

UVA 2021 GREENHOUSE GAS INVENTORY



SUMMER 2022

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 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, such as faculty, staff and student commuting, business air travel, 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 can be found on UVA's [Climate Goal FAQ's webpage](#).

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 2021, Scope 1 and 2 emissions decreased to 164,746.5 MTCO_{2e}, resulting in a **43.4% reduction in emissions over 11 years**. This reduction is a significant step towards achieving UVA's climate goals.

Reduction Strategies

UVA prioritizes strategies that aggressively reduce carbon emissions. Emissions reductions since 2010 can be attributed to the following initiatives:

- District energy efficiency and optimization, which includes upgrades to UVA's centralized electricity, heating and cooling systems;
- Energy efficiency requirements for all new buildings as part of UVA's comprehensive [Green Building Standards](#);
- Energy retrofits for existing buildings, such as the Building Efficiency Program (previously [Delta Force program](#)) and [Smart Labs](#) programs;
- [Renewable energy procurement](#), including six rooftop solar installations on Grounds and two off-site solar facilities that combined account for approximately 20% of the University's electricity consumption;
- Promoting more sustainable commuting practices while continuing to provide the University Transit Service and partnering with Charlottesville Area Transit;
- Improvements to the electric grid, which have reduced the carbon intensity of UVA's electricity consumption; and
- Continuing to transition fleet vehicles to electric and hybrid models,

GHG Inventory Overview

Figure 1 and Table 1: show UVA's Scope 1 and 2 emissions by source. The slight increase from 2020 to 2021 is due to the return to more normal operations during the COVID-19 pandemic. As

this figure illustrates, UVA’s GHG emissions are driven by 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 greenhouse gases come from the University’s vehicle fleet (aka “tailpipe” emissions), fugitive refrigerants and fertilizer.

Figure 1: UVA’s GHG Emissions by source (MTCO2e), Calendar Years 2010-2021

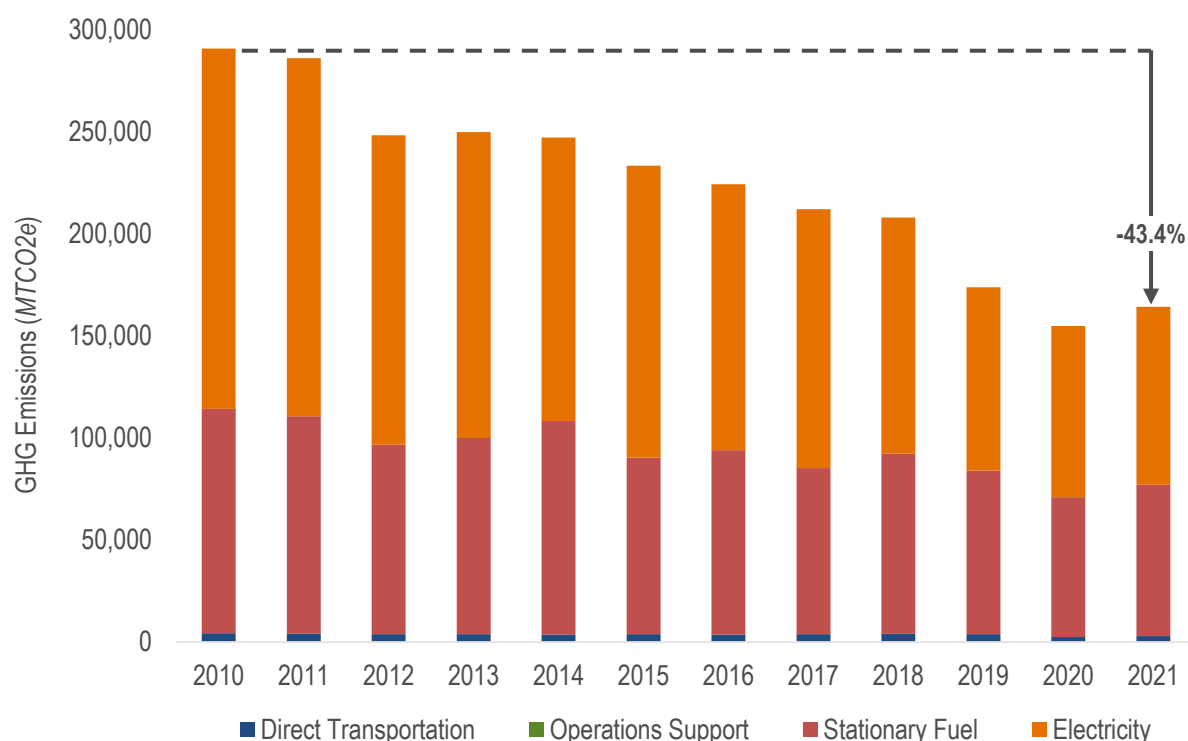


Table 1: UVA GHG Emissions by source (MTCO2e), Calendar Years 2010-2021

GHG Source	2010	2016	2017	2018	2019	2020	2021
Electricity	176,643.8	130,273.8	126,882.4	115,710.0	89,697.5	83,864.5	87,176.4
Fuel	109,886.1	90,274.3	81,282.8	88,228.5	80,215.1	68,465.8	74,292.4
Transportation	4,329.5	3,818.0	3,953.9	4,066.5	3,873.7	2,500.3	2,886.5
Operations	257.6	2,753.0	2,205.2	1,681.7	357.5	264.2	391.2
Total Net Emissions	291,117.0	227,119.0	214,324.3	209,686.8	174,143.8	155,094.8	164,746.5

*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**. 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.

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 purchased electricity – both utility scale solar and non-renewable 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. UVA's GHG Inventory includes the core buildings of the Health System that are contiguous to Grounds, which contribute approximately 30 percent of the total emissions produced by the University.

As UVA Real Estate Foundation properties contiguous to Main Grounds are acquired by UVA, they are added to the inventory and factored in as growth. Non-contiguous UVA Real Estate Foundation land, as well as the University Physicians Group, College at Wise, leased properties, 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 carbon footprint. For example, Scope 3 emissions associated with food purchases and University-affiliated air travel (e.g., study abroad travel) are included in this 2021 GHG inventory for the first time. 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	N/A
	Fuel - Transport	Yes	Yes	Yes
	Fuel - Buildings & District Utilities	Yes	Yes	Yes
	Purchased Electricity	Yes	Yes	Yes
Scope 3	Commuting	Yes	No	No
	Food	Yes	No	No
	Travel	Yes	No	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 the Procurement and Supplier Diversity Services, the University of Virginia Health System, UVA Dine and others.

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 6,218 students, faculty, and staff (18.4% increase). Approximately 3.2 million square feet (20.9% 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 person and by square foot.** In 2010, UVA reported 10.7 MTCO₂e per person and 19.2 MTCO₂e per thousand square feet. In 2021, these numbers decreased to 5.2 MTCO₂e per person and 9.15 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 2021 GHG emissions by scope.

Figure 3: UVA Normalized GHG Emissions by scope (MTCO₂e / weighted campus users), 2010-2021

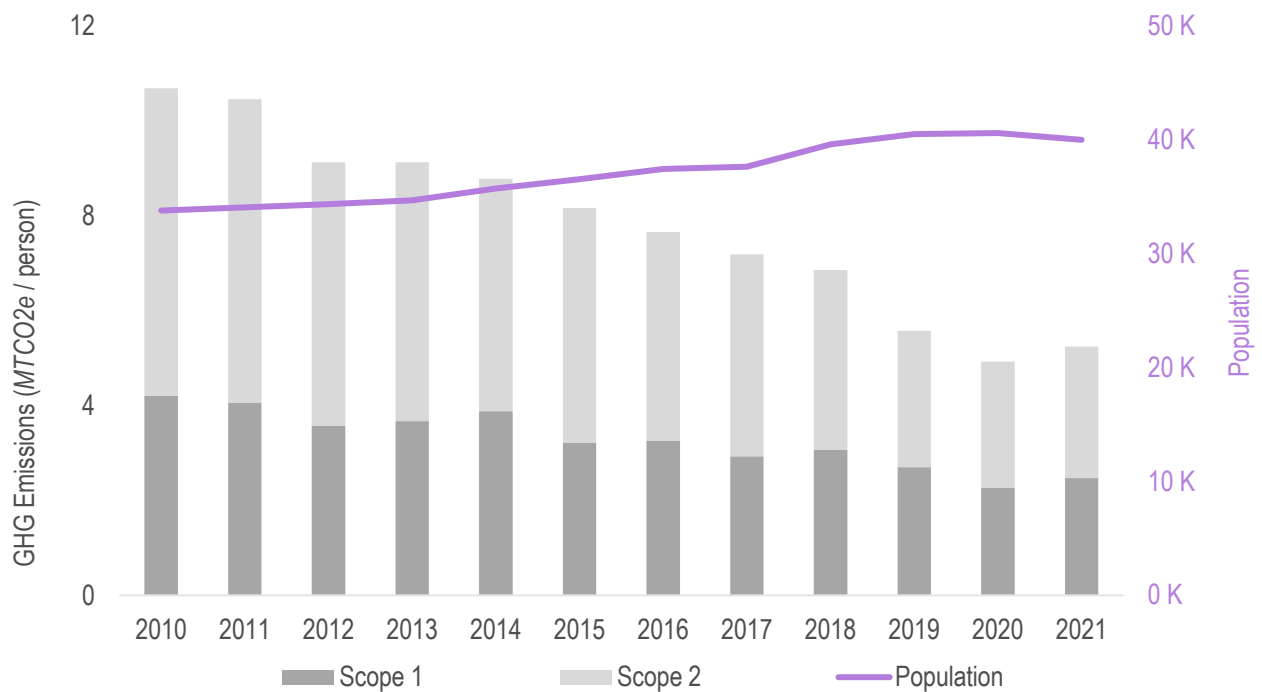
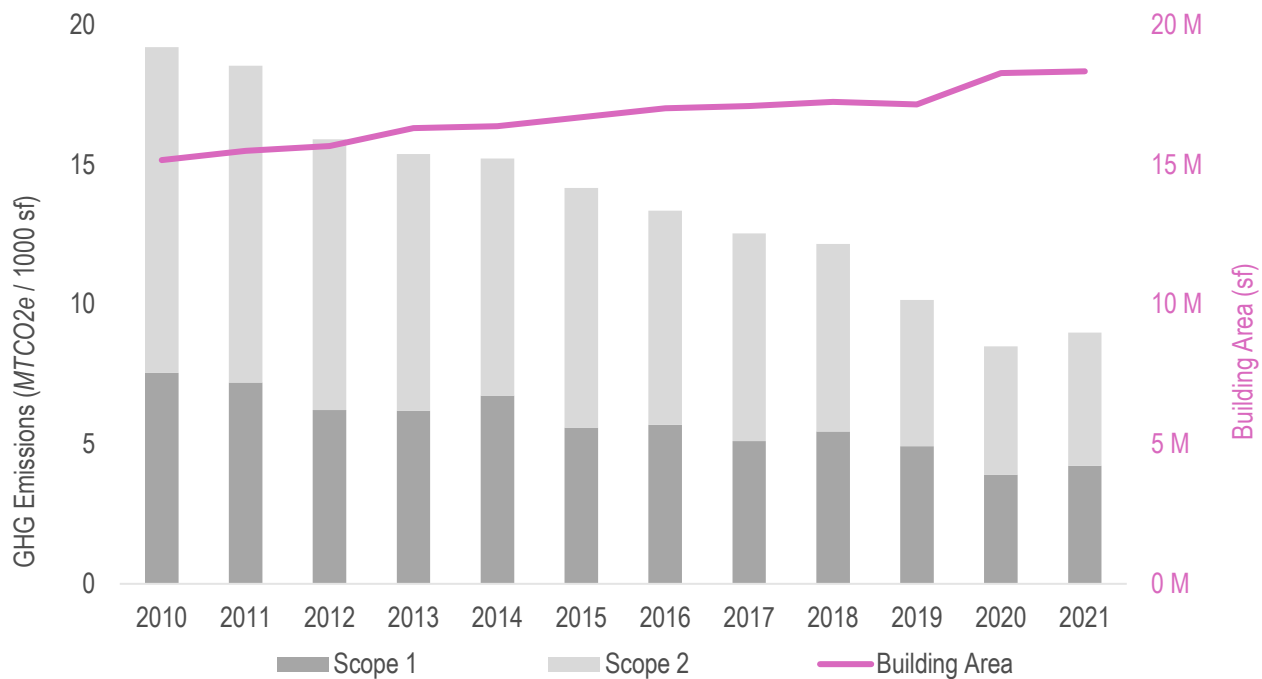


Figure 4: UVA Normalized GHG Emissions by scope (MTCO₂e / 1K TOTAL GROSS SQ. FT.), 2010-2021



COVID-19 Pandemic Strategies

The pandemic has had a clear impact on the University’s GHG emissions. In 2020, UVA experienced a significant reduction in energy usage in academic and administrative buildings, as well as in usage of its vehicle fleet, including the University’s jet. On the other hand, energy consumption increased at the hospital as the 440,000-square foot [University Hospital Expansion](#) project was completed. In response to the pandemic, UVA shut down or set back air flow and temperature setpoint at unoccupied spaces, significantly reducing unnecessary electricity consumption. As the University returned to more normal operation in 2021, UVA continued to implement the best practices established during the pandemic, such as nighttime/unoccupied building energy setbacks. The result is a slight increase in GHG emissions in 2021 compared to 2020. However, total emissions remain lower than in 2019 and the overall trend continues in a strong downward direction.

Emissions by Scope

When comparing the University’s emissions by scope, a number of 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 sources of emissions like refrigerants and fertilizer. The decrease in Scope 1 emissions is driven by energy efficiency upgrades and fuel switching (e.g., consuming more natural gas in lieu of coal). Scope 2

emissions are associated with purchased electricity and have also decreased due to energy efficiency upgrades 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 sources 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, are only available back to 2017. And food-related emissions are only available through 2019 (with 2020 and 2021 emissions inventory still in the work).

Scope 2 emissions, from purchased electricity, constitute the largest contributor to UVA's GHG footprint. In 2021 Scope 2 emissions accounted for 52.9% of total emissions. Scope 1 emissions contributed 47.1%. Figure 5 and Table 2 report UVA's 2021 GHG emissions by scope.

Figure 5: UVA GHG Emissions by scope (MTCO_{2e}), 2010-2021

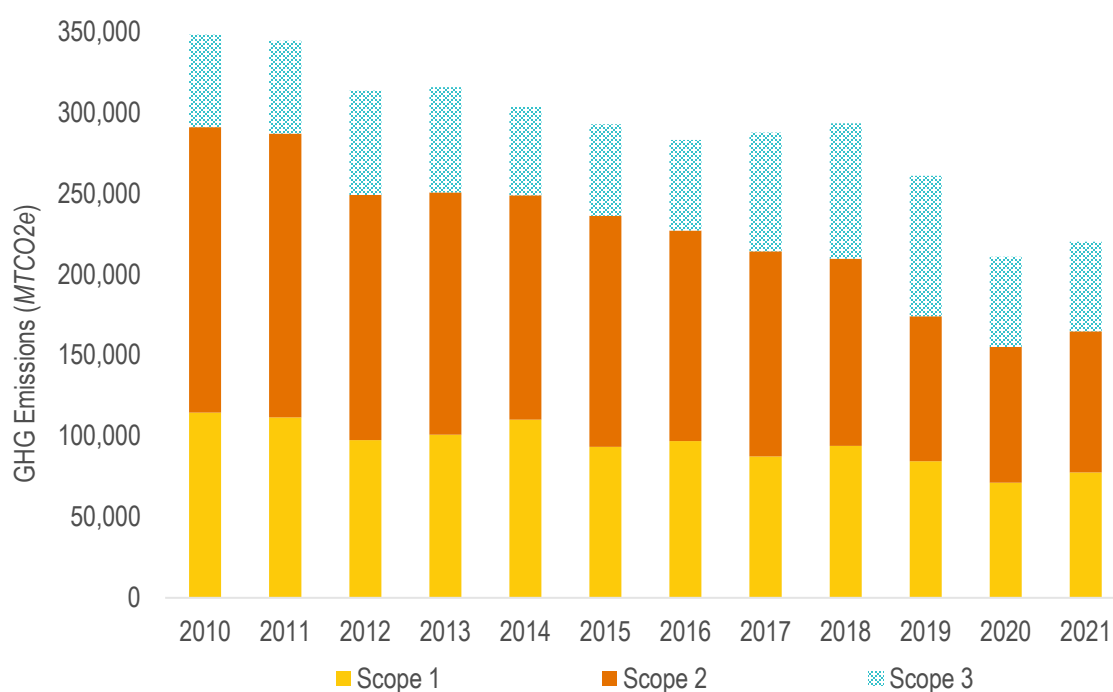


Table 2: UVA GHG Emissions by scope (MTCO_{2e}), 2010-2021

GHG Scope	2010	2016	2017	2018	2019	2020	2021
Scope 1	114,473.2	96,845.2	87,441.9	93,976.9	84,446.3	71,230.3	77,570.1
Scope 2	176,643.8	130,273.8	126,882.4	115,710.0	89,697.5	83,864.5	87,176.4
Scope 3 ^a	57,067.0	56,022.7	73,456.3	83,827.3	86,778.4	55,791.7	55,466.4
Total Net Emissions (excluding Scope 3)	291,117.0	227,119.0	214,324.3	209,686.8	174,143.8	155,094.8	164,746.5

*Totals may not sum due to independent rounding.

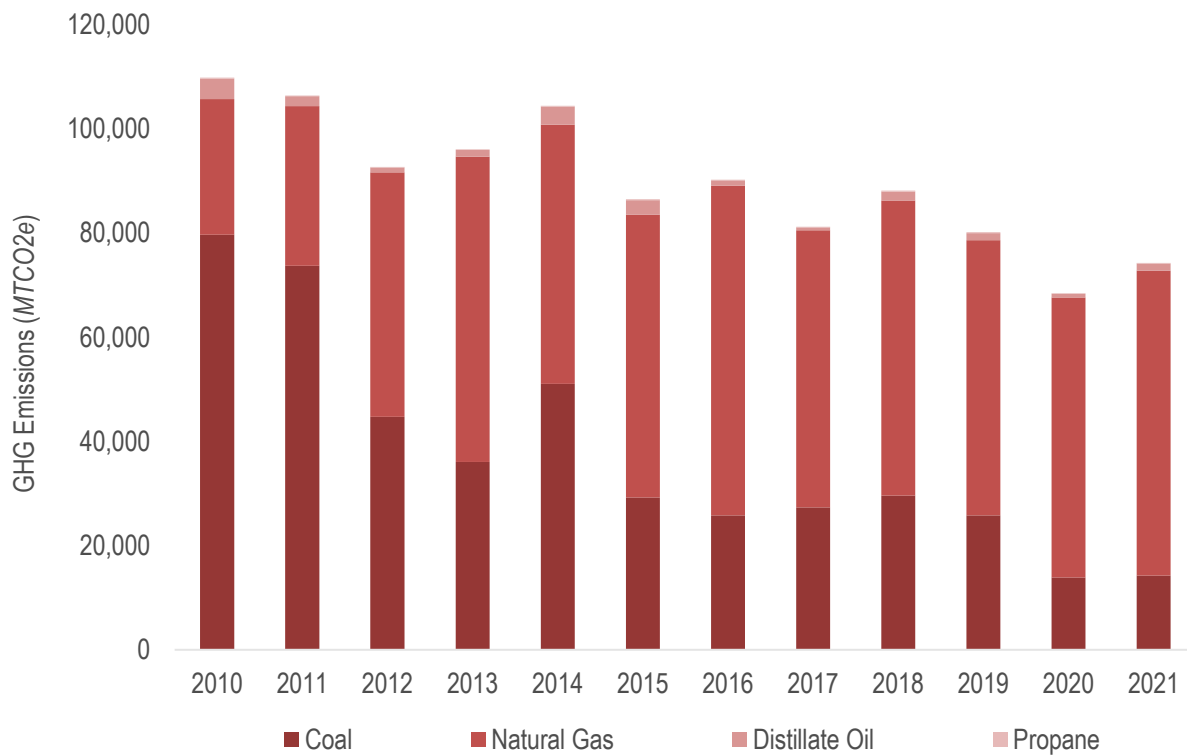
**Refer to Appendix A Table 4 for a complete Scope 1&2 emission data set from 2010 to 2021.

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, 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 2021, these sources accounted for 74,292.4 MTCO₂e, or 45.1% of UVA's emissions. This total was an 8.5% increase from 2020 and a 14.6% decrease from 2010 levels.

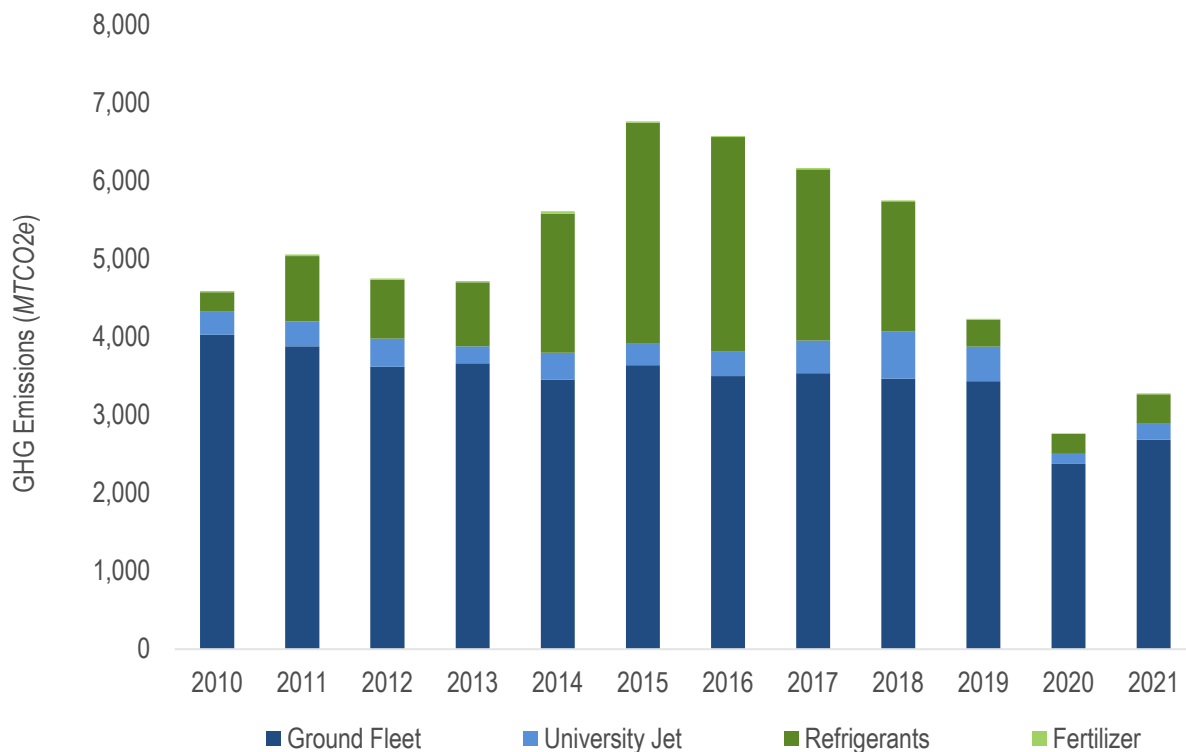
Figure 6: UVA On-Grounds Stationary Combustion Emissions (MTCO₂e) Trends, 2010-2021



Transportation & Operations

The UVA ground-vehicle fleet includes the University Transit System buses, cars, and maintenance vehicles. These vehicles typically consume gasoline, diesel, or biodiesel fuel. The University operates 14 electric vehicles which do not contribute direct Scope 1 emissions. UVA vehicles, and the University’s jet accounted for 2,682.3 and 204.2 MTCO₂e, respectively, in 2021. Together, these sources equal approximately 1.8% of total Scope 1 and 2 emissions. Additionally, UVA calculates the emissions generated from the release of refrigerants and other chemicals into the atmosphere as well as off-gassing from fertilizers. In 2021, these sources represent 379.0 and 12.2 MTCO₂e, respectively, or less than 1% of Scope 1 and 2 emissions.

Figure 7: UVA Transportation and Operations Emissions (MTCO₂e) Trends, 2010-2021

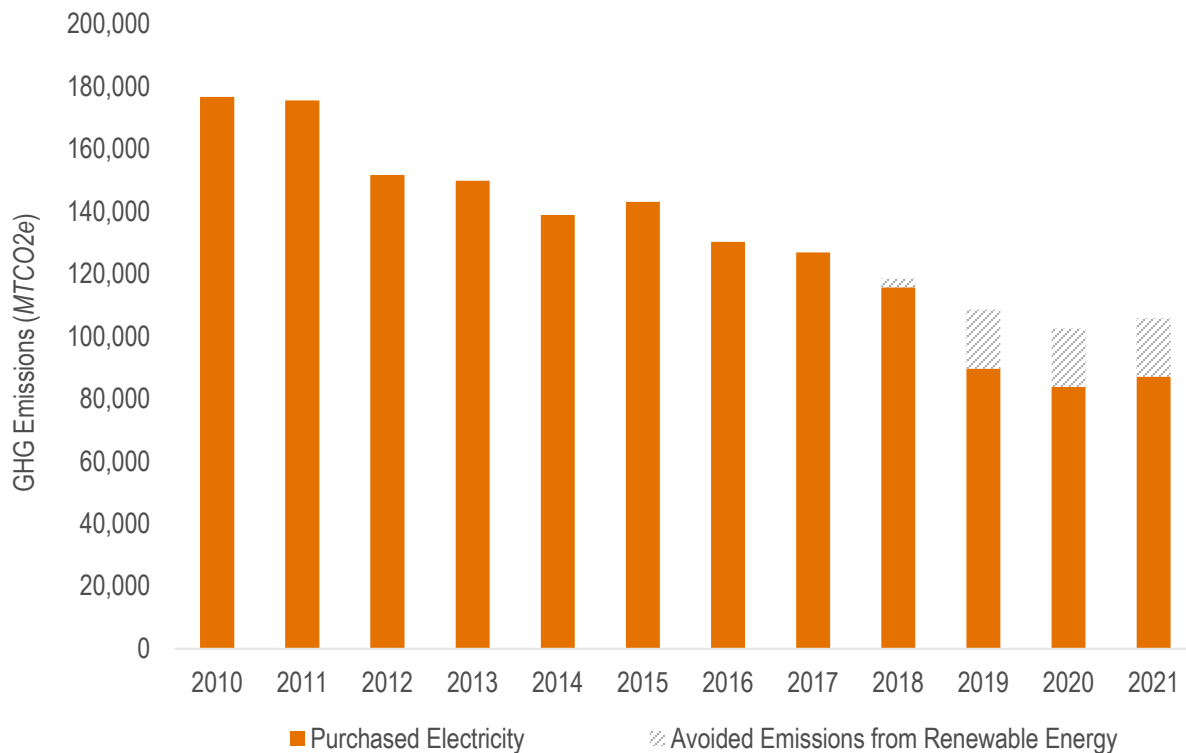


Electricity

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 2021, purchased electricity accounted for 87,176.4 MTCO₂e, or 52.9% of Scope 1 and 2 emissions. This was a 3.9% increase from 2019 and a 50.6% 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 MTCO_{2e} each year.

Figure 8: UVA Electricity GHG Emissions by Source (MTCO_{2e}), 2010-2021



Scope 3 Sources

In addition to the sources 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, electricity transmission and distribution (T&D) losses, waste, wastewater, and food. Due to the highly decentralized nature of purchasing at UVA, not all of the data is readily available, but UVA will continue to calculate additional emissions sources as data is received. 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.

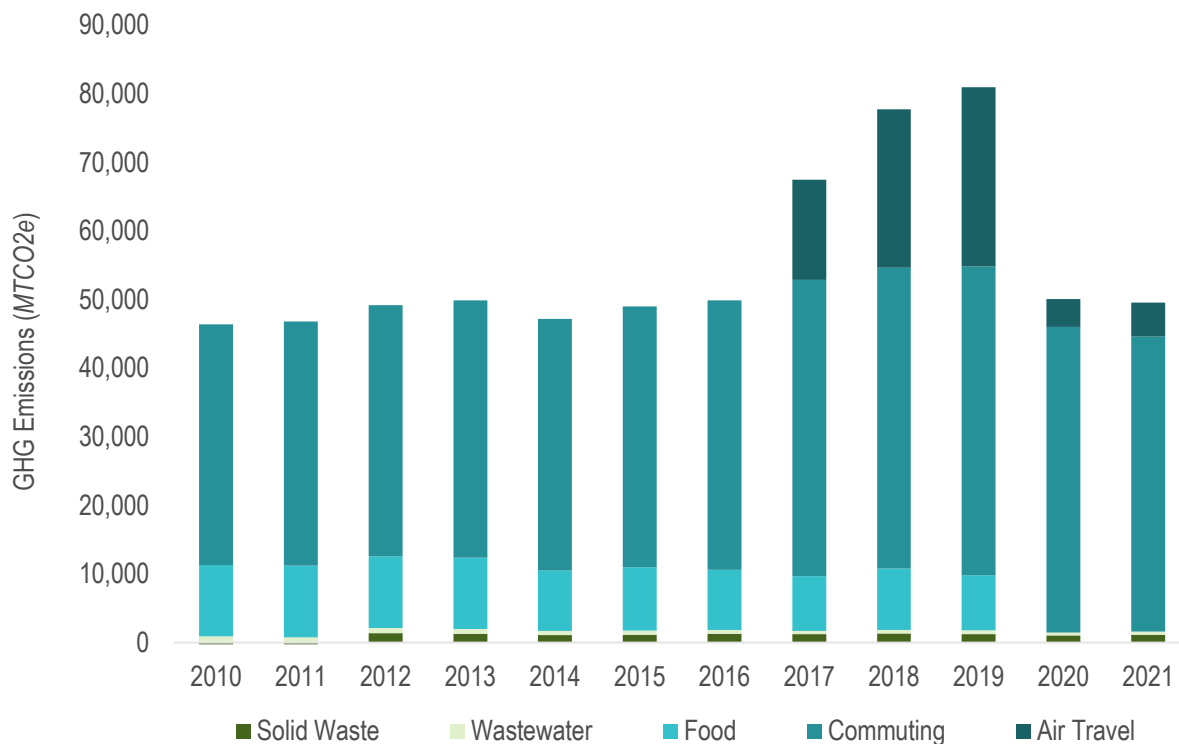
Much of UVA's commuting emissions is captured in the City of Charlottesville and Albemarle County's greenhouse gas inventories because of the way the Virginia Department of Transportation collects that data. For UVA's inventory, commuting emissions are estimated from the approximate miles, frequency 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 2020 and 2021 due to the dramatic change in typical commuting practices in response to the COVID-19 pandemic.

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. Waste activity 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 is calculated based on factors in SIMAP. The food emission inventory has a 2-year delay due to the extra time needed to gather and validate such large amount of data.

It is important to note there are Scope 3 GHG emission sources that are not included or recorded completely in UVA's GHG Inventory such as holiday travel and 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 and McIntire School of Commerce. These emission sources 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. 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.

Figure 9: UVA Scope 3 Emissions (MTCO2e) Trends, 2010-2021

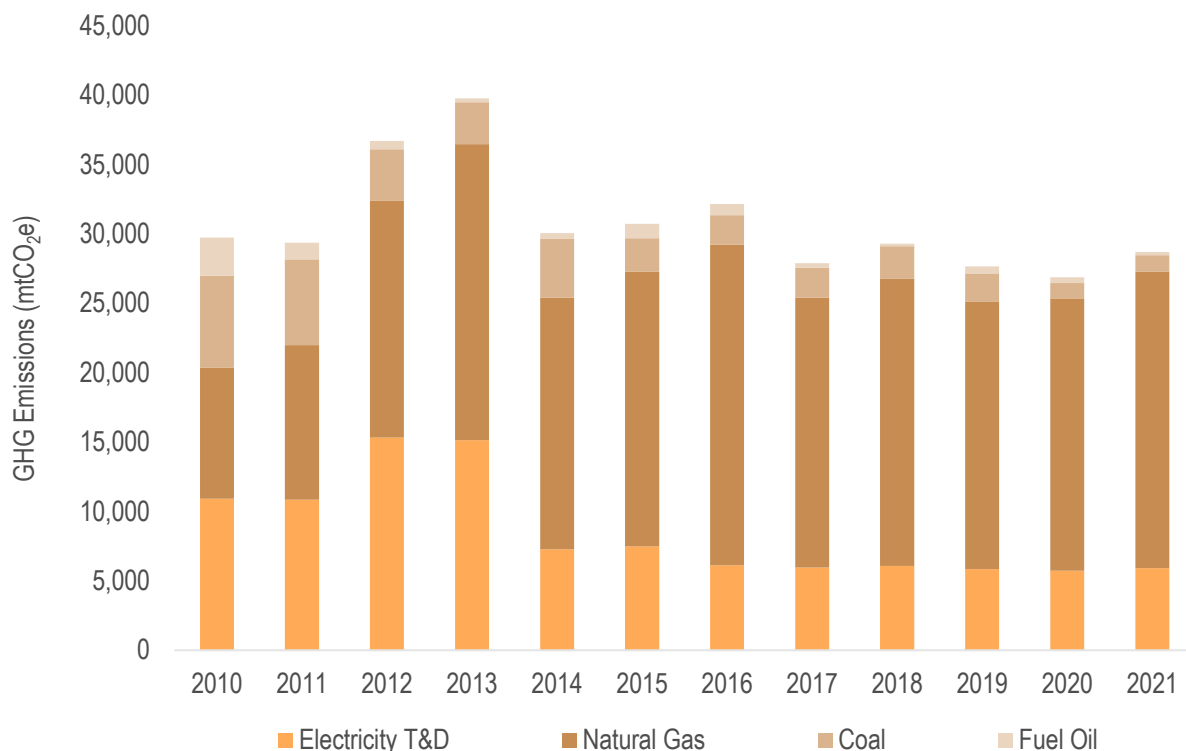


Upstream Energy Emissions

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). Figure 10 provides an estimate of these supply chain emissions for electricity, natural gas, coal, and fuel oil. **It is important to note that the methodologies underlying these emissions estimates are evolving and were developed outside of the SIMAP framework in anticipation of inclusion in future years. Upstream electricity emissions are limited to losses associated with the electric transmission and distribution system – or “grid” losses. Thus, these numbers are initial estimates that will be refined over time.**

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. Fugitive methane emissions (i.e., methane leaks within the natural gas supply chain) are the largest contributor to upstream fuel emissions. This is due to the potency of methane as a greenhouse gas, exhibiting a global warming potential 28 times greater than carbon dioxide (over a 100-year timeframe).

Figure 10: UVA Scope 3 Upstream Energy Emissions (MTCO₂e) Trends, 2010-2021; *Initial estimates as methodology is refined*



Next Steps

UVA's next decade of climate action is currently taking shape. Over the past year, stakeholders from across the University have come together to support two complementary initiatives -- development of the UVA 2030 Climate Action Plan and support of a long-term Strategic Thermal Energy Study. The former is focused on laying out a roadmap for the University to achieve its 2030 carbon-neutrality goal. The latter is a longer-term analysis focused on eliminating fossil fuels within UVA's district energy systems. Both initiatives draw heavily from the University's body of expertise, benefitting from strong interest and support from students, faculty, and staff.

Additionally, the University will work to identify and incorporate additional sources of emission into their inventory. Sources of Scope 1 and 2 emissions that are not currently included, but will be incorporated as more data becomes available include:

- UVA Real Estate Foundation properties
- University Physicians Group properties
- College at Wise properties
- Other leased or satellite (i.e., those outside of Charlottesville or Albemarle) properties

Scope 3 emissions that will be incorporated into the inventory as more data becomes available include:

- Building materials and construction
- Procurement (e.g., paper purchases)
- Services (e.g., off-site laundry services)
- Upstream energy emissions

Appendix A: Emissions and energy trends

Table 3: UVA GHG Emissions by scope (MTCO_{2e}), 2010-2021 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 Net 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
Scope 1	96,845.2	87,441.9	93,976.9	84,446.3	71,230.3	77,570.1
Scope 2	130,273.8	126,882.4	115,710.0	89,697.5	83,864.5	87,176.4
Total Net Emissions	227,119.0	214,324.3	209,686.8	174,143.8	155,094.8	164,746.5

*Totals may not sum due to independent rounding.

Table 4: UVA Electricity Emissions (MTCO_{2e}) Trends, 2010-2021

GHG Source	2010	2016	2017	2018	2019	2020	2021
Electricity	176,643.8	130,273.8	126,882.4	115,710.0	89,697.5	83,864.5	87,176.4
Avoided Emissions from Solar				(2,803.4)	(20,757.4)	(20,493.6)	(18,585.3)
Total Net Emissions	176,643.8	130,273.8	126,882.4	112,906.5	70,806.1	65,213.3	68,591.1

*Totals may not sum due to independent rounding.

Table 5: UVA On-Grounds Stationary Combustion Emissions (MTCO_{2e}) Trends, 2010-2021

GHG Source	2010	2016	2017	2018	2019	2020	2021
Coal	79,735.9	25,788.9	27,320.2	29,614.0	25,830.7	13,896.7	14,248.8
Natural Gas	26,036.5	63,344.8	53,286.0	56,710.0	52,844.8	53,765.6	58,608.3
Distillate Oil	3,968.6	1,020.7	554.5	1,696.9	1,378.7	737.9	1,308.9
Propane	145.1	119.8	122.1	207.6	160.9	65.6	126.4
Total Net Emissions	109,886.1	90,274.3	81,282.8	88,228.5	80,215.1	68,465.8	74,292.4

*Totals may not sum due to independent rounding.

Table 6: UVA Transportation Emissions (MTCO2e) Trends, 2010-2021

GHG Source	2010	2016	2017	2018	2019	2020	2021
B100	271.6	93.2	97.0	92.3	93.8	58.0	63.9
Diesel	2,106.9	1,890.7	1,971.1	1,873.8	1,902.3	1,175.2	1,294.5
Gasoline	1,646.9	1,515.5	1,466.1	1,497.5	1,433.8	1,145.5	1,323.9
Jet Fuel	304.1	318.7	419.7	603.1	443.8	121.7	204.2
Total Net Emissions	4,329.5	3,818.0	3,953.9	4,066.8	3,873.7	2,500.3	2,886.5

*Totals may not sum due to independent rounding.

Table 7: UVA Operations Support Emissions (MTCO2e) Trends, 2010-2021

GHG Source	2010	2016	2017	2018	2019	2020	2021
Refrigerants & Chemicals	239.9	2,741.8	2,189.8	1,666.4	346.5	253.6	379.0
Fertilizer	17.7	11.2	15.4	15.3	11.0	10.5	12.2
Total Net Emissions	257.6	2,753.0	2,205.2	1,681.7	357.5	264.2	391.2

*Totals may not sum due to independent rounding.

Table 8: UVA Scope 3 Emissions (MTCO2e) Trends, 2010-2021

GHG Source	2010	2016	2017	2018	2019	2020	2021
Staff Commuting	27,460.5	31,942.5	34,784.2	37,179.1	38,380.3	37,943.1	36,421.7
Faculty Commuting	5,155.4	4,687.7	5,669.5	5,687.7	5,788.5	5,783.9	5,779.4
Student Commuting	2,475.6	2,641.7	2,723.0	959.5	811.3	812.5	819.2
Directly Financed Air Travel	0.0	0.0	14,614.1	23,113.7	26,130.7	4,039.0	4,526.5
Study Abroad Air Travel	0.0	0.0	0.0	0.0	0.0	0.0	404.4
Solid Waste	(236.7)	1,283.0	1,239.0	1,309.5	1,251.6	1,062.2	1,143.9
Wastewater	893.6	572.7	481.9	520.2	520.9	413.5	452.4
Food	10,400.7	8,770.8	7,979.8	8,974.9	8,059.6	N/A	N/A
Total Net Emissions	46,666.3	47,251.8	65,476.5	74,852.4	78,718.8	55,791.7	55,466.4

*Totals may not sum due to independent rounding.

Table 9: UVA Upstream Scope 3 Energy Emissions (MTCO₂e) Trends, 2010-2021

GHG Source	2010	2016	2017	2018	2019	2020	2021
Electricity T&D	10,918.0	6,124.3	5,964.8	6,082.8	5,835.7	5,737.4	5,919.1
Natural Gas	9,457.8	23,089.5	19,423.0	20,671.1	19,262.2	19,597.8	21,363.0
Coal	8,290.2	2,654.7	2,803.7	3,039.1	2,648.9	1,419.7	1,455.6
Fuel Oil	2,747.2	826.3	306.5	166.5	509.5	414.0	221.6
Total Net Emissions	20,495.1	26,570.5	22,533.2	23,876.7	22,420.6	21,431.5	23,040.2

*Totals may not sum due to independent rounding.