

University of North Carolina Greensboro
Greenhouse Gas Inventory Report
2009-2018



UNC GREENSBORO

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INTRODUCTION

This report tracks the anthropogenic greenhouse gas (GHG) emissions, or carbon footprint, for the University of North Carolina at Greensboro (UNCG) campus for the fiscal years from 2009 to 2018. It provides details concerning the trend of UNCG's greenhouse gas emissions dating back to 2009, the year UNCG first conducted an inventory and the year the University considers to be its baseline by which the University measures its progress in becoming climate neutral by 2050 – a goal stated in the University's Climate Action Plan adopted in 2013.¹

Previous GHG reports conducted by UNCG utilized the Clean Air - Cool Planet Campus Carbon Calculator (CCC), which was originally developed in 2001 by the former non-profit Clean Air - Cool Planet, in partnership with the Sustainability Institute at the University of New Hampshire (UNH), and released to the public in 2004. UNH acquired the CCC in 2014.

In their continued effort to develop a tool which provides as concise a measurement as possible, the Sustainability Institute at UNH discontinued the CCC in the spring of 2018 and replaced it with their new online calculator, the **Sustainability Indicator Management and Analysis Platform (SIMAP)**,² which UNCG used to determine the calculations for this report.

As stated in the SIMAP User Guide,

...the carbon footprint is a measure of the greenhouse gases emitted from a campus' activities. It includes all six greenhouse gases specified by the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFC), and perfluorocarbons (PFC), and sulfur hexafluoride (SF₆). The platform was based on the workbooks provided by the Intergovernmental Panel on Climate Change (IPCC) for national-level inventories, and it incorporates data from the Fourth Assessment Report of the IPCC. SIMAP has adapted this IPCC data for use at institutions like a college or university but follows the same protocols.

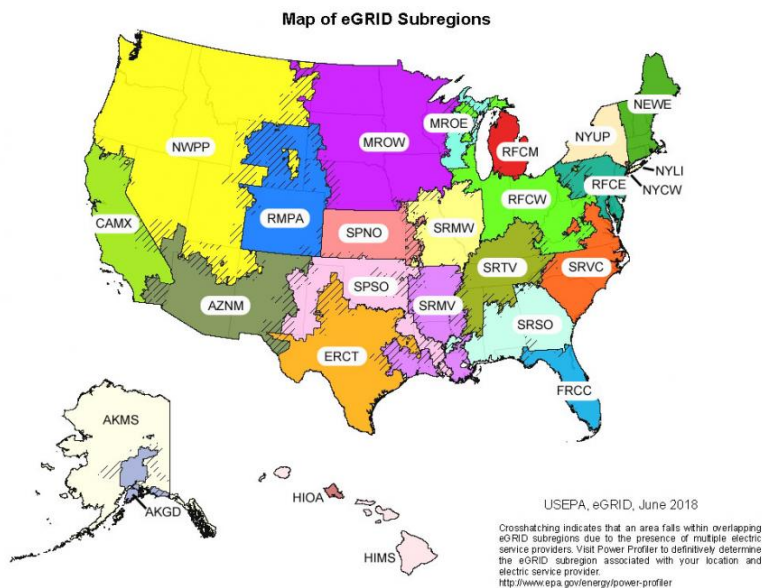
SIMAP's calculations also incorporate guidance provided by the Greenhouse Gas Protocol Initiative (GGPI),³ which is a multi-stakeholder partnership of businesses, governments, and other interested parties that was established by the World Resources Institute and the World Business Council for Sustainable Development in 1998. In 2001, it published the *GHG Protocol Corporate Standard*, "a step-by-step guide for companies to use in quantifying their data." In 2015, the GGPI provided additional guidance on measuring Scope 2 (purchased electricity) emissions and recommended companies report their Scope 2 emissions in two ways: using a location-based method and a market-based method. Both of which UNCG calculated using SIMAP.

¹ <https://sustainability.uncg.edu/wp-content/uploads/2016/06/UNCG-Climate-Action-Plan.pdf>

² <https://sustainableunh.unh.edu/calculator>

³ <https://ghgprotocol.org>

The **location-based** method uses emissions factors from the Emissions & Generation Resource Integrated Database (eGRID), which is a comprehensive inventory of data organized, collected, and administered by the Environmental Protection Agency and the Energy Information Administration⁴. It contains the environmental characteristics of almost all electric power generated in the United States based on available plant-specific data for all U.S. electricity generating plants that provide power to the electric grid and report data to the U.S. government. The eGRID provides emissions factors (average kilograms of CO₂ per kWh from energy generation sources) for 24 regions within the United States. North Carolina (and UNCG) are within the SRVC region.



The **market-based** method was established in 2015 with the release of the Scope 2 Guidance from the GGPI. Its Scope 2 calculations differ from the location-based method's in a few ways. It allows for the input of renewable energy generated on-site and for any renewable energy credits purchased by electricity users.⁵ It also allows for the input of supplier-specific emissions factors, which in UNCG's case are the emissions factors of its utility provider Duke Energy, in place of the eGRID emissions factors.

Thus, where the location-based method places UNCG's Scope 2 emissions in the context of energy generation sources (nuclear, coal, natural gas, etc.) within a larger geographical region, the market-based method localizes the university's Scope 2 emissions to the sources generating the electricity it purchases directly from Duke Energy.

⁴ www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

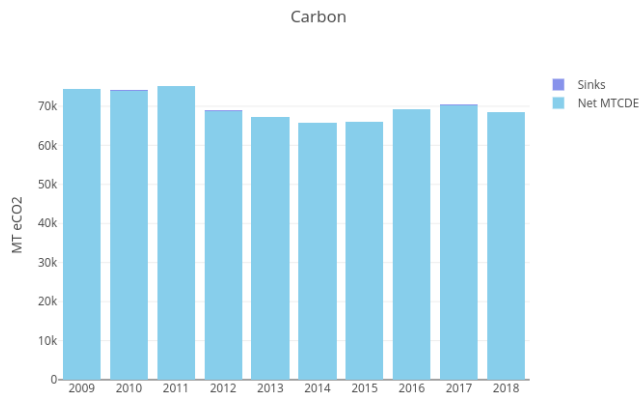
⁵ UNCG does not currently purchase RECs and its significant first solar installation will come online in 2020 when construction of the Nursing & Instructional Building is complete.

RESULTS

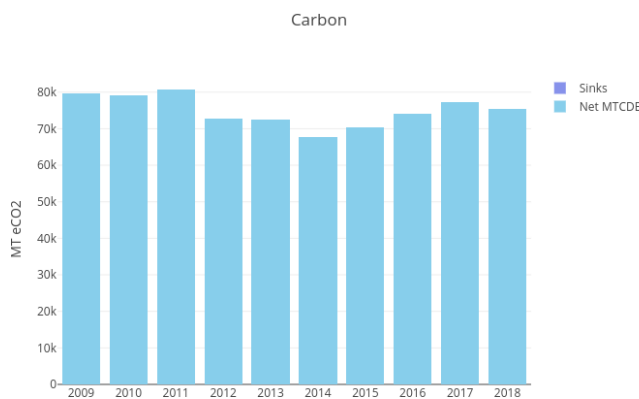
In 2007, UNCG became a member of the Association for the Advancement of Sustainability in Higher Education (AASHE) to further its campus efforts toward building a healthy and just world. As part of its membership, UNCG utilizes AASHE’s Sustainability Tracking, Assessment & Rating System (STARS), which measures and encourages sustainability in all aspects of higher education.

While UNCG calculated its carbon footprint using both the location-based and market-based methods, AASHE STARS requires universities to report their greenhouse gas inventory using only the market-based method. For that reason, and because of its use of supplier-specific emissions factors, much of this report will focus on the results from the market-based method.

Using the **market-based** method, UNCG’s carbon footprint for fiscal year 2018 is **68,368 MTeCO₂** (metric ton equivalent of carbon dioxide), which is an 8% reduction from its 2009 footprint of 74,437 MTeCO₂.



Using the **location-based** method, UNCG’s carbon footprint for fiscal year 2018 is **75,447 MTeCO₂**, which is a 5% reduction from its 2009 footprint of 79,649 MTeCO₂⁶.

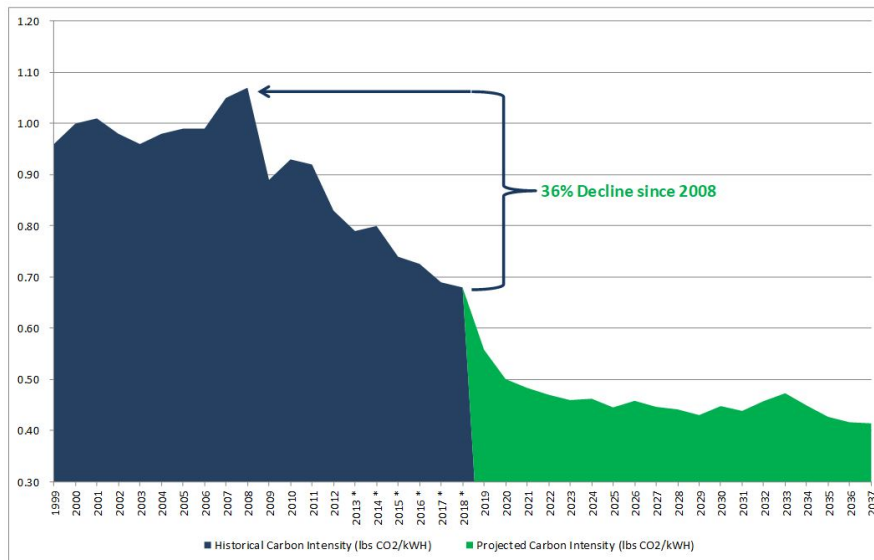


⁶ All data dating back to 2009 was recalculated using SIMAP for both methods.

It is important to note that between the two calculation methods, UNCG’s carbon footprint from the market-based method is 10% smaller when compared to the location-based method result. This is due to Duke Energy’s emissions factors being approximately 21% lower than the eGRID SRVC region’s emissions factors. The chart below shows the trends for the various types of factors (eGRID, supplier-specific, and residual) over the past ten years.⁷

Year	eGrid	Residual	CFM	Supplier-specific	Unit
2009	0.469862084	0.469862084	N/A	0.4036972	kilogram CO2 / kWh
2010	0.486999448	0.486999448	N/A	0.4218409	kilogram CO2 / kWh
2011	0.486999448	0.486999448	N/A	0.41730498	kilogram CO2 / kWh
2012	0.423144436	0.423144436	N/A	0.37648166	kilogram CO2 / kWh
2013	0.423144436	0.423144436	N/A	0.35833797	kilogram CO2 / kWh
2014	0.388539196	0.388539196	N/A	0.36287389	kilogram CO2 / kWh
2015	0.388539196	0.585502344	N/A	0.33665835	kilogram CO2 / kWh
2016	0.388539196	0.538010424	N/A	0.33112243	kilogram CO2 / kWh
2017	0.388539196	0.527019696	N/A	0.31297873	kilogram CO2 / kWh
2018	0.388539196	0.527019696	N/A	0.30844281	kilogram CO2 / kWh

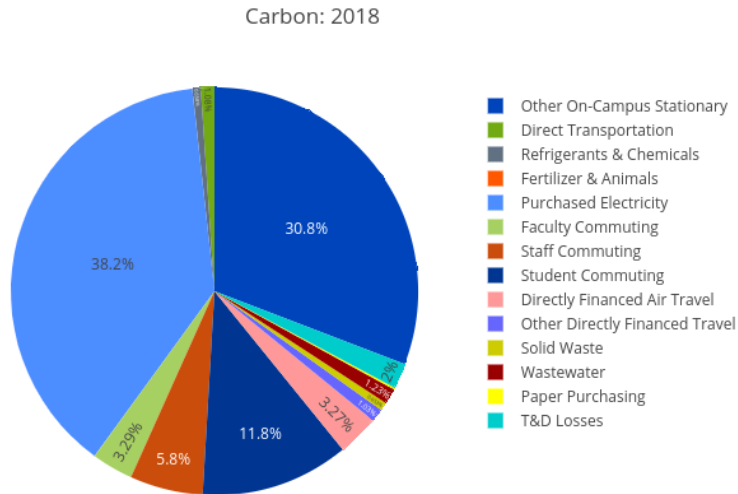
The downward trend of Duke Energy’s annual emissions factors also plays a role in UNCG’s overall reduction in its carbon footprint because Duke has decreased its carbon intensity by 36% since 2008.



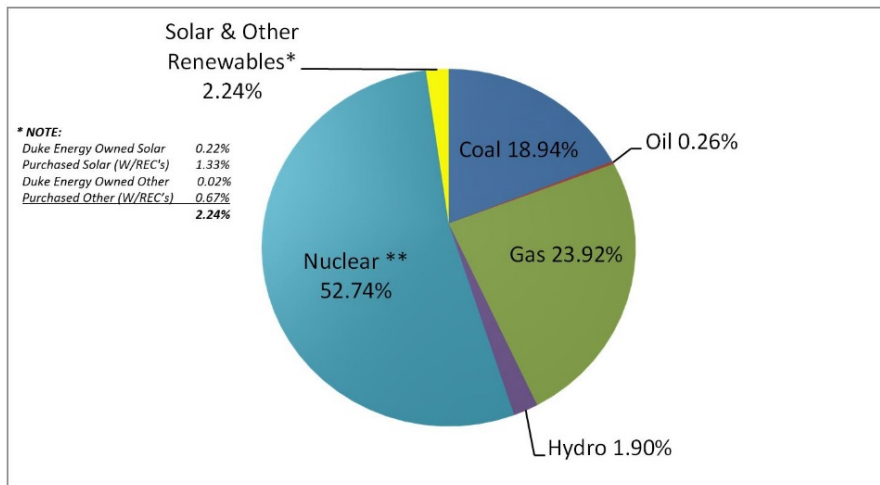
⁷ Should supplier-specific emission factors not be available or used, starting in 2015, the market-based method utilizes a “residual factor” from energy sources in geographical regions, larger and fewer than the eGRID regions, determined by the North American Reliability Corporation (NERC).

Additionally, knowing the sources of Duke Energy electricity generation, 43% of which is from fossil fuels, is important because the greenhouse gases associated with UNCG’s purchased electricity account for the largest percentage (38.2%) of the University’s carbon footprint.⁸

UNCG Market-based Percentages



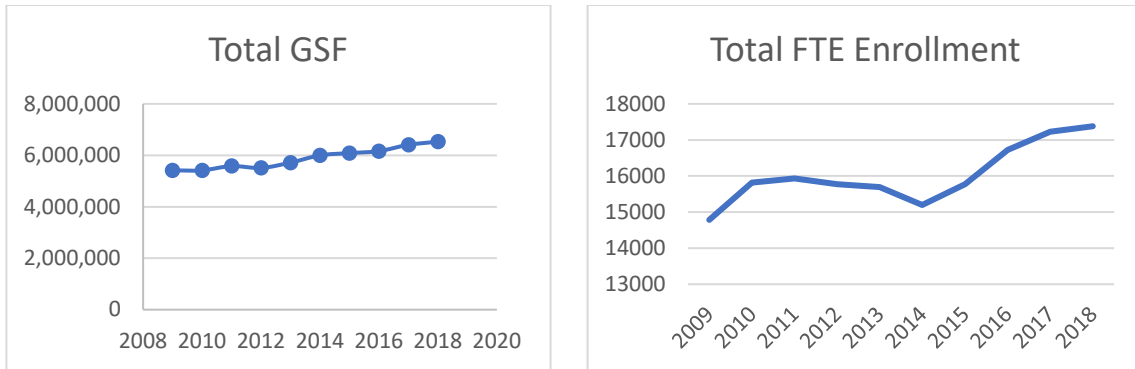
Duke Energy’s 2018 Carolinas’ Combined Fleet Energy Sources (DEC & DEP Owned & Purchased)



⁸ More information about other sources of UNCG’s greenhouse gases can be found in the SIMAP Scope Definitions and additional infographics appendices at the end of this report.

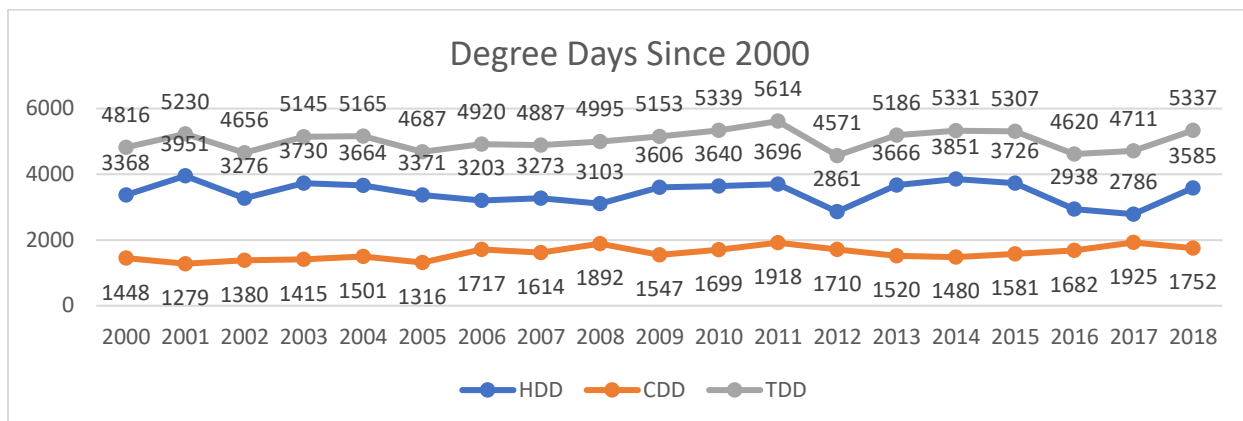
OTHER TRENDS

Between 2009 and 2018, UNCG has constructed more than a dozen new buildings, adding over approximately 1.2 million combined square feet, and has enrolled approximately 2,600 more students. That’s approximately a 21% increase in gross square feet (GSF) and an 18% increase in the student population over the past ten fiscal years.



As visible in the market-based total MTeCO2 bar graph on pages 5 and 17, UNCG’s total emissions were at their lowest in FY2014 when the university had achieved an 11% reduction from 2009. By 2017, emissions had climbed back up 6%. Though emissions then declined 3% from 2017 to 2018, UNCG’s carbon footprint has climbed 4%, starting in FY15.

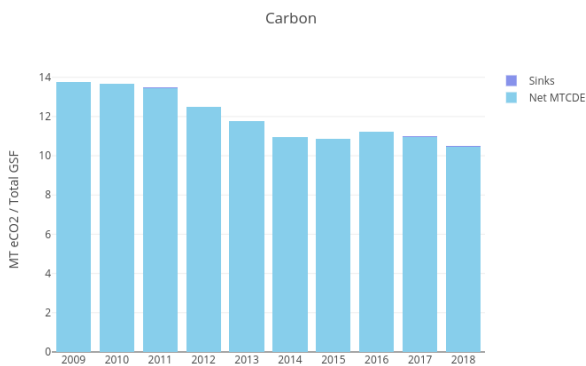
Additionally, the frequency and intensity to which average daily temperatures rise above and dip below 65 degrees Fahrenheit continues to pose a challenge, as intense temperatures (higher highs and lower lows) increase the need to use HVAC systems on campus. Over the last 18 years, the average number of annual cooling degree days (CDD) in the Triad region increased by 21% (13% since 2009), with average annual heating degree days (HDD) becoming more erratic.⁹



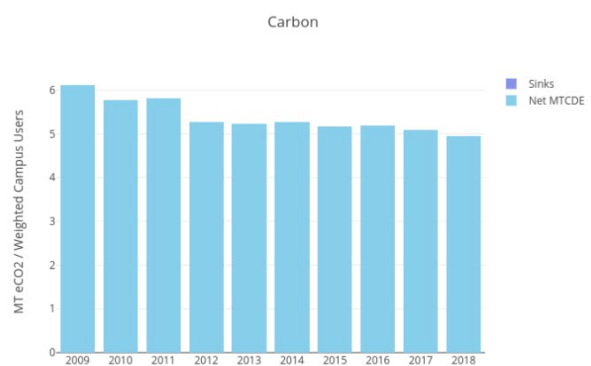
⁹ A degree day being equal to one degree above or below 65 degrees Fahrenheit based on the average temperature for the day. For example, an average temperature of 75 for a day is equal to 10 cooling degree days. Source: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/degree_days/

Despite those trends which lead to increased energy demand, thanks to UNCG’s commitments to improving its energy data analysis capabilities and to designing new buildings to United States Green Building Council’s LEED Silver standards, which improve efficiency in heating, cooling, and lighting buildings, the University has achieved a decrease of 24% MTeCO₂ per 1000 gross square feet and a decrease of 18% MTeCO₂ per weighted campus user since 2009. The positive impact of those commitments is also reflected in millions of dollars of avoided costs in utility bills and an 18% reduction of energy consumption per square foot since 2003 – about which more detail can be read in UNCG’s annual Strategic Energy Plan reports¹⁰.

MTeCO₂ per 1000 GSF



MTeCO₂ per Weighted Campus Users



NEXT STEPS

The University of North Carolina at Greensboro will continue its commitments to achieving climate neutrality by 2050 and to meeting the goals of North Carolina Governor Roy Cooper’s Executive Order 80, which put the State on a path to reduce statewide greenhouse gas emissions to 40% below 2005 levels and to reduce energy consumption per square foot in state-owned buildings by at least 40% from the fiscal year 2002-2003 levels by 2025.

In that pursuit, UNCG will continue to analyze its carbon footprint and identify and improve best practices to reduce greenhouse gas emissions, particularly regarding pollutants that contribute a significant percentage of its emissions, e.g., purchased electricity, its campus vehicle fleet and use of stationary sources (distillate oil, natural gas, and propane), and student and employee commuting.

UNCG will also work to identify gaps in its GHG data collection and improve best practices for collecting data that is as accurate as possible. That process will also include a continued multi-stakeholder examination and implementation of the University’s Campus Master Plan, Climate Action Plan, Strategic Energy Plan, and Transportation Plan.

¹⁰ <https://sustainability.uncg.edu/action-areas/energy/>

CONTRIBUTORS

Nihal Al Raees, Energy Analyst, UNCG
Randy Bennett, University Controller, UNCG
Rochal Blackwell, Vertical Marketing Manager, Office Depot
Douglas Cato, Campus Mechanical Engineer, UNCG
Maggie Capone-Chrismon, Assistant Director, Space Utilization & Planning, UNCG
Desiree Coltrane, Associate Director, Parking Operations & Campus Access Management, UNCG
Andrew Currin, Assistant Director for Grounds, UNCG
Briana DeFlavio, Strategic Account Leader, Staples
Gary Denny, HVAC Supervisor, UNCG
Dr. Shanna N. Eller, Sustainability Coordinator, UNCG
John Guffey, Spartan Printing, UNCG
Ben Kunka, Waste Reduction & Recycling Surplus Warehouse Supervisor, UNCG
Quita Loflin, Assistant Controller, UNCG
Michael Logan, Director of Purchasing and Contracts, UNCG
Sean MacInnes, Sustainability Specialist (Lead Author), UNCG
John Millard, Account Executive, Duke Energy
Scott Milman, Assistant Vice Chancellor for Campus Enterprises and Real Estate, UNCG
Debbie Reynolds, Facilities Operations Accounting, UNCG
Guy Sanders, Associate Director for Administrative Operations, Housing & Residence Life, UNCG
Judy Smith, Director, Office of Space Utilization and Planning, UNCG
Jorge Quintal, Associate Vice Chancellor for Facilities, Chief Sustainability Officer, UNCG
Dr. Bill Zhang, Associate Director of Operations & External Reports, Institutional Research, UNCG

APPENDICES

SIMAP SCOPE DEFINITIONS

Scope 1 – Direct emissions from sources that are owned and/or controlled by your institution. This includes combustion of fossil fuels in college-owned facilities or vehicles, fugitive emissions from refrigeration, and emissions from on-campus agriculture or livestock husbandry. Your institution has complete control over these emissions, and they are no-one else’s responsibility. Examples of these generally include the following:

- On-Campus Stationary Sources
Emissions from all on-campus fuel combustion, excluding vehicle fuels
- Direct Transportation Sources
Emissions from all fuel used in the institution’s fleet (the vehicles it owns)
- Agriculture
N2O emissions from fertilizer use and CH4 emissions from animals (cattle, horses, etc.)
- Refrigeration and other Chemicals
Fugitive emissions from refrigerants and other sources

Scope 2 – Indirect emissions from sources that are neither owned nor operated by your institution but whose products are directly linked to on campus energy consumption. This includes purchased energy: electricity, steam, and chilled water. Although your institution is not directly responsible for these emissions, it is strongly implicated. These emissions come from converting energy sources that release greenhouse gas emissions when used (fossil fuels) to energy sources that do not (electricity, steam, or chilled water). Although your institution did not burn the coal to make the electricity you use, someone had to, and although the electricity producer emitted the gasses, they did not use any of the energy produced.

- Purchased Electricity
Emissions from the production of any electricity the institution purchases off-campus
- Purchased Steam
Emissions from the production of steam purchased from off-campus
- Purchased Chilled Water
Emissions from the production of chilled water purchased from off-campus
- Renewable Energy Certificates

Scope 3 – Other emissions attributed to your institution, deemed “optional” emissions by corporate inventories. This includes emissions from sources that are neither owned nor operated by your institution but are either directly financed (i.e. commercial air travel paid for by the institution) or are otherwise linked to the campus via influence or encouragement (i.e. air travel for study abroad programs, regular faculty, staff, and student commuting). Many Scope 3 emissions are considered “upstream” like the emissions associated with making and transporting plastic silverware. To prevent institutions from accounting for too many upstream emissions, most campuses define distinct financial or control boundaries to distinguish which Scope 3 emissions they are indeed responsible for.

- Commuting

Emissions from regular commuting by faculty, staff, or students (does NOT include student travel to and from home over breaks) (note – student commuting is generally considered to be under more institutional control than staff/faculty commuting)

- Directly Financed Outsourced Transportation

Emissions from travel that is paid for by the institution, but does not occur in fleet vehicles (business trips in commercial aircraft, staff travel in personal vehicles where mileage is reimbursed, etc.)

- Study Abroad Air Travel

Emissions from students flying to their study abroad location

- Transportation and Distribution Losses from Purchased Energy

Energy lost while transporting purchased electricity, steam, or chilled water to campus

- Food

Emissions from producing, transporting, preparing, consuming, and composting food

- Upstream Emissions from Directly Financed Purchases

Emissions associated with paper production, food production, fuel extraction, etc.

- Solid Waste and Wastewater

Emissions from managing the institution’s waste (incineration, landfilling, etc.)

FY18 MTeCO2 Total & Per Category¹

Categories

Carbon

Fiscal Year	Scope	Source	CO2 (kg)	CO2 (MTCDE)	CH4 (kg)	CH4 (MTCDE)	N2O (kg)	N2O (MTCDE)	GHG MTCDE
2018	1	Other On-Campus Stationary	20,997,966	20,997.97	2,151	60.23	51	13.61	21,071.81
2018	1	Direct Transportation	725,225	725.22	106	2.98	38	10.02	738.22
2018	1	Refrigerants & Chemicals	0	0.00	0	0.00	0	0.00	449.69
2018	1	Fertilizer & Animals	0	0.00	0	0.00	16	4.23	4.23
2018	2	Purchased Electricity	25,905,570	25,905.57	3,647	102.11	525	139.09	26,146.76
2018	3	Faculty Commuting	2,198,556	2,198.56	432	12.09	146	38.64	2,249.29
2018	3	Staff Commuting	3,874,617	3,874.62	761	21.32	257	68.10	3,964.04
2018	3	Student Commuting	7,905,898	7,905.90	1,199	33.58	421	111.49	8,050.97
2018	3	Directly Financed Air Travel	2,230,346	2,230.35	22	0.62	25	6.74	2,237.70
2018	3	Other Directly Financed Travel	689,825	689.83	145	4.06	49	12.87	706.76
2018	3	Solid Waste	-320	-0.32	15,946	446.50	0	0.00	446.18
2018	3	Wastewater	0	0.00	28,228	790.38	196	52.05	842.43
2018	3	Paper Purchasing	0	0.00	0	0.00	0	0.00	96.37
2018	3	T&D Losses	1,354,842	1,354.84	191	5.34	27	7.27	1,367.46

Scopes

Carbon

Fiscal Year	Scope	CO2 (kg)	CH4 (kg)	N2O (kg)	GHG MTCDE
2018	1	21,723,191	2,257	105	22,263.95
2018	2	25,905,570	3,647	525	26,146.76
2018	3	18,253,764	46,925	1,121	19,961.20

Total MTeCO2

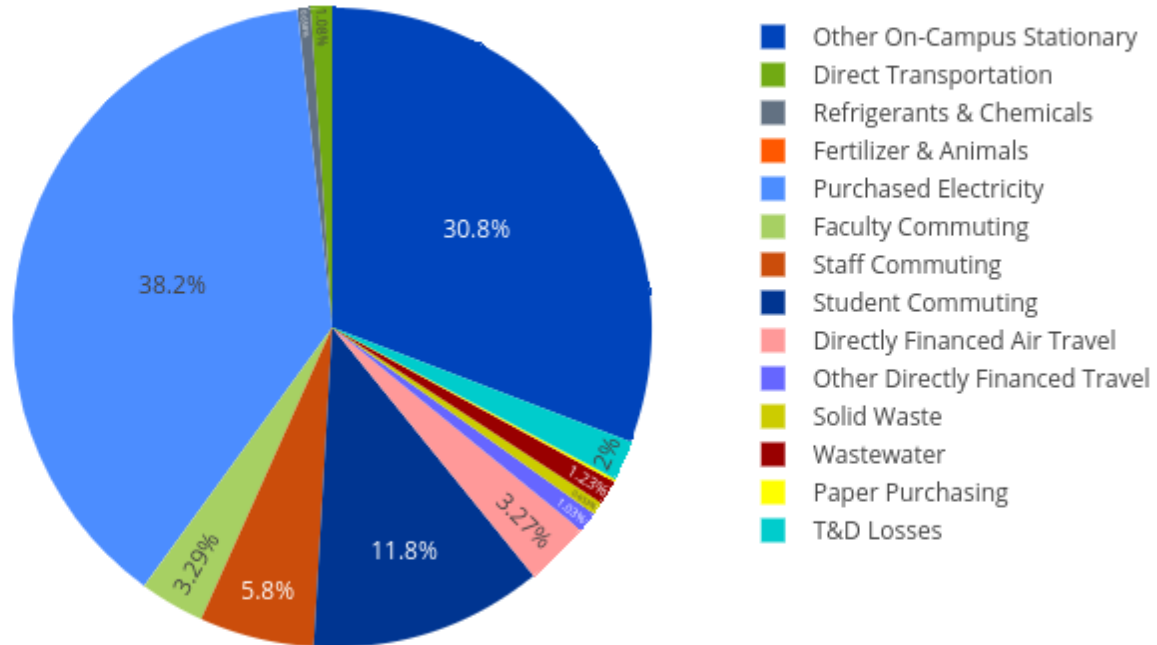
Carbon

Fiscal Year	CO2 (kg)	CH4 (kg)	N2O (kg)	Gross MTCDE	Offsets (MTCDE)	Compost (MTCDE)	Non-Additional Sequestration (MTCDE)	Biogenic (MTCDE)	Net MTCDE
2018	65,882,525	52,829	1,751	68,371.91	0.00	-3.53	72.00	15.05	68,368.38

¹ All data and graphics in this appendix were compiled using the market-based calculation method.

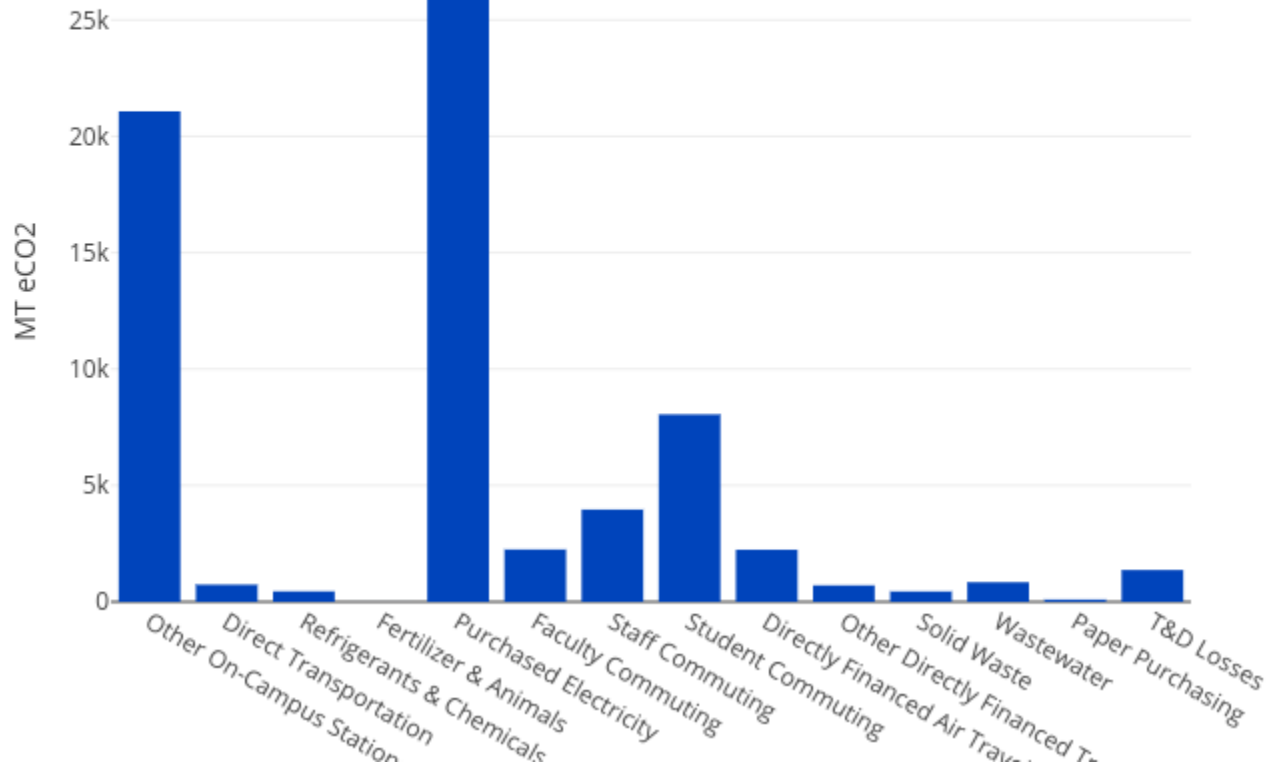
FY18 MTeCO2 % Per Category

Carbon: 2018



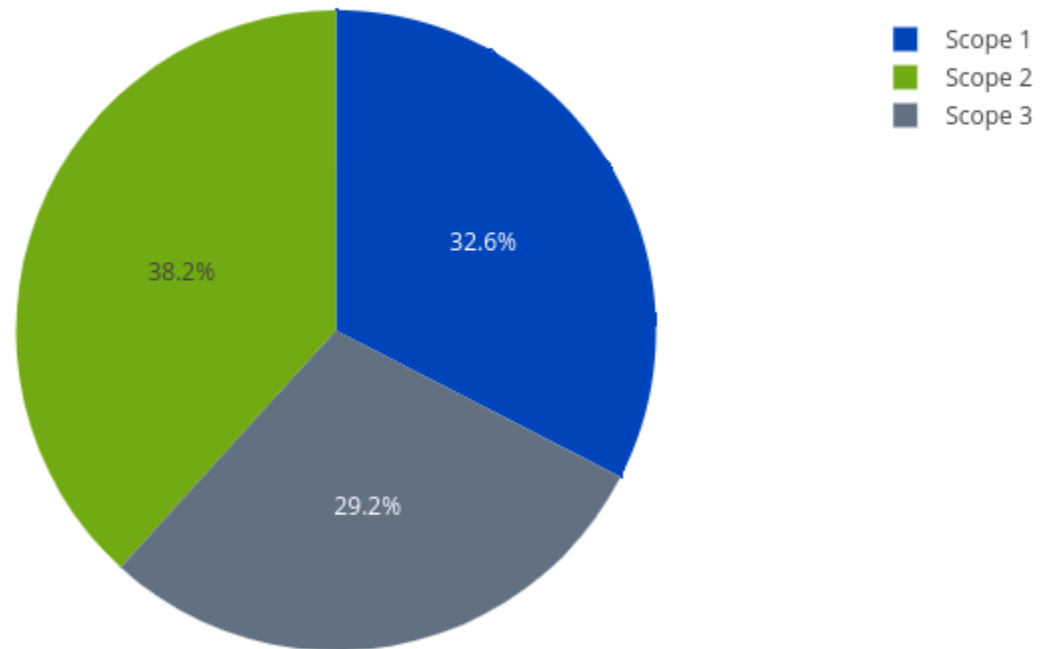
FY18 MTeCO2 Per Category

Carbon: 2018



FY18 MTeCO2 % Per Scope

Carbon: 2018



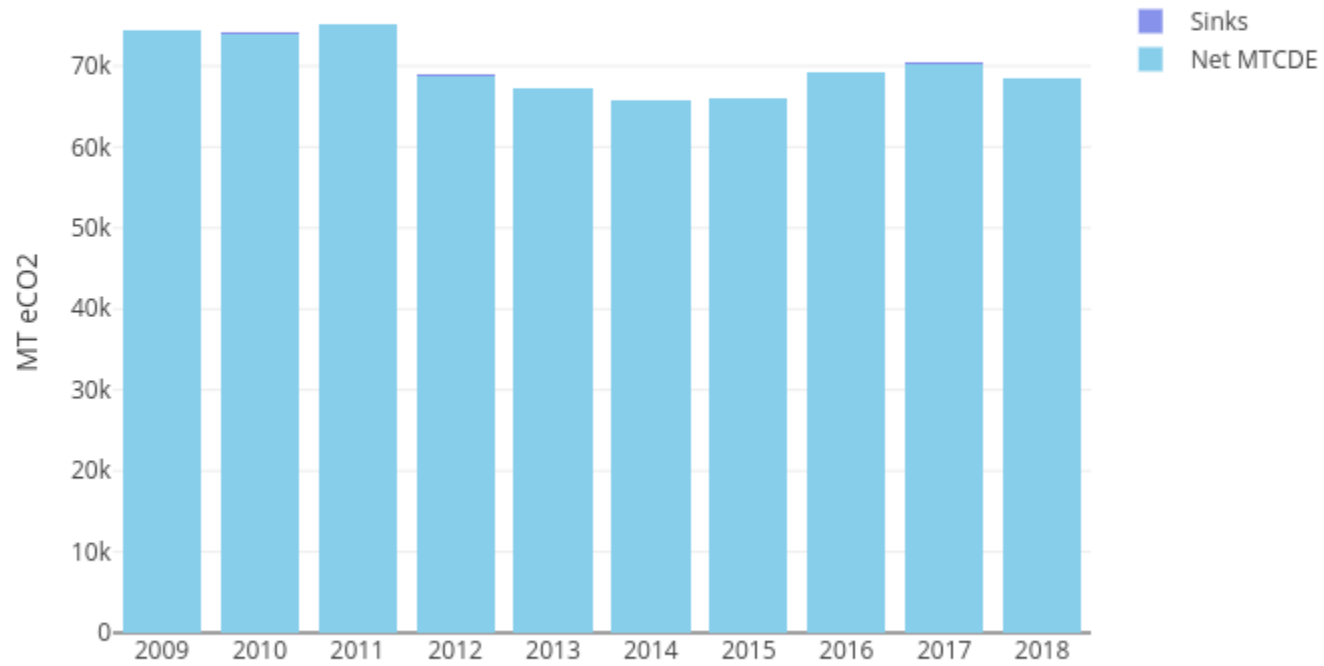
FY09-18 MTeCO2

Carbon

Fiscal Year	CO2 (kg)	CH4 (kg)	N2O (kg)	Gross MTCDE	Offsets (MTCDE)	Compost (MTCDE)	Non-Additional Sequestration (MTCDE)	Biogenic (MTCDE)	Net MTCDE
2009	71,975,862	60,574	2,282	74,444.47	0.00	-7.56	63.64	33.97	74,436.91
2010	71,525,620	60,016	2,219	74,054.32	0.00	-7.56	65.01	40.11	74,046.76
2011	72,428,143	52,881	2,154	75,111.47	0.00	-7.56	65.63	40.40	75,103.91
2012	66,684,590	46,940	1,782	68,826.56	0.00	-5.04	66.34	39.22	68,821.52
2013	64,841,077	47,790	1,695	67,173.40	0.00	-5.04	66.95	37.63	67,168.36
2014	63,030,763	49,230	1,484	65,675.13	0.00	-5.04	67.65	41.14	65,670.09
2015	63,116,488	50,647	1,609	66,047.03	0.00	-3.53	70.28	31.90	66,043.50
2016	66,368,442	52,900	1,840	69,203.40	0.00	-3.53	70.00	20.87	69,199.88
2017	67,119,145	55,241	1,866	70,288.16	0.00	-3.53	71.00	24.03	70,284.63
2018	65,882,525	52,829	1,751	68,371.91	0.00	-3.53	72.00	15.05	68,368.38

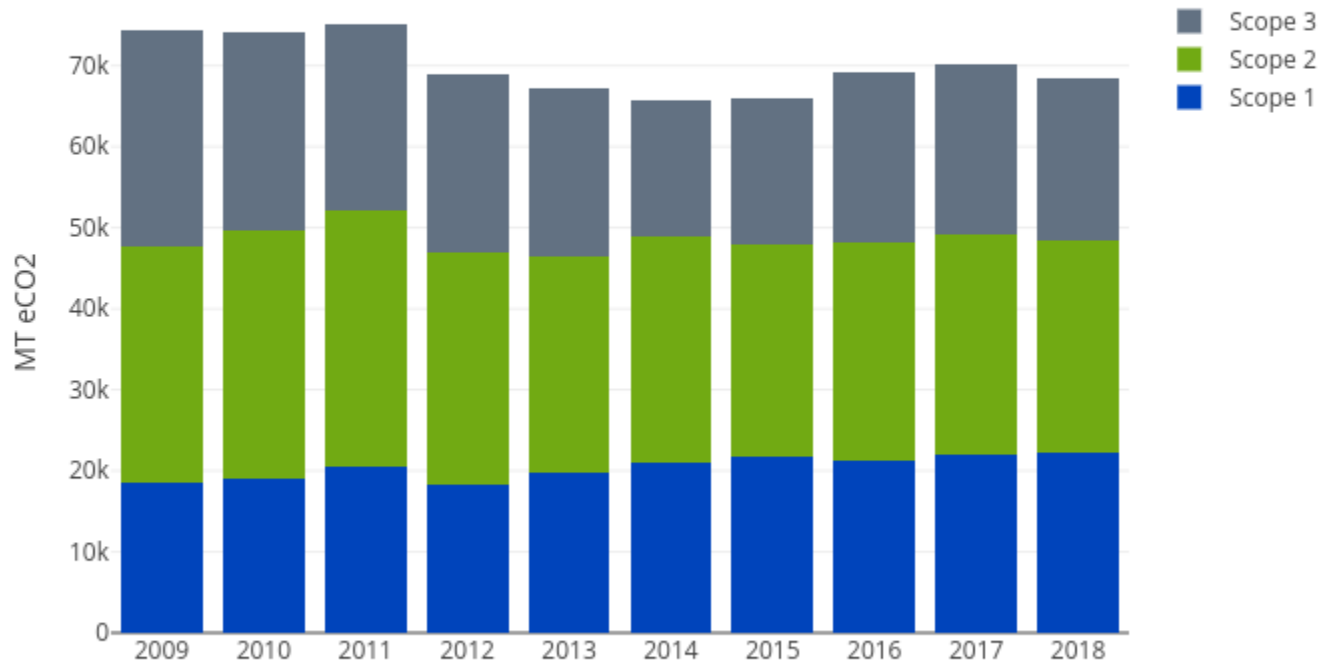
FY09-18 MTeCO2

Carbon



FY09-18 MTeCO2 Per Scope

Carbon



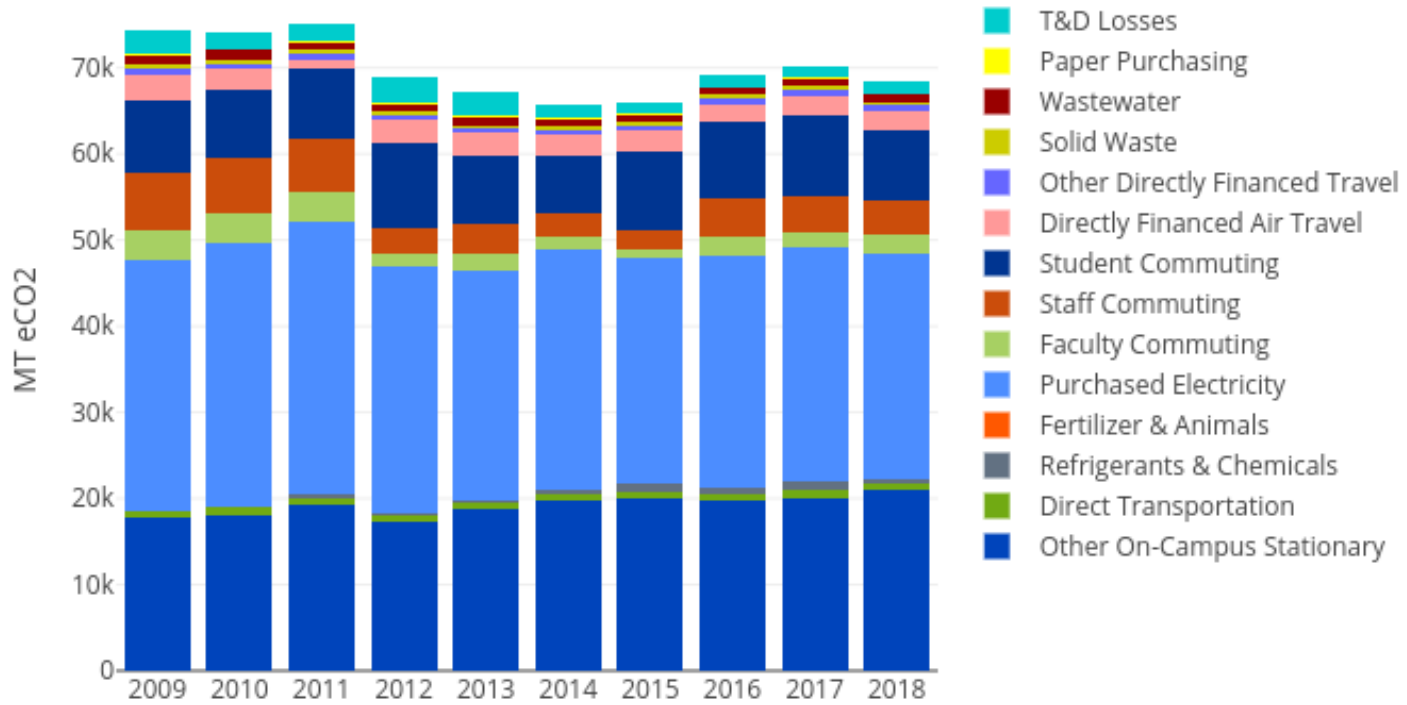
FY09-18 MTeCO₂ Per Scope

Carbon

Fiscal Year	Scope	CO ₂ (kg)	CH ₄ (kg)	N ₂ O (kg)	GHG MTCDE
2009	1	18,449,473	1,903	173	18,610.52
2009	2	28,936,232	699	567	29,106.13
2009	3	24,590,157	57,972	1,542	26,727.82
2010	1	18,845,320	1,941	169	19,095.19
2010	2	30,298,927	707	575	30,471.01
2010	3	22,381,372	57,368	1,475	24,488.12
2011	1	19,881,300	2,058	153	20,423.16
2011	2	31,418,798	741	602	31,599.18
2011	3	21,128,044	50,082	1,398	23,089.13
2012	1	17,925,491	1,846	123	18,243.53
2012	2	28,544,549	824	502	28,700.66
2012	3	20,214,551	44,270	1,157	21,882.37
2013	1	19,413,000	1,989	112	19,765.75
2013	2	26,528,390	804	490	26,680.82
2013	3	18,899,687	44,997	1,093	20,726.83
2014	1	20,313,749	2,084	121	21,122.46
2014	2	27,688,215	3,313	477	27,907.34
2014	3	15,028,798	43,833	886	16,645.34
2015	1	20,717,975	2,123	126	21,773.87
2015	2	25,873,837	3,347	482	26,095.20
2015	3	16,524,676	45,177	1,001	18,177.95
2016	1	20,504,511	2,097	111	21,370.34
2016	2	26,635,276	3,493	503	26,866.28
2016	3	19,228,655	47,311	1,227	20,966.78
2017	1	20,818,181	2,110	109	21,926.77
2017	2	27,073,557	3,756	541	27,321.97
2017	3	19,227,407	49,375	1,217	21,039.41
2018	1	21,723,191	2,257	105	22,263.95
2018	2	25,905,570	3,647	525	26,146.76
2018	3	18,253,764	46,925	1,121	19,961.20

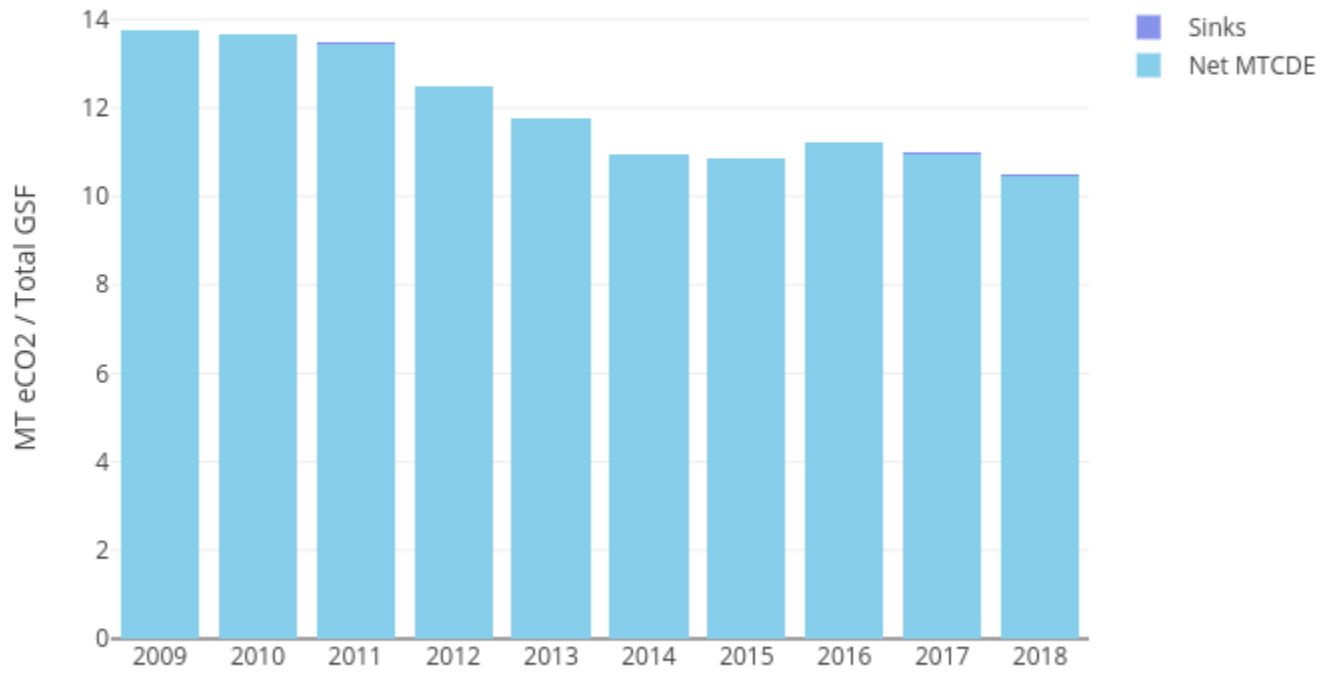
FY09-18 MTeCO2 Per Category

Carbon



FY09-18 MTeCO2 Per 1000GSF

Carbon

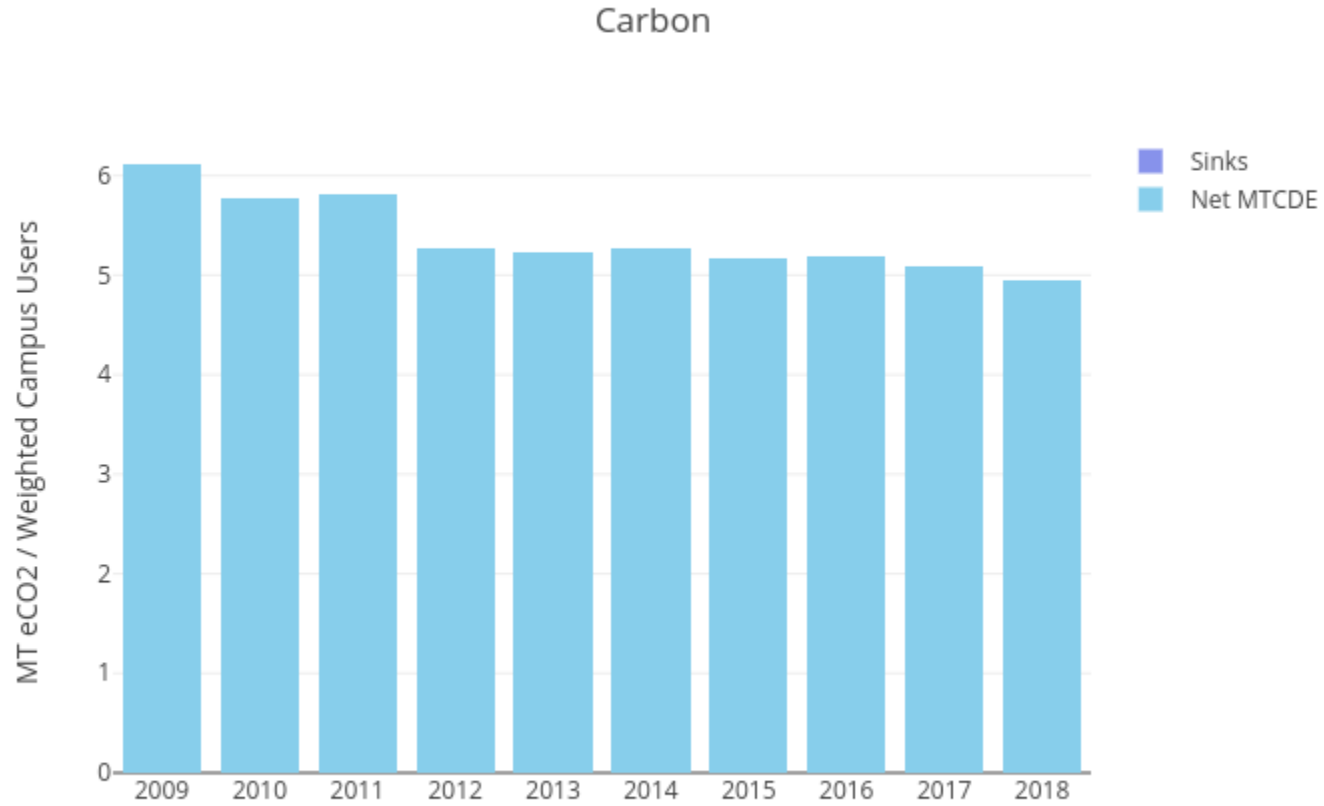


FY09-18 MTeCO2 Per 1000GSF

Carbon

Fiscal Year	CO2 (kg)	CH4 (kg)	N2O (kg)	Gross MTCDE	Offsets (MTCDE)	Compost (MTCDE)	Non-Additional Sequestration (MTCDE)	Biogenic (MTCDE)	Net MTCDE
2009	13,291	11	0	13.75	0.00	-0.00	0.01	0.01	13.75
2010	13,208	11	0	13.67	0.00	-0.00	0.01	0.01	13.67
2011	12,976	9	0	13.46	0.00	-0.00	0.01	0.01	13.46
2012	12,101	9	0	12.49	0.00	-0.00	0.01	0.01	12.49
2013	11,342	8	0	11.75	0.00	-0.00	0.01	0.01	11.75
2014	10,506	8	0	10.95	0.00	-0.00	0.01	0.01	10.95
2015	10,371	8	0	10.85	0.00	-0.00	0.01	0.01	10.85
2016	10,767	9	0	11.23	0.00	-0.00	0.01	0.00	11.23
2017	10,474	9	0	10.97	0.00	-0.00	0.01	0.00	10.97
2018	10,087	8	0	10.47	0.00	-0.00	0.01	0.00	10.47

FY09-18 MTeCO2 Per Weighted Campus User



FY09-18 MTeCO2 Per Weighted Campus User

Carbon

Fiscal Year	CO2 (kg)	CH4 (kg)	N2O (kg)	Gross MTCDE	Offsets (MTCDE)	Compost (MTCDE)	Non-Additional Sequestration (MTCDE)	Biogenic (MTCDE)	Net MTCDE
2009	5,497	5	0	5.69	0.00	-0.00	0.01	0.00	5.69
2010	5,195	4	0	5.38	0.00	-0.00	0.01	0.00	5.38
2011	5,234	4	0	5.43	0.00	-0.00	0.01	0.00	5.43
2012	4,843	3	0	5.00	0.00	-0.00	0.01	0.00	5.00
2013	4,744	4	0	4.91	0.00	-0.00	0.01	0.00	4.91
2014	4,736	4	0	4.94	0.00	-0.00	0.01	0.00	4.93
2015	4,633	4	0	4.85	0.00	-0.00	0.01	0.00	4.85
2016	4,654	4	0	4.85	0.00	-0.00	0.01	0.00	4.85
2017	4,594	4	0	4.81	0.00	-0.00	0.01	0.00	4.81
2018	4,468	4	0	4.64	0.00	-0.00	0.01	0.00	4.64