

Emory University FY21 GHG Inventory Report¹

Introduction

Emory University regularly evaluates its greenhouse gas (GHG) emissions, or carbon footprint, in order to monitor its efforts to reduce emissions to net-zero by 2050 through strategies that entail targeted mitigation, behavior change, clean and renewable energy sources, and new innovations. GHG emissions reporting began in FY10, with 2005 as the original baseline year, and subsequent inventories have been conducted in 2013, 2014, 2016, 2019, and 2021. The goal of these GHG inventories is to assist the University in making short- and long-term mitigation decisions, increase on-campus awareness of mitigation efforts, and provide accountability to these goals.

On October 13, 2021, Emory University joined Second Nature's Presidents' Climate Commitment, which includes 450 higher education institutions committed to achieving net-zero carbon emissions and building resilience to the impacts of climate change. A key component of this commitment is to publicly report an institution's GHG emissions on an annual basis and report on climate action planning efforts. Emory University has always reported its GHG emission on the Office of Sustainability, Resilience, and Economic Inclusion's (OSI) website and through its Sustainability, Tracking, Assessment, and Rating System (STARS) report; however, this inventory is the first shared through the Second Nature reporting platform.

In 2019 Emory's Sustainability Vision Committee proposed an update to Emory's greenhouse gas reduction goals to mirror the latest scientific evidence and recommendations of the United Nations Intergovernmental Panel on Climate Change (IPCC). The scientific evidence shows that in order to stabilize global mean surface temperature to a 1.5-degree Celsius target or lower, net anthropogenic emissions of greenhouse gases must decrease by 45% by 2030 (from 2010 levels), and achieve economy-wide decarbonization (or net-zero) by 2050. In light of this evidence, Emory leadership approved updating Emory's baseline inventory year to 2010, and matching its GHG emissions reductions goal to these global targets [45% reduction by 2030 and 100% reduction by 2050]. In support of these overarching goals, Emory's 2025 Sustainability Vision and Strategic Plan set contributing goals to:

- Invest in a portfolio of innovative greenhouse gas sequestration projects that provide resilience, research, teaching, and national leadership benefits to Emory;
- Achieve carbon neutral construction for all new construction;

¹ This document was prepared for the Office of Sustainability, Resilience, and Economic Inclusion at Emory University by E Rowe Consulting, LLC for internal and external purposes.

- Reduce the University's campus energy use per square foot (EUI) by 50% and total energy use by 25%;
- Develop a local carbon offset program with social justice benefits to allow students, faculty, and staff to offset University travel, commuting, and other GHG producing activities.

Methodology

GHG inventories quantify GHG emissions and mitigation efforts, and are used by a range of stakeholders to identify baseline emissions, track reductions, and inform future mitigation planning. All base figures for calculations, graphs, charts, and tables in this report were generated through SIMAP (Sustainability Indicator Management and Analysis Platform) and all figures were generated in Excel. SIMAP was chosen for this report because it is an emissions calculator specifically designed for higher education and is the GHG reporting platform used by Second Nature for the Presidents' Climate Commitments reporting requirements. SIMAP utilizes an activity-based approach which calculates GHG emissions by multiplying the driver of a GHG producing activity, such as gallons of fuel used, by a conversion or emissions factor to calculate the corresponding GHG emissions.

SIMAP updates its emissions factors and Global Warming Potential (GWP) factors annually, utilizing data from the IPCC, Climate Registry, and Greenhouse Gas Registry. Emory University uses the emissions factors provided by SIMAP, and for FY21, updated factors to match SIMAP's latest recommendations, including:²

- Emissions Factors Version 2021 – emissions factors vary by input type.
- Global Warming Potential Version AR5 100-year – the effect greenhouse gases will have in the atmosphere over a 100-year time period. This GWP does not account for the climate-carbon feedback.
- Radiative Forcing Factor of 2.7 – emissions from air travel are multiplied by a radiative forcing factor (2.7) to account for the higher GWP from emissions released at higher altitudes.
- Scope 2 Market-Based – Emory updated its calculations for Scope 2 emissions from Location-Based to Market-Based to reflect the reporting requirements for Second Nature. The market-based approach allows an institution to account for any renewable energy purchased or sold by the institution. It also accounts for the regional fuel mixes, meaning that regions with less renewable energy in the grid mix, will have higher GHG emissions for Scope 2.

² More information on specific emissions factors is publicly provided on [SIMAP's](#) website.

This inventory was completed by a third-party consultant with internal support from Emory's OSI staff. All data inputs, outputs, and assumptions were reviewed and approved by the Office of Institutional Research in October 2022.

Emissions Sources and Scopes

Emory's emissions are largely from CO₂ because there are no PFC or SF₆ gases emitted on Emory's campus, and emissions of CH₄, N₂O, and HFCs represent only a small percentage of Emory's total emissions. These well-mixed GHGs currently account for 82% of present-day warming.³

CO₂ (carbon dioxide): On-Campus Stationary Sources, Transportation Fuel, Purchased Electricity, Commuting, and Air Travel

CH₄ (methane): On-Campus Stationary Sources, Transportation Fuel, Purchased Electricity, Commuting, Air Travel, Solid Waste, and Wastewater

N₂O (nitrous oxide): On-Campus Stationary Sources, Transportation Fuels, Fertilizers, Purchased Electricity, Commuting, and Air Travel

HFC (hydrofluorocarbon): Refrigerants

GHG 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 fuels in Emory's boilers and fleet vehicles are considered Scope 1 emissions.
2. Scope 2 includes indirect GHG emissions from purchased energy for the institution. Scope 2 emissions physically occur at the facility where electricity is generated, such as Georgia Power's production plants, but are attributable to Emory as the end user of the product.
3. Scope 3 includes all other indirect emissions. Scope 3 emissions are directly attributable to Emory's operations, but are from sources outside the definitions of Scope 1 and 2. Scope 3 emissions include University-funded travel; student, faculty, and staff commuting to the University; wastewater; and landfilled waste generated by the University.

Campus Boundary and Timeframe

GHG emissions for this inventory are collected for the Druid Hill campus of Emory University and Emory Healthcare. This includes all University buildings located on and around Clifton Road,

³ Greenhouse Gas Emissions Information for Decision Making: A Framework Going Forward (2022)

the Briarcliff campus, the Clairmont campus, and Emory National Primate Research Center. Healthcare facilities included are Emory University Hospital and its adjacent buildings, Clinics A, B, and C, the 1525 Clinic, and the Emory Rehabilitation Hospital. Wesley Woods is not included within the campus boundary at this time. All data reported are for FY21 which ran from September 1, 2020 to August 31, 2021.

Utilities

The majority of the emissions in this inventory report come from Stationary Fuels and Purchased Electricity, which together provide the energy necessary to operate the University's buildings.⁴ Emory's campus receives utilities from external sources through several electric, natural gas, and domestic water systems. As of this 2021 inventory, 1,822,81 kWh of solar power was produced on campus – a 75% increase from 2019. In 2020, Emory began installation of 15,000 solar panels which will have the capacity to generate 10% of the University's peak demand and reduce emissions by 4,300 metric tons (MT). 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 to over 100 buildings. Plug and process loads are energy loads that are 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 throughout steam mains to buildings. The steam produces hot water and hot air for water heating and building comfort. The boilers recover energy from the exhaust steam 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. At the time of this inventory, there was not sufficient tracking and reporting information on the system efficiencies (figures required by SIMAP) to include data on the cogeneration facility. In 2019, a system of 400-foot-deep geothermal wells were dug in nearby McDonough Field to provide some 700 tons of heating and cooling capacity to the LEED Platinum-certified Emory Student Center. This system is not directly reported in the GHG inventory since geothermal does not generate power. Instead, this system is indirectly reported through reductions in stationary fuel usage.

⁴ For the purposes of this inventory, water usage is not included in the calculation because SIMAP only accounts for purchased chilled water, and Emory creates its own chilled water via electric water chillers.

Three chilled water plants use electrical centrifugal water chillers to produce 42-degree Fahrenheit 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.

Steam and chilled water (stationary sources) loads have decreased as a result of a temperature control policy, and weekend, evening and holiday building shutdowns. Roughly 20% of Emory's energy use reduction is attributed to occupant behavior modifications.⁵ A LEED (Leadership in Energy and Environmental Design) Silver minimum requirement for all new construction, and complimentary Emory Sustainable Performance Program, are major drivers of EUI reductions for the University, and result in energy efficiency and optimization.

Results

COVID-19 Impacts

Historically, Emory has seen annual GHG reductions at the same time that the University has experienced significant growth. While reductions in GHG emissions for FY21 were expected, they were also impacted by COVID-19 protocols that limited University-sponsored travel, commuting to campus, and energy demand of University facilities.

During Fall 2020, participation in in-person classes for undergraduates was largely limited to first-years, international students, and seniors requiring in-person classes to graduate. Residence halls were open to first-years, international students, and students with other special circumstance. Faculty and staff on campus was largely limited. In Spring 2021, there was a slight increase in the number of residential students and Atlanta-based undergraduate students were allowed to attend classes in-person. Domestic travel was strongly discouraged; however travel restrictions were lifted for faculty beginning in June 2020, which is reflected in air travel emissions (more information below). Study abroad travel was suspended.

During University closures, the engineering department continued to review setpoints and building management programs to identify the energy savings in each building. Emory closely followed CDC and ASHRAE guidelines and recommendations for operation during the pandemic, which included switching to maximum outside air circulation in buildings. This change increased energy usage in buildings, particularly during the summer months, as mechanical systems had to respond by increasing the amount of heating and/or cooling to

⁵ [Emory Greenhouse Gas Emissions Inventory FY19 Update](#)

achieve desired indoor air temperatures and humidity levels. Regardless of this increase in energy usage, as described below, the emissions associated with building operations decreased in FY21. As the University resumes normal operations, the engineering department expects to maintain some of these energy savings, since the pandemic afforded them the opportunity to optimize systems and resolve issues in building programming while the campus was largely empty.

These University-wide policy changes due to COVID-19 make direct comparisons between this inventory and previous inventories difficult. However, these changes in operations clearly demonstrate the profound impact University-wide policies can have on reducing Emory’s emissions in the future (see Appendix B for year-by-year comparisons).

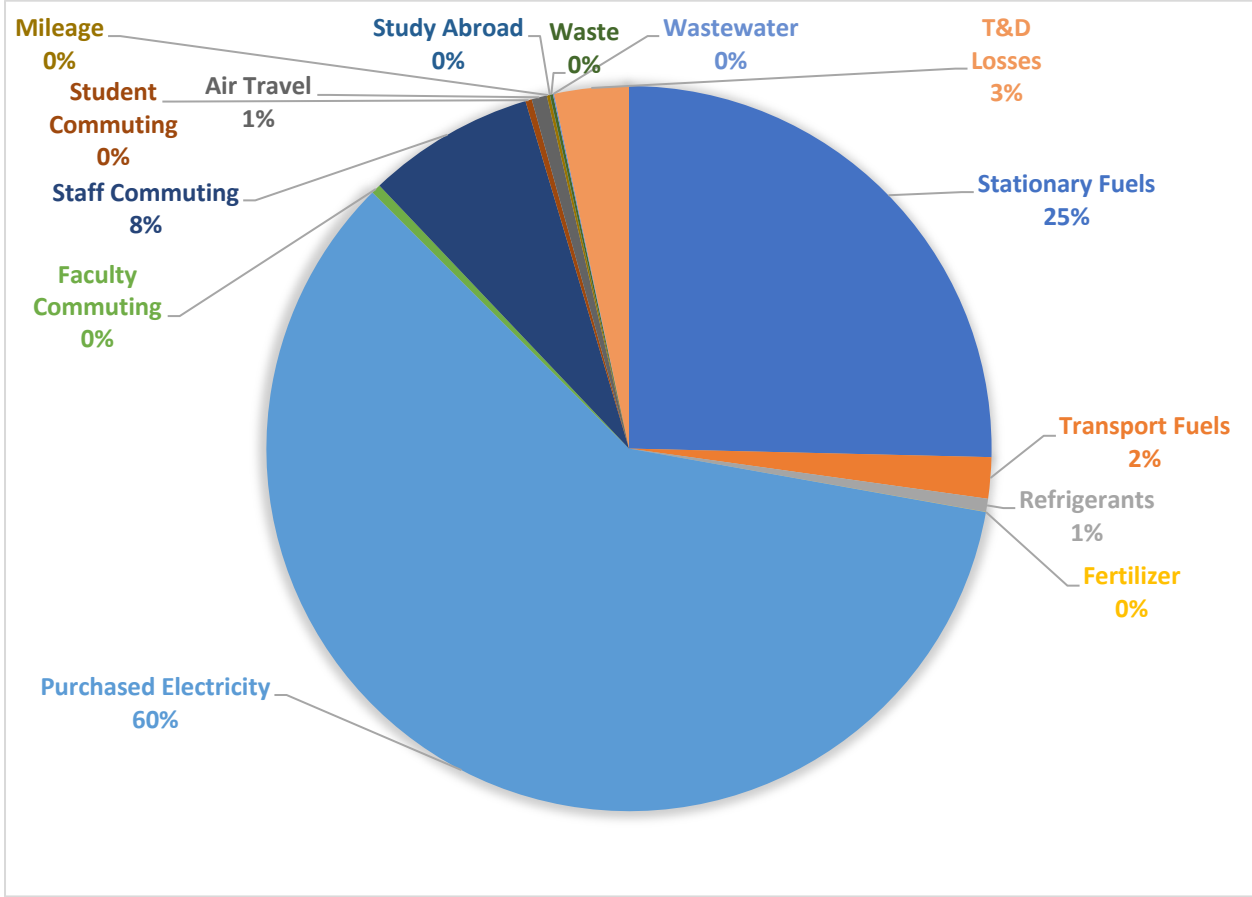
Overall Emissions

Since 2010, Emory has reduced its GHG emissions by 40.85%. Emory emitted a net quantity of 190,728 metric tons of carbon dioxide equivalent (MT CO₂e) in FY21 (see Appendix A for all GHG emissions results). This figure represents a 16.25% reduction in emissions since FY19 (227,722 MT CO₂e) (Figure 1 & 2).

Figure 1. This stacked chart shows GHG emissions by scope from FY10-FY21, and the trend line represents the decrease in total GHG emissions. Emissions are shown in MT CO₂e.



Figure 2. This chart shows the breakdown of Emory’s GHG emissions by input, with Purchased Electricity (Scope 2) and On-Campus Stationary Fuels (Scope 1) making up the largest share of emissions. The pie sections labeled as 0% indicate emissions sources that represent less than one percent of Emory’s total emissions, which have been rounded down to 0% on this chart.



Emory University and Emory Healthcare continue to grow in both campus population and building square footage; however, emissions continue to fall, with a 26.5% EUI decrease in energy consumption from FY05 to FY15, and has decreased EUI by 15.3% in FY21 compared to a FY15 baseline.⁶

Results in this report for historic inventories may be slightly different from previous summary reports. As stated above, Emory has historically utilized regional fuel mix emissions factors to calculate its Scope 2 GHG emissions. However, in accordance with Second Nature reporting requirements, Emory is now utilizing market-based emissions factors for Scope 2. All historic GHG inventories were re-calculated with market-based emissions factors to enable direct comparisons between this report and future reports.

⁶ Emory University’s 2021 Energy Reduction Plan sets a baseline of 2015, as opposed to the 2010 used for the GHG inventory. These energy reduction goals are outlined in the 2025 Sustainability Vision.

Scope 1

Scope 1 emissions are GHG emissions that occur from sources that are controlled and owned by Emory University, which includes stationary fuels, transportation fuels, fertilizers, and refrigerants. In FY21, they represented about 27.8% of Emory's GHG emissions, compared with 24% in FY19 (Figures 4 & 5). However, Scope 1 emissions are comparable between FY21 (53,034 MT CO₂e) and FY19 (54,034 MT CO₂e), with a 3.1% decrease in emissions. Since 2010, Scope 1 emissions have decreased by 25.4%. Scope 1 emissions represent a larger share of emissions in FY21 because Scope 3 emissions were significantly reduced as a result of the University's COVID-19 policies.

Change in Scope 1 Emissions

- Stationary fuels decreased by 18.5% compared to the FY10 baseline, and by 3.7% compared to FY19. Campus Services updated the reporting methodology for all energy usage in this inventory by pulling utility usage directly from utility bills, which on the whole has provided a more accurate report of energy usage. Previously, data were reported based on building meters; however, meters can under or over report usage, and some only provide monthly estimates.
- Transportation fuels decreased by 5.5% compared to FY19. There were increases in certain types of transportation fuels and decreases in other types. This variability reflects the impact University-wide closures and social distance policies had on operations.
- Since FY10, emissions associated with refrigerant use have decreased by 88.8%. Compared with FY19, there was an increase of 45.97%.
- Fertilizer use decreased by 8.6% compared to the FY10 baseline, and while there was a significant increase in emissions from fertilizer use from FY19 to FY21, this is believed to be the result of a reporting error in the FY19 inventory.

Scope 2

Scope 2 emissions are GHG emissions from purchased electricity, steam, and water. Scope 2 emissions physically occur at the facility where electricity is generated, but are attributable to Emory as the end user of the energy. In FY21, they represented about 59.7% of Emory's GHG emissions, compared with 54.4% in FY19 (Figures 4 & 5). Between FY21 (113,831 MT CO₂e) and FY19 (123,996 MT CO₂e), Scope 2 emissions decreased by 8.2%. Since 2010, Scope 2 emissions have decreased by 40%. Scope 2 emissions represent a larger share of emissions in FY21 because Scope 3 emissions were significantly reduced as a result of the University's COVID-19 policies.

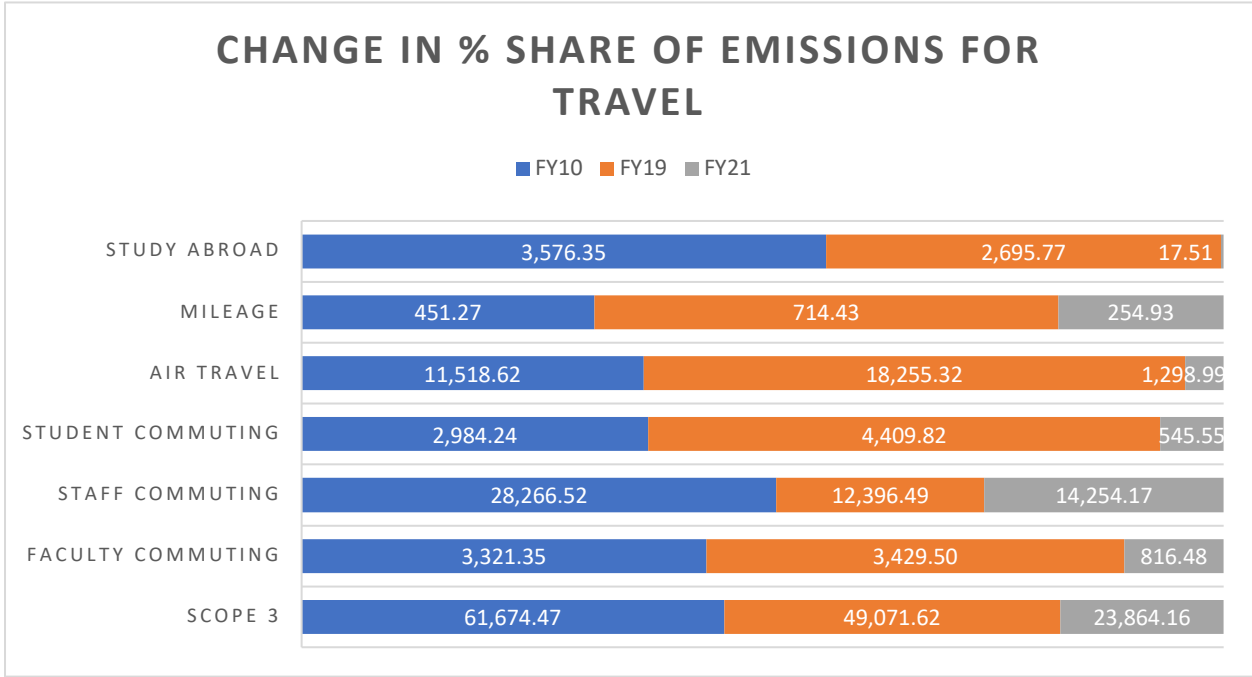
Change in Scope 2 Emissions

Between FY19 and FY21, Scope 2 emissions, and therefore emissions from purchased electricity, have decreased by 10,166 MT CO₂e. During this time, Emory significantly increased its solar capacity, through its 20-year Solar Energy Procurement Agreement (SEPA) with Cherry Street Energy. Emory began installation of ~15,000 solar panels, which will increase Emory's solar capacity by 5.5 MW (megawatts) and is expected to reduce GHG emissions by 4,300 MT annually. As data on FY22 and beyond are collected, the full impact of this SEPA agreement will be demonstrated in the reduction of Scope 2 emissions.

Scope 3

Scope 3 emissions are indirect emissions that are directly attributable to Emory's activities, but are from sources outside of the Scope 1 and 2 definitions. This includes University-sponsored air travel, commuting, landfilled waste, and wastewater. In FY21, these sources represented about 12.5% of Emory's GHG emissions, compared with 21.5% in FY19 (Figures 4 & 5). Scope 3 emissions were greatly reduced as a result of the University's COVID-19 policies, so a direct comparison of these results in particular is difficult. Between FY21 (23,864 MT CO₂e) and FY19 (49,072 MT CO₂e), Scope 3 emissions decreased by 51%. Since 2010, Scope 3 emissions have decreased by 61%; however, as the University resumes normal operations, Scope 3 emissions will likely increase, and this emissions reduction will decrease. However, these results do illustrate the impact Scope 3 emissions have on Emory's GHG totals and the impact University policies can have on reducing emissions in the future (Figure 3).

Figure 3. Each bar in this chart represents 100%, with the three colored bars representing the percentage each fiscal year had on that particular emissions type. All figures reported on each stacked bar represent MT CO₂e. The purpose of this chart is to illustrate how emissions for each travel type have increased or decreased over time, and therefore the impact these emissions sources are having on total emissions.⁷ Clearly, COVID-19 policies in FY21 have contributed to reductions in travel emissions. This also illustrates the impact individual choices can have on University-wide emissions.



Change in Scope 3 Emissions

- Given reductions on accessing campus and policies to limit university-sponsored travel, all emissions sources for travel were significantly reduced. For example, faculty commuting emissions decreased by 75.4% compared to FY10 and study abroad emissions decreased by 99.6% compared to FY10. The only emissions source that did not see these high levels of reductions were staff commuting which decreased by 49.6% compared to FY10. Previous inventories did not account for the commuting of Emory Healthcare staff which were incorporated into this inventory.
- Emissions associated with the methane produced from landfilled waste decreased by 34.8% compared to FY19. Emissions associate with the methane produced from wastewater treatment decreased by 23.8%. Given incomplete data inputs, reduction comparisons cannot be provided from these two emissions sources compared to the baseline.

⁷ It is assumed Healthcare staff were not included in staff commuting for FY19.

Figure 4. This charts shows the percentage of emissions by scope for FY21.

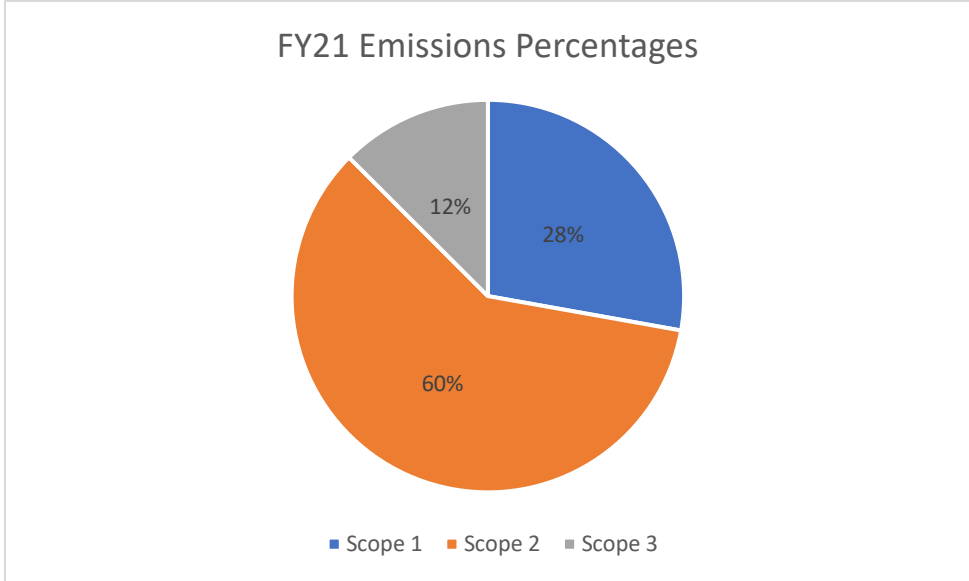
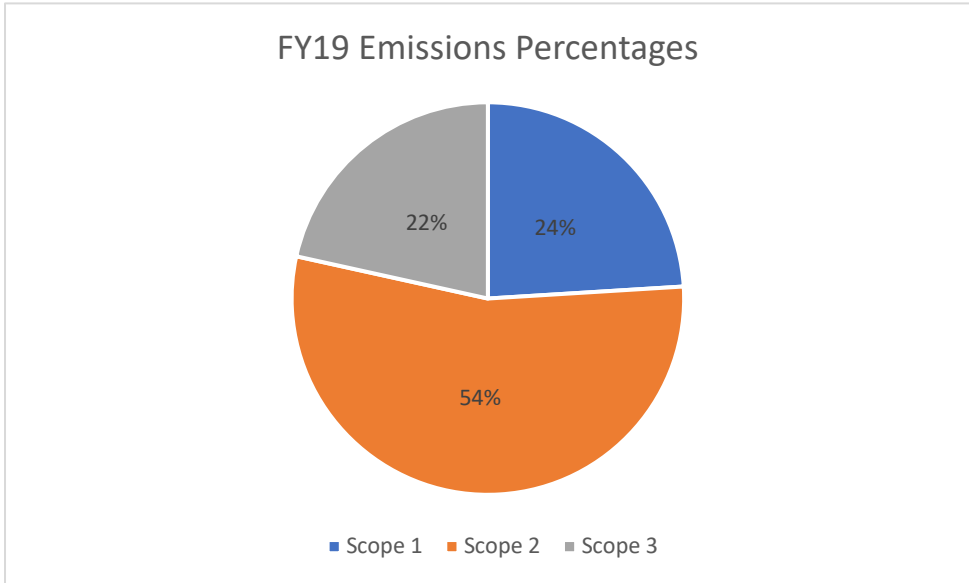


Figure 5. This chart shows the percentage of emissions by scope for FY19, and when compared to Figure 4, this chart shows the impact COVID-19 policies had on Scope 3 emissions.



Conclusion

Completing annual greenhouse gas inventories is an iterative process, and each GHG inventory represents just a snapshot in time. In a given year, there can be a number of limitations in collecting the data, or discovering new data sources. This inventory, and each previous inventory, provides a best estimate of Emory’s GHG emissions. During each inventory, the team

discovers new lessons learned and best practices to be implemented during the subsequent year's data collection process. In addition, as the urgency of the climate crisis continues to strengthen, there is a growing recognition for all sectors to continue to expand their reporting to include more emissions types, particularly for Scope 3. OSI is currently evaluating the feasibility of expanding its Scope 3 reporting to include supply chain purchases. Emory University is committed to annually benchmarking its GHG emissions and updating its reporting methodology to follow industry best practices.

APPENDIX A – FY21 GHG Emissions

This table shows the GHG emissions for each emissions type for FY21. All figures are reported in MT CO₂e.

Emission Type	Emissions (MT CO ₂ e)
Total	190,728.46
Scope 1	53,033.52
Scope 2	113,830.79
Scope 3	23,864.16
Stationary Fuels	48,402.04
Transport Fuels	3,501.92
Refrigerants	1,111.97
Fertilizers	17.58
Purchased Electricity	113,830.79
Faculty Commuting	816.48
Staff Commuting	14,254.17
Student Commuting	545.55
Air Travel	1,298.99
Mileage	254.93
Study Abroad	17.51
Waste	251.84
Wastewater	99.92
T&D Losses	6,324.77

APPENDIX B – Emissions Reduction Comparisons

This table shows a breakdown of emissions reductions over time. Each positive figure is the percent emissions reduction. Each negative figure is a percent increase in emissions. Emory originally calculated GHG emissions using the Campus Carbon Calculator, which was updated and relaunched as SIMAP. During this transition, some original data inputs were not valid for SIMAP, in this case Wastewater and Waste, making comparisons to the FY10 baseline skewed for analysis.

The purpose of this table is to show the following emissions reductions:

- FY21-FY10: compares FY21 to FY10 to show total reduction of emissions, and progress made toward Emory’s carbon neutrality goals
- FY21-FY19: compares FY21 to FY19 to show the percent reductions achieved between the two most recent inventories
- FY19-FY10: compares FY19 to FY10 to show where FY21 are skewed by COVID-19 protocols

Emissions Type	FY21-FY10 (%)	FY21-FY19 (%)	FY19-FY10 (%)
Total	40.85	16.25	29.38
Scope 1	25.47	3.08	23.10
Scope 2	40.04	8.20	34.68
Scope 3	61.31	51.37	20.43
Stationary Fuels	18.46	3.67	15.35
Transport Fuels	-86.67 (increase)	5.47	-97.49 (increase)
Refrigerants	88.77	-45.97 (increase)	92.31
Fertilizer	8.58	-314.62 (increase)	77.95
Purchased Electricity	40.04	8.20	34.68
Faculty Commuting	75.42	76.19	-3.26 (increase)
Staff Commuting	49.57	-14.99 (increase)	56.14
Student Commuting	81.72	87.63	-47.77 (increase)
Air Travel	88.72	92.88	-58.49 (increase)
Mileage	43.51	64.32	-58.32 (increase)
Study Abroad	99.51	99.35	24.62
Waste	Historic Errors	34.79	Historic Errors
Wastewater	Historic Errors	23.79	Historic Errors
T&D Losses	46.10	4.93	43.30