Skidmore College
2019 Greenhouse Gas Inventory

Introduction

The 2019 Greenhouse Gas (GHG) Inventory quantifies the amount of greenhouse gases released from college-related activities between June 1, 2018, and May 31, 2019. This report is Skidmore's fifth GHG inventory and mirrors previous reports to compare current and historical emissions more easily. Reporting GHG emissions is an important part of Skidmore's broader efforts to address climate change. Although assessments like this do not reduce emissions, they allow Skidmore to determine the efficacy of ongoing mitigation strategies and inform future decisions to reduce our carbon footprint.

Skidmore's GHG mitigation efforts align with our goals and values described in Skidmore's strategic plan, *Creating Pathways to Excellence: The Plan for Skidmore College, 2015-2025.* Skidmore's holistic understanding of sustainability reinforces the connections between the pillars of the plan, including integrative excellence, inclusion, and health and well-being, and sustainability. Skidmore's continued investment in sustainability, including measuring and tracking Skidmore's GHG emissions, demonstrates our longstanding commitment to sustainability, environmental justice, and helps to foster a sense of collective responsibility as we examine the impact of current actions and seek solutions to minimize emissions across operations.

Greenhouse Gas Background

A GHG is a gas that is transparent to solar radiation but opaque to infrared (or heat) radiation. That is, a GHG permits the sun's rays to reach the earth, but prevents infrared radiation from escaping back into space. Excess GHG's in the atmosphere interfere with the mechanism by which the planetary temperature is regulated.

The most abundant and naturally occurring GHG in the atmosphere is water vapor, followed by carbon dioxide (CO2). There are naturally occurring (biogenic) sources of GHG's and human-generated (anthropogenic) sources of GHG's.

Various GHG's react in different ways in the atmosphere. The Intergovernmental Panel on Climate Change (IPCC) has quantified these characteristics by determining the global warming potential (GWP) of various gases. The GWP is a metric for how much a given mass of a GHG will contribute to global warming. CO2 was given a value of 1 by atmospheric scientists, and all other GWP are based on this metric. For example, methane has a GWP 28 times that of CO2, so it has a value of 28.

Using the GWP of each gas, scientists can convert emission amounts of each individual gas into an equivalent carbon dioxide emission amount (or Carbon Dioxide equivalent, CDE), so all the emitted GHG's can be added together to obtain a total footprint. For example, 1 metric tonne of emitted CO2 (GWP of '1') plus 1 metric tonne of emitted methane (GWP of 28) equals 29 metric tonnes of CDE (MTCDE)[1].

According to the GHG Protocol, there are six anthropogenic (human-generated) gases to inventory.

1. Carbon Dioxide (CO2) - Enters the atmosphere through the burning of fossil fuels (oil, natural gas, coal,

[1] **Metric Tonnes Carbon Dioxide Equivalent (MTCDE)** -Metric tonnes (2,205 pounds), the standard for reporting GHG emissions, shorthanded as MTCDE (metric tonnes of CDE) and MMTCDE (million tonnes CDE) for larger entities.

and gasoline), solid waste, trees and wood products. CO2 is also the result of various chemical reactions in manufacturing or raw resource extraction.

2. Methane (CH4) – Is emitted during the production and transport of coal, natural gas, and oil, and results from livestock, agricultural practices, and decay of organic wastes.

3. Nitrous Oxide (N2O) – Is emitted during agricultural and industrial activities and is a byproduct of combustion of fossil fuels and solid waste.

4. Hydrofluorocarbons (HFCs)

5. Perfluorocarbons (PFCs)

6. Sulfur Hexafluoride (SF6).

Numbers 4, 5, and 6 are generically called fluorinated gases, which arise from chemical processes, and are used in a variety of substitutes for previously identified ozone-depleting substances. These are typically emitted in small quantities, but they are potent GHG's. Various forms of fluorinated gases have GWP from 300 to as high as 3300 times greater than an equivalent measure of CO2 alone[2].

Greenhouse Gas Emission Inventory Background

A GHG emission inventory documents the total GHG footprint, in metric tonne carbon dioxide equivalent (MTCDE), for which the College is either directly or indirectly responsible.

GHG emissions arise from the consumption or use of carbon-based fuels, products, and chemicals in the following activities**:** to condition space, produce goods, generate purchased electricity, transport people and products, and build, operate, and maintain facilities, housing, and grounds.

Several organizations have developed GHG emission inventory protocols to help entities account for their GHG emissions. The IPCC defined a methodology for countries to account for their national inventories. In 1998, a collaboration between the World Resources Institute and The World Business Council for Sustainable Development created the Greenhouse Gas Protocol, which is now the internationally accepted GHG accounting and reporting standard. It has been voluntarily adopted by dozens of governments and thousands of enterprises, including the U.S. EPA Climate Leaders program, the California Climate Action Registry, the Chicago Climate Exchange, the Clean Air Cool Planet Campus Carbon Calculator, and now the University of New Hampshire's Sustainability Indicator Management and Analysis Platform (SIMAP). This GHG inventory was drafted following the Greenhouse Gas Protocol accounting standards using the University of New Hampshire's SIMAP.

Methodology

Based on the Greenhouse Gas Protocol, emissions are separated into three categories or "scopes" defined by the College's level of control of the emissions. **Scope 1** includes direct emissions from sources that are owned and controlled by the College. **Scope 2** includes indirect emissions resulting from the generation of purchased energy (for example, electricity), and **Scope 3** includes indirect emissions that are a result of activities related to the College, but are not owned or controlled by the College (for example, employee

[2] The Loyalton Group. (2009). Skidmore College Carbon Footprint and Footprint Appendix. Matula, Terry. Available through the Skidmore Sustainability Office.

commuting). A GHG inventory not only accounts for activities that generate GHG emissions, but it also gives credit to activities that reduce GHG emissions such as carbon sinks (contractually preserved forests), renewable energy credits (RECs), composting, and other offsets. RECs are purchased certificates that represent 1 MWh of energy generated by renewable sources such as wind or solar. Carbon sinks and offset purchases are investments in projects that reduce carbon emissions such as composting food waste or a tree planting project. Below is a table showing examples of standard Scope 1, 2 and 3 emissions as well as the emissions from Skidmore that fall under each category.

Table 1. Greenhouse Gas Protocol and Skidmore Scope Emission Boundaries

Scope Description	GHG Protocol's Standard Boundaries	Skidmore's Scope Boundaries
Scope 1: Direct emissions that are owned and controlled by the College	• Consumption of fuels in vehicles and ground equipment, boilers, furnaces, space conditioning, water heating, production heating • Intentional or unintentional leakage of refrigerants and other GHG's (fugitive emissions) • Production of chemical emissions • Release of GHG's from livestock, crop husbandry, and grounds-keeping	• On-site combustion of gasoline, oil, natural gas, diesel and propane • Fugitive refrigerants • Fertilizers • Livestock (horses)
Scope 2: Indirect emissions that are from the purchase of power	• Purchased electricity • Purchased steam, hot water, or chilled water	• Purchased electricity
Scope 3: Indirect emissions that are a result of activities related to the College, but are not owned or controlled by the College	• Academic/business air travel • Employee, student, tenant, and user commuting • Event and lifestyle activities • Waste stream emissions • Extraction, production, and transport of purchased materials • Purchase and consumption of foods and food commodities • Transportation of purchased fuels • Vehicle emissions from outsourced contractors • Line or piping losses from electricity or plant transmission and distribution	• Faculty/staff/student daily commuting (automobile, bus, and carpool) • Faculty/Staff academic/business travel (air and train) • Student travel to and from campus to home (automobile, air, train and bus) • Student study abroad travel • Athletic air travel • Chartered bus travel • Solid waste • Paper consumption • Wastewater
Greenhouse Gas Offset and Carbon Sinks: Greenhouse gas reductions used to compensate for a greenhouse gas emission production elsewhere	• Renewable energy credits (RECs) purchased certificates for electricity generated with renewable sources • Forest protection offset • Composting	• Apartment composting • Dining Services composting • RECs from our solar and hydro project • REC purchases from energy supplier

Table 2. Skidmore's Scope 1 Emission Details

Emission Source	Use	Data Source
Combustion of Natural Gas	Heating buildings	Energy bills from Facilities Services
Combustion of Oil	Heating buildings	Energy bills from Facilities Services
Combustion of Gasoline	Fuel for campus vehicles and grounds equipment	Fuel bills from Facilities Services
Combustion of Diesel	Fuel for campus vehicles and generators	Fuel bills from Facilities Services
Combustion of Propane	Fuel for Bunsen burners, forklift as well as some generators and building heat	Fuel bills from Facilities Services
Fugitive Refrigerants	Includes refrigerants that escape into the atmosphere via links in equipment	Vendor from whom we buy refrigerants. Refrigerants bought for replacement are approximately equal to fugitive refrigerants

Scope 1 GHG emissions were calculated using the Sustainability Indicator Management and Analysis Platform (SIMAP) carbon emission equivalent coefficients.

Table 3. Skidmore's Scope 2 Emission Details

Emission Source	Use	Data Source
Purchased Electricity	Electricity	Electricity bills: transmission/distribution and procurement, electricity generation at solar array and small-hydro facility

Scope 2 emissions were calculated using the "market-based" method, allowing Skidmore to account for REC purchases and grid-tied renewable energy purchases such as our 2-megawatt solar array and small-hydro project. Scope 2 emissions are measured by the Emissions & Generation Resource Integrated Database (eGrid) factors.

Table 4. Skidmore's Scope 3 Emission Details

Emission Source	Data Source
Faculty/Staff/Student daily commuting	Transportation survey results were extrapolated to create a daily commuting emission average per person.
Faculty/Staff business/academic train travel	Travel agency data and transportation survey results were extrapolated to create an average train travel emission per Faculty/Staff.
Faculty/Staff business/academic air travel	Travel agency as well as transportation survey. Data was *not* extrapolated to create an average per person for agency booked travel.

Chartered bus travel	Bus company usage and mileage report.
Student travel to and from home to Skidmore	Commuting survey results were extrapolated to create an emission average for the student population.
Study abroad travel	Office of Off-Campus Study & Exchanges reports.
Solid waste	Waste hauler bills
Waste water	City water bills
Paper use	Reports received from Print Services. This report excludes WB Mason purchases due to limited access to data.

Scope 3 emissions are an optional reporting category; extrapolation of some data to make estimates for the community was required.

In October 2017, 32% of Skidmore faculty and staff and about 15% of students completed the 2017 Commuting and Travel Survey, which meets the Greenhouse Gas Protocol standards for data extrapolation. The survey was created to collect the travel distances and commuting habits of our campus community. Rather than conduct a second Commuting and Travel survey in the 2018-2019 Academic Year, the 2017 Commuting and Travel Survey results were used to extrapolate the emissions from faculty/staff/student commuting, train travel, and student travel to and from home based on 2018-2019 campus population. We chose to use the 2017 survey results for several reasons. First, the Sustainability Office conducted the 2017 Transportation Survey within one year of the 2019 GHG Inventory. We believe the survey results were still representative of our community's travel habits. We were also mindful of survey fatigue, and Skidmore had already conducted or planned to perform other important campus surveys. The Sustainability Office did not extrapolate the data reported for travel agency-booked air, athletic air, chartered bus, and study-abroad air travel.

Results

During the 2019 Fiscal Year (June 1, 2018 to May 31, 2019), Skidmore College emitted approximately 17,356 MTCDE gross, and 17,354 MTCDE net. Scope 1 sources contributed 5,845 MTCDE, Scope 2 contributed 2,321 MTCDE, and Scope 3 contributed about 9,190 MTCDE. Skidmore's apartment composting program and the Dining Hall composting program offset 2.28 MTCDE. It is important to note that the calculations for Scope 3 are less accurate than the calculations for Scopes 1 and 2 because Scope 3 sources are not directly controlled nor regulated by the college, and therefore harder to track.

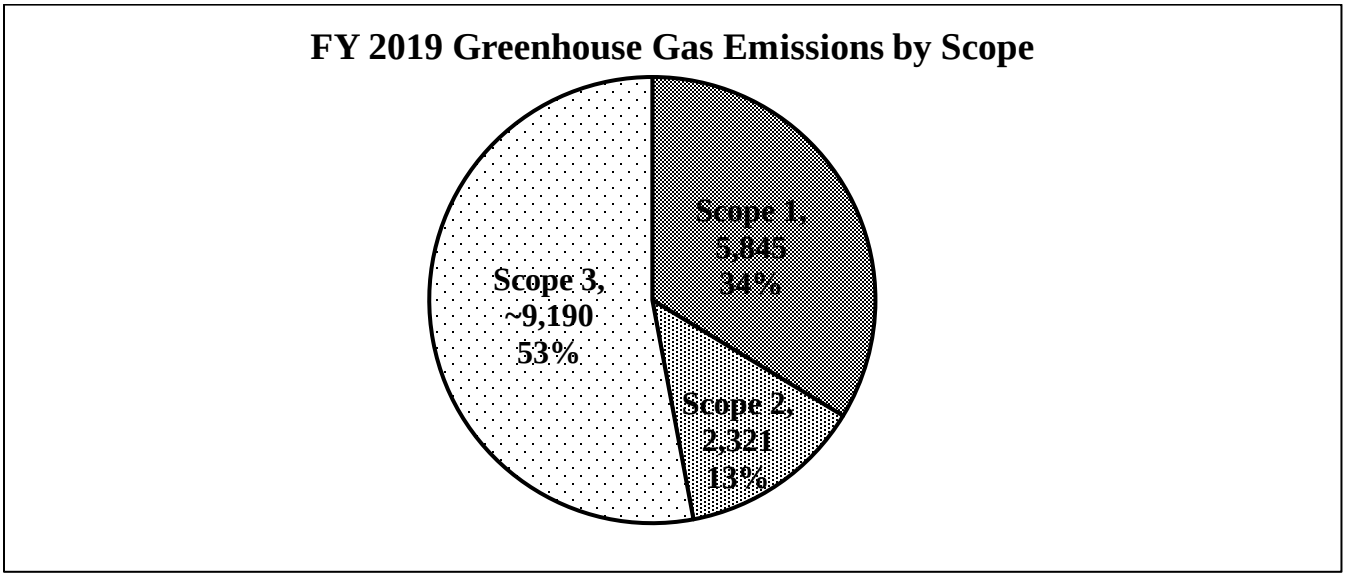

Figure I. Scope emission summary showing total institutional GHG emissions of approximately 17,356 MTCDE for Fiscal Year 2019.

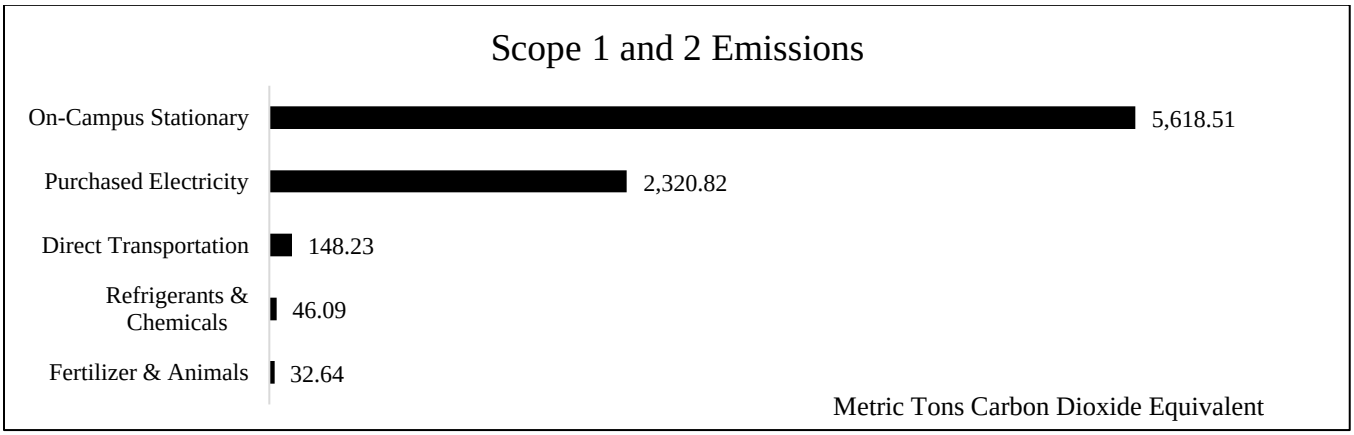

Figure II. Scope 1 and 2 emissions by source.

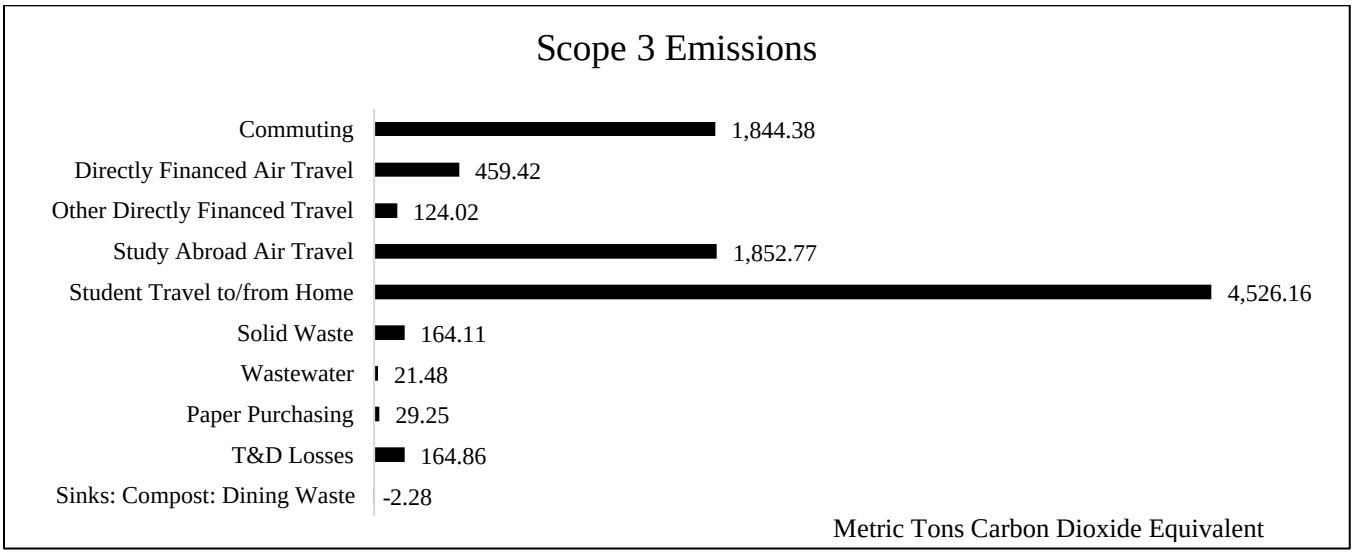

Figure III. Scope 3 emissions by source.

Discussion

There is an uneven distribution between Scope 1, 2, and 3 emissions: 34, 13, and 53 percent, respectively. Compared to the 2016 GHG Inventory, there was a 9% increase in Scope 1 emissions, a 43% reduction in Scope 2 emissions, and a 3% reduction in Scope 3 emissions.

Scope 1 Emissions

Skidmore released 5,845 MTCDE in Scope 1 emissions (34%). Skidmore's natural gas consumption increased 15% (about 14,000 MMBTU) compared to 2016. This increase in consumption is the primary cause for our overall increase in Scope 1 emissions. In addition to natural gas, Skidmore consumed more propane (3,014 gallons), gasoline (1,335 gallons), and distillate oil (306 gallons) in 2019 when compared to 2016. These increases were partially offset by reductions in fugitive refrigerants (104-kg reduction), diesel (6,620-gallon reduction), and fertilizer use (800-pound nitrogen reduction). Other changes in Scope 1 sources, such as emissions from animal husbandry, were negligible.

Scope 2 Emissions

Skidmore released 2,321 MTCDE in Scope 2 emission (13%). Although Skidmore consumed more electricity in 2018-2019, we document a 43% reduction in Scope 2 emissions compared to the 2016 GHG Inventory. The reduction in GHG emissions is driven by changes in Scope 2 accounting methodology. Rather than measuring Scope 2 emissions using the North American Energy Reliability Corporation (NERC) regional factors, institutions are now encouraged to use eGrid emissions factors whenever supplier-specific factors are unavailable. Skidmore could not obtain accurate supplier-specific factors and chose to use eGrid to measure our 2019 Scope 2 emissions. eGrid emissions are more specific to Skidmore's region and much "cleaner" than NERC, resulting in a significant reduction in reported Scope 2 GHG emissions. In the future, Skidmore will continue to use eGrid emissions factors unless supplier-specific emissions are available.

Scope 3 Emissions

Skidmore released 9,190 MTCDE in Scope 3 emissions (53%). We continued to measure a broader set of Scope 3 sources in this inventory. There was a modest 3% reduction in Scope 3 emissions compared to 2016. It is important to recognize the distinct difference between Scope 1 and 2 emissions compared to Scope 3. Data from Scopes 1 and 2 come from highly accurate utility bills, whereas Scope 3 data come from a variety of sources with varying degrees of accuracy. Nevertheless, we have stronger confidence in the accuracy of certain Scope 3 emissions including: air travel data from the Off-Campus Studies and Exchanges Office, faculty/staff air travel data from our travel agency, chartered bus travel and athletic air travel data, waste generation, paper consumption, and water consumption. Scope 3 emissions calculated for faculty/staff/student commuting, non-travel agency-booked air travel, faculty/staff train travel, and student travel to and from home were collected from the Commuting and Travel Survey and then extrapolated to the entire campus population Although this methodology is well within the boundary of compliance with the Greenhouse Gas Protocol, Scope 3 results should be treated as a grosser approximation than Scopes 1 and 2. Additionally, the College has less control over Scope 3 emissions, and in some cases, there are fewer mitigation strategies (for example, air travel). Lastly, more entities are beginning to account for their carbon emissions, which potentially leads to "double counting" certain emissions. For example, if a staff member takes the train to New York City for a meeting, the emissions of the trip could potentially be counted within Skidmore's GHG inventory as well as the train company's inventory. For these reasons, Scope 3 emissions are treated differently than Scopes 1 and 2.

Carbon Offsets

Skidmore's composting programs offset 2.28 MTCDE. The on-campus apartment composting program diverted 8 short tons of food waste from landfills during the 2018-2019 Academic Year. Student compost

managers weigh and record all collected food waste weekly. Our dining hall composting program diverted 56 short tons of pre-consumer food waste. At this time, pre-consumer dining hall food waste is collected and composted by Natural Upcycling. Data for the dining hall composting program is provided to Skidmore in the form of monthly bills.

Tracking progress toward 2025 GHG Reduction Goal

While standardized platforms exist to compare GHG emissions between institutions, Skidmore is more focused on comparing our progress against our 2000 baseline GHG Inventory. Our GHG reduction efforts are guided by the *2015-2025 Campus Sustainability Plan* Energy Goal 3: to reduce Scope 1 and 2 GHG emissions by 75% by 2025. A comparison of current emissions to our 2000 emissions levels show a 52% reduction in Scope 1 and 2 GHG from normalized 2000 levels (figure IV).

Skidmore's Scope 1 and 2 GHG emissions continue to trend downward. The reduction in total Scope 1 and Scope 2 GHG emissions is the product of almost two decades of investment in buildings and infrastructure that have increased campus efficiency, catalyzed new renewable energy development, and engaged the campus community in sustainability education and action. However, for the first time since 2000, we see an increase in Scope 1 emissions compared to our previous reports. Identifying results like these are a perfect example of why it is critical to conduct institutional GHG inventories. By recognizing this increase, Skidmore has time to consider possible Scope 1 mitigation strategies and re-align resources to implement the most effective strategies.

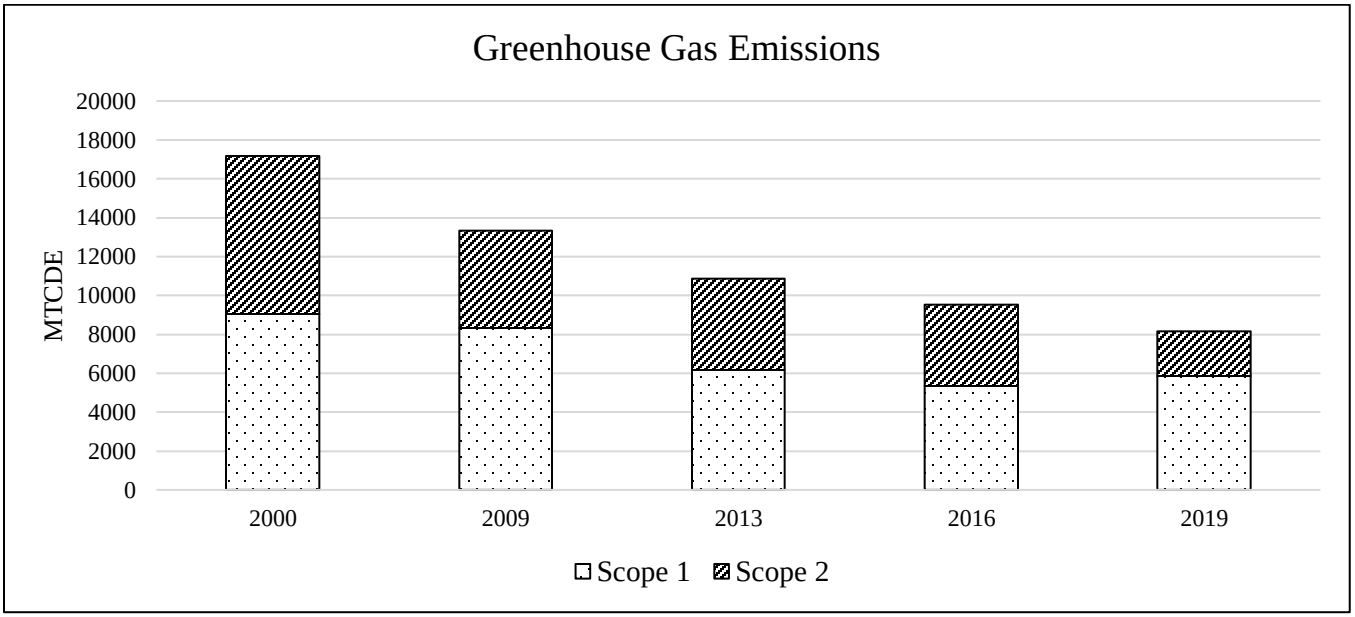

Figure IV. Scopes 1 and 2 GHG emissions by year

Conclusion

As the College looks forward at carbon reduction strategies, it is important to acknowledge all that Skidmore has already accomplished. Skidmore has transformed its campus into a living and learning sustainability laboratory. A few examples of GHG reduction projects include the College's geothermal heating and cooling systems, our 2-megawatt solar array, a power purchase agreement at a historical, low-impact hydro-electric dam, six solar thermal installations, as well as behavior change efforts that have encouraged sustainable habits and decision-making across the College. However, we should keep in mind that campus development and expanded facilities could increase energy consumption and GHG emissions, thus impacting our ability to meet the goals outlined in the *2015-2025 Campus Sustainability Plan*. We

will continue to monitor institutional emissions and work across campus on mitigation efforts wherever possible.

To learn more about Skidmore's sustainability initiatives, please visit: http://skidmore.edu/sustainability

This report was completed by the Skidmore Sustainability Office, with data from Facilities Services, Print Services, and Off-Campus Study and Exchanges.

Definitions:

Greenhouse Gas / Gases (GHG) –Atmospheric gases, such as carbon dioxide and methane, that affect the Earth's average temperature by trapping infrared radiation (heat) in the atmosphere.

Carbon Dioxide Equivalent (CDE) -All greenhouse gases (six including carbon dioxide) have a scientific equivalency to carbon dioxide; this unit is also expressed as equivalent carbon dioxide (ECO2)

Kg -Kilograms (2.2 lbs. per Kg), the standard for reporting small quantities of emissions, there are 1,000 Kg per metric tonne

Renewable Energy Credit (REC)- Certificate representing the environmental and social attributes of megawatt-hour of energy produced from renewable energy sources

Tons –A US standard of weight (2,000 pounds), sometimes called a "short ton" to note the difference with a metric tonne (2,205lbs)

Tonnes -Metric tons (2,205 pounds), the standard for reporting GHG emissions, shorthanded as MTCDE (metric tonnes of CDE) and MMTCDE (million tonnes CDE) for larger entities.