EMORY GREENHOUSE GAS EMISSIONS INVENTORY
FY2014 UPDATE

SUMMARY ANALYSIS
July, 2017

GOALS

Emory regularly evaluates its greenhouse gas (GHG) emissions, or carbon footprint, in order to monitor its emissions reductions efforts toward the goals established by Emory's 2011 Climate Action Plan. GHG emissions reporting began in the year FY2010, with 2005 as the baseline year, and subsequent inventories were conducted in 2012 and 2014.

To maintain biannual reporting of Emory's GHG emissions, this summary analyzes an inventory for the Fiscal Year 2014. Calculations for the inventory data are completed using regional fuel mix emissions factors rather than the national factors. **The following results refer to data collected from the baseline FY2005, FY2010, FY2012 and the most recent FY2014 inventory.**

METHODOLOGY

Emissions Calculator

For reliable investigation of GHG emissions resulting from the operations of an institution, the Campus Carbon Calculator is a widely used calculation tool. Used by over one-third of universities and colleges in North America, the Campus Carbon Calculator is a Microsoft Excel-based reporting framework that is consistent with GHG Protocol standards. Emory's FY2014 greenhouse gas emissions were calculated using version 8.0 of the Campus Carbon Calculator.

The Calculator estimates the greenhouse gas emissions specified by the Kyoto Protocol, a global compact negotiated by the United Nations in 1997 that was not ratified by the United States. The monitored emissions include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6). The calculator then converts emitted gases into units (in this case, metric tonnes) of carbon dioxide equivalents ($MtCO_2e$). This conversion depends on the global warming potential (GWP) of each gas. Emory's emissions are largely from CO_2 because there are no PFC or SF_6 gases emitted on Emory's campus, and emissions of CH_4, N_2O, and HFCs represent only a very small percentage of Emory's total emissions.

Emissions Scopes

Greenhouse gas calculations are delineated as direct and indirect emissions sources by means of three different scopes:

1) Scope 1 includes all direct GHG emissions from sources owned or maintained by Emory. For example, emissions from burning purchased fuel in Emory's boilers or fleet vehicles.
2) Scope 2 includes indirect GHG emissions from purchased fuels consumed by the institution, or otherwise imported into Emory's organizational boundary. Scope 2 emissions physically occur at the facility where electricity is generated (in our case, Georgia Power's production plant) but are attributable to Emory as the end user of the product.
3) Scope 3 is an optional reporting category that allows for the inclusion of all other indirect emissions. Scope 3 emissions are directly attributable to Emory's activities, but are from sources that do not fit into the Scope 1 or 2 definitions. Some examples of scope 3 activities are business travel; commute transportation emissions of students, staff, and faculty; and emissions from waste generated by the institution when the GHG emissions occur at a facility controlled by another company, e.g. methane emissions from landfilled waste. Credits included in Scope 3 may also include carbon offsets, which in Emory's case for FY2014 refers to the carbon sequestration from Emory's on-site composting.

Operational Boundary

The Druid Hills campus of Emory University and Emory Healthcare is included in the GHG emissions inventory boundary, which is consistent with the scope of Emory's STARS (Sustainability Tracking, Assessment, and Rating System) report that is developed by AASHE (Association for the Advancement of Sustainability in Higher Education). This boundary includes all university buildings located on and around Clifton Road, the Briarcliff campus, the Clairmont campus, and Yerkes National Primate Research Institute. Healthcare facilities included are Emory University Hospital, Clinics A and B, Emory Rehabilitation Hospital, 1525 Clifton Rd. Clinic, and Winship Cancer Institute.

Other Emory facilities that are not contiguous to the main campus are not included in the calculation. Facilities not included are Emory University Hospital Midtown, Emory University Orthopedics and Spine Hospital, Emory St. Joseph's Hospital, Emory Johns Creek Hospital, Wesley Woods Hospital, Yerkes Field Station, Oxford College campus, and all other outlying Emory-owned facilities.

Institutional Information

In FY2005, there were 13,507 full time equivalent (FTE) students attending Emory. This number includes undergraduates, graduates, and professional school students. By FY2014, the University recorded a 16.8% increase in FTE students to 15,783.

In FY2014, the Emory employee headcount within the GHG emissions inventory scope was 15,161, a 25.9% decrease from 20,456 in 2005.[1]

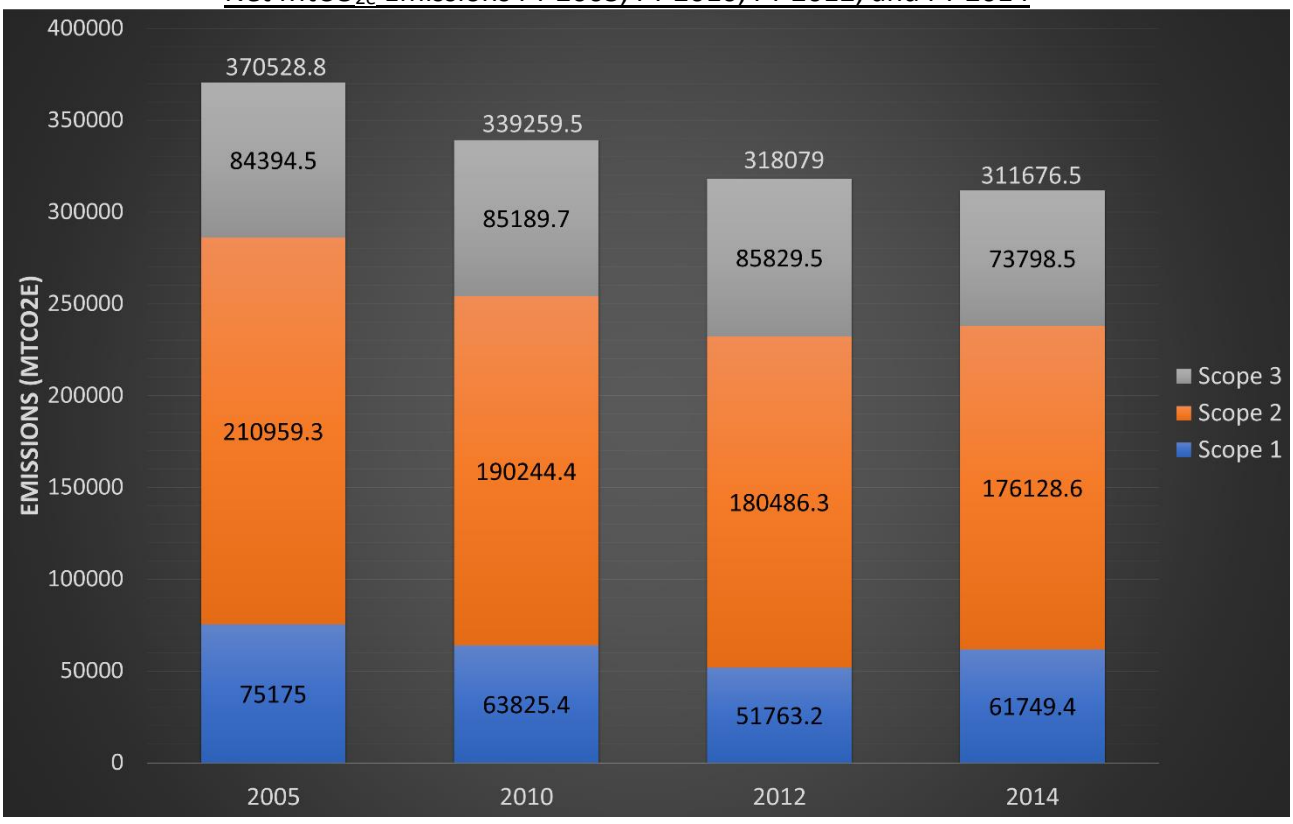
PRINCIPAL FINDINGS

Overview

In FY 2014, Emory emitted a net quantity of 311,496 $MtCO_2e$. This represents a 15.9% reduction from the 370,537 $MtCO_2e$ emissions recorded during the baseline year, FY 2005. Further, comparing 339,050.4 $MtCO_2e$ emitted during FY 2010 and 317,803.4 $MtCO_2e$ recorded in FY 2012, the biannual numbers illustrate a downward trend from the baseline. The emissions data equate to a 9.2% decrease from FY 2005 to FY 2010, a 6.7% decrease from FY 2010 to FY 2012, and a subsequent 2.1% decrease from FY 2012 to FY 2014 recordings. In order to meet Emory University's goal of reducing total carbon emissions by 20% by 2020, the University must reduce emissions by a further 15,066.7 $MtCO_2e$ or 4.8% from the FY 2014 emissions inventory.

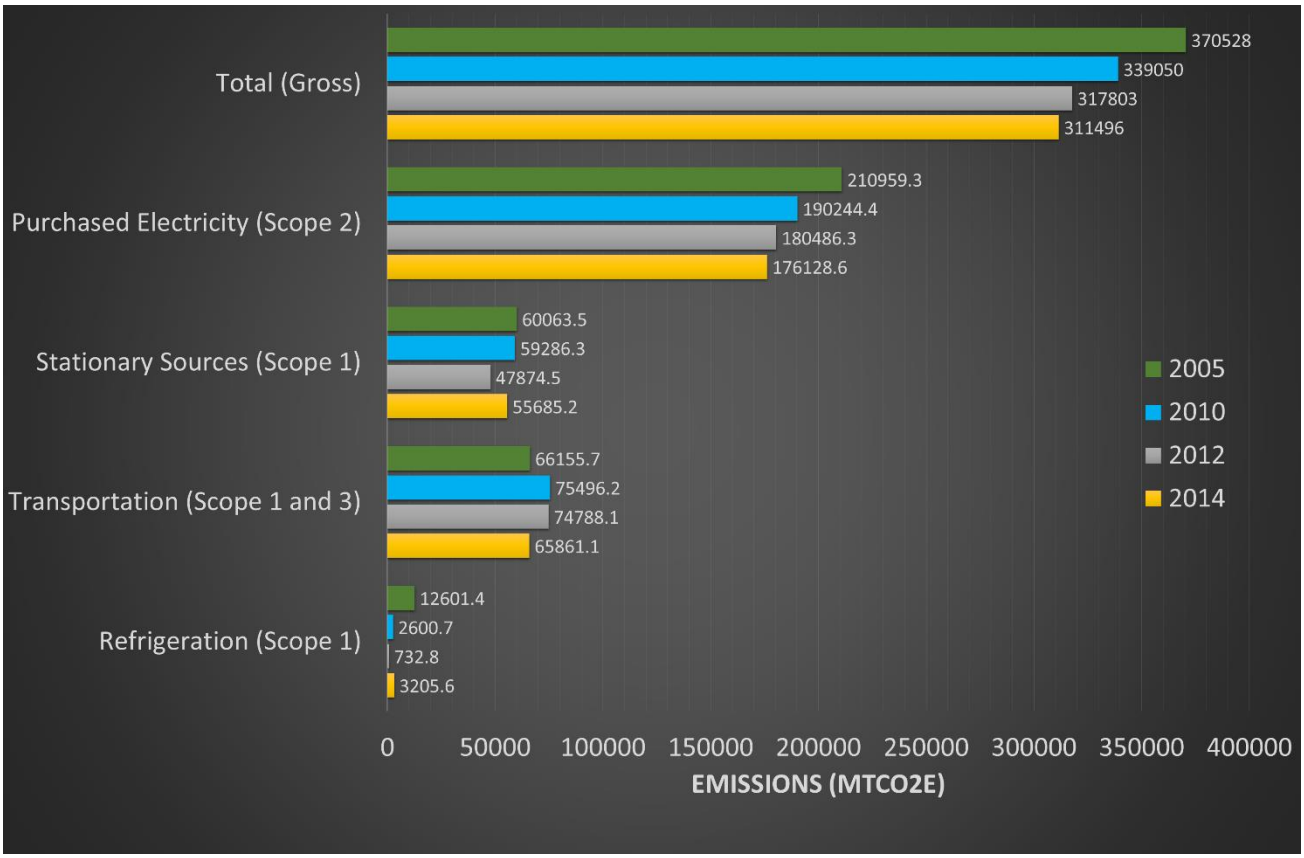
Substantial reductions in all Scope 1, 2, and 3 emissions totals occurred from the baseline year. While the net emissions declined, there were increases in emissions from direct transportation, student commuting, and overall air travel. Trends for these changes are discussed in the respective *Transportation* and *Utilities* sections following.

Net $MtCO_{2e}$ Emissions FY 2005, FY 2010, FY 2012, and FY 2014



[1] Reliable data for headcount, rather than FTE employees, exists for 2014. Employee counts for Emory University and Emory Healthcare include only those employees within the GHG inventory boundary. Employee counts exclude student employees. Faculty counts include non-compensated faculty.

Emissions by Source FY 2005, FY 2010, FY 2012 and FY 2014



Utilities

To understand Emory's energy system, below follows an overview of how electrical power and on-campus energy generation from stationary sources work together to provide energy to Emory's buildings, the largest users. For purposes of this study, water usage is not included in the calculator because the model accounts for only purchased chilled water, and Emory creates its own chilled water via electric water chillers.

Utility Overview

Emory's Druid Hills campus receives utilities from external sources through several electric, natural gas, and domestic water accounts to serve its buildings. 265kWh of solar power are produced on campus, which are fed directly into the electrical grid and counted as renewable energy credits (RECs) that Emory retires. Emory operates a 500,000 pound/hour steam plant and three central chilled water plants to provide cooling, heating, and plug and process load energy [2]to over 100 buildings.

[2] Plug and process loads are energy loads that not related to general lighting, heating, ventilation, cooling, and water heating, and that typically do not provide comfort to the occupants.

Five large natural gas fired boilers in the central steam plant distribute steam through buried steam mains to buildings. The steam produces hot water and hot air for space and water heating. The boilers recover energy from the exhaust stream and control the amount of unburned oxygen to maximize energy conversion efficiency. A new steam-turbine generator began operation in 2016. The generator is part of a cogeneration/combined heat and power (CHP) system utilizing the existing mechanical heat from the natural gas boiler. The heat is captured, generating a higher-pressure steam that runs a turbine that improves the efficiency of Emory's energy use. The new system is expected to provide an additional 1MW of electricity from the same level of natural gas usage.

Three chilled water plants use electric centrifugal water chillers to produce 42^{o} F chilled water. The chilled water is distributed to buildings through buried chilled water mains where it is used to dehumidify and cool the air. Some cooling is required year-round to dehumidify outside air before it is circulated to the interior area of buildings, which is then re-heated for occupant comfort. Heat absorbed from buildings is dissipated using evaporative water cooling towers located outside the chiller plants.

Emory employs a "private" electric distribution loop to supply most buildings in the central campus. Transmission lines rated above 100 kilo-volts (kV) feed two substations on campus. The substations step down the voltage to 20 kV and feed the underground distribution system. At each building on the 20-kV loop, electric transformers step down the voltage to less than 500 volts before it enters the building's electrical system.

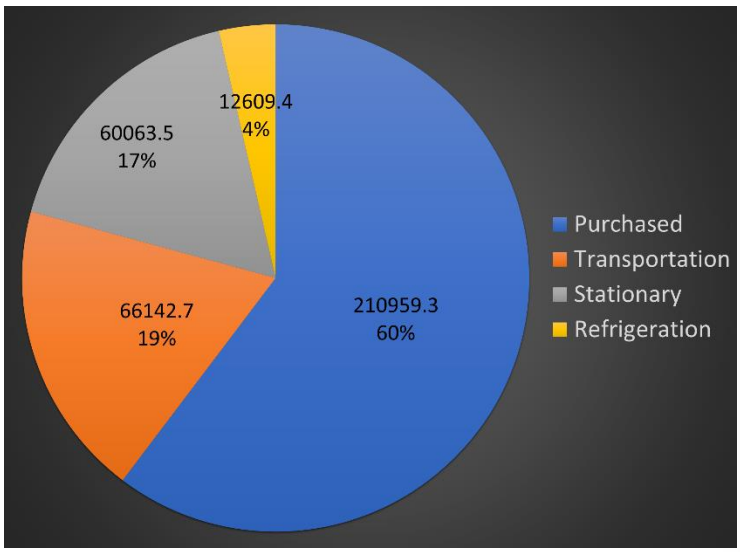
Emory uses private meters to measure and bill the electricity, steam, and chilled water for individual buildings served by the 20kV loop, steam plant, and chiller plants. Other private domestic water meters support billing water to buildings not directly served by the Dekalb County water system. In all, it takes hundreds of private and external utility accounts to allocate the energy consumed by Emory buildings.

Discussion

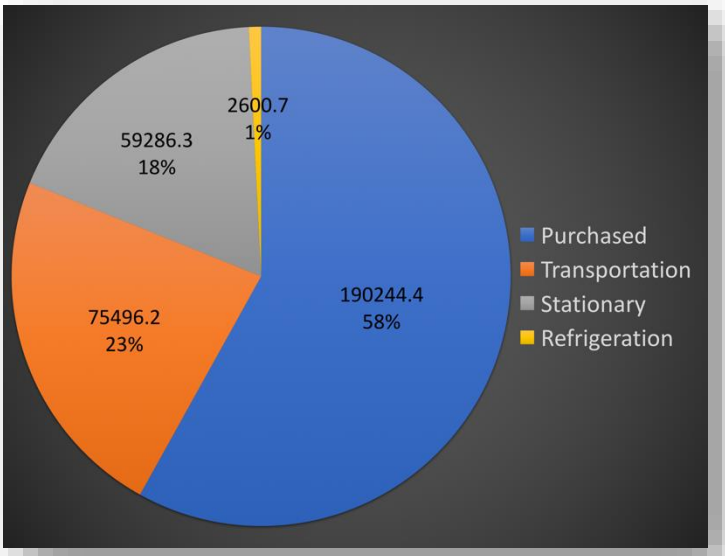
Emory University and Emory Healthcare continue to grow, however Emory proudly recorded a 26.5% per square foot decrease in energy consumption from FY2005 to FY2015. This achievement was made possible through careful monitoring, strategic operations, innovative technology in constructed buildings, and behavior change.

A temperature control policy and weekend, evening, and holiday building shutdowns have decreased the steam and chilled water (stationary sources) loads required to heat and cool university buildings. A general decrease in energy consumption of around 20% is attributed to occupant behavior modifications. A LEED (Leadership in Energy and Environmental Design) Silver minimum requirement for all new construction and the complimentary Emory Sustainable Performance Program ensure that buildings, the largest energy consumers, are built and operate efficiently.

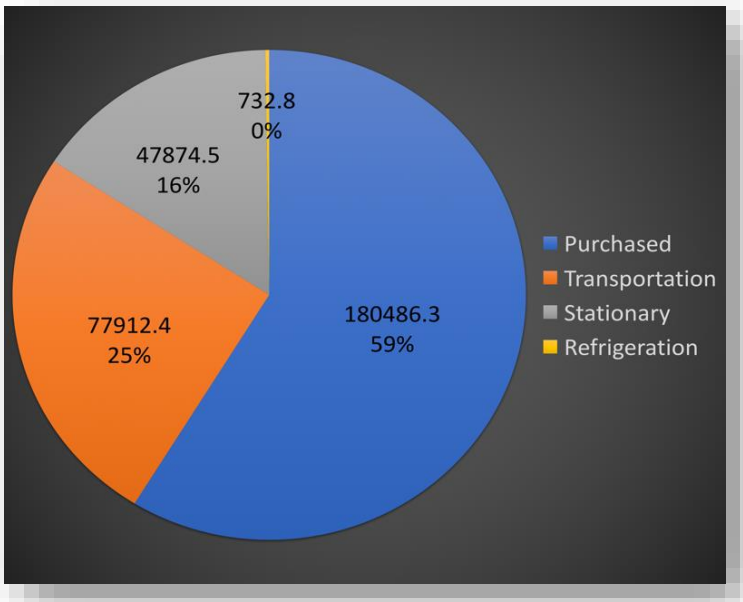
GHG Emissions by Year ($MtCO_2e$): FY 2005



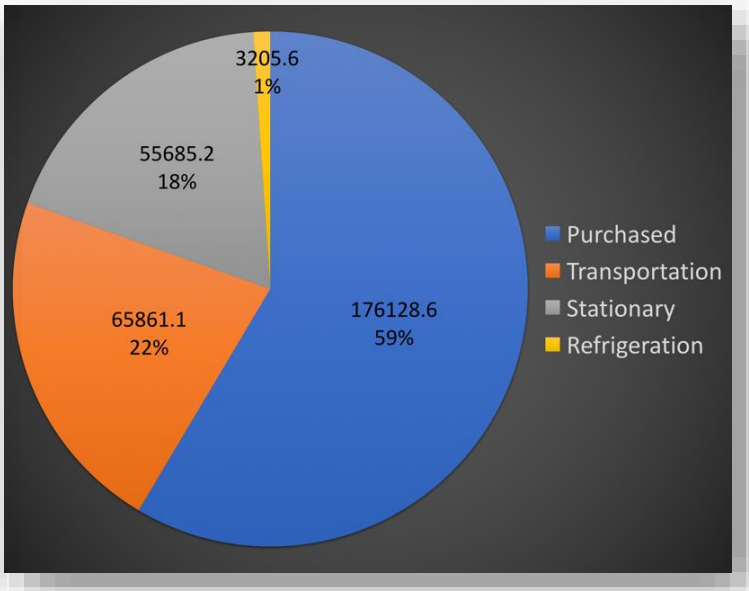
GHG Emissions by Year ($MtCO_2e$): FY 2010



GHG Emissions by Year ($MtCO_2e$): FY 2012



GHG Emissions by Year ($MtCO_2e$): FY 2014



Transportation

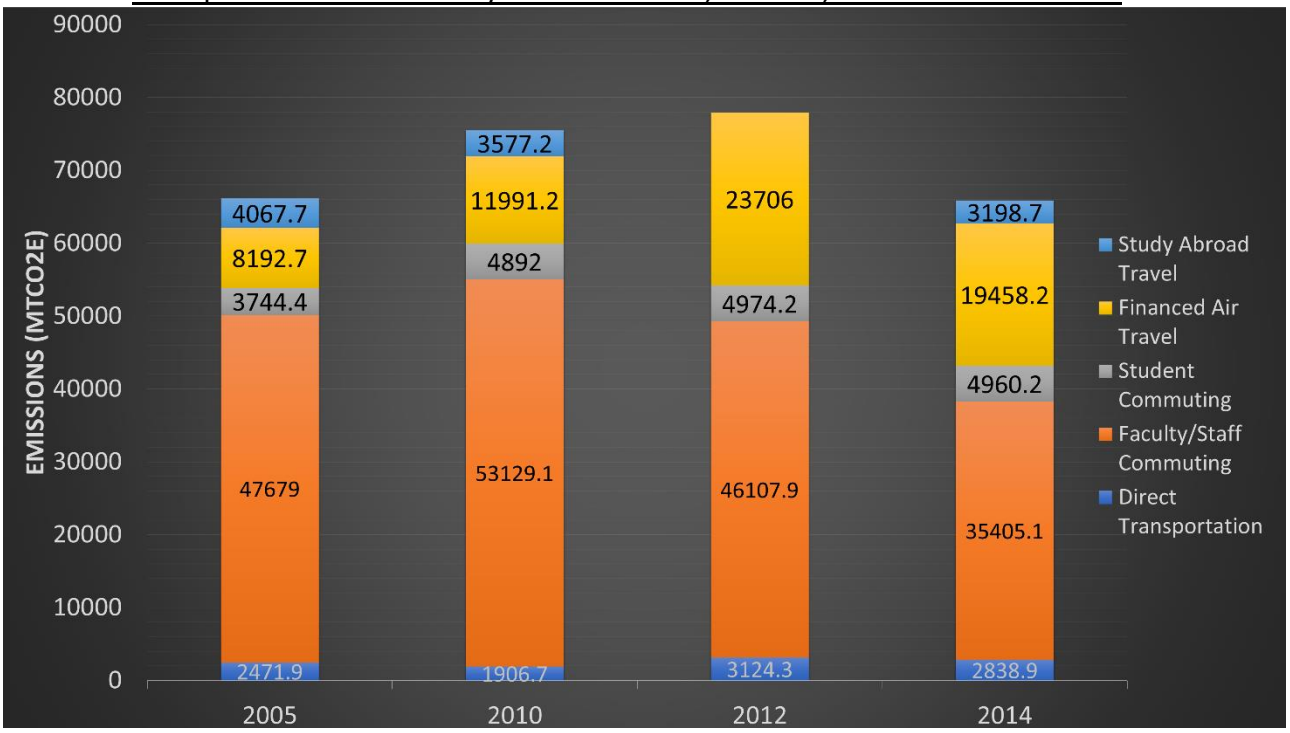
Transportation sub-categories measured in the GHG emissions inventory include university fleet fuel, faculty, staff and student commute modes and miles, and directly-financed air travel.

Discussion

University-related air travel and faculty/staff commuting are the largest sources of Scope 3 GHG emissions. Faculty and staff commuting emissions have decreased, and emissions from student commuting have slightly increased, from the 2005 baseline. The commuting trends are likely attributed to the corresponding changes in populations (an increase in number of students and decrease in number of employees) and increased utilization of sustainable commute modes by faculty and staff. Available data suggest for FY 2014 that Emory faculty and staff reduced commuting emissions by 25.7% from 2005 levels, while student commute emissions increased 32.5% from 2005 levels.

Emissions resulting from Emory-financed air travel have significantly increased, and are particularly difficult to reduce given Emory's commitment to global research. During FY 2014, Emory recorded 22,656.8 MtCO2e in financed air travel. This represents an 85% increase in directly financed air travel emissions from 2005 levels of 12,260.4 MtCO2e. While this increase is significant, the rate at which Emory's directly financed air travel emissions are increasing is slowing, and the net emissions from this source are in decline from FY 2012 levels. In FY 2010, 15,568.4 MtCO2e were recorded, followed by 23,706.0 MtCO2e in FY 2012. Thus, while total air travel emissions have risen from the 2005 base year, they declined 4.6% between 2012 and 2014, marking a reductive trajectory in recent years.

Transportation Emissions by Source FY 2005, FY 2010, FY 2012* and FY 2014



*The data for FY 2012 travel emissions was catalogued by including "Study Abroad Travel" in the "Financed Air Travel" criteria. As such, the FY 2012 distribution appears slightly different than the other years in consideration.