen's PPS staff and external consultants. Criteria for review and evaluation will be based on access to capital, significance of energy and cost savings, GHG impacts and technical feasibility.

Technical measures

1. **Electrical Demand Management** - Demand management during the summer to reduce electrical demand on the provincial grid. The current provincial cost structure incentivizes demand management on peak power days for the Ontario electrical grid, this lowers provincial reliance on GHG intensive generation such as natural gas peaking plants. Currently accomplished via conservation efforts but may be expanded via off peak storage technology or expanded use of embedded generation.

    - Estimated Cost[1]: $45,000
    - Estimated Savings[2]: $500,000 + annually
    - Duration of project impact: Ongoing

2. **Continued Expansion of Real Time Utility Metering –** Install hardware to allow integration of building level steam, water, and gas meters with existing utility data collection database. This data will be used to monitor for leaks and equipment failure related losses, energy management, Preventative Maintenance work, improvements to business operations and provide data to implement occupant awareness.

    - Estimated Cost[1]: $750,000
    - Estimated Savings[2]: $50,000 - $125,000 annually
    - Duration of project impact: Ongoing

3. **Ongoing Lighting Retrofits –** Convert aging fluorescent and HID fixtures in existing buildings to LED, install occupancy sensors, daylight harvesting with photocells, and lighting controls where appropriate.

    - Estimated Cost[1]: $2,750,000
    - Estimated Savings[2]: $320,000 annually
    - Duration of project impact: 10+ years

4. **Equipment Purchasing Program** – Implement process to ensure lowest lifecycle costing for all equipment retrofits/replacements and minor construction projects to ensure energy efficient equipment is selected for systems and design.

- Estimated Cost[1]: $15,000 plus 5% premium over lowest cost option
- Estimated Savings[2]: 20% in annual operating costs
- Duration of project impact: Ongoing

5. **Strategic Laboratory Revitalization –** Engineering feasibility study to develop conservation measures related to more than 400 fume hoods across 4 primary lab buildings on campus. Potential measures to include replacement of outdated fume hoods requiring high exhaust volume, recalibration and testing of existing modern fume hoods capable of safe operation at reduced volume, and removal of underutilized hoods through an internal behavioural incentive program offering researchers compensation for eliminating hoods in their labs.

    - Estimated Cost[1]: $18,000,000
    - Estimated Savings[2]: $900,000 + annually
    - Duration of project impact: 20+ years

6. **Back Pressure Turbine in CHP –** Install a backpressure turbine to utilize the pressure difference between CHP generation pressure and steam system distribution pressure. The turbine would operate year round offsetting electrical consumption in the plant.

    - Estimated Cost[1]: $1,900,000
    - Estimated Savings[2]: $217,000 annually
    - Duration of project impact: Ongoing for lifespan of equipment

7. **Building Retrocommissioning –** Optimization of existing building automation, controls, HVAC balancing and scheduling functions. Through their lifecycle buildings undergo renovations, and changes in their occupancy. The functionality of equipment can be compromised and schedules and operating parameters no longer reflect actual facility use and layout. This behavioural measure will take advantage of the data coming from the real time metering measure to inform where opportunities exist, and verify savings.

    - Estimated Cost[1]: $3.50/m^2
    - Estimated Savings[2]: $2.00 – $4.00/m^2 annually
    - Duration of project impact: Continuous project, ongoing results

8. **Central Heating Plant Boiler Upgrades –** Replacement of one of the main central steam plant boilers is expected to result in 3-5% savings compared to the existing unit.

    - Estimated Cost[1]: – $12,000,000
    - Estimated Savings[2]: $175,000 annually
    - Duration of project impact: 10+ years

Behavioural Measures:

1. **Energy Dashboards** – Make utility data available in real time to empower facility managers and occupants to contribute to energy management. The real time metering suite has the ability to deploy utility dashboards via the web interface to any computer with an internet connection. These dashboards can be provided as a web link to departmental administrators, or put on permanent display in residence foyers to foster student engagement.

    - Estimated Cost[1]: Included in real time metering measure
    - Estimated Savings[2]: TBD
    - Duration of project impact: Ongoing

2. **Queen's Community Engagement** - Fund Sustainability outreach, awareness and engagement activities on campus for staff, faculty and students to foster energy conservation.

    - Estimated Cost[1]: $10,000
    - Estimated Savings[2]: $10,000 annually
    - Duration of project impact: Annual energy impact with ongoing cultural change

3. **Installation of 64 Electric Vehicle Chargers** – High speed charging stations have been installed in several locations around campus to encourage use of sustainable transportation when coming to Queen's.

    - Estimated Cost[1]: $ 110,000
    - Duration of project impact: Annual impact supporting ongoing cultural change

Organizational Measures:

1. **Lifecycle Costing Capital Projects –** Expand current process of lifecycle costing to all energy intensive equipment and systems to ensure energy and water efficiency are primary drivers of equipment selection and design for all major construction and renovation capital projects. Forge the link between operational and capital budgets to ensure integral components are excluded from value engineering efforts.

    - Estimated Cost[1]: 2% of Capital Cost
    - Estimated Savings[2]: 10 – 20% Annual Operational Savings
    - Duration of project impact: Continuous over lifespan of building

2. **Building Standards -** Update internal building standards document to reflect best practices for design, construction and equipment selection, moving toward the institutional goal of carbon neutrality by 2040. All new builds will be a minimum of LEED Gold.

    - Estimated Cost[1]: 2% of Capital Cost
    - Estimated Savings[2]: 10 – 20% Operational Savings
    - Duration of project impact: Continuous

3. **Benchmarking Building Performance with RETScreen Expert –** Use weather adjusted building utility benchmarking to identify and improve buildings with poor performance. In cooperation with other institutions across Ontario's post-secondary sector, and Natural Resources Canada, benchmarking of building performance is being done across all Ontario University campus buildings using RETScreen Expert software.

    - Estimated Cost[1]: $10,000
    - Estimated Savings[2]: Project dependent
    - Duration of project impact: Continuous over lifespan of building

4. **Energy Intensity Targets –** Develop and maintain energy intensity standards for each major construction type.

    - Estimated Cost[1]: $10,000
    - Estimated Savings[2]: 10 – 20% Annual Operating Savings
    - Duration of project impact: Continuous over lifespan of building

5. **Improved Cost Allocation to Users** – Use the data provided by the real time metering suite to improve utility cost allocation to users. Properly assigning utility costs to users encourages conservation behaviour and investment by providing a financial benefit to occupants for managing their utility use.

    - Estimated Cost[1]: Internally driven, most costs part of real time metering measure
    - Estimated Savings[2]: $100,000
    - Duration of project impact: Ongoing

6. **Deferred Maintenance Funding –** Many DM projects will inherently have an energy savings component, examples of this include West Campus Steam Line removal, Lighting Retrofit work, Windows and Doors (i.e. Envelope Upgrades), Motors, Fans, and Pump Retrofits, Steam to Hot Water Conversions, Roof Replacements with Increased Insulation.

    - Estimated Cost[1]: $1,000,000 +
    - Estimated Savings[2]: 10 – 20% of annual operational cost
    - Duration of project impact: Continuous

Notes:

1. *The costs provided are estimates and are based on case studies, consultant reports and previously project experiences. The costs, as estimates are subject to changes and unforeseen conditions which are common when project details and project scope is further investigated and defined. They are also subject to inflation, and potential errors and omissions.*
2. *The estimate savings similarly are based on previous project experience, consultant reports, and case studies. Actual utility and cost savings will be derived from detailed business case development and project exploration and details. The savings, as estimates are subject to changes and unforeseen conditions which are common when project details and project scope is further investigated and defined. They are also subject to inflation, and potential errors and omissions.*

Section 3: Renewable Energy Generation

Development of Distributed Renewable Energy Systems

Installed Systems

- Goodwin Hall – 20KW Solar system, wall mounted to provided additional solar shading of office windows
- Walter Light – Queen's ePower Lab - 18 kW solar and 2 kW wind, for research and power generation

Planned Measures

- On-going investigation of potential sites for additional renewable energy systems
- Incentive system for departmental level investment in renewables

Heat Pumps for New Construction

New builds including a planned residence building will consider geothermal and air source heat pump technology as an alternative to fossil fuel based heating. The evaluation will consider carbon costs as well as the institutional goal of carbon neutrality by 2040.

Section 4: Confirmation of Approval by Senior Management

To: Ontario Minister of Energy

Queen's University's commitment to CDM will continue and this document will serve as a guide in that process over the next 5 years. The plan and details will be revised and updated to reflect opportunities and priorities for conservation and energy efficiency within the Universities operations.

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John Witjes
Associate Vice-Principal, Facilities

Appendix A

Ont. Reg. 507/18 Broader Public Sector Energy Consumption and Greenhouse Gas Emissions Reporting Data		
Timeframe	Jan 2017 - Dec 2017	
Sector	University	
Agency Sub-sector	Post-Secondary Educational Institution	
Organization Name	Queen's University	
Operation Name	Campus Total	
Operation Type	Classrooms and related facilities	
Address	207 Stuart Street	
City	Kingston	
Postal Code	K7L 3N6	
Total Floor Area	7,602,638	Square feet
Avg hrs/wk	60	
Electricity Quantity	106,041,645	kWh
Natural Gas Quantity	18,048,362	Cubic Meter
Fuel Oil 1 & 2 Quantity	15,527	Litre
Fuel Oil 4 & 6 Quantity	7,317	Litre
Propane Quantity	7,242	Litre
Coal Quantity	-	
Coal Unit	-	
Wood Quantity	-	
Wood Unit	-	

Appendix B

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QUEEN'S UNIVERSITY GREENHOUSE GAS INVENTORY REPORT 2017

September 2018

INTRODUCTION

In 2010, Queen's University signed the *University and College Presidents' Climate Change Statement of Action for Canada*, thereby committing to taking action to reduce greenhouse gas (GHG) emissions. As part of this agreement, Queen's is required to track and report all GHG emissions. This is the eighth GHG Inventory Report published, and contains data from January 1, 2017 until December 31, 2017.

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

Queen's Sustainability

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 owned buildings both on and off campus. The report excludes any satellite offices outside of Ontario, the Bader International Study Centre at Herstmonceux, England, and student rental homes leased by Queen's Community Housing.

Scope 1 emissions include all emissions directly produced by the University, most of which are caused by local energy production to heat the campus. The main contributors to Scope 1 emissions include:

- Stationary combustion from the boilers, cogeneration plant, generators, furnaces, and kitchen equipment
- Mobile combustion from various fleet vehicles and grounds maintenance equipment
- Fugitive emissions from electrical switches, fire suppression equipment, lab chemicals, and refrigerants

Scope 2 emissions include all indirect emissions associated with energy that the University purchases, including:

- The University's main and west campus electricity usage
- The electricity consumption of Queen's Biological Station (QUBS)
- The electricity, heating, and cooling in all leased spaces

Figure 1: The Queen's Central Heating Plant (CHP)

METHOD

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.

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.

2017 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 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 **40,643 MTCO$_2$e**. See Table 1 for a summary of the 2017 campus emissions.

MTCO$_2$e *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.*

	2017 Total Emissions – including hospitals (MTCO$_2$e)	2017 Adjusted Emissions – Queen's only (MTCO$_2$e)
Scope 1	45,695	35,972
Scope 2	4,670	4,670
Total	**50,365**	**40,643**
Per Capita Emissions	1.523	1.229
Emissions Per 1000 SF	6.475	5.225

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

2017 RESULTS BY SCOPE

Scope 1 Emissions

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 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.

Scope 1 GHG Sources (adjusted)	2017 Totals ($MTCO_2e$)
Net CHP Emissions	31,459
Heat Generation in Buildings	3,547
Refrigerant Leakage	559
Fuel Combustion in Equipment	333
Laboratory Chemicals	24
Fire Suppression Systems	34
SF6 Leakage	16
Scope 1 Total	**35,972**

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 offices.

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.

Scope 2 GHG Sources	2017 Totals ($MTCO_2e$)
Owned Offices – Net Grid	4,176
Leased Offices – Heating	420
Leased Offices – Grid Electricity	61
Leased Offices – Cooling	14
Scope 2 Total	**4,670**

Table 3. Breakdown of Scope 2 emissions in 2017

RESULTS IN CONTEXT

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.

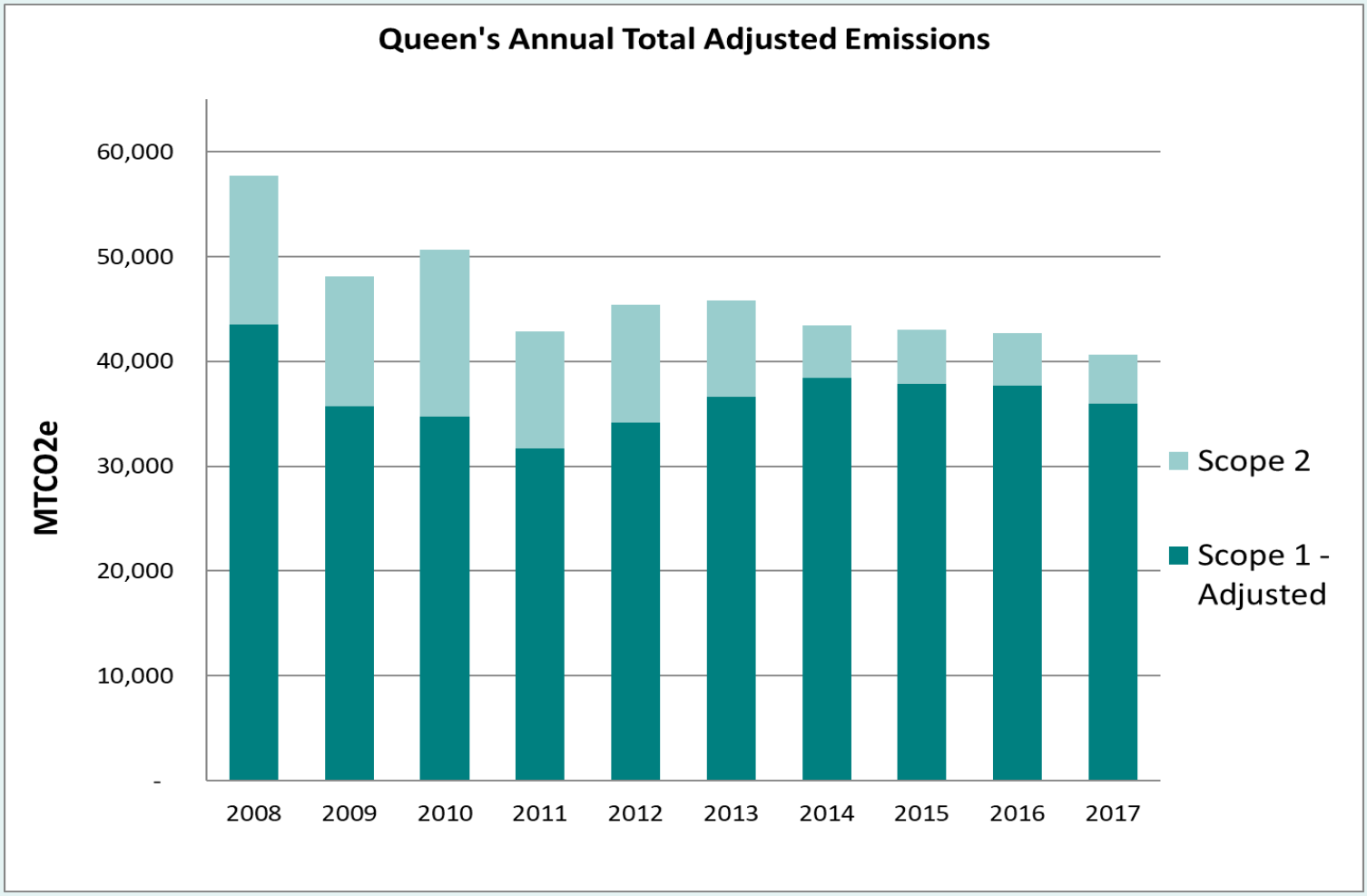

Figure 2: Total Queen's University GHG Emissions from 2008-2017

Downward Trends

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

Energy Reduction Projects

In 2017 Queen's benefitted from the results of CAPit, its energy conservation program. The installation of new heat recovery coils at Chernoff Hall and updates to the mechanical air handling systems to more efficiently heat and cool the spaces in Duncan McArthur Hall, Dunning Hall, and Humphrey Hall have provided a carbon reduction of 1234 MTCO2e per year. Other lighting and water system retrofit projects in over 60 buildings on campus have contributed additional reductions of 1566 MTCO2e per year.

Grid Emission Factor

In addition to reduced electricity consumption, the provincial electric grid emission factor has decreased this year, after an increase in 2016. 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.

Cooling Degree Days

Cooling Degree Days (CDDs) 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 7. The total number of CDDs for 2017 was 162, compared to the 312 in 2016. With fewer CDDs, significantly less electricity is required to keep all campus buildings at a comfortable temperature for occupants.

Heating

Producing steam and electricity at the central heating plant (CHP) is responsible for 87% of the total scope 1 emissions. Similar to CDD, the number of Heating Degree Days is the total number of degrees that a daily average temperature is below 18°C. In 2017 the total number of HDDs was 3948 compared to 3859 in 2016. Even with a higher heating load this year the total CHP emissions decreased by 837 MTCO2e. This downward trend is likely due to the energy reduction projects mentioned above.

Reduction of Oil Usage

Queen's continues to burn less oil at the Central Heating Plant (CHP). In 2017 18,475 liters of oil was consumed compared to 2016's consumption of 57,427 liters, which was offset 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

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.

In collaboration with Honeywell, an Energy Service Company (ESCo), Queen's implemented the largest energy reduction projects to ever take place on campus. Through the CAPit energy conservation program, a heat recovery system in Chernoff, better building energy management systems in Duncan Mcarthur, Dunning and Humphrey Hall as well as numerous lighting and water retrofit projects have reduced campus emissions in 2017 by 2800 MTCO2e.

Year	Scope 1 adjusted ($MTCO_2e$)	Scope 2 ($MTCO_2e$)	Total ($MTCO_2e$)
2008	43,532	14,182	57,716
2009	35,675	12,451	48,126
2010	34,700	15,973	50,672
2011	31,710	11,171	42,881
2012	34,167	11,248	45,415
2013	36,575	9,204	45,779
2014	38,414	5,006	43,420
2015	37,815	5,174	42,989
2016	37,681	5,042	42,723
2017	35,972	4,670	40,643

Table 4. Scope 1 and 2 emissions from 2008-2017

Next up, by severing the main to west campus steam and condensate lines and introducing a more efficient district energy system, Queen's will further reduce its annual emissions by 1,500 MTCO2e. 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. Even with the increasing energy demand created by new buildings and an increasing student and staff population, the promising 30% decrease in carbon emissions since 2008 is leading us towards our sustainability goals.

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