

UVA 2022 GREENHOUSE GAS INVENTORY

SUMMER 2023

UVA SUSTAINABILITY



SUSTAINABILITY · UVA
From the Grounds Up

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Executive Summary

In December 2019, the University of Virginia Board of Visitors committed to **be carbon neutral by 2030 and fossil fuel-free by 2050**. UVA's carbon neutrality goal includes greenhouse gas (GHG) emissions related to the operation of the University – commonly referred to as Scope 1 and Scope 2 emissions. This best aligns with the Climate Registry's Protocol and Operational Control Approach, which includes emission sources UVA has the authority to affect through operating policies and initiatives. The University also tracks indirect emissions, known as Scope 3 emissions, from sources such as faculty, staff and student commuting, business air travel, food, and student study abroad as part of the University's larger inventory. This inventory tracking will continue to expand and improve as more data continue to be collected and as methodology for calculations become more robust. More information on UVA's climate goals can be found [here](#).

In calendar year 2010, the baseline year for emissions analysis, UVA's Scope 1 and 2 GHG emissions footprint was 291,117 metric tons of carbon dioxide equivalent (MTCO_{2e}). In 2022, Scope 1 and 2 emissions decreased to 161,319 MTCO_{2e}, resulting in a **44.6% reduction in emissions over 12 years**. This reduction is a significant step towards achieving UVA's climate goals.

Reduction Strategies

Emissions reductions since 2010 can be attributed to the following initiatives:

- Energy efficiency requirements for all new buildings as part of UVA's comprehensive [Green Building Standards](#);
- Energy efficiency upgrades for existing buildings, such as the [Building Efficiency Program](#) and [Smart Labs](#) programs;
- District energy system optimization, which includes fuel switching, equipment upgrades, and connecting more facilities to UVA's centralized electricity, heating, and cooling systems;
- [Renewable energy procurement](#), including six rooftop solar installations on Grounds and two off-site solar facilities that combined account for approximately 15% of the University's electricity consumption;
- Continuing to transition fleet vehicles to electric and hybrid models;
- Improvements to the electric grid, which have reduced the carbon intensity of UVA's electricity consumption; and
- Promoting more sustainable commuting practices and coordinating with regional transit partners which reduces scope 3 emissions.

GHG Inventory Overview

UVA's Scope 1 and 2 emissions by category is shown in Figure 1 and Table 1. As this figure illustrates, most of UVA's GHG emissions come from electricity and stationary fuel consumption.

The latter is driven by the combustion of natural gas and oil to provide heating for university buildings, with coal as a back-up source when the University is curtailed on natural gas. Additional sources of GHG emissions come from the University’s vehicle fleet (aka “tailpipe” emissions), fugitive refrigerants and fertilizer. Notably, UVA’s GHG emissions reductions have been realized despite continuous growth in the University’s operational and physical footprint. The increase in GHG emission from 2021 to 2022 is due to UVA fully returning to normal operations after the COVID-19 pandemic.

Figure 1: UVA’s GHG Emissions by category (MTCO₂e), Calendar Years 2010-2022

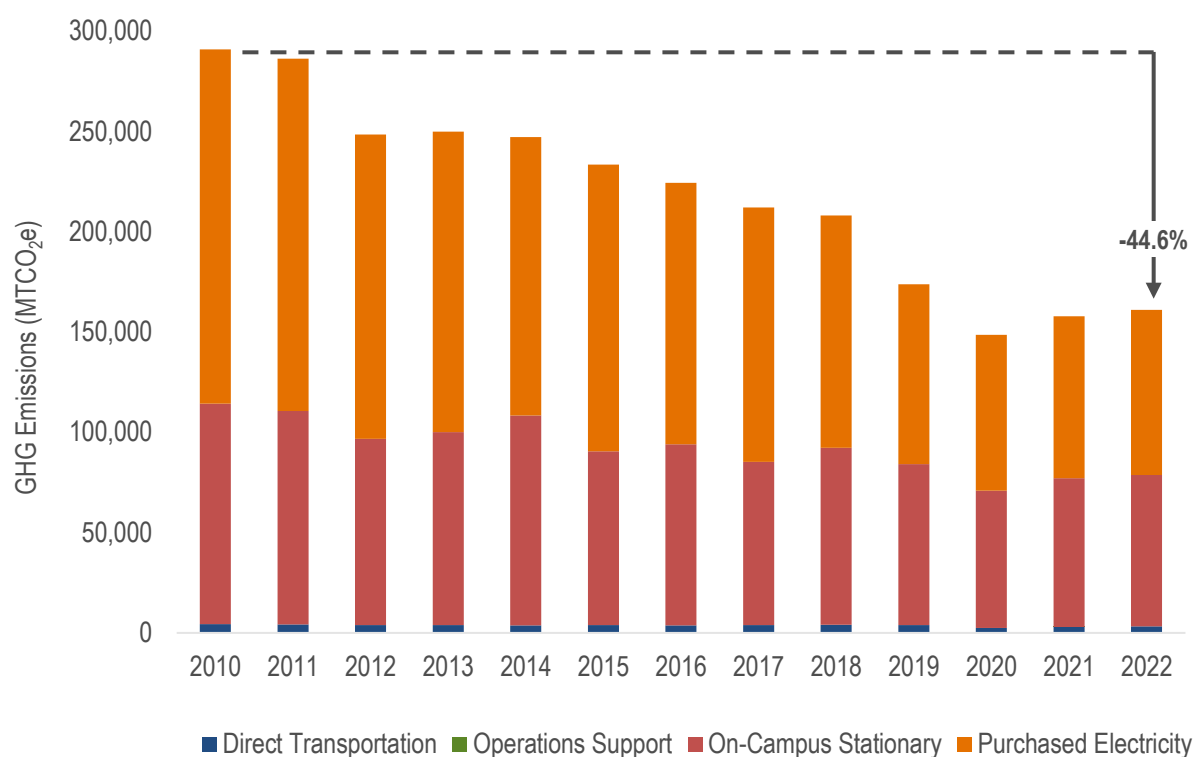


Table 1: UVA GHG Emissions by category (MTCO₂e), Calendar Years 2010-2022

GHG Source	2010	2017	2018	2019	2020	2021	2022
Electricity	176,644	126,882	115,710	89,698	77,569	80,633	82,259
Stationary Fuel	109,886	81,282	88,229	80,215	68,466	74,292	75,500
Transportation	4,330	3,954	4,067	3,874	2,500	2,887	3,232
Operations	258	2,205	1,682	358	264	391	328
Total Gross Emissions	291,117	214,324	209,687	174,144	155,095	164,747	161,319

*Totals may not sum due to independent rounding.

Background

In December 2019, the UVA Board of Visitors approved a resolution for **the University to be carbon neutral by 2030 and fossil fuel-free by 2050**. UVA Office for Sustainability has worked with stakeholders to develop and implement strategies to meet these reduction goals. These goals align with UVA's 2030 Great and Good Plan and build upon the successes of the board's 2011 and 2013 sustainability resolutions, the first UVA 2016-2020 Sustainability Plan, and the work of thousands of engaged individuals over the past several years. This report defines UVA's GHG accounting methodology, documents the current footprint, and analyzes the observed emission trends to target areas for further reductions.

Methodology

UVA's GHG Inventory is calculated each calendar year and measured against a 2010 baseline using the web-based Sustainability Indicator Management & Analysis Platform ([SIMAP](#)) developed by the University of New Hampshire. The methodologies in this tool align with the recommendations of the American College and University Presidents' Climate Commitment guidance, which refers to the Climate Registry's General Reporting Protocol and the World Resource Institutes' Greenhouse Gas Protocol Corporate Accounting and Reporting Standard.

SIMAP calculates emissions from activities that produce carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), refrigerants, and other greenhouse gases. These emissions are converted to metric tons of carbon dioxide equivalent (MTCO₂e) using global warming potentials provided by the Intergovernmental Panel on Climate Change's Assessment Reports. Calculation results are reviewed within Facilities Management, by SIMAP reviewers, and then posted publicly on the UVA Sustainability website. In this report, "carbon emissions" and "carbon footprint" refer to the total GHG emissions converted to carbon dioxide emissions equivalent (CO₂e).

Climate Goal and GHG Inventory Boundaries

The 2030 carbon neutrality and 2050 fossil fuel-free goals include all UVA-owned properties in the vicinity of Main Grounds in City of Charlottesville and Albemarle County, including both Academic and Health System properties (approximately 550 buildings). These buildings use electricity and thermal energy provided from one of UVA's heating or chilled water plants. UVA's climate goals include all Scope 1 and 2 emissions within this boundary. Per SIMAP recommendations, "de minimis" sources that make up less than 1% of the total scope 1 and 2 footprint are excluded from this calculation. More information can be found on UVA's [Climate Goal FAQ webpage](#).

As UVA Real Estate Foundation properties contiguous to Main Grounds are acquired by UVA, and as new buildings are constructed, they are added to the inventory and factored in as growth. Non-contiguous UVA Real Estate Foundation land, as well as University Physicians Group, College at Wise, leased, and satellite properties are not currently included in the goal because they are either outside of UVA's operational control or utility data is not available.

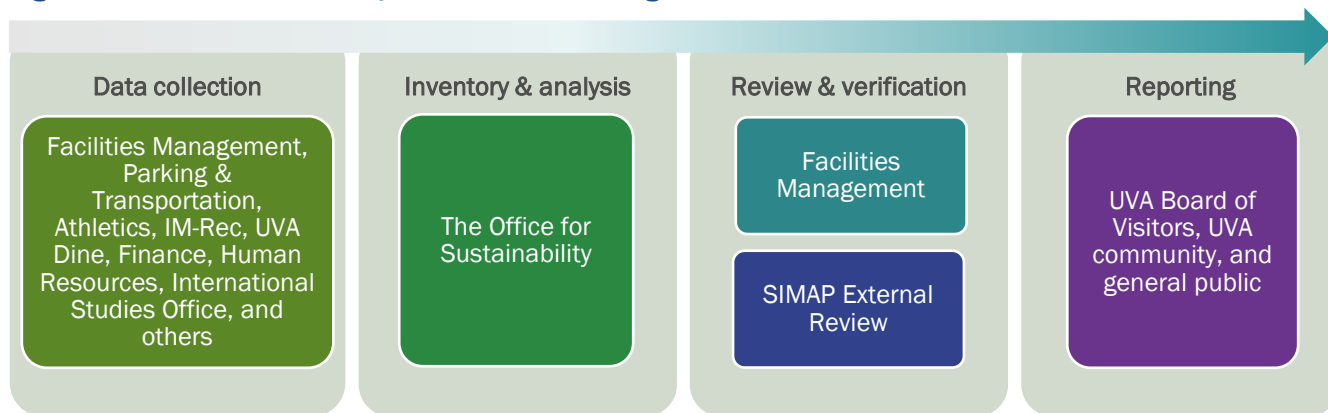
While Scope 3 emissions (e.g., commuting and food-related emissions) are not included in the 2030 and 2050 climate goals, they are included in UVA’s annual GHG Inventory. The table below illustrates which sources of emissions are included in or excluded from this inventory and the University’s two major climate goals. While not directly included in an emissions reduction goal, the University will continue to track, manage, and mitigate indirect Scope 3 emissions where possible. As information about additional sources of Scope 3 emissions becomes available over time, these sources will be incorporated into the University’s GHG footprint. For example, Scope 3 emissions associated with university-affiliated air travel (e.g., study abroad travel) began to be included in the 2021 GHG inventory for the first time. We are currently in the process of backfilling data for study abroad travel and business travel. More information is provided in the *Scope 3 Sources* section below.

	Greenhouse Gas Inventory	Carbon Neutral Goal	Fossil Fuel Free Goal
Scope 1 & 2	Refrigerants, Fertilizer, & Chemicals	Yes	Yes
	Fuel - Transport	Yes	Yes
	Fuel - Buildings & District Utilities	Yes	Yes
	Purchased Electricity	Yes	Yes
Scope 3	Commuting	Yes	No
	Food	Yes	No
	Travel	Yes	No

Data Collection

Data input into SIMAP is derived from a variety of University personnel and sources. Fuel and electricity consumption are metered, and records are retained by Facilities Management. Direct transportation fuel consumption is maintained by Parking and Transportation. Records of refrigerant use are sourced from a variety of locations, with Facilities Management and UVA Dine being the primary contributors. Fertilizers are used and logged by Landscaping (Facilities Management), Athletics and Intramural-Recreational Sports. Data for estimating Scope 3 emissions are provided by numerous UVA schools and business units, including Procurement and Supplier Diversity Services, the University of Virginia Health System, UVA Dine, Darden School of Business, the International Studies Office (ISO), and others. Figure 2 portrays UVA’s institutional arrangements regarding the GHG Inventory process.

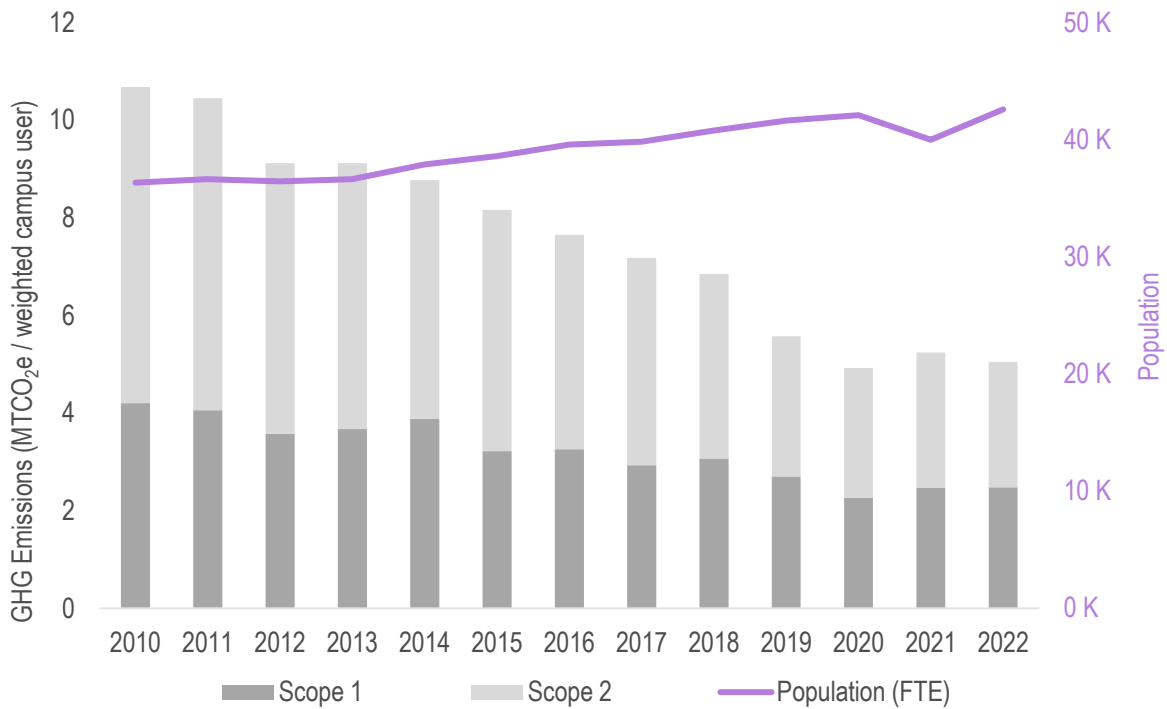
Figure 2: UVA GHG Inventory Institutional Arrangements



Addressing growth

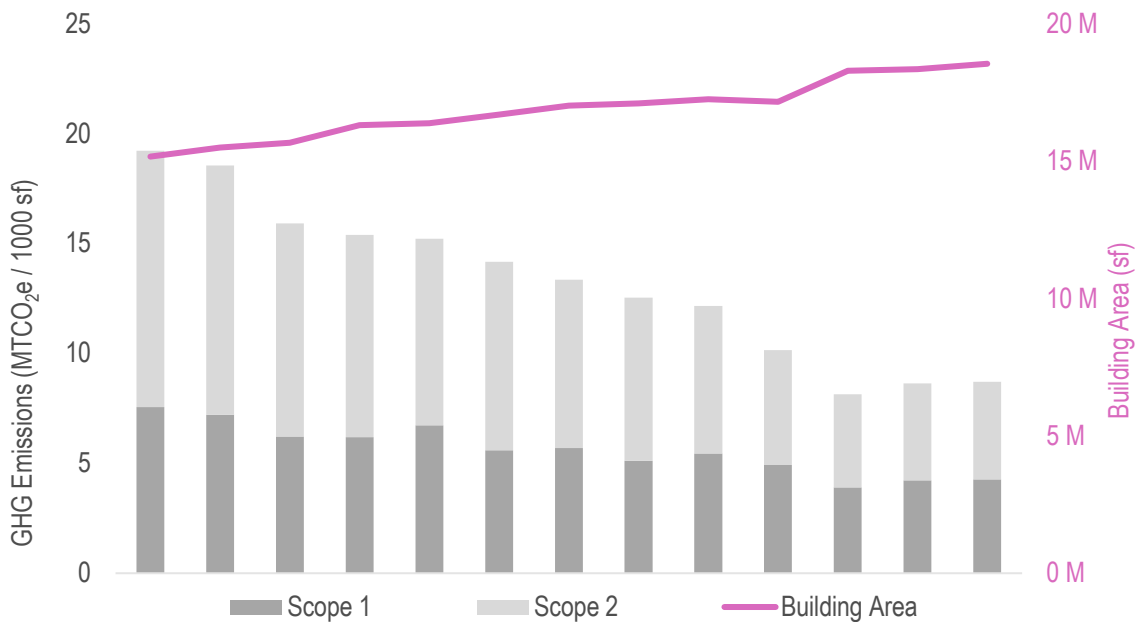
Expansion of the University's offerings has resulted in growth in both population and building area. Since 2010, the population has increased by 6,253 students, faculty, and staff (17.2% increase). Approximately 3.4 million square feet (22.3% increase) of building space has been added to UVA's footprint and included within the boundaries defined for UVA's GHG inventory. **Despite growth, UVA has reduced its normalized, Scope 1 and 2 emissions both per weighted campus user* and by square foot.** In 2010, UVA reported 12.7 MTCO₂e per person and 22.9 MTCO₂e per thousand square feet. In 2022, these numbers decreased to 6.5 MTCO₂e per person and 9.03 MTCO₂e per thousand square feet, respectively. The University's commitment to achieving its carbon neutrality and fossil fuel-free goals, considering its continuing expansion, ensures integration of sustainability in renovations and new construction to enhance the University's operations and building portfolio. Figure 3 and 4 report UVA's normalized 2022 GHG emissions by scope.

Figure 3: UVA Normalized GHG Emissions by scope (MTCO₂e / weighted campus user), 2010-2022



*Weighted campus user is [based on AASHE STARs 2.1 definition](#)

Figure 4: UVA Normalized GHG Emissions by scope (MTCO₂e / 1,000 gross square feet), 2010-2022



Emissions by Scope

When comparing the University’s emissions by scope, several trends emerge. As Figure 5 illustrates, Scope 1 and 2 emissions have decreased over time, while Scope 3 emissions exhibit a less consistent pattern over time. Scope 1 emissions are those produced by the combustion of fossil fuels in buildings, heating plants, and University fleet vehicles, as well as smaller categories like refrigerants and fertilizer. The decrease in Scope 1 emissions is mainly driven by district energy system optimization, which includes fuel switching, equipment upgrades, and connecting more facilities to UVA’s centralized heating and cooling systems. Scope 2 emissions are associated with purchased electricity and have also decreased due to energy efficiency upgrades in buildings and energy systems over time. Electricity-related emissions have dropped even more as the regional grid has become less carbon intensive and the University has procured renewable electricity. The variation in Scope 3 emissions represents the increase in total sources of emissions over time, adding more categories of data to the calculations, as well as a time lag in the availability of data across a decentralized institution. Estimates for University-affiliated air travel emissions, for example, were only added to the inventory in 2021. Efforts to populate historical data back to 2010 are ongoing. Food-related emissions are only available through 2021 (with 2022 emissions inventory still in the works). More information on changing emissions factors can be found in section 2 of the appendix.

Scope 2 emissions, from purchased electricity, constitute the largest contributor to UVA’s GHG footprint (excluding scope 3 emissions outside of the University’s goal). In 2022, Scope 2 emissions accounted for 51.0% of total emissions. Scope 1 emissions contributed 49.0%. Figure 5 and Table 2 report UVA’s 2022 GHG emissions by scope.

Figure 5: UVA GHG Emissions by scope (MTCO₂e), 2010-2022

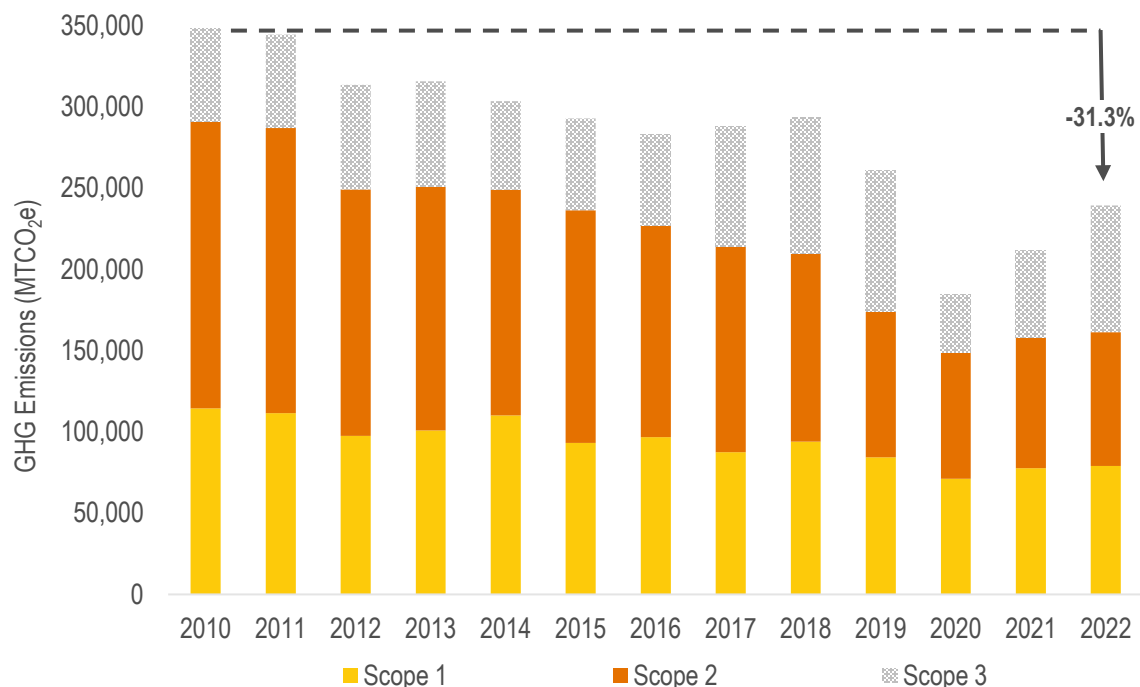


Table 2: UVA GHG Emissions by scope (MTCO₂e), 2010-2022

GHG Scope	2010	2017	2018	2019	2020	2021	2022
Scope 1	114,473	87,442	93,977	84,446	71,230	77,570	79,060
Scope 2	176,644	126,882	115,710	89,698	77,569	80,633	82,259
Scope 3 ^a	77,284	97,971	110,355	111,247	58,100	78,630	103,954
Total Gross Emissions (excluding Scope 3)	291,117	214,324	209,687	174,144	148,799.6	158,203	161,319

*Totals may not sum due to independent rounding.

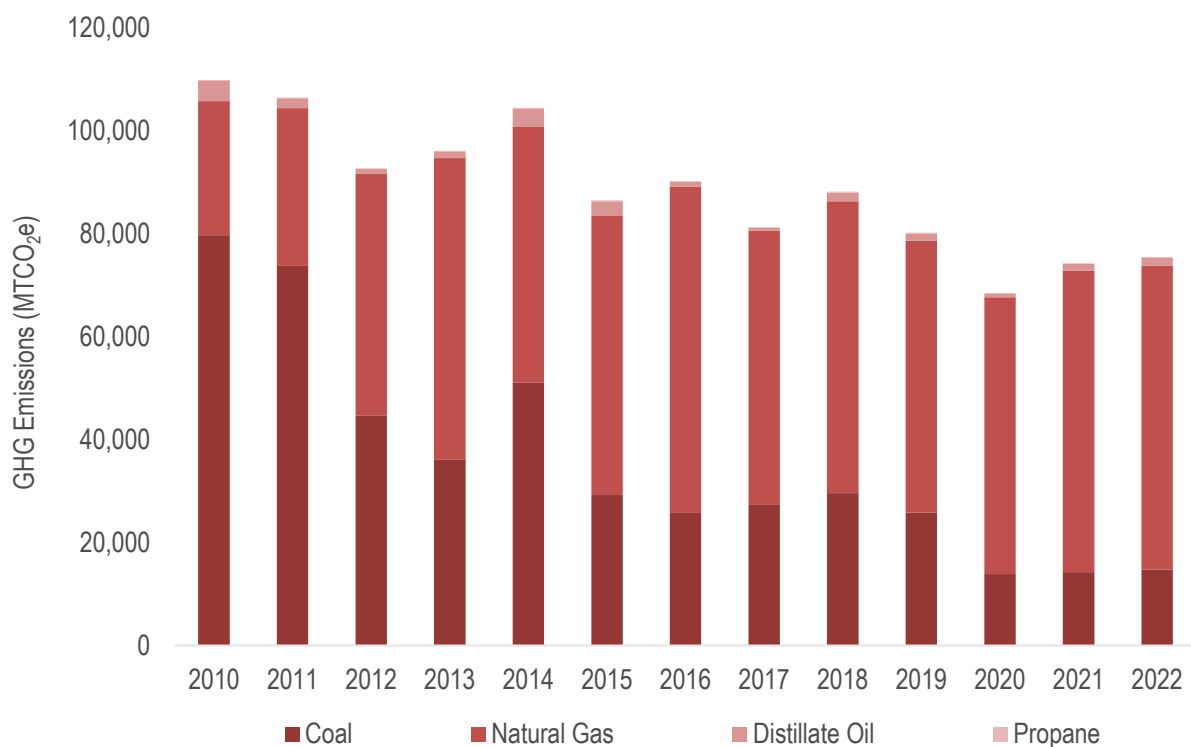
**Refer to Appendix A Table 4 for a complete Scope 1&2 emission data set from 2010 to 2022.

a. UVA Tracks Scope 3 emissions, however they are not considered part of UVA's carbon neutral and fossil fuel-free goal

Fuel (On-Grounds Stationary Sources)

Most of UVA's Scope 1 emissions stem from on-Grounds stationary fuels used for heating. Additional uses of stationary fuels include emergency and temporary generators. These sources include natural gas, coal, distillate oil, and propane gas. When the University is curtailed on using natural gas (due to larger considerations on the grid), coal is a back-up source to ensure reliability for the hospital system and other critical spaces. In 2022, these sources accounted for 75,499.6 MTCO₂e, or 46.8% of UVA's emissions. This total was an 1.6% increase from 2021 and a 31.3% decrease from 2010 levels.

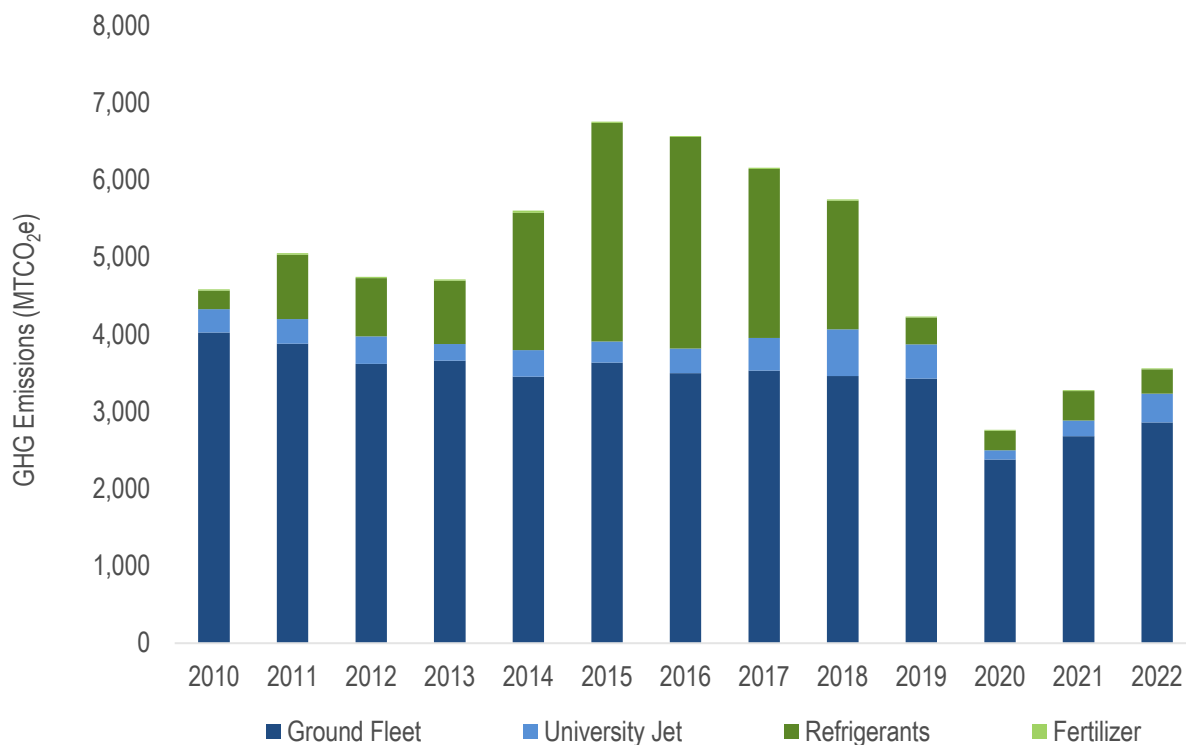
Figure 6: UVA On-Grounds Stationary Combustion Emissions (MTCO₂e) Trends, 2010-2022



Transportation & Operations

The UVA ground-vehicle fleet includes the University Transit System buses, cars, and maintenance vehicles that are owned and operated by the university. These vehicles typically consume gasoline, diesel, or biodiesel fuel. The University operates fourteen electric vehicles whose emissions contributions are included with Scope 2 electricity-related emissions, as they do not contribute direct Scope 1 emissions. UVA vehicles and the University’s jet accounted for 3,232.1 MTCO_{2e}, in 2022. Together, these sources equal approximately 2.0% of total Scope 1 and 2 emissions. Additionally, UVA calculates the emissions generated from the release of refrigerants and other select chemicals into the atmosphere as well as off-gassing from fertilizers. In 2022, these sources represent 316.7 and 11.5 MTCO_{2e}, respectively, or less than 1% of Scope 1 and 2 emissions.

Figure 7: UVA Transportation and Operations Emissions (MTCO_{2e}) Trends, 2010-2022

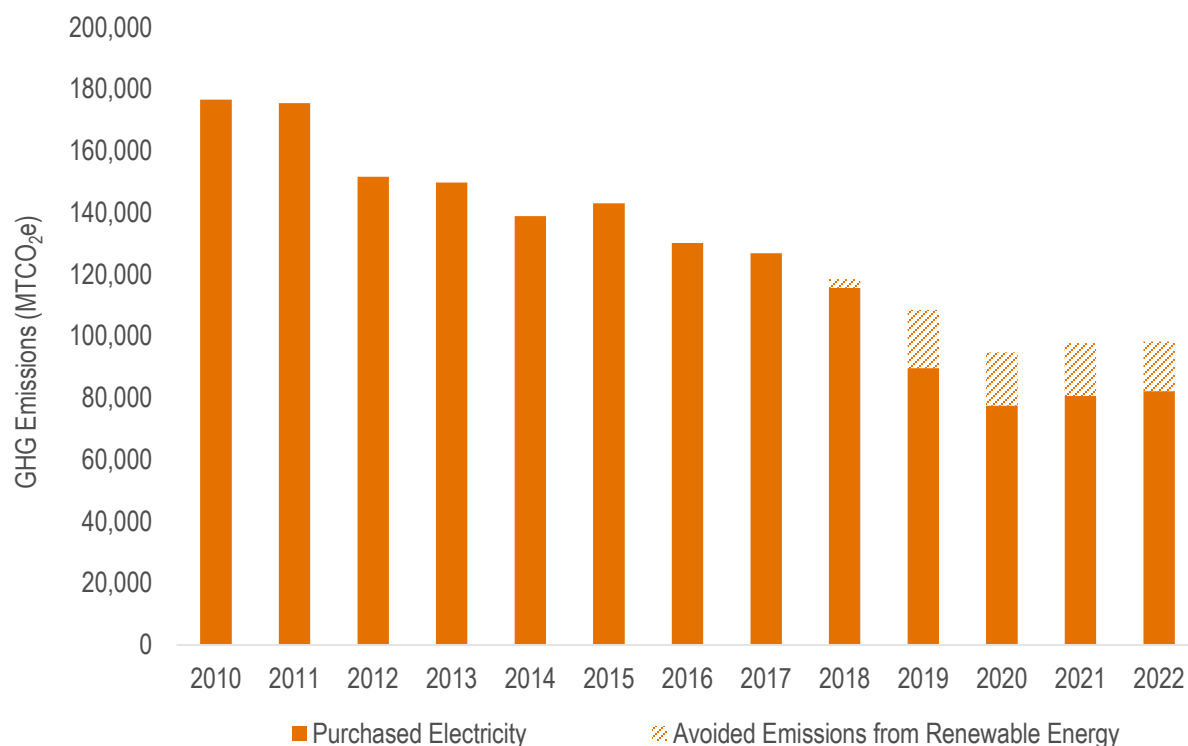


Electricity

Electricity consumption, used primarily for cooling and electrical services such as lighting and equipment in buildings, continues to be the largest source of GHG emissions at UVA. In 2022, purchased electricity accounted for 82,259.2 MTCO_{2e}, or 51.0% of Scope 1 and 2 emissions. This was a 2.0% increase from 2021 and a 53.4% decrease from 2010. Additionally, through a power purchase agreement with Dominion Virginia Power, UVA is generating approximately 60,000 megawatt hours of solar renewable electricity annually. This electricity is generated from

two off-site, utility-scale solar fields, known as Hollyfield and Puller. Together, these installations help UVA avoid approximately 20,000 MTCO₂e of emissions each year.

Figure 8: UVA Electricity GHG Emissions by Source (MTCO₂e), 2010-2022



Scope 3 Categories

In addition to the categories included in UVA’s GHG reduction goal, the University collects data on emissions for several indirect sources including student, faculty and staff commuting, directly financed air travel, study abroad air travel, waste, wastewater, food, electricity transmission and distribution (T&D) losses, and other fuel- and energy-related activities (FERA). Due to the highly decentralized nature of purchasing at UVA, the requisite data may not be readily available, but UVA will continue to calculate additional emissions sources as data is received. Additional Scope 3 emissions categories may not be included due to their de minimis contribution. Thus, Scope 3 emissions numbers will likely increase as more data is added. Regardless, UVA is committed to implement strategies to reduce these emissions to the extent possible.

Much of UVA’s commuting emissions is captured in the City of Charlottesville and Albemarle County’s greenhouse gas inventories because of the way the Virginia Department of Transportation collects that data, based on miles traveled. For UVA’s inventory, commuting emissions are estimated from the approximate miles, frequency and mode of transportation students, faculty, and staff utilize to travel to and from the University each day. This information is collected through a University-wide survey that is conducted every three years, the last being 2017. The survey was postponed in through 2022 due to the dramatic change in typical

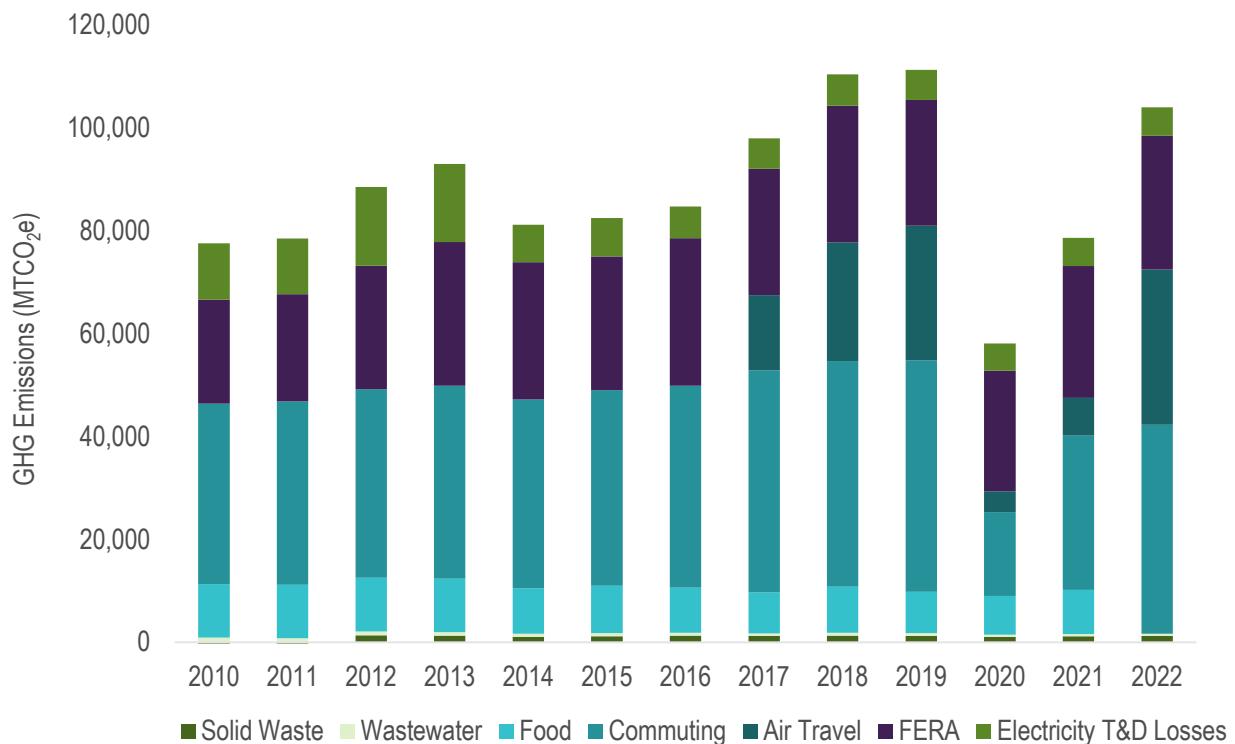
commuting practices in response to the COVID-19 pandemic. Following guidelines proposed by SIMAP and university policies, estimates were made based on university populations through 2020 and 2022 to determine a better estimate for community during the COVID-19 pandemic.

Waste-related data are collected and reported by Facilities Management. Wastewater emissions are estimated based on monthly sewer charges to the University.

Food data is collected as part of the Nitrogen goal tracking process based on data from dining halls, cafes, and restaurants on Grounds, as well as various catering services. Emissions factors for this data are calculated based on factors in SIMAP. The food emission inventory has a 1-year delay due to the extra time needed to gather and validate such large amount of data.

Upstream energy emissions refer to GHG emissions associated with energy supply chains that are otherwise not included in Scopes 1 and 2. Examples include energy transmission and distribution losses (e.g., power lines, natural gas pipelines). Purchased electricity’s transmission and distribution (T&D) losses are calculated as a percentage of total electricity consumption based on regional estimates provided by the U.S. Environmental Protection Agency. Upstream emissions associated with fossil fuel consumption (natural gas, coal, and fuel oil) are associated with the extraction, refining, storage, and transport of each fuel. In past years, these FERA emissions have not been included in SIMAP and have been done through external calculations. However, in 2022, SIMAP included FERA emissions built into their scope 3 emissions estimates. These are included in Figure 9 below.

Figure 9: UVA Scope 3 Emissions (MTCO₂e) Trends, 2010-2022



It is important to note there are Scope 3 GHG emission categories that are not included or recorded completely in UVA's GHG Inventory such as holiday travel and some aspects of study abroad travel. The study abroad air travel only includes undergraduate programs data from International Studies Offices and graduate programs data from Darden School of Business, UVA Law School, McIntire School of Commerce. These emission categories have not been included or recorded completely because University-wide reporting methods do not currently exist in the appropriate capacity to generate consolidated and complete information. The increase in 2022 air travel is due to additional schools (UVA Law) being added to the inventory and a return to travel post-COVID 19. Likewise, GHG emissions from purchased paper is not included in this inventory because a method of accurately accounting for paper purchasing on a university-wide basis is not currently available.

Appendix A: Emissions and energy trends

Table 3: UVA GHG Emissions by scope (MTCO₂e), 2010-2022 Complete Data

GHG Scope	2010	2011	2012	2013	2014	2015
Scope 1	114,473.2	111,532.6	97,474.0	100,867.0	110,109.1	93,294.6
Scope 2	176,643.8	175,505.8	151,650.5	149,829.3	138,885.7	143,030.3
Total Gross Emissions	291,117.0	287,038.4	249,124.4	250,696.3	248,994.8	236,324.9

(Continue)

GHG Scope	2016	2017	2018	2019	2020	2021	2022
Scope 1	96,845.2	87,441.9	93,976.9	84,446.3	71,230.3	77,570.1	79,059.9
Scope 2	130,273.8	126,882.4	115,710.0	89,697.5	83,864.5	87,176.4	82,259.2
Total Gross Emissions	227,119.0	214,324.3	209,686.8	174,143.8	155,094.8	164,746.5	161,319.1

*Totals may not sum due to independent rounding.

Table 4: UVA Electricity Emissions (MTCO₂e) Trends, 2010-2022

GHG Source	2010	2017	2018	2019	2020	2021	2022
Purchased Electricity	176,643.8	126,882.4	115,710.0	89,697.5	77,569.4	80,632.6	82,259.2
Avoided Emissions from Solar	-	-	(2,803.4)	(18,891.4)	(17,251.2)	(17,190.2)	(16,030.3)

*Totals may not sum due to independent rounding.

Table 5: UVA On-Grounds Stationary Combustion Emissions (MTCO₂e) Trends, 2010-2022

GHG Source	2010	2017	2018	2019	2020	2021	2022
Coal	79,735.9	27,320.2	29,614.0	25,830.7	13,896.7	14,248.8	14,747.7
Natural Gas	26,036.5	53,286.0	56,710.0	52,844.8	53,765.6	58,608.3	59,059.9
Distillate Oil	3,968.6	554.5	1,696.9	1,378.7	737.9	1,308.9	1,581.4
Propane	145.1	122.1	207.6	160.9	65.6	126.4	110.6
Total Gross Emissions	109,886.1	81,282.8	88,228.5	80,215.1	68,465.8	74,292.4	75,499.6

*Totals may not sum due to independent rounding.

Table 6: UVA Transportation Emissions (MTCO₂e) Trends, 2010-2022

GHG Source	2010	2017	2018	2019	2020	2021	2022
B100	271.6	97.0	92.3	93.8	58.0	63.9	67.6
Diesel	2,106.9	1,971.1	1,873.8	1,902.3	1,175.2	1,294.5	1,372.6
Gasoline	1,646.9	1,466.1	1,497.5	1,433.8	1,145.5	1,323.9	1,418.2
Jet Fuel	304.1	419.7	603.1	443.8	121.7	204.2	373.7
Total Gross Emissions	4,329.5	3,953.9	4,066.8	3,873.7	2,500.3	2,886.5	3,232.1

*Totals may not sum due to independent rounding.

Table 7: UVA Operations Support Emissions (MTCO₂e) Trends, 2010-2022

GHG Source	2010	2017	2018	2019	2020	2021	2022
Refrigerants & Chemicals	239.9	2,189.8	1,666.4	346.5	253.6	379.0	316.7
Fertilizer	17.7	15.4	15.3	11.0	10.5	12.2	11.5
Total Gross Emissions	257.6	6,159.0	5,748.4	4,231.1	2,764.5	3,277.7	3,560.4

*Totals may not sum due to independent rounding.

Table 8: UVA Scope 3 Emissions (MTCO₂e) Trends, 2010-2022

GHG Source	2010	2017	2018	2019	2020	2021	2022
Faculty Commuting	5,155.4	5,669.5	5,687.7	5,788.5	2,325.6	4,235.2	5,352.9
Staff Commuting	27,460.5	34,784.2	37,179.1	38,380.3	13,876.8	25,557.8	34,922.9
Student Commuting	2,475.6	2,723.0	959.5	811.3	89.2	223.5	297.2
Directly Financed Air Travel	0.0	14,614.1	23,113.7	26,130.7	4,039.0	6,687.0	22,842.9
Study Abroad Air Travel	0.0	0.0	0.0	0.0	0.0	596.5	7,372.3
Solid Waste	(236.7)	1,239.0	1,309.5	1,251.6	1,062.2	1,143.9	1,217.7
Wastewater	893.6	481.9	520.2	520.9	413.5	452.4	468.3
Food	10,400.7	7,979.8	8,974.9	8,059.6	7,545.9	8,585.5	N/A
FERA	20,217.4	24,514.4	26,440.6	24,468.5	23,440.6	25,673.3	25,978.2
T&D Losses	10,918.0	5,964.8	6,082.8	5,835.7	5,306.8	5,474.8	5,501.5
Total Gross Emissions	77,284.4	97,970.7	110,355	111,246.9	58,099.6	78,629.8	103,953.8

*Totals may not sum due to independent rounding.

Appendix B: Additional Information

Emissions Factors

Year to year emissions factors for several sectors may change due to new data sets becoming available or new methodologies are recommended. For example, electricity emissions factors for greenhouse gases change on an annual basis with an expected two-year lag for the [eGRID](#) to publish updates. We expect and account for updates to the eGRID emission factors on a yearly basis. Other instances of emissions factor changes are when new methodologies are recommended by the GHG protocol to better estimate emissions. These happen on a more infrequent basis and are often alerted to our team through announcements from the [SIMAP](#) platform. Updating our values – which in turn means updating numbers in prior year’s reports to reflect new methodologies allows us to make the best estimate of UVA’s emissions. This the primary reason a prior year’s total emissions may change in subsequent reports.

Additional Resources

This section provides external links to resources listed within the report.

1. [Sustainable Indicators Management and Analysis Platform \(SIMAP\)](#): Platform used to tabulate GHG footprint on an annual basis with information provided by stakeholders.
2. [Charlottesville City Climate Action Plan](#): Explains what is included in the Charlottesville City GHG inventory and what actions are being taken to reduce emissions.
3. [Albemarle County Climate Action Plan](#): Explains what is included in the Albemarle Climate GHG inventory and what actions are being taken to reduce emissions.