THE UNIVERSITY OF CHICAGO

Greenhouse Gas Emissions Inventory Overview 2012–2017

May 2018

THE UNIVERSITY OF CHICAGO | Office of Sustainability

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INTRODUCTION

Executive Summary

This report includes a brief background on environmental sustainability at the University of Chicago, an overview of the methodology employed to calculate the University's greenhouse gas emissions, and a summary of results of the University's current greenhouse gas emissions inventory. This inventory includes the University of Chicago Hyde Park campus, excluding the medical campus.

The University of Chicago

Located in the Hyde Park community on Chicago's South Side, 15 minutes south of the city center, the University of Chicago (uchicago.edu) is recognized as one of the world's most accomplished and prestigious intellectual communities. The University of Chicago Hyde Park campus covers 217 acres and includes more than 135 buildings operated and managed by Facilities Services. These buildings host and support multiple academic programs, research, arts, and culture. Various space functions include classrooms, laboratories, administration, athletics, and recreation. Facilities Services (facilities.uchicago.edu) is responsible for the design, construction, renovation, operation, and maintenance of campus and residential buildings, property, and infrastructure.

UChicago Sustainability

The University of Chicago is committed to creating a sustainable campus. To do this, the University has established an ambitious plan to quantify and manage greenhouse gas emissions, raise visibility and awareness of environmental issues on campus, and engage University students, faculty, and staff in developing sustainable programs and practices. The University is addressing the everyday issues of sustainability while seeking to understand the long-term impacts of decisions made today and valuing the benefits of a thriving planet.

With its tradition of rigorous inquiry, the University is uniquely positioned to evaluate the challenges of sustainability and create measurable results. One such challenge is climate change, a complex and global phenomenon that requires an in-depth understanding of greenhouse gas emissions. These emissions are a reflection of our resource consumption across several categories, so understanding the scope and sources of our emissions is a critical step in campus sustainability planning. Managing greenhouse gas emissions is one of the University's top sustainability priorities and a Facilities Services Theme.

The University of Chicago has a Sustainability Plan that includes goals in nine areas: Climate Change and Energy, High Performance Buildings, Multi-Modal Transportation, Waste Reduction, Food Systems, Green Space, Water Conservation, Environmentally Preferable Procurement, and Building Awareness and Partnerships. The Climate Change and Energy area of the Sustainability Plan outlines the 2025 goal.

2025 Goal

The University of Chicago recognizes the importance of acting responsibly to avoid the worst global impacts of climate change. Greenhouse gas emissions reduction is the key sustainability goal as the University seeks to understand and reduce its contribution to climate change.

The University has a goal to reduce its greenhouse gas emissions by 20 percent by 2025.

Greenhouse gas emissions are tied to all major campus operations, including buildings, transportation, waste, food, landscape, and procurement. Each of these areas is included in the Sustainability Plan, with energy efficiency in buildings as the top priority. By reducing building energy use, the University reduces greenhouse gas emissions and realizes major economic benefits.

The first step in managing greenhouse gas emissions is quantifying the emissions. The University's greenhouse gas emissions inventory provides a clear understanding of the emissions profile. Understanding the inventory enables the Office of Sustainability (sustainability.uchicago.edu), in collaboration with Facilities Services and various partners across campus, to develop sustainability programs targeted to areas of specific concern or inefficiency. Further, it allows the monitoring of sustainability progress for cost effectiveness, environmental benefit, and social responsibility.

BACKGROUND REPORTING AND METHODOLOGY

Inventory Overview

Greenhouse gas emissions inventory data was collected for fiscal years 2009 through 2017. The inventory was completed according to widely accepted referenced standards and approved calculation tools. The greenhouse gas emissions were quantified using the University of New Hampshire Campus Carbon Calculator, specifically designed for universities, and the Sustainability Indicator Management and Analysis Platform (SIMAP™). The referenced standards used for the greenhouse gas emissions inventory include *The Climate Registry General Reporting Protocol, Version 2.0* (2013) and *The World Resources Institute Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)* (2004).

Units of Measure and Calculations

Equivalent Carbon Dioxide (eCO_2)

Emissions from greenhouse gases (such as carbon dioxide, methane, and nitrous oxide) can be calculated by taking the amount of fossil fuel consumed and multiplying it by the appropriate emissions factor and global warming potential.

The global warming potential is used to convert metric tons of specific greenhouse gases to metric tons of carbon dioxide equivalents. This conversion is based on the gas's relative impact on climate change compared to that of carbon dioxide. The global warming potential indicates the contribution each gas makes to climate change relative to carbon dioxide.

For example, emitting a metric ton of methane (CH_4) has the same impact on climate change as emitting 25 metric tons of carbon dioxide, and emitting a metric ton of sulfur hexafluoride (SF_6) is equivalent to emitting 22,800 metric tons of carbon dioxide. The global warming potential of several prominent gases is reported in Table 1.1.

By converting all emissions into the same unit, the contribution of emissions sources can be more easily aggregated and compared. This also enables comparison between organizations. Therefore, the following units of measure are used for greenhouse gas emissions.

Units of Measure

Carbon Intensity
kilograms equivalent carbon dioxide per square foot per fiscal year
[kg eCO_2/sqft/FY]

Absolute Emissions
metric tons equivalent carbon dioxide per fiscal year
[MT eCO_2/FY]

Where:
eCO_2 = equivalent carbon dioxide
FY = fiscal year
MT = 1 metric ton = 1,000 kilograms

Temporal Boundary

The temporal boundary is fiscal years 2012 through 2017. The University's fiscal year is July 1 through June 30. For example, fiscal year 2012 is July 1, 2011, through June 30, 2012. See page 5 for more information.

Organizational Boundary

The operational control approach was used to define the organizational boundary, since this is how the University can make the most impact for a positive change. Operational control is defined as having the authority to introduce and implement operating policies. Under the operational control approach, emissions from each operation within the University's operational control must be reported.

Operational Boundary (Scopes)

Emissions from scopes 1, 2, and 3, as applicable to the University of Chicago, are tracked and reported, as indicated at the right and in Table 1.2. Some portions of scope 3 are based on estimates and calculations.

Greenhouse gas emissions from refrigerants and chemicals, including HFCs (hydrofluorocarbons) and PFCs (perfluorocarbons), are omitted from this report. The following greenhouse gases are also not reported: SF_6 (sulfur hexafluoride) and $(NF_3)^3$ (nitrogen trifluoride).

The following greenhouse gases are tracked and reported: CO_2 (carbon dioxide), CH_4 (methane), and N_2O (nitrous oxide).

Scopes

Scope 1: Direct Emissions (mandatory reporting)

- Combusting fuels on campus for heating and cooling
- Combusting fuels to power campus-owned transportation vehicles
- Off-gassing of fertilizers used on campus
- Fugitive release of refrigerants and chemicals that are greenhouse gases (not reported)

Scope 2: Indirect Emissions (mandatory reporting)
Off-campus combustion of fuels to produce electricity, steam, or chilled water for the campus

Scope 3: Other Indirect Emissions (optional reporting, not included in 2025 goal)

- Daily commuting to/from campus by students, faculty, and staff (fuel combusted in vehicles) (not reported)
- Air or ground travel for University business or for study abroad (fuel combusted in personal or transit vehicles/aircraft)
- Solid landfilled waste (landfill methane and/or emissions from incineration only)
- Transmission and distribution losses from scope 2 electricity

BACKGROUND REPORTING AND METHODOLOGY

Table 1.1: 100-Year Global Warming Potentials		
Common Name	**Chemical Formula**	**GWP**
Carbon dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_2O	298
Sulfur hexafluoride	SF_6	22,800

Source: IPCC Fourth Assessment Report

Table 1.2: Data Compiled for the Greenhouse Gas Emissions Inventory	
Institutional	**Unit of Measure**
Student, Faculty, and Staff Population	[count/FY]
FICM Gross Area	[sqft/FY]
Scope 1: Direct Emissions (mandatory reporting)	**Unit of Measure**
Distillate Fuel Oil #2*	[gallons/FY]
Natural Gas	[MMBtu/FY]
Unleaded Fuel (University-Owned Fleet and UGo Shuttles)	[gallons/FY]
Diesel Fuel (University-Owned Fleet and UGo Shuttles)	[gallons/FY]
Refrigerants and Chemicals, Fugitive Emissions†	[pounds/FY]
Fertilizer, Nitrogen	[pounds N/FY]
Scope 2: Indirect Emissions (mandatory reporting)	**Unit of Measure**
Electricity	[kWh/FY]
Scope 3: Other Indirect Emissions (optional reporting)	**Unit of Measure**
Student, Faculty, and Staff Commuting to/from Campus‡	[various]
Business Travel (Air, Automobile)	[miles/FY]
Study Abroad Travel (Air)	[miles/FY]
Landfilled Waste	[short tons§/FY]

* Distillate fuel oil #2 usage in FY2017 was zero gallons.
† Omitted from reporting. Expected to be a very small amount of overall University emissions. Reporting is anticipated when verifiable and reliable data is available.
‡ Omitted from reporting.
§ 1 short ton = 2,000 pounds

Target Base Year

The **target base year** is used as a basis for setting and tracking progress toward a greenhouse gas emissions reduction goal. In other words, the target base year is used to assess greenhouse gas emissions performance. For example, to assess performance for fiscal year 2017, the greenhouse gas emissions from fiscal year 2017 are compared to the greenhouse gas emissions from the target base year.

The target base year can be calculated or selected based on when reliable and verifiable emissions data are available. If calculated, the target base year is an average of annual emissions over several consecutive years. This is done to account for unusual fluctuations (such as weather) in greenhouse gas emissions that would make a single year's data unrepresentative of the University's typical emissions profile. The target base year emissions should be as close to a "typical" year as possible.

The results of the greenhouse gas emissions inventory data integrity analysis indicate that in order to comply with the *The World Resources Institute Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)* (2004), the target base year should be calculated using an average of fiscal years 2012 through 2014 because of the following reasons:

- This average is typical of the University's emissions profile.
- The data from these years is verifiable and reliable.

Therefore, the decision was made to begin the inventory at fiscal year 2012, but still keep the fiscal year 2009 through 2011 data on file for historical purposes. All future reporting, starting with this report, will include fiscal year 2012 through the present.

target base year = aveGHGEmissions(FY2012, FY2013, FY2014)

Analysis

The greenhouse gas emissions inventory was evaluated in two ways:

- Absolute Emissions
  [MT eCO_2/FY]
- Carbon Intensity
  (emissions per square foot)
  [kg eCO_2/sqft/FY]

Carbon intensity (emissions per square foot) allows the emissions to be examined without penalty or reward for such changes in square footage as new construction or demolition.

Carbon intensity is used for the 2025 goal, and is therefore the metric reported on pages 6 and 7 of this report.

2025 Goal Reporting Summary

2025 goal: The University has a goal to reduce its greenhouse gas emissions by 20 percent by 2025.

The 2025 goal is based on carbon intensity (emissions per square foot) and includes scopes 1 and 2.

The 2025 goal is measured by comparing 2025 greenhouse gas emissions to the target base year greenhouse gas emissions.

The target base year is an average of fiscal years 2012, 2013, and 2014 greenhouse gas emissions.

Emissions from scope 3, as applicable to the University of Chicago, are tracked and reported, although they are not part of the 2025 goal.

RESULTS

The results of the University of Chicago greenhouse gas emissions inventory indicate that carbon intensity (greenhouse gas emissions per square foot) for scopes 1 and 2 has declined approximately 6 percent from the target base year to fiscal year 2017.

The main reasons for this decline include:

- A decline in carbon intensity from natural gas consumption
- A decline in carbon intensity from electricity consumption

This means that for both natural gas and electricity, the University consumed less per square foot in campus buildings in fiscal year 2017 than in the target base year.

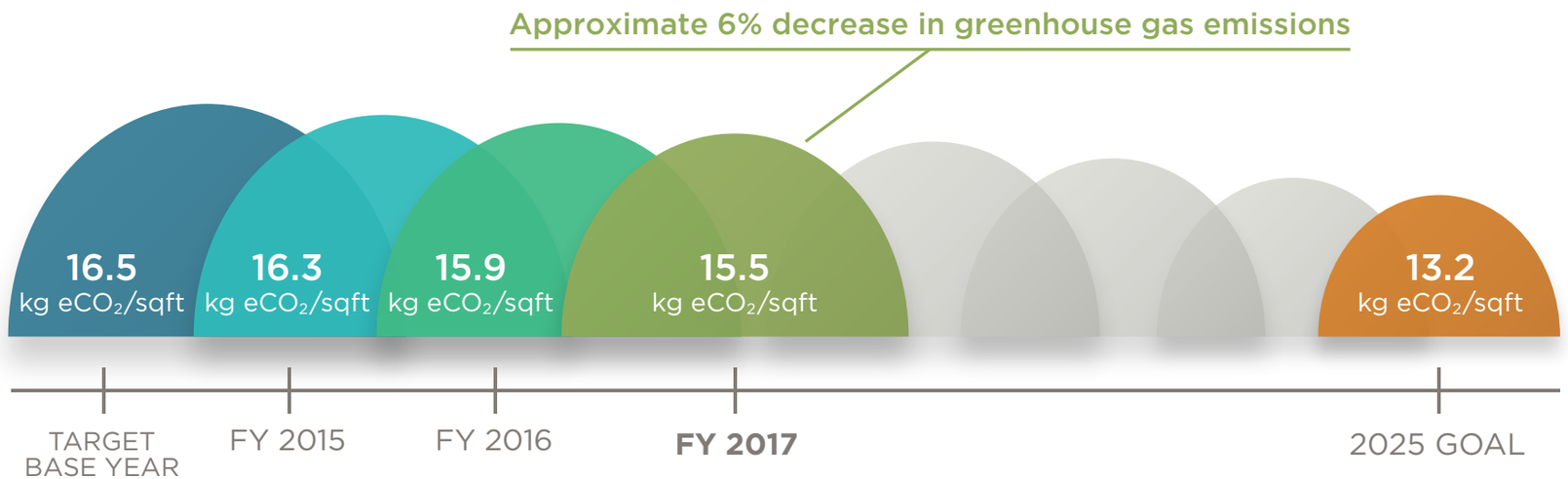
Figure 2.1 shows that carbon intensity has decreased annually from the target base year.

As indicated in Figures 2.2 and 2.3, in fiscal year 2017 electricity was 49 percent of the overall emissions, natural gas was 24 percent of the overall emissions, and 27 percent of the overall emissions were from other sources. Business air travel was the third-largest contributer to greenhouse gas emissions, at approximately 18 percent.

Figure 2.1: Scopes 1 and 2 Carbon Intensity (Greenhouse Gas Emissions Per Square Foot)

UNIVERSITY GREENHOUSE GAS EMISSIONS

Carbon intensity (greenhouse gas emissions per square foot) is measured in kilograms equivalent carbon dioxide per square foot (kg eCO_2/sqft). The 2025 goal is based on scopes 1 and 2 carbon intensity.

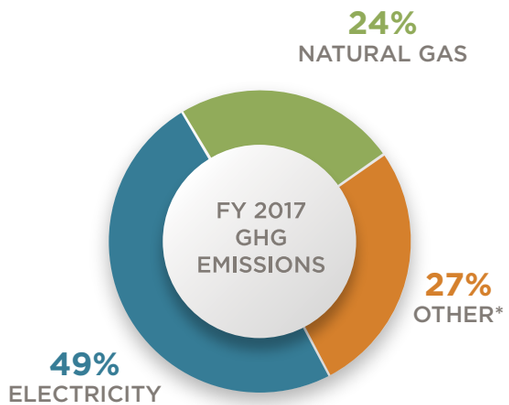


A NOTE ON TARGET BASE YEAR The target base year is calculated and is the average of the greenhouse gas emissions from fiscal years 2012 through 2014. It is used for setting and tracking progress toward the Sustainability Plan greenhouse gas emissions reduction goal. For example, to assess performance for fiscal year 2017, the greenhouse gas emissions from fiscal year 2017 (15.5 kg eCO_2/sqft) are compared to the greenhouse gas emissions from the target base year (16.5 kg eCO_2/sqft). This comparison reveals an approximate 6 percent decrease in greenhouse gas emissions. Greenhouse gas emissions for each subsequent year will be compared to the target base year, and performance will be assessed accordingly.

RESULTS

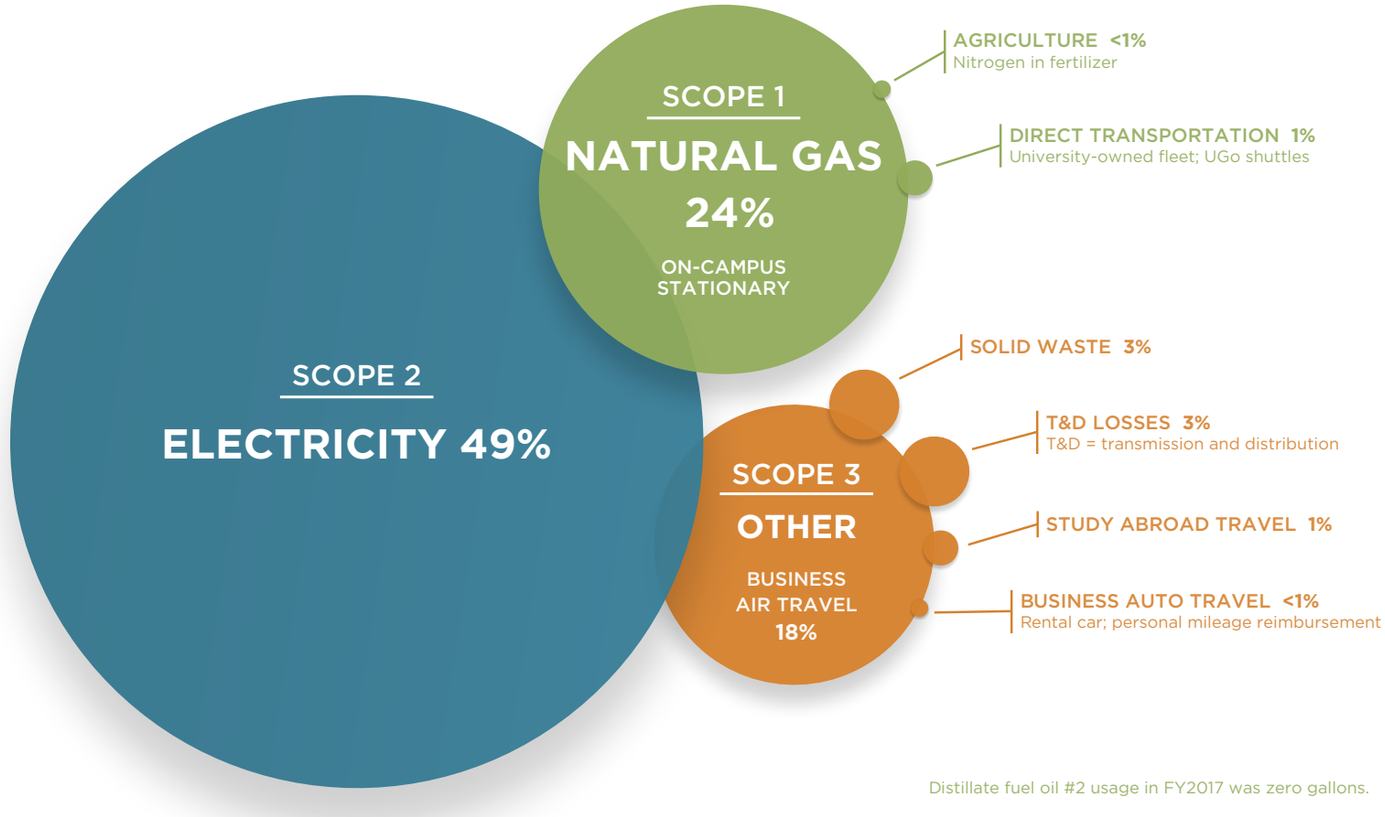
Figure 2.2: Greenhouse Gas Emissions by Source (FY2017)

Natural gas and electricity usage contributed to approximately 73 percent of University greenhouse gas emissions in fiscal year 2017.



*Other includes University-owned fleet, UGo shuttles, agriculture (nitrogen in fertilizer), business air and automobile travel, study abroad travel, solid waste, and transmission and distribution losses from scope 2 electricity.

Figure 2.3: Scopes 1, 2, and 3 Greenhouse Gas Emissions by Source (FY2017)



Distillate fuel oil #2 usage in FY2017 was zero gallons.

Emissions Reduction Plan

Managing greenhouse gas emissions is a top priority for the University; it allows for progress in multiple areas of the Sustainability Plan. The results of the University's greenhouse gas emissions inventory indicate progress, but underscore the need for additional action, especially in the area of energy efficiency. It is necessary to reduce electricity and natural gas consumption—the two largest contributors to the University's greenhouse gas emissions. Since the 2025 goal is based on scopes 1 and 2 emissions, and natural gas and electricity usage in campus buildings contributes to approximately 70 percent of the University's greenhouse gas emissions, limiting electricity and natural gas consumption in campus buildings will make the biggest impact on reducing greenhouse gas emissions.

To achieve the 2025 goal, energy efficiency projects are currently planned for fiscal years 2018 through 2025, as outlined in the University of Chicago Greenhouse Gas Emissions Reduction Plan (FY2018–FY2025).

ADDITIONAL RESOURCES

Acronyms and Chemical Formulas

Maroon text indicates UChicago-specific acronyms

Btu ..... British thermal unit

CCC ..... University of New Hampshire Campus Carbon Calculator
Also referred to as UNH CCC

CH_4 ..... methane

CO_2 ..... carbon dioxide

CR ..... The Climate Registry

eCO_2 ..... equivalent CO_2

EF ..... emissions factor

FICM ..... Facilities Inventory and Classification Manual

FS ..... Facilities Services

$(FS)^2$ ..... Facilities Services Facility Standards

FY ..... fiscal year

GHG ..... greenhouse gas

GWP ..... global warming potential

HFC ..... hydrofluorocarbons

kWh ..... kilowatt hour

MMBtu ..... 1 MMBtu = $1x10^6$ Btu

MT ..... 1 metric ton = 1,000 kg

$(NF_3)^3$ ..... nitrogen trifluoride

N_2O ..... nitrous oxide

OS ..... Office of Sustainability

PFC ..... perfluorocarbons

SF_6 ..... sulfur hexafluoride

SP ..... Sustainability Plan

UNH CCC ..... University of New Hampshire Campus Carbon Calculator

Links

The University of Chicago
uchicago.edu

Facilities Services
facilities.uchicago.edu

Office of Sustainability
sustainability.uchicago.edu

Sustainability Plan
sustainability.uchicago.edu/sp

Facilities Services Facility Standards (FS)²
facilities.uchicago.edu/about/partners/facilitiesstandards

Sources

Referenced Standards
The Climate Registry General Reporting Protocol, Version 2.0 (2013)

The World Resources Institute Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition) (2004)

Global Warming Potentials (GWPs)
IPCC Fourth Assessment Report

Emissions Factors
United States Environmental Protection Agency

Climate Zone
Chicago is in CBECS climate zone 2.
United States Climate Zones for 2003 CBECS (Commercial Buildings Energy Consumption Survey)

Area (square footage)
Facilities Inventory and Classification Manual (FICM)

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May 2018

sustainability.uchicago.edu

ACKNOWLEDGMENTS
Collecting the data required for the University of Chicago greenhouse gas emissions inventory for fiscal years 2009 through 2017 was a collaborative effort, involving contributions from many University departments and individuals. The Office of Sustainability offers a sincere thank you to everyone who contributed.

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