RADFORD UNIVERSITY

Sustainability

Radford University's 2020 Greenhouse Gas Inventory

July 1, 2019 – June 30, 2020

Summary

Radford University conducts an annual inventory of its greenhouse gas emissions. The process collects data about emissions sources related to university operations and calculates the association between these operations and greenhouse gas emissions. The inventory described here encompasses Fiscal Year 2020 (July 1, 2019 through June 30, 2020). During this time, Radford University's estimated net greenhouse gas emissions totaled **37,996.18 metric tons of carbon dioxide equivalent** ($MTCO_2e$).

This report summarizes the 2020 Greenhouse Gas Inventory (GGI), provides important information pertaining to certain measured criteria, and benchmarks Radford University's 2020 performance against university inventories conducted since 2010 (the baseline year for RU's greenhouse gas inventory).

Introduction

In 2009, Radford University became a signatory of the American College & University President's Climate Commitment (ACUPCC). As such, the University pledges to pursue net carbon neutrality and to provide students with the knowledge and skills they need to be successful in meeting the challenges of the 21st Century. (See Appendix B). The ACUPCC requires that signatories conduct a GGI during the first year of participation to establish a baseline emissions calculation. The participant then submits a GGI annually, as it enables the university to analyze emissions sources, track progress towards target goals, and ultimately reduce the campus's contribution to climate change. Radford University has conducted a GGI each year since 2010, with the exception of 2015.

Methods

For the initial GGI in 2010, Radford University selected the Clean Air-Cool Planet Campus Carbon Calculator (CCC) as the tool for calculating and analyzing its emissions, as it was the preferred tool of the ACUPCC. The CCC was developed and managed by the University of New Hampshire. Radford University used the CCC for each GGI from 2010 – 2017. In 2018, the University of New Hampshire launched SIMAP (Sustainability Indicator Management & Analysis Platform), a new web-based platform for analyzing greenhouse gas emissions and suspended support for the CCC. All data from previous inventories is now in SIMAP.

Organizational Boundary: The 2020 GGI included emissions data for all Radford University buildings under operational control of the university. For this inventory, the organizational boundary includes the Radford Campus, all University-leased buildings in Radford that operate as part of the Radford Campus, and the Selu Conservancy. This inventory does not include Radford University Carilion or Radford University operations in the Roanoke Higher Education Center, the Southwest Virginia Higher Education Center, in Danville, or in Martinsville. These are shared spaces that are under the operational control of another entity.

Data Collection: The GGI process requested information and support from many individuals, departments, offices, and the Sustainability Steering Committee. The data included in the inventory is the most up-to-date and accurate information available and provides a comprehensive snapshot of the University's greenhouse gas emissions. Some assumptions and estimations were necessary due to limitations in the data. These assumptions and estimations are accepted industry standards and are outlined below.

- **Faculty, Staff, & Student Commuting**: The Sustainability Office oversaw a new commuter survey for the 2018 – 2019 fiscal year. A Geospatial Science major, under direct supervision of Dr. Stockton Maxwell, used a GIS model with the home address data of each commuter parking pass holder. The model calculated the shortest driving distance between each address and the Radford University campus. The student then extrapolated the daily mileage for the entire year by estimating the number of commuting days per year for each classification of permit holder – students, faculty, and staff. For students, faculty, and staff without commuter parking passes, the RU Sustainability Manager gathered information about these commuters and made informed assumptions about their method of travel.

  The 2019 – 2020 inventory uses the commuter survey from 2018 – 2019. Due to COVID-19 and the transition to remote learning and operations on March 23, 2020, daily commuter traffic reduced significantly.

  - Faculty and students, worked and learned remotely for the final 7 weeks of the semester, which reduces their commuting weeks from 30 to 23.
  - Staff, including AP Faculty and classified/non-classified employees, represent a wide range of essential and non-essential employees. This means that while some employees did not experience an interruption in travel to campus to work, others worked remotely until July 1. Many employees commuting schedule was ultimately somewhere in between. Currently, all staff are calculated at 32 out of 46 weeks.

- **Directly Financed Air Travel**: SIMAP calculates total air travel mileage using the Average Cost per Mile of commercial air travel. All employee air travel is processed through Christopherson Business Travel, which provides the total cost of directly financed air travel. Due to the COVID-19 pandemic, all non-essential air travel ceased on March 1, before the usual season of extensive conference travel.
- **Study Abroad Air Travel**: The Director of the Center for Global Education and Engagement started in spring 2020, just before the onset of the COVID-19 pandemic. No study abroad travel occurred during the spring 2020 semester. Fall study abroad travel data is limited.
- **Solid Waste**: All Radford University trash is transferred to the Cloyd's Mountain Landfill in Pulaski County, VA. The landfill weighs all trash per load delivered, providing us a very accurate measurement of our landfilled waste. At the landfill, Ingenco Distributed Energy is operating a landfill gas capture and electricity production operation. This greatly reduces the greenhouse gas emissions of our organic landfilled trash and is reflected by the calculations in SIMAP.
- **Paper**: Radford University Procurement and Contracts provided the data on purchased paper. The paper figure is limited to general purpose/copier paper purchases from different suppliers and does not include every type of paper utilized within a year by the University. General use and copier paper are delivered in reams, and single ream of paper weighs 4.75 pounds. This weight is used to estimate the total pounds of paper used.

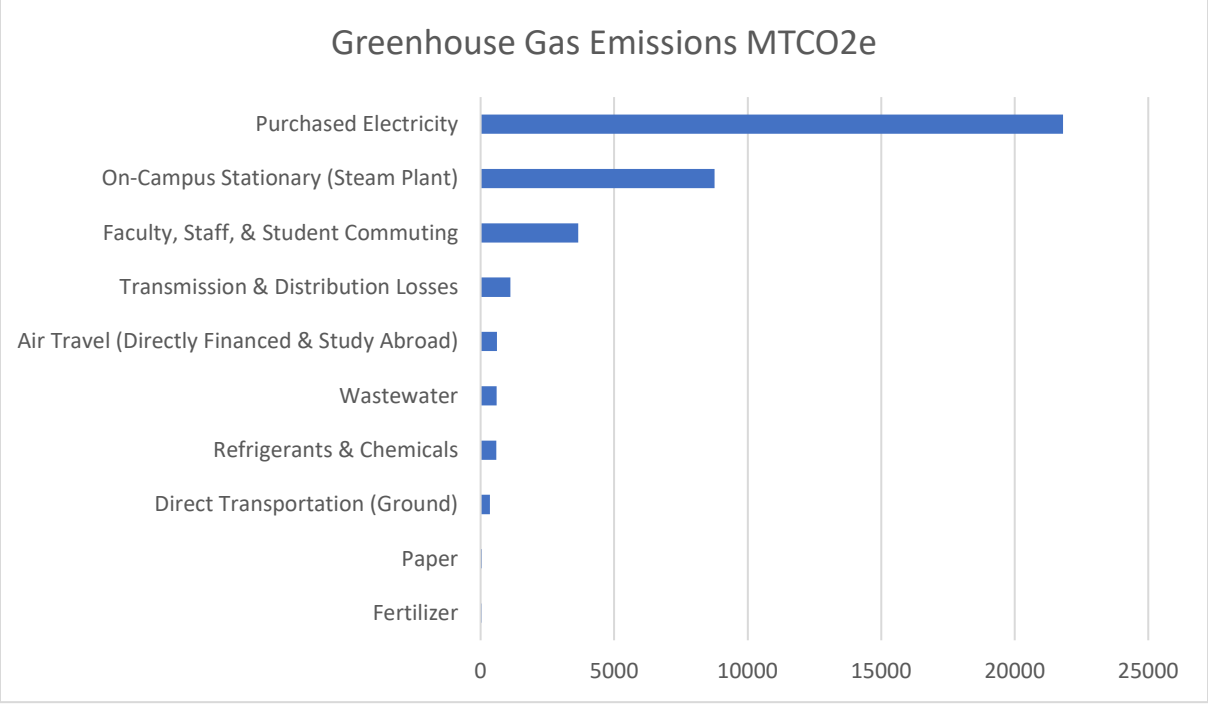
Radford University's Sustainability Manager worked with the university's Energy Manager to initiate the GGI process. Radford University's Energy Manager collected most of the data related to facilities and operations, Scopes 1 and 2, by reaching out to the appropriate manager or department contact from each category. The Sustainability Manager collected all of the Scope 3 data and demographic information.

During the data processing phase, the Sustainability Manager entered the data into SIMAP where appropriate and processed other data into units that are compatible with the tool. When the data processing was complete, the Sustainability Manager and other university employees began analyzing the results for any omissions or unusual discrepancies.

Results and Discussion

SIMAP processes all data with emissions conversion factors and calculates energy consumption, amounts of three different greenhouse gases, emissions from each source and scope, and total metric tons of carbon dioxide equivalent ($MTCO_2e$).

Top 10 Sources	Greenhouse Gas Emission MTCO2e
Purchased Electricity	21,813.53
On-Campus Stationary (Steam Plant)	8,762.57
Faculty, Staff, & Student Commuting	3,654.63
Transmission & Distribution Losses	1,119.59
Air Travel (Directly Financed and Study Abroad)	612.35
Wastewater	603.12
Refrigerants & Chemicals	585.4
Direct Transportation (Ground)	347.8
Paper	48.72
Fertilizer	36.63



Emissions by Scope

Emissions sources are categorized based on their origin and are referred to as Scopes 1, 2, and 3. Scope 1 emissions are direct sources from campus and include on-campus steam production, mobile fuel usage, refrigerants, and fertilizers. Scope 2 refers to off-campus emissions sources that are directly linked to campus operations, primarily purchased electricity. Scope 3 emissions are indirect emissions linked to university activities. These emissions include university travel, solid waste disposal, water treatment, and faculty, staff, and student commuting.

Approximately 57.4% of Radford University's emissions are Scope 2, from purchased electricity. Scope 1 emissions sources account for 25.6% of total emissions, produced primarily by burning propane and natural gas on campus, along with on-campus vehicles. The remaining emissions are considered Scope 3, and account for 17% of total emissions. These are primarily commuting, business air and ground travel, and wastewater.

2020 Greenhouse Gas Emissions by Scope	Greenhouse Gas Emissions MTCO2e
Scope 1: Direct emissions sources from campus. Includes steam, mobile fuel use, fertilizers, etc.	9,732.4
Scope 2: Direct, off-campus emissions. Includes purchased electricity.	21,813.53
Scope 3: Indirect emissions linked to university activities. Includes business travel, study abroad, solid waste, commuting, wastewater, etc.	6,450.25

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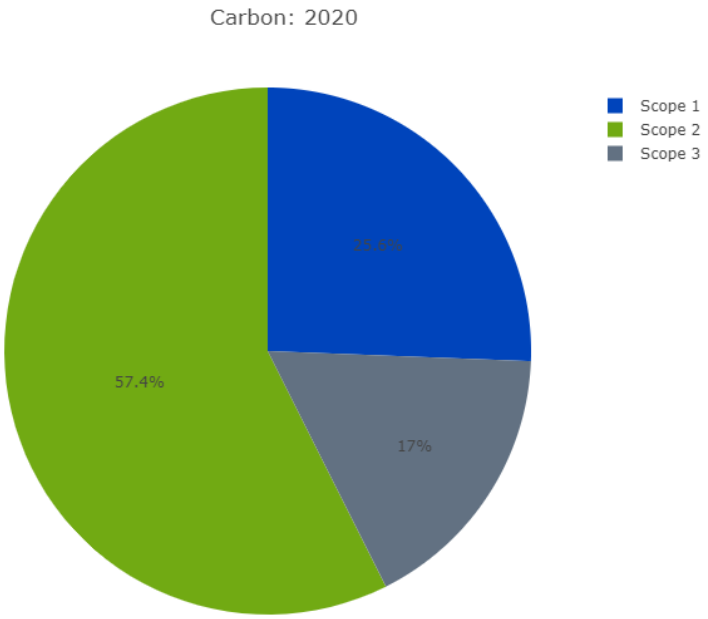

Top 5 Emissions by Source

1. **Purchased Electricity – 57.4% of Total Emissions**: Purchased electricity, a Scope 2 emission source, continues to be the university's largest emissions source. During FY2020, Radford University purchased 38,419,007 kilowatt hours (kWh) of electricity from the City of Radford's Utility. The approximate fuel mixture for producing electricity in the university's eGrid Subregion, RFC West, is used to calculate these emissions.

   Purchased electricity produced 21,183.53 $MTCO_2e$ in FY2020.

2. **On-Campus Stationary Sources – 23% of Total Emissions**: These emissions sources are Scope 1 emissions and represent stationary (non-mobile) fuel sources consumed on the Radford University campus. In FY2020, the university used 5,130 gallons of propane (LPG), and 164,221.5.78 MMBtu of natural gas. Natural gas is the primary fuel source burned in Radford University's Steam Plant to generate steam for heating on-campus

   buildings. Propane provides heat sources for several on-campus and off-campus university-owned or operated buildings.

   On-campus Stationary produced 8,762.57 $MTCO_2e$ in FY2020.

3. **Faculty, Staff, and Student Commuting – 9.61% of Total Emissions**: In FY2019 Faculty, Staff, & Students logged an estimated 12,659,479, miles in their personal vehicles during their regular daily commute to and from campus. This is a Scope 3 emission source. Faculty parking pass holders (80% of all faculty) have an average, one-way daily commute of 31.2 miles (3,444,480 miles annually). Staff parking pass holders (83% of all staff) have an average, one-way daily commute of 13 miles (4,109,695 miles annually). Student commuter parking pass holders (10% of all students) have an average, one-way daily commute of 29.1 miles (5,105,304 miles annually).

   Due to the COVID-19 pandemic, daily commuting decreased. Commuting weeks per year for faculty and students decreased from the normal 30 weeks to 23 weeks, and for all other employees, from 46 – 32 weeks. Faculty, Staff, and Student commuting produced 3,654.63 $MTCO_2e$ in FY2020.

4. **Transmission and Distribution Losses (T&D Losses) – 2.94% of Total Emissions:** T&D Losses account for the electricity that is lost between the power station and the final user. The U.S. Energy Information Administration (EIA) estimates that T&D losses average about 5% of the electricity that is transmitted and distributed annually in the United States.[1] T&D Losses will increase or decrease based on the amount of electricity that the University purchases and/or the sources from which it is produced, and is currently 2.94% of total emissions. This emissions source is considered Scope 3. T&D Losses produced 1,119.59 $MTCO_2e$ in FY2020.

5. **Air Travel (Directly Financed and Study Abroad) – 1.6% of Total Emissions**: In FY2020, air travel for University business and for study abroad accounted for approximately 1.6% of total emissions.

   University air travel produced 612.35 $MTCO_2e$ in FY2019.

1. Frequently Asked Questions. How much electricity is lost in transmission and distribution in the United States. U.S. Energy Information Administration: Independent Statistics & Analysis. https://www.eia.gov/tools/faqs/faq.php?id=105&t=3. Feb 16, 2017.

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COVID-19 Pandemic and Radford University Greenhouse Gas Emissions

From March 22 through June 29, 2020, Radford University moved to remote learning and remote operations in response to the COVID-19 pandemic. During this time, only essential workers reported to campus, while most other employees worked remotely. All non-essential business travel was prohibited, all study abroad travel was cancelled, and the majority of students did not return to campus for the remainder of the spring 2020 semester.

As a result, Radford University's net greenhouse gas emissions decreased by 3,953.52 MTCO2e, or 9.4%, from 2019 to 2020.

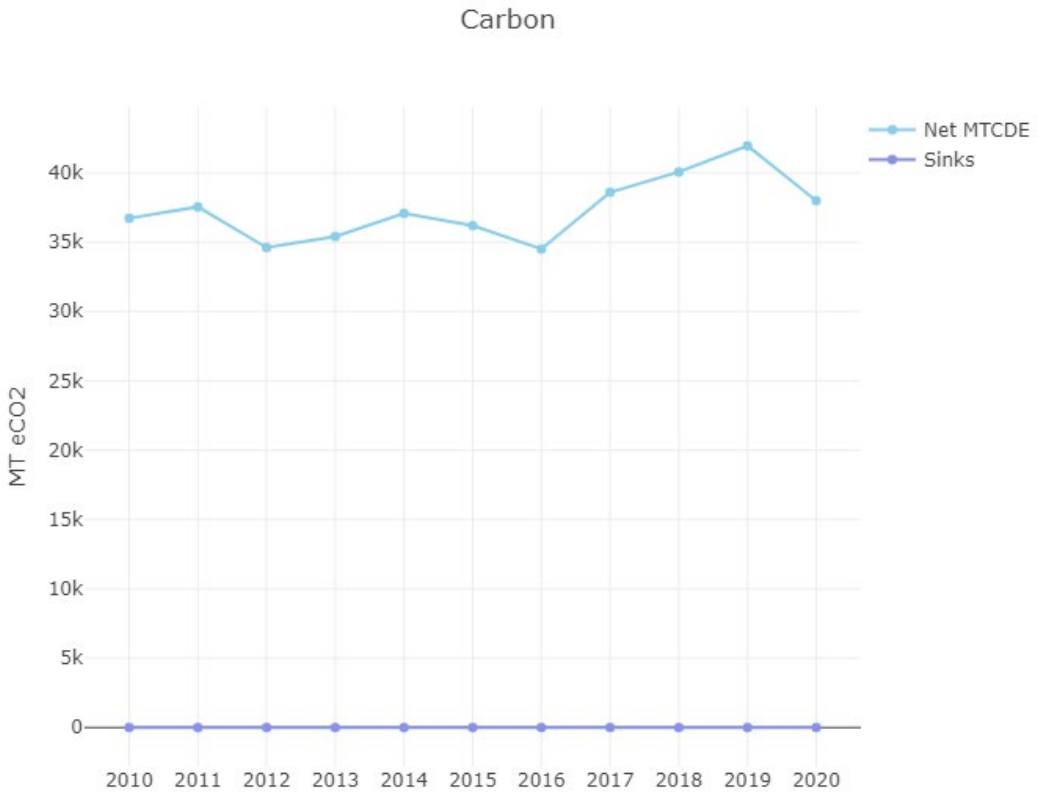
Significant emissions reductions included:

- Air Business Travel – 37.57%
- Faculty, Staff, & Student Commuting – 25.74%
- Ground Business Travel – 21.24%
- On Campus Stationary Power – 7.55%
- Purchased Electricity – 5.33%

While some of these categories may remain lower throughout the course of the pandemic, others will likely return to pre-pandemic levels immediately with the return to on-campus operations.

Normalization and Trends

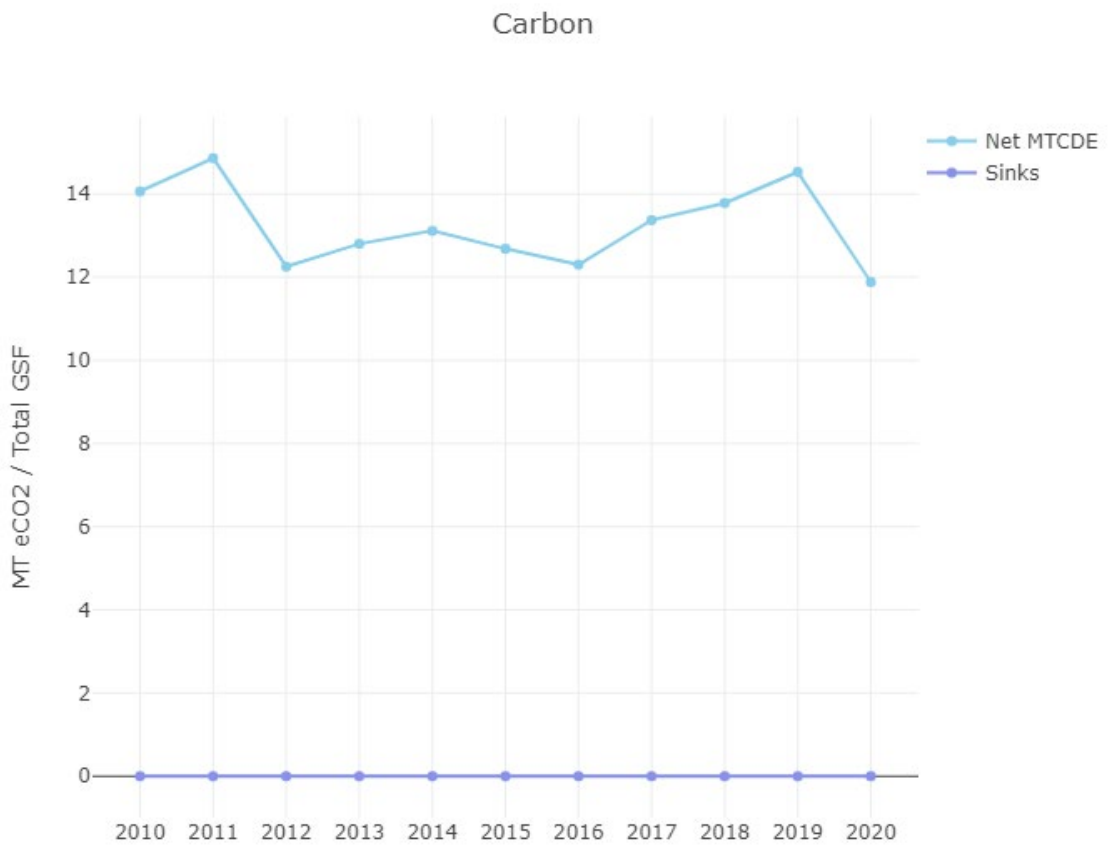
1. Since 2016, Radford University's total greenhouse gas emissions ($MTCO_2e$) have increased each year.



Total Emissions during FY2019 are much less than the 2010 Greenhouse Gas Inventory "Business As Usual" projection for total emissions in 2019.

- Total emissions increased from 37,749.6 $MTCO_2e$ in 2010 to 42,554.39 $MTCO_2e$ in 2019; a total increase of 4,804.8 $MTCO_2e$ or approximately 12.7%.
- The "Business as Usual" projection for 2016 was over 50,000 $MTCO_2e$, an increase of approximately 12,250 $MTCO_2e$, or approximately 32%.
- The Radford University Climate Action Plan published in 2013 set a 2020 target of reducing total emissions by 30% from the 2010 baseline, to 26,424.72 $MTCO_2e$. This target will require a 38% reduction from the 2019 total emissions.

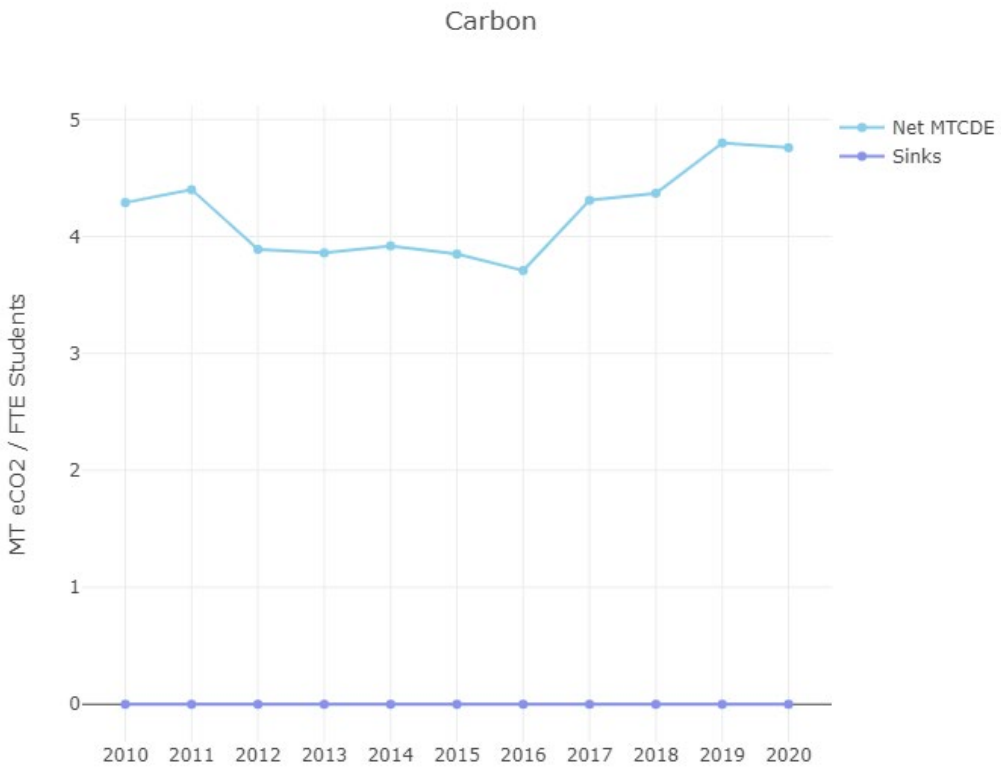
2. Emissions per square foot are lower than in 2010, but have increased consistently between 2016 – 2019.



Buildings are the primary consumer of electricity and steam on the Radford University campus. Together, with T&D Losses, these account for nearly 80% of the University's total emissions. Since 2010, the gross square footage of total building space has increased 274,251 square feet, a 10.5% increase. Since 2016, much of this new building space is "energy intensive" space in laboratories in Center for the Sciences (115,000 square feet) and the College of Humanities and Behavioral Sciences (143,600 square feet), and in FY 2019, the addition of 77,660 square feet of off-campus apartment space.

In 2010, net greenhouse gas emissions per 1000 gross square feet was 14.07 $MTCO_2e$, as compared to 14.74 $MTCO_2e$ in 2019, a 4.7% increase.

3. Emissions per student (FTE Enrollment) are increasing.



In 2010, FTE Student Enrollment was 8,558, as compared to 8,746 in 2019, an increase of 2.2%. During this same period of time, gross square footage has increased 10.5% and net greenhouse gas emissions has increased 12.7%.

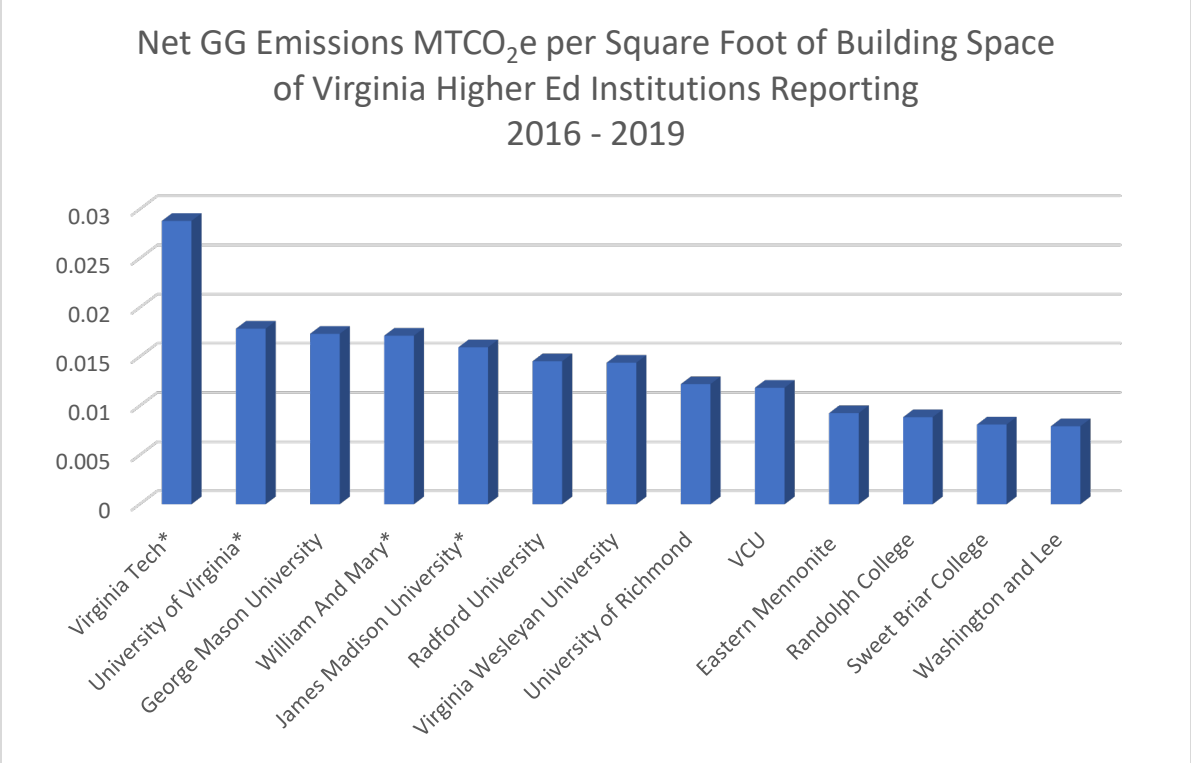
As such, emissions per student (FTE Enrollment) increased from 4.3 $MTCO_2e$ in 2010 to 4.87 $MTCO_2e$ in 2019, an increase of 13.3%.

Appendix

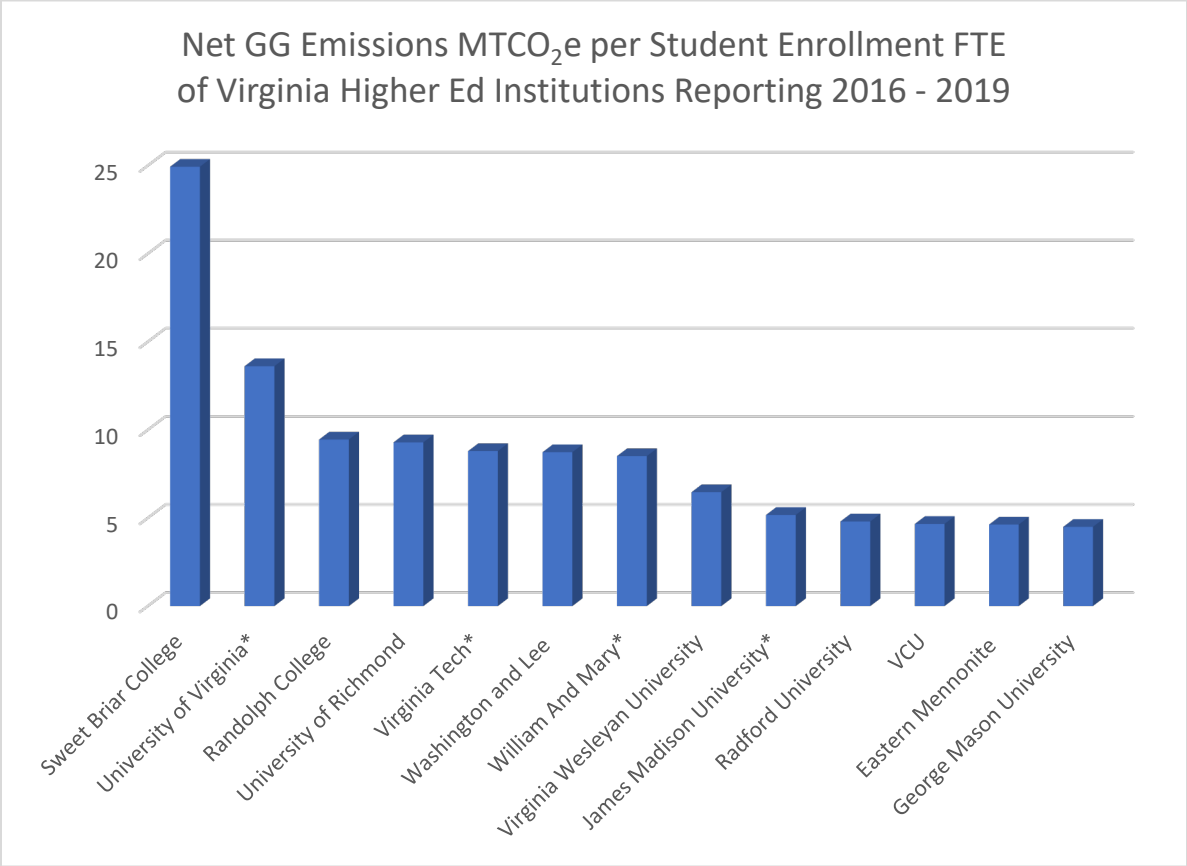
A. Benchmarking with Other Virginia Institutions of Higher Education

Making meaningful comparisons between higher education institutions is challenging, as each institution is unique, not all emissions inventories are identical, and building square footage and FTE Enrollment fluctuate. For this comparison, all data is publicly available on Second Nature's online reporting dashboard and on STARS reports. Only institutions that have reported since 2016 are included. Second Nature is the organization managing the implementation of Carbon and Climate Commitments (formerly ACUPCC) and there are currently 15 higher education institutions in Virginia that are Second Nature reporting signatories. Radford University is one of only three public higher education institutions in this group (George Mason University and Virginia Commonwealth University). The University of Virginia and Virginia Tech are public universities and are not signatories, but recently reported their emissions in STARS reports.

Because 2019 – 2020 is currently an outlier for greenhouse gas emissions and reporting, the figures below include data between FY2016 and FY2019.



*Not a Carbon Commitment signatory. Emissions and building space data from most recent STARS reports.



*Not a Carbon Commitment signatory. Emissions and Enrollment FTE data from most recent STARS reports.

B. Links to Other Reports & Resources

American College and University President's Climate Commitment:
https://www.radford.edu/content/dam/departments/administrative/Sustainability/Documents/Signed-ACUPCC.pdf

Radford University Climate Action Plan:
https://www.radford.edu/content/sustainability/home/initiatives/ClimateActionPlan.html

Radford University Initial Greenhouse Gas Inventory Narrative, 2010:
https://www.radford.edu/content/dam/departments/administrative/Sustainability/Documents/greenhouse-gas-narrative.pdf

Second Nature: http://reporting.secondnature.org/

SIMAP – Sustainability Indicator Management & Analysis Platform: https://unhsimap.org/

STARS – Sustainability Tracking, Assessment, and Rating System: https://stars.aashe.org/