2022-23 Sustainability

Annual Report

VIRGINIA TECH™

EXECUTIVE SUMMARY

Since the Board of Visitors' approval of the 2020 Climate Action Commitment (Climate Action Commitment) in March of 2021, Virginia Tech has shown ongoing progress toward meeting its ambitious climate action goals. Virginia Tech continues to be recognized for its sustainability work at the Commonwealth, national, and global level with its Sustainability Tracking, Assessment, and Rating System (STARS) Gold rating, which remains the highest in Virginia and the Atlantic Coast Conference; its Tree Campus Higher Education status for the fifteenth year in a row; and recognition for its sustainable transportation options with the 2023 Best Workplaces for Commuters designation. This past year the university also saw its ratings improve for its Times Higher Education Impact Ranking from 98th in the world in 2022 to 92nd in 2023 out of nearly 1,600 institutions.

The overarching goal of the Climate Action Commitment is for Virginia Tech's Blacksburg campus to become carbon neutral by 2030. This is no small task at an institution the size of Virginia Tech. Meeting this aggressive goal will require decreasing the university's carbon emissions and energy consumption while simultaneously increasing its portfolio of renewable energy and sustainability-oriented educational programs. Working collectively to create a shift in campus culture is key. The major milestones to meet this ambitious climate action target are split between 15 goals, progress towards each of which is presented in this report.

To meet both the infrastructural and sociological goals outlined in the Climate Action Commitment, the Office of Sustainability has been hosting collaborative meetings bringing together climate action, sustainability, energy, waste, dining, transportation, and academic representatives on a biweekly basis to discuss progress and challenges. This collaborative spirit of working in tandem with the many areas of campus that directly touch sustainability is key to continued success.

The university's efforts for waste reduction and minimizing contamination in its waste stream are paying off, in 2022 Virginia Tech saw a 60 percent recycle rate and 78 percent waste diversion rate owing largely to the diversion of high tonnage building materials. To assist in reaching Virginia Tech's zero waste goal, the university hired a zero waste consultant who brought innovative ideas for further improvements to recycling and waste diversion to the Climate Action, Sustainability, and Energy team.

The completion of the Multi-Modal Transit Facility is on the horizon, and with it the university hopes to see significant reductions in transportation emissions from commuting members of campus as well as a general improvement in the quality of local public transportation. This effort, along with many other programs supported by the Sustainable Transportation Department, will provide Virginia Tech community members with reliable and convenient commuting options other than single-occupancy vehicles, helping to reduce scope 3 emissions.

Efforts of the campus arborist and grounds teams are seen across campus as Virginia Tech continues to expand its campus tree canopy and pollinator habitats. The goal to reach 25 percent tree cover by 2050 will provide energy savings while also fostering a lush, green campus environment. Beyond Blacksburg campus, over ten thousand native trees and shrubs were planted along Stroubles Creek with the help of thousands of volunteers in an effort to improve water quality and wildlife habitat downstream from Virginia Tech.

The Climate Action Living Laboratory (CALL) has also begun to transition from informal organization to a more formal structure during this past academic year. Several pilot projects were advanced and leadership was transferred to the Climate Action Fellow. The network of over 150 faculty members decided that an enhanced CALL webpage and a governance structure would be the next steps in terms of officiating the CALL and so that is the main focus for the next academic year.

The Climate Action, Sustainability, and Energy Committee (CASEC) has continued to grow this past year and take on even more responsibility for Climate Action Commitment implementation. There was the addition of two new subcommittees designed to tackle the university's energy goals, which will be populated by a broad constituency in the next academic year. Additionally, membership grew for each of the existing subcommittees and they individually made substantial progress towards their goals.

The Virginia Tech 2022-23 Sustainability Annual Report begins with a broad overview of the university's ongoing sustainability programs. It presents the 15 goals of the Climate Action Commitment and showcases sustainability highlights and progress along the way.

INTRODUCTION

Virginia Tech's Climate Action Commitment defines sustainability as the simultaneous pursuit of environmental quality, economic prosperity, and social justice and equity. The goal of the Office of Sustainability and the university's Climate Action Commitment is to achieve this pursuit through action, education, and engagement to address current needs without compromising the capacity and needs of future generations. Virginia Tech's sustainability vision is to be a leader in climate action in service to its community, the commonwealth, and the world in line with the university's land grant and educational mission.

Virginia Tech's sustainability mission is to achieve carbon neutrality by 2030 through changes to the university's physical infrastructure, collective and individual behaviors, and educational mission; to engage everyone in creating a culture of sustainability, and to accomplish these objectives through just and equitable means. This will require significant infrastructural changes and strategic planning to ensure success.

Additionally, the university has adopted the major initiatives to increase affordability and access for students and to become a top-100 global research university. The Climate Action Commitment is an essential bridge policy and roadmap for achieving both of these goals and represents a core pillar of the university's land-grant mission.

VIRGINIA TECH CLIMATE ACTION COMMITMENT

During Earth Week in April 2008, former university President, Charles W. Steger charged the Energy and Sustainability Committee to develop a climate commitment and accompanying sustainability plan that was unique to Virginia Tech. On April 22, 2009, the University Council voted to recommend approval of the Virginia Tech Climate Action Commitment and accepted the accompanying Sustainability Plan. On June 1, 2009, the Virginia Tech Board of Visitors unanimously approved the Virginia Tech Climate Action Commitment and it became Presidential Policy Memorandum 262. The commitment included 14 sustainability goals, objectives, and aspirations. In academic year 2012-13, the Energy and Sustainability Committee revised the commitment and added a sustainability definition, vision, and mission. The University Council approved the revision on May 6, 2013.

On November 8, 2019, Virginia Tech President Tim Sands, released a statement in response to a climate strike held by students on campus in which he stated, "climate change represents one of the world's most pressing problems and as a global land-grant university, Virginia Tech has a duty to respond." Within his statement was a charge to update the Virginia Tech Climate Action Commitment.

In response, the Virginia Tech 2020 Climate Action Commitment Working Group was established consisting of over 150 students, faculty, staff, and community members. The group worked to produce the Virginia Tech 2020 Climate Action Commitment which was presented to the Board of Visitors on Nov. 15, 2020. Over the next three months, a dozen key operations and finance personnel at the university conducted a high-level review of the costs to implement the commitment. This financial analysis and review was presented to the Virginia Tech Board of Visitors on March 21, 2021, where the review, and the commitment as a whole, were approved. The 2020 Climate Action Commitment includes 15 goals for advancing long-term university sustainability over the next ten years. The Sustainability Annual Report provides an update on the university's progress towards each of the goals.

The actualization of the 15 goals depends on comprehensive planning, unparalleled collaboration, and a shared pledge to advancing sustainability. Through broad university participation and collaboration, Virginia Tech has made tremendous progress, but still has more to do.

Sustainability Plan

Virginia Tech adopted the Association for the Advancement of Sustainability in Higher Education's (AASHE) and its Sustainability Tracking, Assessment, and Rating System (STARS) protocol as the foundation of the Sustainability Plan. The STARS report consists of over 60 topical areas which fall into one of four categories: academics, engagement, operations, and planning and administration. Additional credit is earned for unique initiatives that are not otherwise covered in the STARS report. Data and information submitted are measured against a national standard and points are earned for each credit. Total points earned yield an overall rating of Bronze, Silver, Gold, or Platinum.

Virginia Tech has received five STARS ratings: Silver in 2011, Silver in 2013, Gold in 2014, Gold in 2017, and Gold in 2021. For the 2021 Gold rating, Virginia Tech earned 72.78 points, the highest achieved score for any college or university in Virginia, and the highest achieved by peer institutions in the Atlantic Coast Conference. The STARS Gold rating is valid for three years and the Office of Sustainability is currently collecting data for Virginia Tech's 2024 submission.

Office of Sustainability

On June 1, 2009, following the approval of the original Virginia Tech Climate Action Commitment, the university established the Office of Sustainability. Recognized as the university department overseeing climate action initiatives, the Office of Sustainability has the following duties and responsibilities:

▶ Coordinate programs for campus sustainability

▶ Oversee implementation of the Virginia Tech Climate Action Commitment and Sustainability Plan

▶ Monitor annual electricity/energy use and GHG emissions in collaboration with the Office of Energy Management

▶ Work with faculty and departments to develop programs that utilize the campus as a sustainability laboratory

▶ Coordinate communication with university communications regarding campus sustainability initiatives and programs to the university community and external audiences

Climate Action, Sustainability, and Energy Committee

Virginia Tech established the Energy and Sustainability Committee on April 30, 2007 as part of adopting the university's original Climate Action Commitment. At the time, the committee was unique in that it had the broadest membership of any committee and included four student representatives rather than two. As part of the 2020 Climate Action Commitment, the Energy and Sustainability Committee has been reevaluated, restructured, elevated, and renamed to the Climate Action, Sustainability, and Energy (CASE) Committee.

The CASE Committee's charge is "to provide guidance to the university administration on implementation of the university's Climate Action Commitment and opportunities to enhance Virginia Tech's pursuit of environmental quality and social sustainability." The committee makes recommendations regarding the application of policies; infrastructural and operational changes; educational strategies and modifications; and other steps intended to foster broad engagement with the university's environmental goals. The committee oversees subcommittees that each execute aspects of the committee's charge. In addition to broadening the charge, the committee also reevaluated and expanded its membership to include members from black, indigenous, and economically disadvantaged groups in line with Virginia Tech's commitment to frontline communities and climate justice, which is unique among all shared governance entities and reflects a commitment to climate justice.

During the 2022-23 academic year, the CASE Committee oversaw ten subcommittees to target implementation strategies, policies, and planning efforts for the goals of the 2020 Climate Action Commitment. These task forces are strategically essential for making progress toward the top level goal of carbon neutrality by 2030. Additionally, they include members from all across the university, including some who are outside of the core CASE Committee membership, which helps to institute climate action as a broader priority and communicate Climate Action Commitment progress across the institution. Updates of subcommittee efforts from the past year can be found throughout the annual report and each subcommittee is required to submit their own individual report to the CASE committee for approval by governance.

Office of Sustainability Partners

UNIVERSITY COLLEGES AND DEPARTMENTS

The Office of Sustainability collaborates with faculty and staff in virtually all of the colleges at Virginia Tech to include the College of Agriculture and Life Sciences; College of Architecture; Arts, and Design; Pamplin College of Business; College of Engineering; College of Liberal Arts and Human Sciences; College of Natural Resources and Environment; College of Science; and the Virginia-Maryland College of Veterinary Medicine.

STUDENT ORGANIZATIONS

The Office of Sustainability works with many student groups including the Undergraduate Student Senate, Graduate Student Senate, Residence Hall Federation, Environmental Coalition, Food Justice at Virginia Tech, Galileo Living Learning Community, Hypatia Living Learning Community, Students for Sustainable Practice, Art for Environmental Justice, Student Chapter of the American Water Resources Association, Campus Kitchens at Virginia Tech, United Feminist Movement, Citizens Climate Lobby, Outdoor Club, and Virginia Tech for Climate Justice.

The Office of Sustainability collaborates with the Town of Blacksburg, the local citizens' group and nonprofit Sustainable Blacksburg, the Blacksburg Farmers Market, the YMCA, the Blacksburg Public Library, and Blacksburg Parks and Recreation.

Awards and Recognition

Virginia Tech has consistently demonstrated its commitment to being a leader in campus sustainability and has received awards and recognition both at the state and national levels.

92th in the world
and 5th in the US

2008-2023

2021-2023

Highest score in
Virginia and the ACC

12 received to date

2019-2023

Times Higher Education Impact Rankings

After making its debut in the Times Higher Education Impact Rankings in 2021 and then rising to the global top 100 in 2022, Virginia Tech now finds itself ranked 92nd out of 1,600 institutions, an improvement from the university's ranking of 98th last year. Virginia Tech also continues to hold its spot in the top 10 in the United States for the 2023 Impact Rankings. The Times Higher Education Impact Rankings are the only global performance metrics that assess universities against the United Nations Sustainable Development Goals (SDGs). The rankings use calibrated indicators to compare universities across four areas: research, stewardship, outreach, and teaching. This year, Virginia Tech received an overall impact ranking of No. 92 out of roughly 1,600 universities spanning over 100 countries and 5th in the United States.

Global Top 100

92nd
in the world

5th
in the US

This ranking was supported by the university's high marks in six individual categories, with a top ranking of No. 17 out of 647 institutions globally in the category of zero hunger. This category considers a university's research on hunger, their teaching of food sustainability, a commitment to tackling food waste, and a commitment to addressing hunger on campus and locally. The Center for Food Systems and Community Transformation helped with the high ranking in this category.

Virginia Tech also earned a high ranking in the category of responsible consumption and production. This category measures universities' research on responsible consumption on their approach to the sustainable use of resources. Additionally, procurement strategies and The Office of Sustainability's green lab and green office certification programs also supported the goal of responsible consumption.

Virginia Tech's work to better both its campuses and the community beyond has been globally recognized within the sustainable cities and communities category. This is in no small part due to the hard work of the Office of Sustainability and Division of Student Affairs town-gown relationship around environmental stewardship.

Other top marks for Virginia Tech came in the categories of reduced inequalities (No. 63 out of 901 institutions), life on land (No. 73 out of 586), and climate action (No. 80 out of 735). Beyond the global top 100, Virginia Tech also submitted information for the categories of clean water and sanitation and partnerships for the goals. Updates on Virginia Tech's progress towards each of the SDGs can be found on the university's Impact Dashboard.

Virginia Tech Dining Services

Dining Services continues to demonstrate its commitment to leading the campus community in sustainable efforts. In the past, the department has received awards and recognition at the Commonwealth and national levels for their sustainable endeavors. The Virginia Tech Dining Services Sustainability team was invited back to the National Association of College and University Food Services Sustainability (NACUFS) Awards Committee in spring of 2023. This taskforce works to create a framework for the national award parameters in the sustainability field. The Dining Services team continues to support NACUFS in promoting these efforts across various universities.

Virginia Tech Sustainable Transportation

The Sustainable Transportation Department seeks to meet all the travel needs of students, faculty, and staff in healthy and environmentally friendly ways. Virginia Tech has been named one of the 2023 Best Universities for Commuters. Best Universities for Commuters demonstrate that options for commuting such as public transit, carpools, vanpools, and teleworking are economically and environmentally beneficial, yielding value to workers, employers, and our communities.

Virginia Tech was awarded a Silver ranking as a Bicycle Friendly University through the League of American Bicyclists from 2019 to 2023. This is an improvement from our previous Bronze rating. Virginia Tech has been recognized as a Bicycle Friendly University since 2013.

2023 Tree Campus Higher Education Re-accreditation

For the fifteenth consecutive year, Virginia Tech has been recognized for its best practices in campus urban and community forestry through the Arbor Day Foundation's Tree Campus Higher Education program. Launched in 2008, Tree Campus Higher Education is a national program that honors colleges and universities for effective campus urban forest management and engaging students, faculty, and staff in conservation goals. Virginia Tech achieved Tree Campus Higher Education recognition by meeting five national standards,

which include maintaining a tree advisory committee, operating a campus tree-care plan, dedicating annual expenditures toward trees, organizing an Arbor Day observance, and executing student service-learning projects. Thousands of trees have been planted across campus since 2008. Trees are among the most visible representations of Virginia Tech's commitment to environmental stewardship.

Bee Campus USA

Virginia Tech earned Bee Campus USA certification in spring 2022. This initiative is sponsored by the Xerces Society for Invertebrate Conservation. Bee Campus USA requirements serve as a guideline for affiliated campuses to increase their commitment to preserving these native pollinators. This is achieved through a long-term plan to increase native plant habitat, provide pollinator nesting sites, reduce pesticide use on campus, and develop pollinator conservation education and outreach opportunities for the campus community. The Virginia Tech Bee Campus Standing Committee is composed of dedicated and enthusiastic students, faculty, and staff from multiple disciplines across campus.

Virginia Energy Efficiency Leadership Award

Virginia Tech was recognized by the Virginia Energy Efficiency Council with a Virginia Energy Efficiency Leadership Award for the Chiller Plant Phase II's contributions toward energy efficiency advancement. "Our team of professionals invested an extraordinary amount of effort to design and construct a well-functioning, efficient, and effective chilled water system," said Steve Durfee, campus energy manager. "The excitement continues to build as we see excellent operational performance results and, of course, the resulting award by the Virginia Energy Efficiency Council. We are quite pleased with the realized operational cost savings and the reduced environmental impacts."

2022-23 SUSTAINABILITY PROGRESS

1 Carbon Neutrality

"Achieve a carbon neutral Virginia Tech Campus by 2030."

Carbon neutrality is defined as net-zero emissions of Carbon Dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O) by Virginia Tech operations on the Blacksburg campus based on the geographic and greenhouse gas (GHG) scope of the 2020 Climate Action Commitment. The initial scope of the 2020 Climate Action Commitment includes all Virginia Tech-owned lands and buildings on the Blacksburg campus, buildings leased by the university in Blacksburg, and agricultural/forestry operations and lands in the Blacksburg region. The GHG scope includes:

▸ Scope 1 emissions from campus direct fuel use,

▸ Scope 2 emissions related to purchased electricity (CO_2 and N_2O transmission/distribution losses), and

▸ Scope 3 emissions related to campus behavior (commuter driving, transit bus fuel, waste/recycling/ compost, water/wastewater, aviation fuel, and commercial business travel).

Annual CO$_2$ Emissions

The following figures show the change in GHGs from a calendar year perspective. CY2022 shows a 10 percent reduction in total emissions from CY2021. When compared to the baseline year of 2019, there was an 8.5 percent decrease in total emissions.
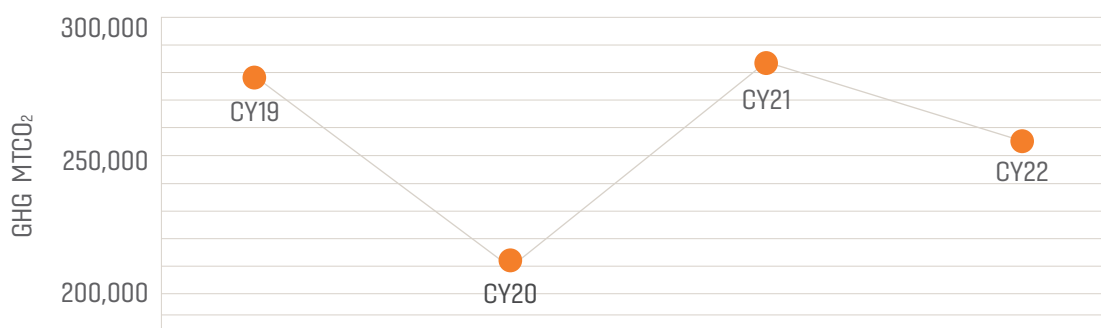
Figure 1. Annual CO$_2$ Emissions

Figure 2. Summary of Annual Greenhouse Gas Emissions by Scope (Calendar Year)

	2019 MTCDE	2021 MTCDE	2022 MTCDE
Scope 1	115,021	96,317	102,609
Scope 2	124,166	152,823	127,842
Scope 3	42,148	36,474	26,986
Total	**281,335**	**285,614**	**257,437**

The decrease this year compared to previous years is due to a couple of factors:

▶ Scope 2 emissions were 25,000 metric tons of carbon dioxide emissions (MTCDE) lower in CY2022 compared to CY2021. Greenhouse gas emissions for purchased electricity decreased 16 percent from CY2021 to CY2022. This is largely due to the reduced electricity purchased on campus. In addition to several Energy Action Plan projects that reduced energy consumption (discussed below), the power plant cogeneration system was online for the year. In addition to the overall purchased electricity reduction, the electric grid emissions factors (kilogram CO$_2$/kWh) decreased by nine percent in the New River Valley region.

▶ Transportation greenhouse gas emissions have been reduced across multiple categories including direct transportation; faculty, staff, and student commuting; as well as directly financed air travel. These reductions in CY2021 to CY2022 have reduced the campus footprint by about 8,000 MTCDE.

▶ The use of fertilizers on campus has decreased. When compared to the baseline year, 2019, emissions were reduced in this area by 5,500 MTCDE.

The pie chart shows the distribution of GHG emissions by source for the 2022 calendar year. The largest source of GHG emissions is purchased electricity (50 percent) followed by natural gas (27 percent).

Figure 3. GHG Emissions Breakout FY2022
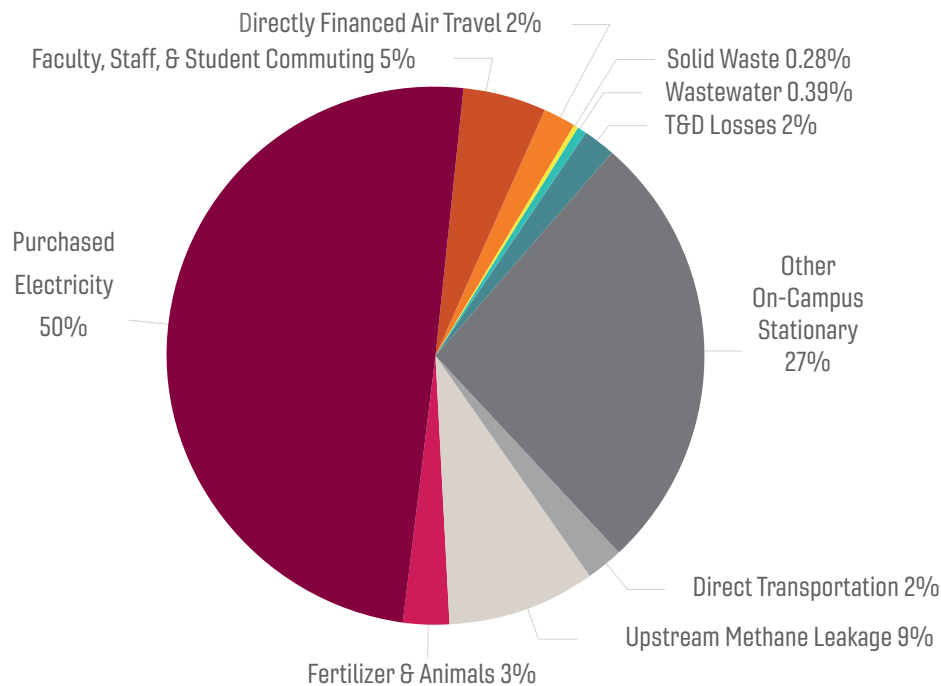
Greenhouse Gas Inventory and Assessment Report

Since 2007, Virginia Tech has been monitoring GHG emissions from direct and indirect sources to assess its carbon footprint. It is often associated with the burning of fossil fuels for energy or transportation, but GHG emissions can result from many other sources. The Greenhouse Gas Inventory and Assessment Report is a quantitative analysis, critical for driving planning, policies, and operations that will continue to result in emissions reductions across the university. As Commonwealth, national, and worldwide leaders seek to limit or reduce GHG emissions by 2030, Virginia Tech is well positioned to do its part. As the university transitions its GHG emissions accounting to match the 2020 Climate Action Commitment's broadened demands, the CASEC GHG subcommittee and Office of Energy Management spent time creating a new protocol for GHG reporting so that Virginia Tech can have strong and consistent data to work with over the next decade.

The Greenhouse Gas Inventory and Assessment Report also serves as a resource for students, faculty, and staff to learn more about their associated impacts on the environment. As part of the 2020 Climate Action Commitment, the carbon the university accounts for with the Greenhouse Gas Inventory and Assessment Report has been broadened to include Scopes 1 and 2 emissions (direct and indirect energy usage), as well as a significant portion of Scope 3 emissions. Scope 3 emissions correspond to activities that many of us can influence through individual choices, such as commuting, purchasing, and waste management. The university will need dedicated action and support from the entire campus community to meet Virginia Tech's goal of carbon neutrality by 2030. The GHG Assessment uses SIMAP, the Sustainability Indicator Management and Analysis Platform, developed by the University of New Hampshire.

The Greenhouse Gas Inventory and Assessment Report was published in 2022 using 2021 data and an update is currently underway using 2022 data. The Office of Energy Management, the Office of Sustainability, and Dr. Sean McGinnis from the Green Engineering program have collaborated to develop these inventories. Historically, this project has had contributions through an experiential learning program for students. There will be further student engagement this academic year through a carbon sequestration independent study within the Virginia Tech Green Engineering program.

CASE Subcommittees

The Climate Action, Sustainability, and Energy Committee organizes subcommittees to address Climate Action Commitment goals and develop related implementation strategies.

GHG INVENTORY SUBCOMMITTEE

The GHG Inventory subcommittee manages the development of Virginia Tech's Greenhouse Gas Inventory. During the 2022-23 academic year, the group finalized the 2021 GHG Inventory and Assessment and they worked towards developing the 2022 GHG Inventory and Assessment. The subcommittee is also working towards developing a strategy to include the Campus Tree Inventory into the campus carbon sequestration calculations, is exploring methods for analyzing the large amounts of dining/food data to estimate upstream food emissions, and is helping to inform carbon offset and RECs discussions..

CARBON OFFSET AND MANAGEMENT SUBCOMMITTEE

The Carbon Offset and Management subcommittee is working to develop strategies for Virginia Tech's acquisition of carbon offsets including local and regional options to achieve net-zero emissions by 2030. Critical considerations for the task force include: defining acceptable carbon offset characteristics; identifying and prioritizing carbon offset options based on capacity, feasibility, quality, and cost; finding collaborators for internal carbon offset development; and working closely with the GHG Inventory subcommittee to estimate the magnitude of carbon offsets required in future years.

2 100 Percent Renewable Electricity

"Achieve 100 percent renewable electricity by 2030."

Solar Project Development

A solar energy power purchase agreement (PPA) will help boost Virginia Tech's Climate Action Commitment implementation efforts toward 100 percent renewable electricity by 2030. The Solar PPA project is currently in the construction drawing phase for installations on McComas Hall, Sterrett Center, Virginia-Maryland College of Veterinary Medicine, and Durham Hall. Approximately 1.3 MW of generation are anticipated to be in operation in late 2024. Thinking beyond the currently selected buildings for rooftop solar, the team is also pursuing a potential solar installation on the roof of War Memorial Hall and is working with the Office of University Planning to conduct a viewshed and glare analysis.

# 3 Energy System Efficiency and Total Steam Plant Conversion to Natural Gas

"Complete the total conversion of steam plant fuel to natural gas by 2025, plan for full transition to renewable steam plant fuel after 2025, and continue to improve efficiency of campus energy systems."

Virginia Tech Power Plant

The Virginia Tech power plant is a co-generation asset that produces centralized steam and simultaneously uses some of the steam as a by-product to generate up to 6.25 MegaWatt (MW) of electricity. The steam turbine powered generator produced 26,094,411 kWh of electricity at the plant from July 2022 through June 2023. That electricity production offsets the electricity purchased by the university for distribution across campus and within Blacksburg. Co-generation increases the thermal efficiency of the Virginia Tech power plant, reduces greenhouse gasses and other emissions, and refocuses the infrastructure investments on distributed generation and smart energy options.

Figure 4 shows power plant fuel consumption and GHG emissions between FY2014 and FY2023. Power plant GHG emissions have been reduced significantly since the change in fuel source to natural gas nine years ago. Fuel consumption at the power plant increased 12 percent from FY2022, which can be attributed to weather events and the recent campus area increase.

Figure 4. Power Plant Fuel Consumption (Fiscal Year)
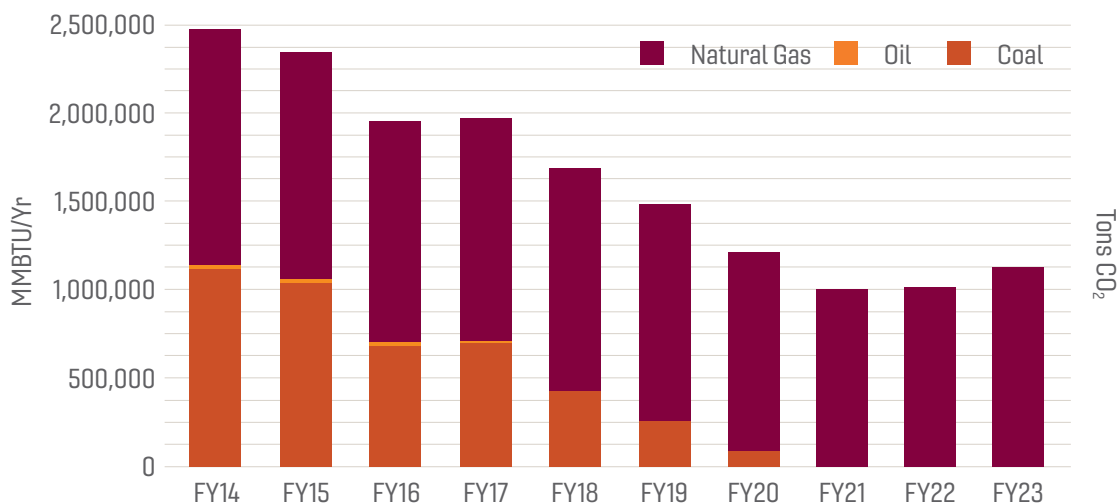
While the power plant emissions increased slightly in FY2023, when compared to the baseline FY2019, greenhouse gas emissions have significantly declined. This can be attributed to several upgrades and efficiency initiatives. In fall 2021, a new natural gas fired boiler was installed along with a reverse osmosis (RO) system, which removes scale-forming salts from the boiler feedwater. This reverse osmosis system replaced the less efficient demineralizers in the plant and also reduced the handling of corrosive and dangerous materials in the plant. Additionally, the air dryer in the plant was recently replaced with a more efficient unit equipped with an energy management mode that allows for a longer drying cycle, longer

Figure 5. Power Plant Greenhouse Gas Emissions (Fiscal Year)
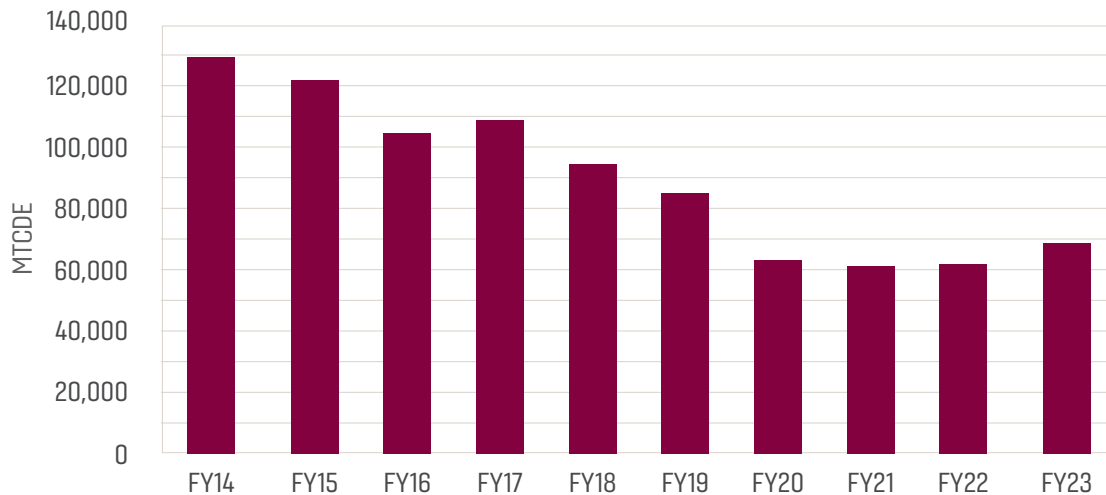
runtimes, and fewer regenerations. To further reduce the plant's emissions, the cogeneration system will be rewound in the coming year, along with the replacement of the generator cooling water piping. This will allow for a higher volumetric flow rate through the system, providing better heat transfer.

Campus Chilled Water Infrastructure

Virginia Tech completed its chilled water infrastructure capital construction project, a multi-year project beginning in July 2019. Previously, two on-campus plants, the North and Southwest Plants, distributed chilled water through an underground piping network to cool buildings across the Blacksburg campus. In addition to the installation of three state-of-the-art 3,000 chillers, roughly four miles of the new underground piping were installed across campus. This extensive network of piping enabled the connection of the North and Southwest Chiller Plants and standalone chiller systems into one continuous chilled water loop.

Demand Side Management

The Office of Energy Management within the Division of Campus Planning, Infrastructure, and Facilities guides the operations of the university to achieve tangible reductions in energy consumption on Virginia Tech campuses through the development and implementation of various Demand Side Management policies, initiatives, and projects.

Demand Side Managemen promotes energy efficiency through upgrading, retrofitting, and commissioning mechanical, lighting, building automation, and electrical systems in university buildings. While Demand Side Managemen is primarily concerned with reducing on-site energy consumption and related costs, it also supports the university's commitment to sustainability. The benefits gained from the program include carbon footprint reduction, improvement of indoor air quality, and conservation of resources. The Demand Side Managemen program will help the university to be less vulnerable to sudden changes in the energy market and helps set the way toward a net zero energy future.

Virginia Tech Guidelines for Energy Efficient Design

The Division of Campus Planning, Infrastructure, and Facilities updated its Design and Construction Standards Manual (DCSM) in 2022 to ensure that the design and construction of buildings at Virginia Tech comply with the Virginia Energy Conservation code as well as ASHRAE 90.1. The purpose of the Virginia Tech Guidelines for

Energy Efficient Design is to formulate additional requirements that go beyond the applicable Energy Code and are specific to the university. The DCSM presents recommended design elements in ten sections, each representing a vital interrelated component of an energy-efficient design, including running a building energy simulation, efficient building shell design, windows and daylight harvesting, efficient use of lighting and power, heating and cooling, ventilation, local service water heating, building automation, renewable energy systems, and energy metering.

Data-Driven Energy Optimization

Using data to guide decisions and achieve energy efficiency at scale is at the core of the Energy Action Plan. The Office of Energy Management utilizes a combination of a central energy management platform and building-level energy data spreadsheets to monitor energy usage in real-time. New buildings are added to the energy management platform during construction and help to visualize real-time parameters of energy use. Building spreadsheets enable detailed analysis of the performance of buildings, especially concerning efficiency project savings achieved.

Through newly-installed smart meter and sub-meter infrastructure, energy data is stored in various campus systems that enable the Office of Energy Management and other users to identify potential projects and track energy usage per building. Practitioners can then identify energy consumption patterns to optimize lighting, ventilation, heating, and air based on demand. Data visualization can also help detect irregular spikes in energy usage.

The Office of Energy Management is currently working with other departments to develop a Master Metering Plan to provide enhanced metering capabilities on campus. This will ultimately enable more detailed and accurate cost accounting and budgeting for Blacksburg campus building users, along with providing even more data that can be analyzed. Upgrades to metering, controls, and data management are underway. Several buildings have migrated to a modernized platform that enables advanced automation and energy savings initiatives. Additionally, all metering data has migrated to the newly developed Operational Data Warehouse (ODW) system. This has improved real-time access to utility performance data through extensive dashboards and advanced analysis tools.

Virginia Tech Electric Service

Few universities serve the electrical needs of their surrounding communities - and none to the extent of Virginia Tech and the Virginia Tech Electric Service (VTES). VTES has been in the business of providing primary electrical distribution service to the Blacksburg campus and other roughly 7,000 customers for more than 100 years.

4 Existing Building Energy Efficiency

"Reduce building energy consumption to enable carbon neutrality by 2030."

Climate Action Commitment Goal 4.1 By the end of 2022 reduce electricity consumption (kWh) by 10 percent and electricity intensity (kWh/GSF) by 20 percent below 2006 levels.

Climate Action Commitment Goal 4.2 By 2030 employ energy management retrofit to reduce total energy consumption (Btu+kWh) in all buildings by 10 percent and Energy Use Intensity or EUI (Btu+kWh/gsf) by 20 percent below 2020.

Figure 6. Campus electricity consumption (kWh)/Area (SF) (Fiscal Year)
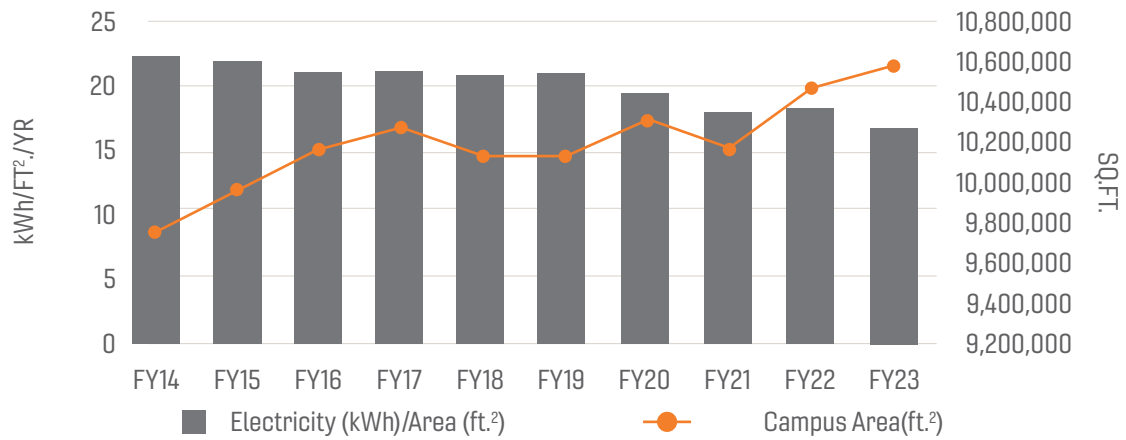

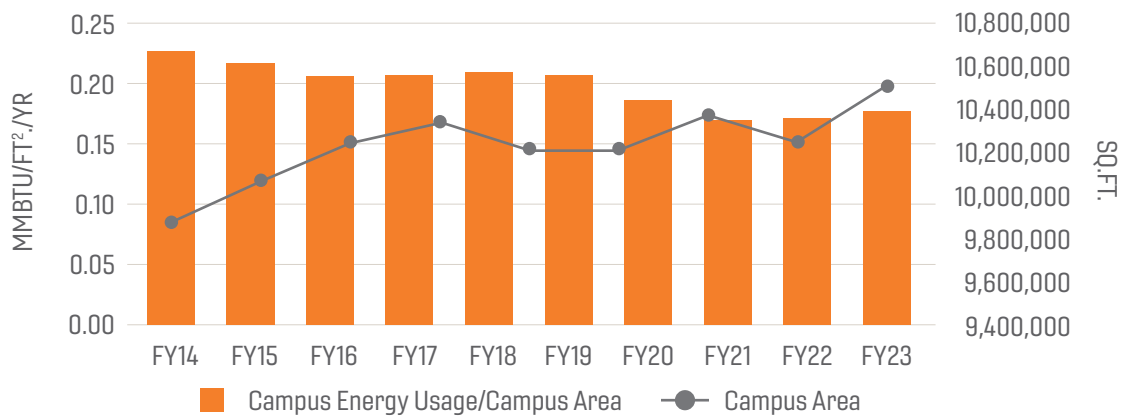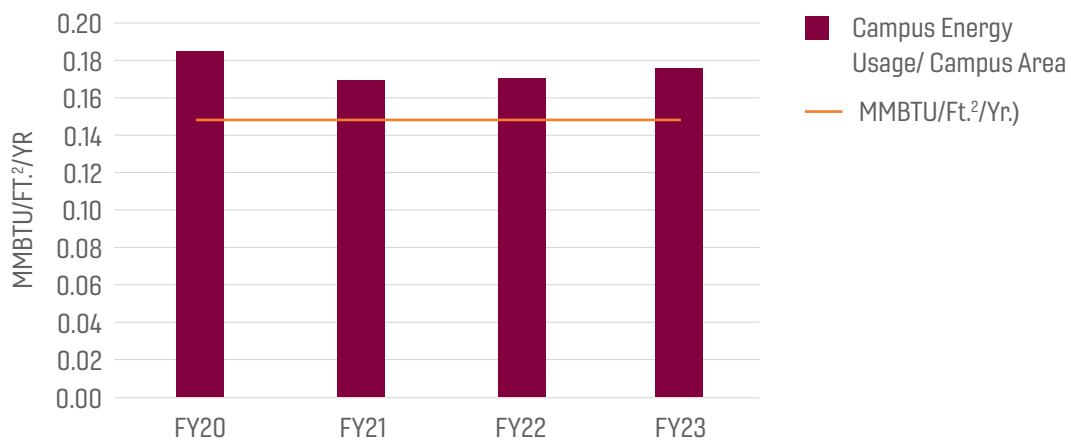Figure 7. Campus energy consumption (MMBTU/Area (SF) (Fiscal Year)

Figure 8. Progress towards goal 4.3 (Fiscal Year)

The energy reduction intensity of 20 percent of the 2020 EUI is demonstrated in Figure 8. Virginia Tech is targeting this goal (0.15 MMBTU/Sq. Ft./Yr) by 2030.

More efficient buildings reduce GHG emissions as they reduce fossil fuel emissions created by electricity, steam, and chilled water generation. Building-level energy savings initiatives are underway with many additional projects planned.

Energy Action Plan 6

The Office of Energy Management is continuing to work on the sixth phase of the Energy Action Plan (EAP). The EAP 6 projects include the conversion of 3 buildings to a new Building Automation System (BAS) platform, an LED lighting overhaul of 10 educational and general (E&G) buildings, various retro-commissioning projects, additional energy metering installations, and chilled water system optimization.

Energy Action Plan 7

The Office of Energy Management has proposed the seventh phase of the Energy Action Plan to continue efforts for the implementation of the Virginia Tech 2020 Climate Action Commitment. EAP 7 proposed projects include improvements and modernization of the Building Automation Systems for 20 buildings, as well as an LED lighting overhaul for 20 buildings.

Building Automation System Upgrades

The Building Automation System is a critical tool for energy management operations. A recent BAS assessment identified and proposed efficiency opportunities through modernization and investments in the BAS. These upgrades are in progress.

LED Lighting Upgrades

In fall 2022, the Office of Energy Management completed the final phase of lighting audits on Blacksburg campus (71 buildings or 35 percent of the campus area) to develop plans for LED retrofits. The potential savings exceed 6.7 million kWh or roughly $629,800 in energy savings annually. These upgrades would also divert nearly 11,700 lamps from landfills.

Currently, 22 percent of the campus has LED lighting installed. Lighting retrofits are underway for 10 buildings under EAP 6 with plans to complete the EAP 7 in the next couple of years. In FY2022-23, LED lighting projects were completed in 10 buildings (430,000 SF) under EAP 5. These buildings include Henderson Hall, Williams Hall, Theater 101, Surge Space Building, Sterrett Center, Shanks Hall, Major Williams Hall, Burchard Hall, Library Storage, and the Architecture Annex. These projects are expected to save 1,126,158 kWh annually.

Additional projects completed this past year include the Urban Horticulture Farm, Media Building, McBryde Hall stairwells, Kentland Dairy Farms, Virginia-Maryland College of Veterinary Medicine, Smith Career Center, the Virginia Tech Power Plant cogeneration room, the Brooks Center classroom/hallway, and the Torgersen Bridge exterior lighting. These projects were funded by the Office of Energy Management, as well as various sources including the Green RFP program.

Retro-Commissioning Efforts

The EAP 6 budget included a robust retro-commissioning (RCx) program. RCx is a systematic process applied to existing buildings for identifying and implementing operations and maintenance improvements within the heating, ventilation, and air conditioning systems to ensure their continued high performance over time. Retro-commissioning projects usually have a 10 year payback. These types of savings, when combined with other larger payback projects (i.e. solar) will help maintain overall energy fund simple paybacks within target values. RCx will continue to be a major contributor to reducing energy consumption on campus and will be instrumental in Virginia Tech meeting its energy efficiency goals in the updated Climate Action Commitment.

Laboratory Ventilation Optimization Project - Steger Hall North and South

In spring 2023, Virginia Tech installed a laboratory ventilation optimization system and program for Steger Hall North and South. Steger Hall was identified as a candidate for this air quality monitoring and optimization system installation, measuring and reporting air quality and safety in real time while reducing unnecessary energy usage. The project cost $400,000 and has annual energy cost savings of $73,000 (a 5.5 year simple payback period).

Fume Hood Assessment

In spring 2023, the Office of Energy Management completed an assessment of 783 fume hoods in 45 buildings on campus. The fume hoods were evaluated for safety and energy savings opportunities. The study provided an implementation roadmap for a fume hood program. A quick payback project for HVAC RCx and laboratory ventilation optimization in 20 buildings has begun. This is an $800,000 investment with less than a two-year simple payback period. It will yield a four percent annual energy reduction in campus usage.

Energy Savings Performance Contracting

Virginia Tech stakeholders are utilizing the Energy Savings Performance Contracting (ESPC) model, which would provide additional funding and resources for energy efficiency and infrastructure upgrades. The initial ESPC evaluation is underway.

Additionally, work is being done to develop financing strategies for energy management of auxiliary buildings, including the Division of Student Affairs and the Virginia Tech Athletics Department. Meetings and discussions are underway with the Virginia Tech Foundation on revenue-neutral energy efficiency improvements on Foundation-owned buildings used by Virginia Tech units.

LEED Operations and Maintenance Recertification Program

Virginia Tech launched its Leadership in Energy and Environmental Design (LEED) Operations and Maintenance (O&M) recertification pilot project, beginning with Moss Arts Center, which was originally LEED-certified by the U.S. Green Building Council (USGBC) in 2014. The LEED O&M program requires a year of actual building performance data collection and verifies ongoing high-performance and sustainable operations. The Office of Sustainability's student interns supported the Office of Energy Management in the energy, water, waste stream, and occupant health and satisfaction data collection process. Currently Moss Arts Center,

Goodwin Hall, and New Classroom Building data collection is underway with plans to expand the program to the remaining eligible LEED-certified buildings on campus.

Student Affairs Facilities and Operations

Summer is a critical time for facilities and operations to upgrade and improve student housing, dining, student centers, and recreational sports facilities, in anticipation of student's return to campus in August. At the end of summer 2022, the Student Affairs Facilities and Operations team concluded 10 total projects in just 14 weeks. Many of these projects focused heavily on reducing energy consumption to enable carbon neutrality for the university (Goal 4).

WINDOW UPGRADES

East Eggleston Hall underwent a rigorous $1,800,000 project that replaced all exterior windows on the unit by the end of summer 2022. New double insulated windows were successfully installed, barring supply chain shortages and a tight timeframe. Double paned windows effectively reduce the transfer of heat - preventing a heat gain and loss inside the building. The newly placed windows will contribute greatly to the university's ongoing energy reduction effort by increasing efficiency and regulating moisture concerns.

HVAC PROJECT PHASE II

Following the first major HVAC project in the summer of 2021, Payne Hall Phase II was completed at the end of summer 2022. This is a $5 million multi-phase capital project that includes numerous building upgrades. Most notable is the HVAC piping system that moves the building from a two pipe system to a four pipe system. This new network creates an energy efficient system that also addresses air quality concerns within the building. The newly upgraded units will be able to reduce energy consumption through more efficient cooling and heating cycles throughout the year, while reducing emissions. This project addresses an ongoing humidity concern by reducing moisture in the residence halls, while increasing comfort levels.

REC SPORTS LIGHTS

The Recreational Sports and Marching Virginian Field Lights were upgraded to meet energy reduction goals in the summer of 2022. This project replaced light pole cables and upgraded existing fixtures with new LED lights.

PEDDREW YATES & NEW RESIDENCE EAST HALL COMMUNITY KITCHENS

In an effort to improve living space for our residents, a $200,000 renovation project was completed this past summer for two community kitchens. The projects replaced plumbing, lighting, finishes, casework and furniture. Working to meet the university's Climate Action Commitment tenets, the project managers focused on utilizing sustainable materials:

▸ All Virginia Tech flooring is made up of 30 percent minimum recycled content.

▸ Carpeting contains 30 percent minimum recycled content.

▸ Installed carpet is enrolled in a "cradle to grave" program with Barrows — this means the company will remove and recycle old carpet, during future replacements.

▸ All adhesives and paints: low VOCs (volatile organic compounds)

- Whirlpool Range and Whirlpool Refrigerator are energy efficient models - this reduces energy consumption by 20 percent in a standard household annually.

- All new lighting is energy efficient LED, activated by motion sensor.

- Newly installed shades are 'partial blackout' to reduce solar gains.

- All ceramic tile is made up of 30 percent minimum recycled content.

CREATIVITY AND INNOVATION DISTRICT RESIDENCE HALL (CID)

The CID building houses experiential learning labs throughout the first floor of the residence hall. These labs utilize wood, metal, and paper products regularly. The Campus Planning and Facilities department has implemented a recycling partnership that allows the CID community to recycle scrap materials for reuse, as opposed to tossing them in the landfill. This program began in Feb. but is already improving material handling and promotes recycling over trashing supplies.

COMMON AREA LIGHTS

In summer 2023, Campus Planning and Facilities began replacing lounge and hallway lights in Peddrew-Yates Hall and New Residence Hall East. All fixtures will be upgraded through the academic year to LED and Slusher Tower will see similar changes. Student room and common hallway lights have been upgraded to LED fixtures.

HVAC PROJECT PEDDREW-YATES AND NEW RESIDENCE HALL EAST

Goals have been set to begin the next HVAC project at the beginning of Summer 2023. These upgrades will allow for improved air quality and better dehumidification. Fan-coils and air-handler units will be provided with different water temperatures - creating a more energy efficient system.

DINING FACILITY UPGRADES

Virginia Tech Dining Services is focused on utilizing locally sourced and sustainable food products. Local is defined as within 250 miles of Blacksburg or within the commonwealth. This past spring, the Dining Services sustainability team initiated conversations with primary vendors to create transparency and open communication regarding local, organic, and sustainable food expectations and goals. Dining Services has been able to track current use in these categories. This knowledge will allow Virginia Tech's chefs to continue to expand utilization of local and sustainable products during menu development.

In addition to the university's 12-acre organic produce farm, Dining Services utilizes additional products that are produced on Blacksburg's campus. The College of Agriculture and Life Sciences produces eggs, milk, and various protein products (beef, lamb, and pork) that our chefs consistently add to their menus.

This past summer, the Division of Student Affairs Facilities and Operations team worked with Dining Services to refresh Frank's in Owens Hall. This project focused heavily on utilizing and converting to sustainable materials in the unit. All lighting was upgraded to LED. Ultra low flow plumbing fixtures were implemented at a rate of 1.0 gallons per minute. Renovation materials met several green certifications:

- **Acoustical ceiling tiles:** GreenGuard Gold certified and contain no VOCs

- **Cambria Quartz counters:** Declare certified, GreenGuard Gold certified for low VOC emissions.

- **Paints:** Zero VOCs

- **Wall tiles:** Contain pre-consumer recycled material, zero VOCs, zero PVCs, and zero formaldehyde
- **Plastic Laminates:** Contain 34 percent or greater post-consumer recycled wood fiber, GreenGuard Gold certified, and FSC responsible forestry certified.

5 New Building Energy Efficiency

"Operations of new buildings initiated by 2030 will be carbon neutral."

LEED Standards

Designing for high energy efficiency in new buildings is necessary to achieve and maintain carbon neutrality and sustainable operations. The U.S, Green Building Council provides a green building certification program known as LEED, or Leadership in Energy and Environmental Design. This program scores buildings on their overall sustainability based on a points system scoring the building on various criteria such as energy and water efficiency, waste reduction, and various other features. Currently, Virginia Tech has 23 LEED-Registered buildings and an additional 13 in-progress LEED building projects (four pending certification, eight under construction, and one in design) totalling over 3.3 million gross square feet. The university has specified that all new buildings entering the design phase of construction that are greater than 5,000 gross square feet, or the renovation of such buildings where the cost of renovation exceeds 50 percent of the value of the building, shall conform to LEED Silver standards or better.

Designing a Sustainable Student Life Village

The university has been developing a Student Life Village master plan that proposes residential, well-being, recreation, dining, and enrichment spaces for up to 5,000 students on campus with sustainability as a component. The plan will focus on integrated, high-quality student-life offerings as well as living-learning programs, amenities, and public spaces to serve both on- and off-campus students. The Board of Visitors met in June 2023 to authorize the planning of Phase 1 of the Village. This represents a major step towards the Student Life Village becoming a reality

Status	LEED Projects	GSF
●	Ambler Johnston Hall	269,463
●	Goodwin Hall	154,935
●	Henderson Hall Renovation and Theatre 101 Addition	38,750
●	Human & Agricultural Biosciences Building I	93,860
●	ICTAS- Phase II	42,190
●	Moss Arts Center	147,382
●	O'Shaughnessy Hall Renovations	69,200
●	Student Athlete Performance Center	25,800
●	Football Locker Room Addition	42,145
●	Lavery Hall	77,301
●	Vet Med Instructional Addition	24,600
●	Chiller Plant Phase I (Southwest Chiller Plant)	16,655
●	Indoor Athletic Training Facility	91,600
●	Pearson Hall East	111,191
●	Oak Lane Phase IV	20,508
●	Pearson Hall West	108,765
●	New Classroom Building	72,275
●	Davidson Hall (RRAB)	25,151
●	VT Carilion Biomedical Research Expansion	139,586
▶	Rector Field House	43,949
▶	Baseball Facilities Improvements	49,872
▶	CID LLC	224,500
▶	Holden Hall Renovation	101,240
▶	New Upper Quad Residence Hall	58,000
▶	Data & Decision Sciences	120,000
▶	Corps Leadership & Military Science Building	60,500
■	Hitt Hall & New Dining Facility	112,000
■	Innovation Campus Academic Building	300,000
■	Multi-Modal Transit Facility	13,606
■	Undergraduate Science Labs - New Construction	102,366
●	Visitors & Undergraduate Admissions Center	18,155
●	Davidson Hall	44,845
●	Sandy Hall (RRAB)	19,889
●	Liberal Arts Building (RRAB)	15,394
■	Student Wellness Improvements	263,000
✳	Mitchell Hall (Replace Randolph Hall)	284,000
	Total GSF	3,337,053

● Complete ■ Construction ▶ Pending ✳ Design

Certification Level

Gold	Silver	Green

as it allocates $19.5 million to provide preliminary designs (50 percent drawings) for sitework, landscaping, utilities, residential structures, dining structure, recreation, structure, roads, and pathways. A subsequent request for a construction authorization for Phase 1 may be considered after designs are underway and a firm scope, acquisition strategy, cost, funding, and schedule for Phase 1 of the Village are established.

Design and Construction Standards

The university's Design and Construction Standards Manual (DCSM) outlines the philosophy, standards, recommendations, and requirements for the design and construction of campus buildings. As a component of the DCSM, the Guidelines for Energy Efficient Design address the energy efficiency and on-campus renewable energy utilization requirements for our campus buildings. These standards apply to all new construction, additions, and renovation projects on campus and are essential for fostering sustainability among new building projects.

# 6 Agricultural, forestry, and land use operations will be carbon neutral by 2030.

Stroubles Creek Restoration

Stroubles Creek is an approximately 12-mile-long stream that runs through the Town of Blacksburg, the Virginia Tech campus, and Montgomery County, Virginia, until it empties into the New River. Virginia Tech, in partnership with the Stroubles Creek Restoration Initiative and students from many organizations across campus, has been working to repair the riparian area along the segment of the stream leaving campus since 2014. Restoration efforts are partially funded through student proposals submitted via the Green RFP program.

In spring of 2023, 10,364 native trees and shrubs were planted with the help of 2,879 volunteer hours. Fifty-two different native species were planted along the stream and all plantings were equipped with 5-foot tall biodegradable tree shelters. Total planted stream bank length equals 11,982 linear feet or 2.27 miles. Total planted riparian acreage totals 23.05 acres. Efforts were also made to manage aggressive invasive vegetation through integrated pest management to promote the establishment of native species.

Another accomplishment of this year was the creation of the Riparian Buffer/Wetland Restoration Projects GIS layer. The map layer shows past and active project areas as well as potential future target sites for restoration.

Figure 9. GIS layer showing riparian buffers and wetland restoration projects
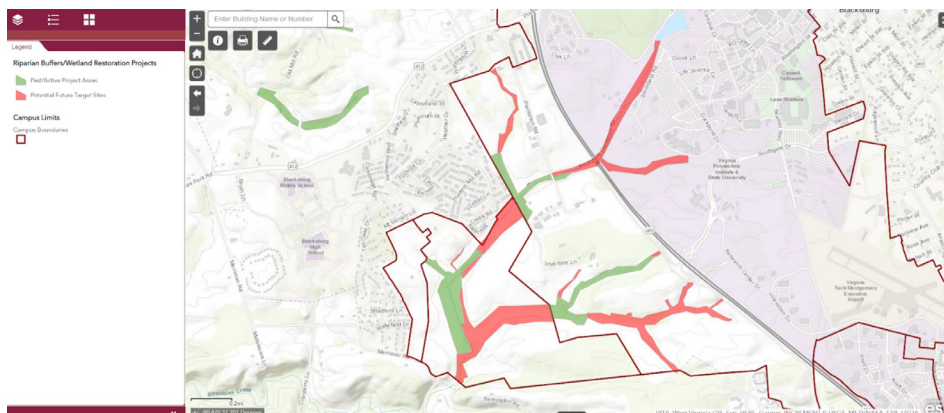
Bee Campus USA

Virginia Tech earned Bee Campus USA certification in spring 2022. This initiative is sponsored by the Xerces Society for Invertebrate Conservation. Bee Campus USA certification requirements serve as a guideline for affiliated campuses to increase their commitment to preserving these native pollinators. This is achieved through a long-term plan to increase native plant habitat, provide pollinator nesting sites, reduce pesticide use on campus, and develop pollinator conservation education and outreach opportunities for the campus community. The Virginia Tech Bee Campus Standing Committee is composed of dedicated and enthusiastic students, faculty, and staff from multiple disciplines across campus.

During the 2022-23 academic year, the committee expanded the Hillcrest pollinator habitat with the help of student volunteers during Earth Week. The habitat more than doubled in size and species variability, providing even more habitat for native pollinators. Two additional pollinator habitats were installed in the roundabouts on the east side of the Drillfield, which Office of Sustainability staff, in partnership with Facilities Operations, helped maintain over summer 2023 while students were away. Staff volunteer maintenance helped prevent the use of herbicides in the space. All pollinator habitats were funded through innovative means, such as partnerships with the Honors College and the student Green RFP program.

Management of Lawn and Grounds

Virginia Tech's turf and grounds cover approximately 300 acres. Although lawns and grounds do not adhere to a prescribed Integrated Pest Management plan, they are maintained with herbicides for broadleaf weeds and invasive plant material.

All lawn mowers utilize mulching blades for normal mowing operations. This allows the grass clippings to be used as mulch for the lawns. Virginia Tech no longer vacuums areas of the lawn that have clippings built up but rather use high-velocity blowers to distribute the clippings evenly across the lawn. Additionally, in the fall, the mulching mowers are used to chop leaves to avoid the need to collect leaves and transport them off the Blacksburg campus. All tree limbs less than four inches in diameter are also chipped and used on campus to mulch areas under large canopy trees and stormwater management facilities.

Landscaping Native Preferences

The Virginia Tech Design and Construction Standards Manual states that "native plants will be used to the maximum extent possible." See Section 4.7.6.1.7. The DCSM also considers energy-efficient landscape design strategies and states, "a landscape of predominantly long-lived shade trees with accents of flowering and evergreen trees is preferred. To simplify maintenance, shrubs should be planted in masses, avoiding complicated multi-species arrangements while serving a specific function (screening, traffic control, unmowable slope cover, etc.)." Designing landscapes with maintenance in mind limits the creation of spaces that require intensive care with lawns and other maintenance equipment and, as a result, less emissions.

Homefield Farm

Homefield Farm is a partnership between Dining Services and the School of Plant and Environmental Sciences within the College of Agriculture and Life Sciences (CALS). This is a 12-acre farm that grows vegetables, fruits and herbs for Virginia Tech Dining Services. It is the only certified organic operation owned by a university in Virginia. Homefield is also good agricultural practices (GAP) certified which ensures that crops are produced,

packed, handled, and stored to reduce risk of food safety hazards. Our farm staff produces roughly 45,000 pounds of produce annually - it all goes directly to our dining centers to be served to our students. This partnership serves as a site for experiential learning, research, and community outreach. The overarching goal is to produce locally and educate our students on the source of their food. Homefield Farm is a supporter of sustainable events on campus and can also be found in Xpress Lane on occasion.

This year our farm manager worked closely with chefs to produce specific needs for fresh menu items, campus events, and Limited Time Offerings. In addition to numerous varieties of fruits and vegetables, Homefield Farm started a few long term projects - shiitake mushrooms, asparagus, and blueberries. These items will produce large harvests for years to come.

Specific to the university's commitment for 100 percent utilization of Homefield Farm products, one of Dining Services' chefs commits their summer months to canning and food preservation. Chef Mortiz orders items from the farm such as tomatoes, onions, carrots, potatoes, and herbs, among other produce, to produce large portions of sauces and soups. These food products will then be canned, frozen, and otherwise preserved for service during the academic year. Their commitment to locally sourced, farm fresh produce helps Homefield Farm flourish and offers students an enhanced dining experience throughout the year.

May of this year brought back the volunteer program to Homefield Farm. This is a venture that allows students to work alongside our farm staff to gain hands-on experience and skills cultivating and harvesting produce.

In addition to our volunteer program, we've opened an internship position with the Sustainability Manager that focuses heavily at our farm location. This student will help bridge the gap between the farm and student education on campus. The intern will work with the Sustainability Manager and farm staff to reintroduce farm stands to the Blacksburg campus during the coming academic year.

Management of Crop Lands

Virginia Tech's crop and farm lands cover approximately 1,800 acres. All 1,800 acres are maintained in accordance with a four-tiered Integrated Pest Management (IPM) Plan as follows:

▶ **Action Thresholds:** Each of our crops (corn, alfalfa, barley, grass hay, pasture) is grown over numerous fields through the College of Agriculture and Life Sciences farm system. Each field is treated separately in the IPM plan so we never treat an entire crop as one unit when making applications; instead, it's handled one field at a time. A manager is regularly scouting fields to determine what, if any, course of action is required. Applications are only made if the manager thinks crop losses will outweigh application expenses.

▶ **Monitor and Identify Pests:** Managers regularly monitor crop needs, identifying pests and pest damage. Managers only take actions when warranted, not as a standard practice.

▶ **Prevention:** The goal is to use the lowest possible rates possible to control pests. Concentrated pesticides are purchased in bulk containers to reduce plastic container waste.

Catawba Sustainability Center

Virginia Tech's Catawba Sustainability Center is a 377-acre farm property situated in the Catawba Valley of Virginia. The center serves as a living laboratory to advance environmental stewardship and community engagement to provide a learning environment for research, teaching, and demonstration of sustainable practices in agriculture, forestry, and land management.

As a site managed by Virginia Tech's Outreach and International Affairs, the work at the Catawba Sustainability Center exemplifies the notion that learning is interdisciplinary and occurs in both the classroom and on the farm. Currently, Associate Professor of Practice in the College of Natural Resources and the Environment (CNRE) Ron Meyers, in partnership with the Office of Sustainability, has been conducting a feasibility study for agrivoltaic solar potential on the site. We expect the result of this survey in Fall 2023.

The Catawba Sustainability Center offers a space for faculty, students of all ages, community members, and visitors just passing through to learn about sustainable agriculture production, agroforestry, water quality monitoring, wetland restoration, and more.

Urban Forestry

Virginia Tech takes a holistic approach to campus urban forestry and management of university lands. This approach, rooted in planning, collaboration, education, and community engagement, helped the university earn Tree Campus Higher Education recognition for the 15th consecutive year in 2022.

Leading Virginia Tech's urban forestry efforts is Urban Forest Manager and University Arborist Jamie King, who joined the Division of Campus Planning, Infrastructure, and Facilities in 2019. Trees are among the most visible representations of Virginia Tech's commitment to environmental stewardship and tree preservation, reforestation, and education are prescribed throughout a number of key university frameworks, including the Campus Master Plan, the 2020 Virginia Tech Climate Action Commitment, and the Virginia Tech Blacksburg Campus Urban Forest Master Plan (UFMP), which is currently in under Campus Planning, Infrastructure, and Facilities leadership review.

"Trees play an integral part in maintaining a sustainable campus. They help support air quality, water quality, energy conservation, stormwater management, carbon capture and storage, wildlife habitat, and community wellbeing, all while creating spaces on campus that serve as a living learning lab."

— Jamie King, University Arborist

Since 2008, more than a thousand canopy and ornamental trees have been planted on the Blacksburg campus and many more thousands have been planted in riparian areas on Virginia Tech lands. Over the 2022-23 planting season, more than 500 landscape trees were planted across the core campus as part of tree replacement programming and capital projects. Many of these trees were planted with support from partners in the Office of Sustainability, CNRE, the Division of Campus Planning, Infrastructure, and Facilities, and the Virginia Department of Forestry offering students immersive learning experiences and public service opportunities, all centered around urban forest management and environmental stewardship on campus. These programs include hands-on academic sessions at campus trees and forests, tree planting events throughout the year, and urban forestry student internships.

A complete field inventory of trees on Virginia Tech's Blacksburg campus was completed in 2018 and the report can be obtained on the Virginia Tech Facilities website. A collaboration among the Division of Campus Planning, Infrastructure, and Facilities ,and CNRE, the inventory includes tree identity, precise location, measurements, health, and condition details for trees all over campus. As of July 12, 2023, the Blacksburg campus is home to approximately 11,510 living trees are logged in the Core Campus Tree Inventory.

The graphical representation of the Campus Tree Inventory is seen in Figure 10. Each dot represents campus urban trees including the trees located in the old growth forest adjacent to Lane Stadium. Some urban trees and various larger forests are not included and require future inventory and assessment. This resource helps guide tree preservation and maintenance as well as promoting education and awareness as the Campus Tree Inventory and Interactive Tree Map is available online for public access.

Figure 10. Aerial Photograph with Campus Tree Overlay

Figure 11. Campus District Overlay and 2020 i-Tree Canopy Study Data

District	Acres	UTC %	Impervious %	Plantable %	District	Acres	UTC %	Impervious %	Plantable %
Ag Belt	209	16	1.7	64.7	North Academic	70.2	10.1	42	14.3
Athletics and Recreation	196.4	4.5	37.8	13.5	Student Life	64.8	17.3	30	12.7
Creativity and Innovation	37.4	16.5	32.9	10.6	Northeast and Upper Quad	29.9	8.2	36.5	9.4
Drillfield	23.1	23.4	12.5	12.5	Oak Lane	38.7	28.4	33	12.5
Life Sciences and Technology	125.3	18.4	48.2	13.5	21st Century Living Learning	43.3	19.4	2	59.2
Meadow	67.9	27.8	8.7	29.6	**All Campus**	**1,051**	**19.6**	**24.4**	**26.6**

Replacement Value of the Blacksburg Campus Urban Forest

$30,622,817

Carbon stored in campus trees:

4,573 TONS = $566,214

When we utilize urban wood resources from campus, we store this carbon for much longer.

Carbon sequestered every year:

59.75 TONS = $7,751

Campus trees and other VT forests offset university carbon emissions by ~3%

Stormwater mitigated every year:

257,072 FT³ = $17,184

Slower runoff = Healthier VT Streams

Air pollution removed every year:

2.7 TONS = $6,459

Cleaner air = Healthier VT community

The total value of the structural and environmental benefits provided by the trees on the Blacksburg campus was included in the 2018 inventory and analysis. The data collected as part of this project was analyzed with software developed by the United States Forest Service called i-Tree Eco, a tool that models the structure of an urban forest and how trees influence the world around them. The software then analyzes the results and quantifies the environmental benefits provided by the inventoried trees to the community.

Virginia Tech's trees sequester and store enough carbon every year to offset approximately three percent of the carbon produced through total university operations (Randolph 2020, Figure 10). As trees are removed through management operations, the wood may be utilized for student academic projects, construction and woodcraft, wildlife habitat, or mulching materials, continuing the storage of carbon, sometimes for many generations. These trees also slow the runoff of stormwater on campus, reducing severe flooding events and improving water quality. The leaves on campus trees filter particulates and pollution from the air; this air quality improvement allows the community to experience fewer respiratory health challenges.

If Virginia Tech were to replace every tree recorded in the Blacksburg Campus Tree Inventory with the largest commonly available planting stock, the expense would amount to almost $31 million;. This analysis does not account for the generations required for trees to mature and provide the benefits the Virginia Tech community enjoys today. These assets require continued investment in maintenance and protection to maximize tree benefits, including carbon capture and storage, for generations to come.

Currently, the urban tree canopy (UTC), the percentage of surface area covered with tree leaves during the growing season, at Virginia Tech is 14.7 percent (Hwang and Wiseman 2020). In 2019, 20.9 percent of colleges and universities in the U.S. reported having a campus tree cover goal (8.7 percent) or were currently developing one (12.2 percent) (Schmitt-Harsh 2019). The UFMP proposes a Virginia Tech Tree Policy that establishes an UTC goal of 25 percent, an increase of tree leaf area equivalent to 108 acres, by 2050. This goal supports carbon capture and storage on Blacksburg's campus and will contribute significantly towards campus carbon neutrality while providing all of the other environmental and social benefits described in detail above.

Another assessment, conducted in 2019-2020 by students in the Urban and Community Forestry course in CNRE utilized a sample-based photo interpretation method to determine UTC of specific campus districts (Byers and Wiseman 2020). The students utilized an application called i-Tree Canopy, a software developed by the United States Forest Service, that combines aerial photographs with ecosystem models to determine estimates of land cover types and the ecosystem services provided by UTC cover at specific locations. This land cover data is created through a process called sample-based photo interpretation where analysts classify land cover types through statistical point sampling, allowing fast and inexpensive UTC reports. The i-Tree results report 16.9 percent UTC campus-wide, allowing comparison of UTC and ground cover data between districts across the Blacksburg campus. The results only differ slightly from the earlier Hwang and Wiseman 2020 study (14.7 percent campus-wide) due to differences in imagery dates and analysis methods. The final report illustrates the UTC relative to other ground covers in each zone on Blacksburg's campus and the results of the primary campus districts are illustrated in Figure 11. Districts with high UTC include Oak Lane (28.4 percent or 10.9 acres), Meadow (27.8 percent or 18.9 acres), and Drillfield (23.4 percent or 5.4 acres). The Drillfield district tree canopy is relatively high when considering the canopy is restricted to the edges of the Drillfield district. These districts show great contrast when compared to districts with low UTC like Athletics and Recreation (4.5 percent or 8.3 acres), North Academic (10.1 percent or seven acres), and Northeast and Upper Quad (8.2 percent or 2.4 acres). This assessment informs tree planting

and preservation priorities across the campus so tree benefits, including carbon capture and storage, are maximized as more complete tree planting and preservation plans are developed to maximize plantable space tree protection in districts with challenging constraints.

Each year the urban forestry team conducts tree assessments focused on safety and preservation within the Old-Growth Forest by Lane Stadium and across the campus. These risk assessments are scheduled and executed as a means to continue the preservation of campus trees and help ensure the safety of the campus community. The proactive assessments focus on trees adjacent to pathways and campus thoroughfares. Ongoing inspections, tree risk assessments, and maintenance activities are critical tools in advancing Virginia Tech's tree preservation commitment, natural resource management goals, and the Climate Action Commitment. These assessments and operations are conducted in close alignment with the University Arboretum Committee and the Virginia Tech community.

In partnership with CNRE professor and tree physiology expert John Seiler and the urban forestry team, Virginia Tech was awarded a Virginia Department of Forestry Urban and Community Forestry Assistance Grant to plan and execute a complete inventory of trees in the old growth forest adjacent to Lane Stadium. Throughout the summer of 2022, a crew of student interns conducted a census of trees four inches in diameter and greater that included performing measurements and assessments of each tree for data to input into i-Tree for ecological analysis. The resulting report details the ecological services provided by the forest to the Virginia Tech community and allows development of a detailed conservation and management plan for the old growth forest adjacent to Lane Stadium in the coming years. More than 50 different species make up the 1,711 tree inventory in the forest providing 1,016.51 tons of carbon storage and 15.7 tons of sequestration each year.

Other inventory and urban forest assessment projects are ongoing including a campus legacy tree analysis conducted by urban forestry intern Grace Steger. Throughout Steger's internship with the urban forestry team, they have identified potential legacy trees across Virginia Tech's Blacksburg campus, assessed each tree for criteria to meet the legacy tree status, appraised qualifying trees to report each tree's asset value, and prescribed tree protection zones for reference during campus development. This sub-inventory is a huge asset for the university as campus development, facility replacement and renovation, and infrastructure projects are planned and executed allowing the university to better preserve and protect its most precious tree assets.

Throughout each academic year, University Arborist Jamie King explores campus trees, discusses the Urban Forestry Management Program, hosts hands-on learning opportunities and lectures for courses across the university, and leads campus urban forest tours for various community groups. Notable examples in 2022-23 include outreach and demonstrations with Radford High School and an urban forest tour for the Virginia Master Gardener College hosted by the Virginia Cooperative Extension where participants learned the history of many of the famous trees of Virginia Tech while also receiving personal perspective and context concerning the future of trees and other natural resources on campus.

For Arbor Day 2023, the urban forestry team partnered with CNRE, the Earth Week Committee, and the Undergraduate Student Senate to host a legacy tree planting ceremony at the old growth forest adjacent to Lane Stadium. Participants learned the story of the legacy white oaks grown from seeds collected in the forest and a tree planting demonstration was conducted near the Virginia Tech Engage Center.

Zero Waste Campus

"Virginia Tech to become a Zero Waste Campus by 2030."

Virginia Tech, the Town of Blacksburg, the Town of Christiansburg, and Montgomery County are the four jurisdictional members of the Montgomery Regional Solid Waste Authority. Located in Christiansburg, MRSWA operates a transfer facility that receives the majority of the university's principal recyclable materials (PRMs) and all municipal solid waste (MSW).

Virginia Tech transitioned to a single-stream recycling system on July 1, 2015. Recyclable materials are transported from the university to the Montgomery Regional Solid Waste Authority, weighed, and further transported to Recycling and Disposal Solutions in Roanoke, Virginia. Recycling and Disposal Solutions serves as the recycling hub for the region, receiving materials from both the New River and Roanoke Valleys. Solid waste materials are transported from the university to the Montgomery Regional Solid Waste Authority, weighed, and transported to the local landfill operated by the New River Resource Authority (NRRA) in Pulaski County in Dublin, Virginia.

2022 Recycle Rate Report

In compliance with Virginia's Department of Environmental Quality, Virginia Tech completes an annual recycling rate report. These reports provide details on specific materials collected on campus. For CY2022, Virginia Tech reported 6430 tons of principal recyclable materials which included 304.83 tons of food waste, 287 tons of fiber (paper and cardboard), and 242.04 tons of commingled materials (single-stream recycling). Virginia Tech reported 4631 tons of municipal solid waste (trash). The university's recycling rate was 60 percent and the waste diversion rate (waste kept out of the landfill) was 78 percent.

Zero Waste Consultant Work

Virginia Tech hired Reduction In Motion to help determine what steps should be taken to make progress toward the goal of becoming a zero waste campus by 2030. Work in FY23 focused on interdepartmental waste programs collaboration, organic waste separation on campus, efficiency of hauling equipment and processes, and feasibility of an on-site composting facility. The consultant team worked with an interdepartmental group of stakeholders in fiscal year 2023 to complete an assessment that included two week-long site visits and monthly stakeholder calls.

Next steps determined by the consultants are as follows:

1. Improve zero waste subcommittee planning and reporting.
2. Develop one consistent zero waste communications plan for the entire university to follow.
3. Establish equipment and communication standards for all outdoor waste holding areas used by students and staff.
4. Use the zero waste communications plan to first improve front-of-house and back-of-house recycling and composting from dining services.
5. Establish a zero waste events subcommittee dedicated to developing tools and projects to reduce waste and increase waste diversion at small and large events of all types on campus.
6. Establish a zero waste residents sub-committee dedicated to developing tools and projects to educate all residents on waste separation guidelines and empower residents to be zero waste champions.
7. Use the zero waste committee to facilitate the steps necessary to produce a development and operating proposal for an on-site composting facility at Kentland Farm.

Y-Toss

Coordinated by the YMCA at Virginia Tech, Y-Toss is one of the largest sustainability events on Virginia Tech's campus. Each year, the program collects gently used items, such as furniture and clothing, from the residence halls during student move-out. Those items are then made available to students during a fall move-in sale at greatly reduced prices. All of the profits from the sale support YMCA student programs.

Collection was held from May 5-10th, 2023 during move-out. Eight PODS storage containers were set up across the residential side of campus to collect donated goods. With the help of 45 volunteers, over 1,000 pounds of clothes, 100 pounds of food for Meals on Main, and 400 pounds of linen were collected.

Since the program's inception in 2015, with the help of partners, sponsors, and volunteers, Y-Toss has diverted over 100 tons of gently used household items from the waste stream. At the same time, the program has engaged over 1,300 community volunteers and generated over $60,000 to support student-led programs.

Compost and Waste Reduction

Dining Services has diverted over 7,000,000 pounds of waste from the landfills through its composting program. Since 2009, Dining Services has made composting a core foundation in their waste management systems. Compost from our units is consolidated by our waste contractor, Meridian Waste, and then delivered to our composting facility, Royal Oak Farm. Royal Oak Farm is a local family-owned business that converts waste to rich soils.

As of Spring 2023, we are improving the efficiency of our waste management program by implementing a new waste labeling system across all back of house units. By utilizing color-coded bins and labels, we will increase efficiency, unify our system and improve training mechanics. In addition, we will be developing new training posters for our dishrooms to improve understanding and clarity when staff is sorting waste.

Similarly, in June, we began the process of auditing our front of house waste receptacles for lucidity and uniformity. Along with our marketing team, the sustainability division will begin implementing the new waste management program to our dining rooms. This implementation will create a cleaner and more cohesive look that should assist students when self-sorting their waste.

Sustainable Products

Since 2014, Dining Services has been offering a free reusable to-go program that reduces waste in our landfills. The program is simple — Eat, Return, and Repeat! The Dining Services sustainability team is continuing to work on outreach programs with both the Division of Student Affairs and faculty researchers to promote the use of containers and increase return rates. In addition, we are currently working to push china initiatives in our centers. This concept promotes in-house meal consumption and therefore reduces single use products in our waste streams from to-go packaging.

In Fall of 2022, all single-use plastic to-go utensils were replaced in our dining centers with compostable flatware. Across campus, you will find flatware dispensers that house compostable forks, spoons and knives for students on the go. These items can then be sorted into compost bins after use and contain no additional packaging.

As a continuation of our flatware change, we are currently undergoing a disposable product review across all dining facilities. In an effort to meet our university goal for zero waste, we aim to eliminate all grab-and-gobble non-recyclable plastics in our centers and promote compostable products where possible. This will be a long-term ongoing effort.

Race to Zero Waste

Virginia Tech participated in Race to Zero Waste, a competition between universities in the U.S. and Canada to reduce waste, increase recycling, and raise awareness of conservation efforts from Jan. through March of 2023. Participating in this challenge helped raise awareness about waste management practices on campus as well as educated people on the roles they play within the larger system of waste at Virginia Tech.

The competition offers different levels of participation depending on a university's goals. Virginia Tech participates in three categories. The first is diversion, looking at how much of the waste produced on campus is rerouted from landfills to be recycled or donated. The second category is per capita recycling, which normalizes waste generation across universities by looking at how much waste is generated per person on average. Finally, the third category is food organics, which examines how much food waste is composted, but also takes into consideration any measures taken to reduce food waste in the first place.

8 Establish the Sustainable Procurement Policy and Procedures by 2022.

Sustainable Procurement Policy

In accordance with the Virginia Tech Climate Action Commitment, the Virginia Tech Procurement Department recognizes its responsibility to support the university in its efforts to minimize negative impacts on health and the environment while supporting a vibrant campus community and local economy. The Procurement Department recognizes that products and services have inherent social, health, environmental, and economic impacts and that the department should make procurement decisions that embody the university's commitment to sustainability whenever possible.

Climate Action, Sustainability, and Energy Committee's Sustainable Campus Culture, Engagement, and Sustainable Choices Subcommittee

Over this past academic year, the Campus Culture, Engagement, and Sustainable Choices subcommittee met four times. The first few meetings were held to align the goals of the group and brainstorm ideas on how to take them forward. Some of the most important discussions have revolved around incentivizing participation in the Green Office and Green Labs Certification programs, designing strategies to get department heads more involved in such programs, and initiating conversations with colleges to practice sustainable purchasing practices.

The goal of the subcommittee is to eliminate barriers to sustainable behavior on campus. The subcommittee engages students, faculty, and staff in moving forward with the creation of a culture on campus that aids sustainable choices.

The members of the subcommittee discussed Virginia Tech's Sustainable Procurement Policy in great depth and discussed ways to make it more actionable and implementable. The subcommittee aligned on revising the policy in a way that eliminates barriers that offices or labs may be facing in terms of procuring basic materials that are sustainable or green certified. With regards to this the members viewed it important to highlight businesses or manufacturers that sell sustainable products. HokieMart currently indicates businesses that are small, minority-owned, or women-owned. Taking this view forward, two members of the subcommittee met with the Procurement Team to understand their role and current efforts in establishing 'campuswide sustainability' as part of Virginia Tech Procurement Policy. On reporting back to the subcommittee, the members decided to target small purchases and reorient the purchasing patterns to be more sustainable as part of the future action plan.

Discussions also revolved around building awareness regarding the Green Office and Green Labs Certification programs. Presently two members of the subcommittee work in labs and assisted in establishing an understanding of what it takes to adopt sustainable practices in a lab. Learning from their experiences, conversations with other lab managers were initiated. Taking this thought forward, an Earth Week event 'The Making of a Green Lab' was held on April 21, 2023. The event was well-attended and provided an opportunity to get the word out on the advantages of participating in the program. Conversations with lab managers across campus have been continued to widen the network of participants in the certification programs.

Looking ahead, the members of the subcommittee are/will be working on the following action points:

▸ Reaching out to the colleges regarding their purchasing patterns and initiating a conversation on drafting a resolution to become a paperless college and in turn a paperless campus. The idea is to pilot the resolution within the College of Liberal Arts and Human Sciences, as their purchasing patterns are more conducive to the program.

▸ Reworking the details on the reusable to-go container program – members of the subcommittee will be supporting research headed by faculty members at Pamplin College of Business and the College of Architecture, Arts, and Design to eliminate barriers faced by students in returning reusable containers to the dining halls.

▸ Outreach on Green Office and Green Lab Certification Programs – the members will continue advancing efforts on increasing participation in both.

▸ Reaching out to additional faculty members that are experts in the fields of social psychology and behavioral economics to help drive the goals of the subcommittee with a focus on using social marketing in diminishing barriers to sustainable behavior on campus.

University Policy 5505: Campus Energy, Water, and Waste Reduction

University Policy 5505 plays an integral part of Virginia Tech's procurement process. This policy ensures that Virginia Tech follows the three R's of waste reduction (reduce, reuse, and recycle) by minimizing waste on the front end through procurement of products as opposed to just focusing our efforts on products' end-of-life disposal.

The Climate Action, Sustainability, and Energy Committee initiated a round of substantial revisions to Policy 5505 "Campus Energy, Water, and Waste Reduction" in the spring of 2022. This represents the first major update to the policy in six years. The revisions came in response to Virginia Tech's 2020 Climate Action Commitment and were meant to bolster the policy to help the university achieve those goals. There are several goals that align well with Policy 5505 and they are as follows:

Goal 4 – Reduce building energy consumption

Goal 7 – Achieve a zero waste campus

Goal 8 – Establish a sustainable procurement policy and procedures

Goal 9 – Reduce transportation related GHG emissions and single occupancy vehicle commuting

Goal 12 – Diminish barriers to sustainable behaviors

Goal 13 – Implement the Climate Action Commitment at a high level of university administration and governance

The most substantial change to the policy is the inclusion of section 3.7 Procurement, which references our current sustainable procurement policy. This section was included due to the positive impact that environmentally conscious purchasing can have on limiting waste of all forms. All other sections received minor changes to listed considerations, titles, links, and descriptions to better align with the new Climate Action Commitment. These changes were suggested and/or reviewed by various committee members involved in the Policy 5505 taskforce or subject matter experts around the university. This resulted in the policy updates gaining approval in summer of 2023.

Building Material and EV Charging Sustainability

Virginia Tech's Design and Construction Standards Manual (DCSM) outlines the philosophy, standards, recommendations, and requirements for the design and construction of campus buildings. The DCSM requires that Life Cycle Cost and Energy Analyses are considered through a project and the results of such analyses should inform purchasing decisions for materials used within projects. The goal of these guidelines is to have more sustainability-minded design practices implemented throughout the building process.

The DCSM also adds in considerations for electric vehicle charging station design guidelines which can be found in section 4.9.9 of the manual. These guidelines include topics of consideration such as location, equipment, electrical, and sign placement.

9] Transportation GHG Emissions Reduction

"Reduce single-occupancy-vehicle commuting to campus by 20 percent by 2025 and reduce transportation-related GHG emissions by 40 percent by 2030."

Department Rebranding

In January 2023, Sustainable Transportation rebranded as Sustainable Transportation. This change helped increase alignment with Virginia Tech's Climate Action Commitment. Sustainable Transportation was increasingly involved in planning for electric vehicles, which are not always driven with two people but still play an important role in the university's efforts to reduce GHG emissions. More broadly, this rebrand was part of an effort to have non-drive-alone transportation modes be on the same level as driving alone. It's not necessarily an "alternative," it's just another option.

Multi-Modal Transit Facility

The product of decades of planning led by the Town of Blacksburg, in close coordination with Virginia Tech, the Multi-Modal Facility project will deliver a central transportation hub and Sustainable Transportation facilities in the vicinity of Perry Street, embedded within the North Academic District. Construction of the Multi-Modal Transit Facility began during academic year 2020-21 and has continued to progress. Construction is estimated to be completed in its entirety and operational by Spring 2024.

Bike Census

The bike census is an annual analysis of bike parking conditions on campus. It was performed through the Sustainable Transportation Department on Sept. 20th, 2022. The purpose was to evaluate the condition of the bike racks around Blacksburg's campus, count the number of bikes at each rack and compute a utilization percentage, as well as update any other information necessary. From the census, the Sustainable Transportation Department identified highly utilized bicycle racks that need increased capacity in the area. Bike racks in poor condition or fair condition were also recognized and noted.

BIKE PARKING IMPROVEMENTS

The Department of Sustainable Transportation installed 24 bike racks with a net capacity increase of 100 bicycles. One of the racks, at Steger Hall, is covered.

Electric Vehicle Charging Stations

The first publicly-available EV charging stations were installed on campus in Nov. 2021. There are three level 2 charging stations in the Squires Lot with a total capacity of six vehicles. One of the spaces is an accessible parking space. These charging stations have recorded over a thousand charging sessions from more than 417 unique drivers. This is a huge increase from the 187 unique drivers that we saw in FY22. The use of these charging stations has resulted in the avoidance of 27,765 kg of GHG emissions; that's over three times the kg avoided in FY22.

Electric Buses

Blacksburg Transit added five more electric vehicles to their fleet, bringing the total number of electric buses to 10. This represents 19 percent of their total fleet. Twelve more electric buses are on order and should arrive in a year and a half. Blacksburg Transit also has nine hybrid electric buses and is on track to be fully electric by 2032.

Sustainable Transportation Fair

Sustainable Transportation hosted the Sustainable Transportation Fair on August 25, 2022 to communicate transportation options available to all faculty, staff, and students at the start of the fall semester. The fair highlighted current programs and explored future opportunities for transportation. Representatives from Blacksburg Transit, the Office of Sustainability, Hokie Wellness, the Virginia Tech Police Department, Recreational Sports, RIDE Solutions, and more were on hand to talk to attendees about the services they offer and answer any questions. People had the opportunity to learn how Sustainable Transportation is promoting modes of transportation beyond single occupancy vehicle commuting to decrease Virginia Tech's greenhouse gas emissions and improve campus life.

Hokie Bike Hub

The Hokie Bike Hub is a free bike repair and maintenance workshop for Virginia Tech affiliates. Cyclists have access to tools and one-on-one help for self-service bike repair. They can also attend bike maintenance workshops and other cycling-related classes. The Hokie Bike Hub has become the home of bicycling on campus and serves as a social space for cyclists to interact and learn from one another. Having a space like this available for free on campus can help encourage and support the use of bicycles as a mode of transportation.

There were 3,232 visits to the Hokie Bike Hub last fiscal year. This represents a 22 percent increase over the previous fiscal year. The top five reasons for visiting the Hokie Bike Hub last year included: pumping/repairing flat tires, routine maintenance, brake issues, parts replacement, and shifting issues.

10 Climate Action Living Laboratory

"Integrate the Climate Action Commitment into Virginia Tech's educational mission through the Climate Action Living Laboratory beginning in 2021."

Experiential Learning Partnerships

The Office of Sustainability has continued its long history of working with staff, faculty, and students to build climate action learning opportunities. In the 2022-23 academic year we worked with over 10 classes from a variety of colleges. Some of these partnerships were ones we had built in previous semesters, such as Chair and Associate Professor of Urban Affairs and Planning Todd Schenk's course proposing Green RFP projects. Others were new partnerships including working with Assistant Professor in Industrial Design Yoon J. Choi's course to build better receptacles for reusable to-go containers or working with the living learning initiatives.

Additionally, during summer 2023 several CALL pilot projects were initiated as a way to scale up the Office of Sustainability's engagement with faculty and students. These pilot programs were testing how we could supply funding for research projects across campus that would strongly benefit the host department and simultaneously add new experiential learning opportunities. These included a building energy efficiency audit, a solar feasibility study for the Catawba farmsite, and a review of the university's maintenance protocols. By leveraging university expertise, the goal for these pilot projects is to prove that we can accomplish vital infrastructural and educational work at a fraction of the cost of what we would pay outside consultants or specialists, which would both save financial resources and add new learning dimensions. The results of these pilot projects will be available in the 2023-24 academic year.

We also took steps to create internal documentation as a way to track our ongoing experiential learning partnerships. This lets us map our relationships year after year as the Office of Sustainability increasingly leverages academic partners.

Climate Action, Sustainability, and Energy Committee's Climate Action Living Lab Subcommittee

The Climate Action Living Lab (CALL) subcommittee met throughout the academic year to build out documentation for defining the shape of the CALL. The CALL will be an interdisciplinary and collaborative group that incentivizes research projects that improve the built environment of campus and implement the Climate Action Commitment; however, the institutional home for the CALL has been reopened for investigation and discussion.

The bulk of this year's discussion was about how to form the CALL and bring it into existence at Virginia Tech. To this end, the group talked about ongoing CALL projects, exploring some successful existing partnerships between the Office of Sustainability and different faculty that have continued to provide fruitful experiential learning opportunities for students. The group also discussed new and exciting partnerships such as between the CASE team and an Honors College faculty member specifically meant to advance the CALL.

The subcommittee also spent time reviewing an executive summary document drafted by Climate Action Fellow Jack Leff to provide a central vision for the CALL. Conversations were held to receive input from people who want to be part of the CALL; their feedback will be incorporated into future drafts to be shared with the subcommittee for further iterations during the 2023-24 academic year.

The next immediate action items are meant to prepare the subcommittee to hit the ground running Fall 2024. It was decided that a webpage would be a strong start to help materialize, formalize, and promote the CALL. Additionally, faculty will begin working over summer 2024 to prepare course materials that will support the CALL that will improve the planning document, explore peer institution comparisons, and better define other dimensions of the project.

11 Climate Justice

"Establish climate justice as a core value of the Virginia Tech Climate Action Commitment."

Climate Action, Sustainability, and Energy Committee's Climate Justice Subcommittee

The climate justice subcommittee has been highly active this past year. The group met several times to discuss how best to move forward with climate justice initiatives and build on progress from last year. Boasting now over 30 members, it is a large subcommittee committed to facilitating equitable implementation of the climate action commitment.

Part of the goal of this subcommittee is to facilitate interdisciplinary partnerships between faculty, staff, and students around the issue of climate justice. In addition, it has provided a space to update attendees about what the Climate Action, Sustainability, and Energy team has been doing in the background over the last year. The group was particularly excited about new energy generation projects and energy efficiency improvements, with specific interests in solar panel life cycle considerations. There was also a robust discussion on the Climate Action Living Lab.

Additionally, the team has made good progress on the major goal to expand membership and get climate justice subcommittee member representation on all of the other subcommittees. Subcommittee membership has grown substantially to accommodate that goal and the group has developed a timeline for implementing it by Spring 2024.

Climate Action, Sustainability, and Energy committee and subcommittee composition remained a hot topic for the climate justice subcommittee. There are hopes to continue expanding representation over the course of the upcoming academic year to create a more inclusive environment. Additionally, the goal is to ultimately create an accountability board for infrastructure projects to ensure compliance with the value of climate justice. The subcommittee continues to explore opportunities for embedding climate justice into the decision making process of the university's operations.

12 Sustainable Choices and Behavior

"Diminish barriers to sustainable behaviors through institutional change, education, and social marketing."

Week of Welcome

Weeks of Welcome is part of Virginia Tech's extended orientation and transition experience. It serves as an opportunity for students to find their place at Virginia Tech and meet people, while also learning more about the campus community. At the start of the fall 2022 semester, Dining Services, Sustainable Transportation, and the Office of Sustainability gave a joint presentation to students covering sustainability on campus.

Sustainable Eats Walking Tour

Dining Services and Residential Wellbeing celebrated sustainable dining as both a journey and a destination with its recent Sustainable Eats Bike Tour. The tour welcomed students to visit campus dining centers, sampling locally sourced and plant-forward dishes while learning about campus sustainable dining measures at each stop. This was the fourth annual Sustainable Eats Tour.

Climate Action, Sustainability, and Energy Committee's Sustainable Campus Culture, Engagement, and Sustainable Choices Subcommittee

Over this past academic year, the subcommittee met four times. The first few meetings were held to align the goals of the group and brainstorm ideas on how to take them forward. Some of the most important discussions have revolved around incentivizing participation in the Green Office and Green Labs Certification programs, designing strategies to get department heads more involved in such programs and initiating conversations with colleges to practice sustainable purchasing practices.

The goal of the subcommittee is to primarily eliminate barriers to sustainable behavior on campus. The subcommittee also deems engaging students, faculty, and staff an essential component in moving forward with the creation of a culture on campus that aids sustainable choices.

The members of the subcommittee discussed Virginia Tech's sustainable procurement policy in great depth and discussed ways to make it more actionable and implementable. The subcommittee aligned on revising the policy in a way that eliminates barriers that offices or labs may be facing in terms of procuring basic materials that are sustainable or 'green certified' With regards to this the members viewed it important to highlight businesses or manufacturers that sell sustainable products. HokieMart currently indicates businesses that are minority-owned or women-owned. Taking this view forward, two members of the subcommittee met with the Procurement Team to understand their role and current efforts in establishing 'campuswide sustainability' as part of Virginia Tech Procurement Policy. On reporting back to the subcommittee, the members decided to target small purchases and reorient the purchasing patterns to be more sustainable as part of the future action plan.

Discussions also revolved around building awareness regarding Green Office and Green Labs Certification Programs. Presently two members of the subcommittee work in labs and were a great resource in establishing an understanding of what it takes to adopt sustainable practices in a lab. Learning from their experiences,

conversations with other lab managers were initiated. Taking this thought forward, an Earth Week event 'The Making of a Green Lab' was held on April 21, 2023. The event was well attended and was a great opportunity to get the word out on the advantages of participating in the program. Conversations with lab managers across campus have been continued to widen the network of participants in the certification programs.

Looking ahead, the members of the SCCESC subcommittee are/will be working on the following action points:

▸ Reaching out to the colleges regarding their purchasing patterns and initiating a conversation on drafting a resolution to become a paperless college and in turn a 'paperless campus'. The idea is to pilot the resolution with the College of Liberal Arts and Human Sciences as their purchasing patterns are simpler than colleges that have functioning labs and/or studios.

▸ Reworking the details on the reusable to-go container program – members of the subcommittee will be supporting research headed by faculty members at Pamplin School of Business and the College of Architecture and Design to eliminate barriers faced by students in returning reusable containers to the dining halls.

▸ Outreach on Green Office and Green Lab Certification Programs – the members will continue advancing efforts on increasing participation in both.

▸ Reaching out to additional faculty members that are experts in the fields of social psychology and behavioral economics to help drive the goals of the subcommittee with a focus on using social marketing in diminishing barriers to sustainable behavior on campus.

Green Office Certification

The Green Office Certification program gives faculty, staff, and students the tools they need to become greener Hokies working in more sustainable office areas. The goal of the program is to help employees reduce their footprint and improve the overall well-being of our planet. Virginia Tech's Climate Action Commitment outlines goals surrounding energy efficiency, waste minimization, and greenhouse gas reductions. By participating, employees can directly help the university achieve its climate action goals while saving money and resources for their office.

Offices can participate by identifying a Green Representative who completes a training session through the Office of Sustainability. In this training, they gain the skills and knowledge needed to create a greener workplace. Once the Green Representative completes the training, they will unlock the Green Office Certification checksheet, where they will work with their colleagues to complete tasks and become more sustainable. Offices are scored in the following categories: Recycling and Events, Energy, Purchasing, Waste Reduction, Transportation, and Innovation. Offices are then awarded either Bronze, Silver, Gold, or Platinum certification. There are currently 13 certified offices across campus.

GREEN LAB CERTIFICATION

Officially launched in Jan. 2022, the Green Lab Certification Program is a self-assessment tool that empowers, encourages, and recognizes labs that are engaging in sustainable practices. The program provides faculty, staff, and students with the tools needed to go green in their labs. There are over 1,200 labs across Virginia Tech's Blacksburg campus, so there are lots of opportunities to improve energy efficiency, conservation, and waste and recycling efforts in labs. A year into its launch, 30 labs have been certified and the numbers continue to grow. The Green Lab Certification program has aided in creating a culture of sustainability in labs.

Originally developed by Ellen Garcia M.S. '20, the efforts to certify green laboratories continues to be spearheaded by students with support from principal investigators and lab managers. Her work on this program led to the current iteration of the Green Labs tool, which assesses the laboratory's sustainability efforts spanning 11 different topic areas. There are plans to strengthen the process by providing more support to labs in going green. To reinforce these plans, a Green Lab working group consisting of various stakeholders around campus has been formed. The goal of this group is to make the certification process more user friendly and continue to support the existing culture of sustainability in labs. The membership of this group is open to all interested students, faculty, and staff.

OFFICE OF SUSTAINABILITY STUDENT INTERNSHIP PROGRAM

The mission of the Student Internship Program is to provide students with valuable opportunities to create lasting, sustainable change at Virginia Tech while developing their professional skills and expanding their knowledge of the inner workings of the university. The program encourages ownership, creativity, and collaboration to solve some of the toughest sustainability challenges the world is facing today. The program blends real-world projects with practical, skills-based professional development workshops to prepare students for an ever-changing career in the sustainability field. The projects the students complete, paired with professional development classes and other training, allow them to sharpen and expand their environmental and professional skill sets. Intern teams work on a variety of tasks, including:

▶ **Partner Projects:** Teams will partner with various departments such as the Office of Energy Management, Stormwater Management, Dining Services, and Residential Well-Being to complete technical projects.

▶ **Education and Outreach:** Teams will plan and execute outreach events in partnership with community organizations such as the YMCA, the Town of Blacksburg, and the Blacksburg Farmers Market. Past events include thrift swaps, pop-up farmers markets, and seed plantings.

▶ **University-wide Campaigns:** Teams will assist in executing large-scale campaigns including Earth Week, America Recycles Day, and World Water Day.

The projects that our intern teams worked on during the 2022-23 academic year include:

▶ **Water Team:** Created a GIS layer mapping out the water bottle refill stations across campus in an effort to visualize water access, document station conditions and filter status, and identify areas where additional stations may be needed to close gaps in water accessibility. The team also explored the impact that adding a position for campus water management could have on Virginia Tech in terms of water metering, efficiency improvements, and quality monitoring.

▶ **Food Team:** Researched hydroponics systems and completed grant applications to secure funding for a hydroponics system at The Market at Virginia Tech. The Market provides food to students in need as part of an effort to reduce food insecurity for Virginia Tech students. The new system allows The Market to improve the sustainability of its operations by growing their own greens and herbs without excess packaging while also saving money. The food team also created a magazine for campus community members focusing on sustainable dining options both on and off campus.

▶ **Waste Team:** Piloted a soft plastic recycling program on campus. The program placed specialized bins across campus which the students worked to advertise and manage throughout the year. The students collected thousands of items through this program, helping to reduce contamination in our waste stream. The waste team also coordinated and hosted a sustainable fashion show during Earth Week to educate students on the impacts of fast fashion and to showcase outfits that were thrifted or handmade.

▶ **Energy Team:** Researched, wrote, and submitted multiple Green RFPs for the betterment of campus energy systems. The energy team also created and distributed a survey to assess student behaviors and beliefs in regards to energy consumption on campus, garnering nearly 700 responses. The interns then analyzed this data and presented their findings to stakeholders during Climate Action Commitment Day.

Earth Week

Virginia Tech's annual Earth Week events are led by the Environmental Coalition at Virginia Tech and the Office of Sustainability with support from over 30 student, university, and community groups. Earth Week 2023 was held Monday, April 17 through Saturday, April 22. The particular events held during Earth Week change from year to year, but the basic mission to celebrate and take action for a sustainable campus is carried throughout. This year, our partners held 26 events throughout the week. Some events of note include our Bee Campus pollinator habitat expansion at Hillcrest Hall, our Sustainable Fashion Show, the Arbor Day celebration, and our first annual Climate Action Commitment Day.

Climate Action Commitment Day

The Office of Sustainability hosted its first annual Climate Action Commitment Day on Wednesday, April 19 as a means of connecting with the campus community on the progress that has been made towards accomplishing the goals laid out in our Climate Action Commitment. This celebratory and educational event took place throughout the day in Squires Student Center, featuring stand-alone, half hour sessions with experts dedicated to almost every goal of the Commitment.

Game Day Green Team

The Game Day Green Team promotes tailgate recycling during home football games by having volunteers walk around the high impact parking lots surrounding Lane Stadium educating tailgaters on what can and can't be recycled, and how to green their game day experience. The Game Day Green Team is led by students who manage supplies, recruit volunteers, and work with the Division of Campus Planning, Infrastructure, and Facilities on waste collection to execute the program at each home game. During the 2022 season, we had 52 volunteers who helped make this program possible.

Green Graduates

Figure 12. Number of Green Graduates by College for Academic Year 2022-23 by College.
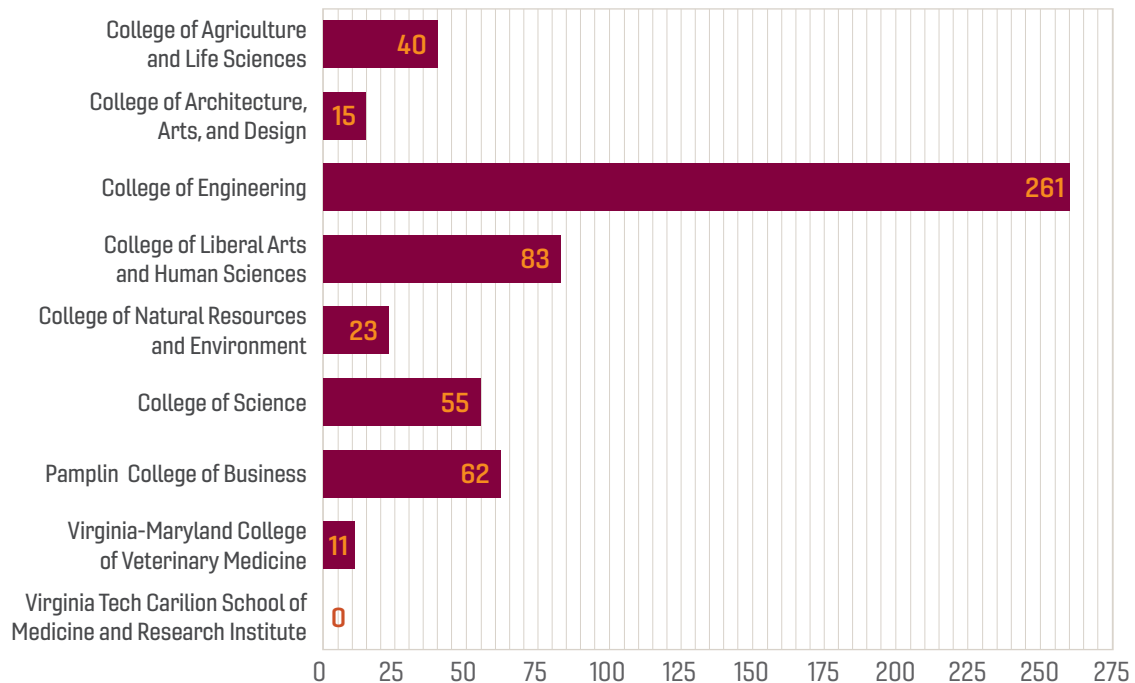
The Green Graduates of Virginia Tech program asks graduating students to take a personal sustainability pledge to think about the environmental impacts of their jobs, travel, and other adventures after leaving the university. By pledging, students are committing to fostering sustainable behaviors both in their own lives and in the lives of their friends, family, and coworkers.

To honor the students who wish to take the pledge, the Office of Sustainability awards each student a free green cord to wear at graduation. All undergraduate and graduate students are eligible to participate. Thanks to tabling and social media outreach by Office of Sustainability Graduate Assistant Gia Ha, 524 students participated in the program during the 2022-23 academic year. This is an increase of nearly 150 percent from last year, demonstrating the growth of the program and the continuing increase of student interest. Our green graduates represent eight different colleges and 93 majors with participants at the bachelor's, master's, and doctorate level. The Virginia Tech Green Graduates program has been running for eight years straight now.

13 Climate Action Commitment Implementation and Engagement

"Implement the Virginia Tech Climate Action Commitment at a high level of university administration and governance; by integrating goals for facilities, education, and campus culture; and with stakeholder engagement for evaluation of goals and progress."

Hokie Wellness and Benefits Fair

On Wednesday, May 17, 2023, the Climate Action, Sustainability, and Energy team tabled at the Hokie Wellness and Benefits Fair to educate faculty and staff on the goals of the Climate Action Commitment. After teaching members of the Virginia Tech community about the goals of the Climate Action Commitment, they were invited to vote for which sustainability topic was most important to them. The top three areas of interest were clean water, social equity, and waste reduction. Through this activity, we were able to engage with approximately 500 employees.

Climate Action Commitment Day

The Office of Sustainability hosted its first annual Climate Action Commitment Day on Wednesday, April 19 as a means of connecting with the campus community on the progress that has been made towards accomplishing the goals laid out in our Climate Action Commitment. This celebratory and educational event took place throughout the day in Squires Student Center, featuring stand-alone, half hour sessions with experts dedicated to almost every goal of the Commitment. This event is a key point of engagement with the campus community on Climate Action Commitment progress.

Strategic Plan Dashboard Inclusion

Virginia Tech's strategic planning dashboard showcases metrics and milestones that will be used to track progress towards achieving the goals of the strategic plan. The strategic planning dashboard provides the most recent available information on outcomes in each of the identified milestones. In fall 2021, milestones were added to the strategic planning dashboard relating to sustainability, illustrating the university's commitment to sustainability and the connection that the topic has to Virginia Tech's strategic plan. The sustainability goal being tracked on the strategic planning dashboard is focused on our efforts to achieve an annual net reduction of campus greenhouse gas (GHG) emissions of three percent through 2030.

Climate Action Commitment Roadshows

To educate the campus community on the 2020 Climate Action Commitment, members of the Office of Sustainability, alongside representatives from The Office of Energy Management, The Office of Waste Management, Dining Services, and the Budget Office, continued their roadshow series across all administrative levels of the university to gain additional support from key stakeholders who play a role in its implementation and success.

In these roadshow presentations, the group not only educates attendees on the goals of the Climate Action Commitment, but also helps make connections between the Climate Action Commitment and their areas of work while also acknowledging the work that stakeholders have already done to promote sustainability. Conversations are then held to cooperatively develop opportunities for partnership and growth. These roadshows have also served as an opportunity to receive feedback on the work done thus far by the Office of Sustainability and its partners.

Throughout this roadshow process, a network of sustainability champions from nearly every unit across campus has been created. The Office of Sustainability now has contacts that can support efforts for future program development and promote opportunities to the broader campus community.

The roadshow series began in Fall 2021 and since then, presentations have been given to the Office of the Executive Vice President and Chief Operating Officer; Division of Student Affairs; the Office for Equity and Accessibility; Auxiliary and Business Services; the Undergraduate Student Senate; the Faculty Senate; the Graduate and Professional Student Senate; the University Council; Facilities Operations, Campus Planning and Capital Financing; the A/P Faculty Senate; Advancement; and Office of Undergraduate Admissions. In addition to these formal presentations, informal meetings were held with Virginia Tech Athletics and the Virginia Tech Transportation Institute.

14 Innovative Financing

"Develop innovative budgeting and financing mechanisms to generate funding and staffing to achieve Climate Action Commitment goals."

Giving Day

Giving Day was held Feb. 15-16, 2023 and served as a special opportunity for Hokies to unite and give back to their favorite departments, programs, student organizations, and teams. The Office of Sustainability was able to promote the opportunity to raise funds for our Division of Campus Planning, Infrastructure, and Facilities Sustainability fund during this time. As our second year participating in Giving Day and thanks to the support of 27 individuals, over $3,000 was raised for the Division of Campus Planning, Infrastructure, and Facilities Sustainability fund. These funds will go towards projects on campus that support Climate Action Commitment implementation.

Green RFP Program

Student engagement and leadership are important aspects in advancing sustainability at Virginia Tech. The Green Request for Proposal (RFP) Program gives students the opportunity each year to submit a proposal for a sustainable idea that they would like to see implemented on the university's Blacksburg campus. Due to the

popularity of the program, several faculty members have integrated the process into their class curriculum with support from the Office of Sustainability. This has resulted in many high-quality proposals moving on to review by the Climate Action Sustainability & Energy Committee. For proposals to be considered for approval, they must support one or multiple goals of the Climate Action Commitment. Since its initiation in the academic year 2010-11, the Green RFP program has provided funds in excess of $2.08 million for 133 student sustainability proposals.

The Office of Sustainability received 49 proposals during the 2022-23 academic year. Of those proposals, 13 were selected to be reviewed by the Office of Budget and Financial Planning. Of those proposals, 10 were approved for funding on June 30, 2023 for a total of $332,000. Some examples of funded projects include: LED lighting and occupancy sensors in New Residence Hall East and Peddrew-Yates, expanded battery recycling, campus tree plantings, and a sustainable autoclave for Engel Hall. The full list of approved proposals is available at **facilities.vt.edu/sustainability/sustainability-programs/green-rfp-program.**

The Office of Sustainability continues to work to improve the program and has begun formulating additional opportunities for student engagement in the Green RFP review process for the 2023-24 academic year. This will further utilize the program as a Climate Action Living Laboratory (CALL) opportunity for students to gain valuable leadership and management skills.

15 Fossil Fuels Free by 2050

"Develop pathways after 2030 to eliminate fossil fuels and carbon offsets by 2050."

Virginia Tech is laying the groundwork for being fossil fuel free by 2050. Currently, a Utilities Master Plan is under development for the university. The Utilities Master Plan will provide a comprehensive road map to align campus-wide utility systems with the strategies of the Campus Master Plan and the sustainability goals of the Climate Action Commitment. The university operates and maintains numerous utility systems that will all be managed by this detailed plan. Some expected benefits and outcomes include campus-wide collaboration, development of an asset management system to monitor capacity and condition of major utilities, prioritization of service-level risks regarding performance and sustainability of systems, and the creation of a programmatic embedded structure for utility planning that can be carried into the future. Additionally, efforts to transition to renewable energy sources by 2030 will be instrumental in moving towards this long-term goal, as will technological innovations and reductions in our natural gas usage at the power plant. When the Climate Action Commitment is revisited in 2025, there will be a more substantial discussion on the pathway toward this goal.

CONCLUSION

Virginia Tech demonstrates a strong commitment to tackling the challenge of climate change through its adoption of the 2020 Climate Action Commitment in March 2021. Efforts made throughout the past year highlight substantial progress towards meeting the goals laid out in this commitment. The overarching goal of carbon neutrality by 2030 is complex and will require the entire university community to be on board with making the necessary improvements happen. We are starting to see a clear shift in the institutional priorities and attitudes around sustainability, and we will need to continue pushing for these shifts in the years to come.

Sustainability at Virginia Tech extends beyond campus life and is a partnership between colleges, departments, units, students, employees, and the local community. All Hokies can be climate action champions, contributing to making Blacksburg and the Commonwealth a more sustainable place.

The Office of Sustainability has been producing Sustainability Annual Reports since 2010. For access to all prior reports, please visit our website.

Acknowledgments

The 2022-23 Sustainability Annual Report was prepared by the Office of Sustainability

- **Nathan King,** Campus Sustainability Manager
- **Emily Vollmer,** Sustainability Coordinator
- **Kristina Cook,** Program Coordinator
- **Jack Leff,** Climate Action Fellow
- **Katie Smith,** Student Intern

With assistance from:

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- **Larissa Gimmy,** Graphic Designer

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- **Virginia Tech and Blacksburg Communities**

APPENDIX

2020 Climate Action Commitment

Calendar Year 2022 Recycle Rate Report

2022-23 Student Green RFP Memorandum

VIRGINIA TECH™

2020 VIRGINIA TECH

Climate Action Commitment Working Group Final Report

EXECUTIVE SUMMARY AND OVERVIEW

November 2020

7 TIME WINNER OF GOVERNOR'S
ENVIRONMENTAL EXCELLENCE AWARD

#14 ON PRINCETON'S REVIEW TOP 50 GREEN
COLLEGES OF 2019

24% REDUCTION IN GREENHOUSE GAS
EMISSIONS SINCE 2006

EXECUTIVE SUMMARY

From January to June 2020, the Virginia Tech Climate Action Commitment Working Group executed its charge to evaluate the university's current position and future role in addressing climate change.

This summary report and the much longer full 2020 Virginia Tech Climate Action Commitment Working Group Report, Subcommittee Reports, and associated appendices provide a clear road map for not only how Virginia Tech can do its part to address climate change, but also become a leader in taking bold action to combat this worldwide crisis.

Throughout 2020, a global pandemic brought unprecedented hardship and suffering, particularly for the most vulnerable among us. In this public health crisis, citizens are learning an important lesson: when experts are near unanimous in ringing the alarm bells on looming crises, society must take decisive action.

This unique time is engendering a tremendous spirit of innovation and collaboration that is highly applicable to the Climate Action Commitment revision process.

In late 2019 – prompted by the demands of students and other community members involved in climate strikes and resolutions from the Faculty and Staff Senates, Student Government Association, and Graduate Student Assembly – President Tim Sands and Senior Vice President and Chief Business Officer Dwayne Pinkney established a Climate Action Commitment Working Group comprised of 26 faculty, students, staff, and community members. In announcing the creation of the Working Group, President Sands stated that "climate change presents one of the world's most pressing problems...and Virginia Tech has a duty to respond."

The Working Group was charged to assess the university's progress in implementing the 2009/2013 Virginia Tech Climate Action Commitment, compare our experience to peer institutions, and develop a new commitment. Virginia Tech, like other universities, is facing both short-term fiscal challenges and long-term uncertainties in these challenging times. Nonetheless, the university remains committed to taking bold action to do its part to address the climate emergency.

Please read on to learn more about the 2020 Virginia Tech Climate Action Commitment. The full Working Group Report and other pertinent documents and information may be found at svpoa.vt.edu/index/VTCACRevision. Chapter references that follow are applicable to the full report.

WORKING GROUP PROCESS

In order to engage a broad range of expertise and perspectives from across the university and wider community and conduct an ambitious work program, the Working Group established 12 subcommittees including a total of 130 faculty, students, community members, and staff to investigate and discuss specific issues relevant to the commitment. Most of the subcommittees met weekly from early February through the end of May. The subcommittees included:

- Agriculture, Forestry, and Land Use
- Budget and Finance
- Buildings Opportunities
- Climate Justice
- Community Engagement
- Energy Opportunities
- Greenhouse Gas (GHG) Inventory
- Peer Institutions Comparison
- Renewables Opportunities
- Structuring Sustainable Choices
- Transportation Opportunities
- Waste-Recycling-Composting and Procurement

The Working Group developed several mechanisms to expand community involvement in the process, including a website and email address for comment and two online surveys. Plans for face-to-face town hall meetings and conference sessions had to be reimagined when the university shut down after spring break. In place of the in-person events, the Working Group hosted 12 Zoom Convening sessions in April, attended by over 220 participants who provided excellent feedback. In anticipation of these Convening sessions, the Working Group and its subcommittees also developed ten creative videos that describe the Climate Action Commitment proposals. Learn more about campus community engagement in the process and access videos at svpoa.vt.edu/index/VTCACRevision.

The Working Group's efforts have focused on developing effective strategies the university can advance to achieve meaningful climate action. Throughout the multitude of Working Group, subcommittee, and community Zoom meetings, discussions have also reflected on the important opportunity for Virginia Tech to reinvent itself, not only in its commitment to climate action, but also in its responsiveness to the needs of the world around us, in the spirit of *Ut Prosim.*

The recommended Climate Action Commitment is bold, aggressive, and comprehensive. Its goals range from necessary upgrades to the campus physical plant to reduce GHG emissions, to integrating those improvements into the educational mission through a Climate Action Living Laboratory, to engaging everyone in creating a culture of sustainability–all to position Virginia Tech as a leader as the clean energy economy evolves in the Commonwealth and the world.

PROGRESS IMPLEMENTING 2009 VIRGINIA TECH CLIMATE ACTION COMMITMENT

Virginia Tech has made considerable progress in implementing its 2009/2013 Climate Action Commitment (2009 Virginia Tech Climate Action Commitment) over the past decade. The 2009 Virginia Tech Climate Action Commitment and Sustainability Plan was a cutting-edge effort for its time, but a decade later it fails to prescribe what climate scientists recognize as necessary actions and also falls short of many peer universities' recent initiatives.

In many respects, however, Virginia Tech has been forging ahead beyond the 2009/2013 Climate Action Commitment. Virginia Tech is a recognized leader in campus sustainability with a Sustainability Tracking and Rating System (STARS) Gold score that is highest among Virginia and ACC peer institutions. Virginia Tech has won numerous awards and recognitions since 2010, including Princeton Review's top 50 Green Colleges (#12 in 2019), the Governor's Environmental Excellence Award (7 times), Best Workplaces for Commuters (every year, gold in 2019-20), Bicycle Friendly Campus (every year, silver level in 2019), Tree Campus USA certification (every year), and many others.

The university has reduced greenhouse gas (GHG) emissions by 24 percent from 2006-19, despite 22 percent growth in campus building size and enrollment. This reduction is faster than the 2009 Climate Action Commitment targeted trajectory. It resulted from investments in energy efficiency in existing and new buildings, and most importantly, from replacing coal with natural gas in the steam plant, which was enabled by a new gas pipeline. Virginia Tech now has 36 LEED-certified buildings constructed or in process, amounting to 30 percent of campus space, and in 2015-20 the university invested $14 million in energy efficiency improvements, resulting in energy and dollar savings with a 5-year payback.

Virginia Tech has done much to develop alternative transportation choices, including dual use trails, bike share, ride share, and car share programs. The university has had record ridership on its partner Blacksburg Transit and innovative plans for campus mobility. Virginia Tech has a functional, although fragmented, waste management program with an 80 percent waste diversion rate (waste diverted from landfill) and 40 percent recycling rate, although shy of the 50 percent by 2020 goal of the 2013 Virginia Tech Climate Action Commitment. In April 2020, the Procurement Department unveiled a Sustainable Procurement Policy; and in May, the Facilities Department produced new Design and Construction Building Standards, both reflecting the ideals of the Virginia Tech Climate Action Commitment.

The university has an enviable array of sustainability-related academic programs, majors, coursework, and research, in green engineering, natural resources, agriculture, power and energy systems, environmental policy, and smart and sustainable cities. In the STARS rating system, Virginia Tech scores 89 percent of possible points in academic categories. It also scores 95 percent of possible points in campus engagement. Virginia Tech has a rich campus life for students with a wide array of opportunities, including strong environmental student organizations. Indeed, these student groups have energized the university community to move forward on climate action, both in 2008 and in 2019.

The Division of Campus Planning, Infrastructure, and Facilities has embraced sustainability and climate action as part of its mission, and the Office of Sustainability is second to none, even with limited staff. The university has the highly unique and valuable Virginia Tech Electric Service (VTES), a university-owned electric energy utility system, which serves not only the campus, but also 6,000 Town of Blacksburg customers.

In other areas, however, the university is falling behind. Although the 2009/2013 Virginia Tech Climate Action Commitment was a leading effort for its time, from the perspective of 2020, it is limited in both scope and ambition. It did not include several sources of campus GHG, such as agriculture, business travel, and leased building space, the latter amounting to 13 percent of operational square footage. It did not mention renewable energy nor the human cost of climate change. Furthermore, its overall goal of an 80 percent reduction in GHG from 1990 levels by 2050, while a typical goal for its time, is not aggressive enough compared to the contemporary needs for climate action and the national movement of our peer institutions.

2020 VIRGINIA TECH CLIMATE ACTION COMMITMENT

The major product of the Working Group is a new Climate Action Commitment. It aims to be bold and visionary, but also comprehensive and pragmatic for a leading academic institution. Goals 1-9 target physical means to achieve carbon neutrality by 2030, Goals 10-14 address education, culture, social equity, and engaged implementation, and Goal 15 sets a longer-range goal of a fossil-fuel-fee campus. The Working Group also developed a set of potential pathways to achieve each goal. The table to the right lists the goals, and they are presented with summary pathways. More detailed pathways are presented in chapter 2.

Vision of the 2020 Virginia Tech Climate Action Commitment

In the spirit of *Ut Prosim,* Virginia Tech will be a leader in climate action in service to our community, the Commonwealth, and the world.

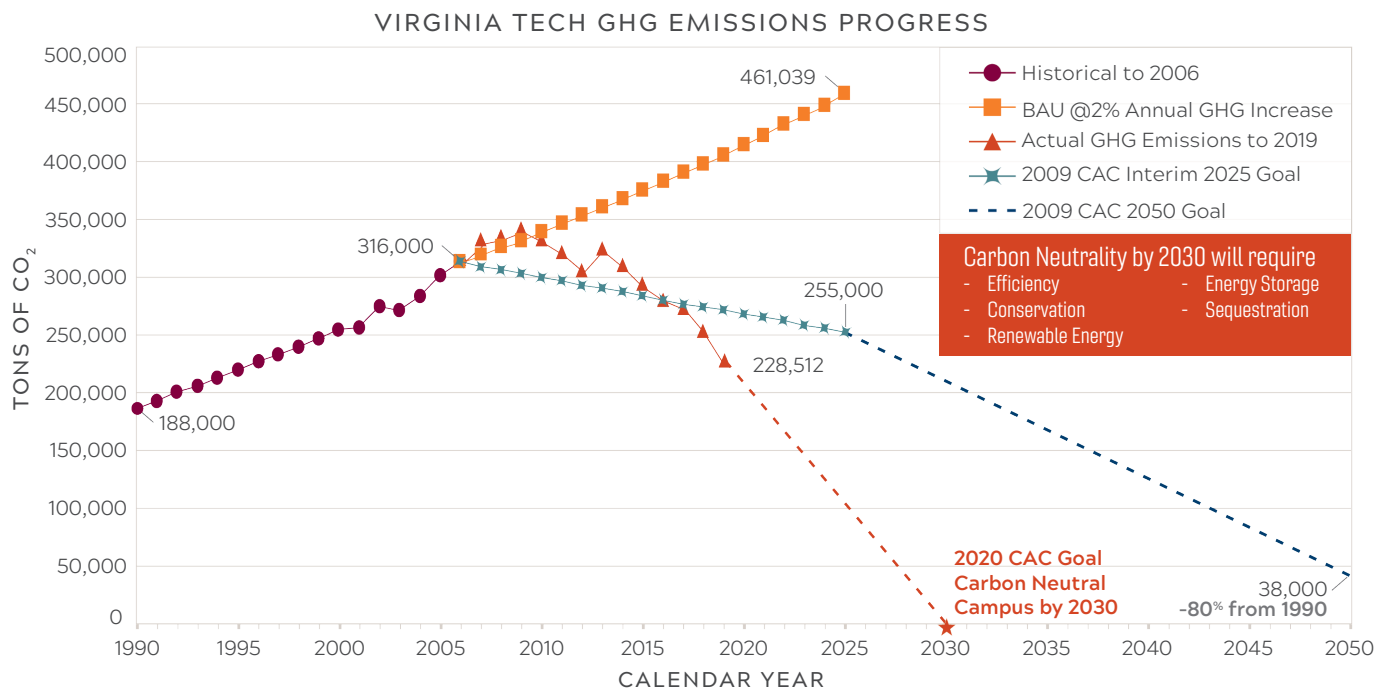## Mission of the 2020 Virginia Tech Climate Action Commitment

The mission of the 2020 Virginia Tech Climate Action Commitment is to achieve carbon neutrality by changing the university's physical infrastructure, collective and individual behaviors, and educational mission; to engage everyone in creating a culture of sustainability; and to achieve these objectives through just and equitable means.

2020 VIRGINIA TECH
CLIMATE ACTION COMMITMENT GOALS

1. Achieve a carbon neutral Virginia Tech campus by 2030.

2. Achieve 100 percent renewable electricity by 2030.

3. Complete the total conversion of steam plant fuel to natural gas by 2025, plan for full transition to renewable steam plant fuel after 2025, and continue to improve efficiency of campus energy systems.

4. Reduce building energy consumption to enable carbon neutrality by 2030.

5. Operations of new buildings initiated by 2030 will be carbon neutral.

6. Agricultural, forestry, and land use operations will be carbon neutral by 2030.

7. Virginia Tech to become a Zero-Waste Campus by 2030.

8. Establish the Sustainable Procurement Policy and Procedures by 2022.

9. Reduce single-occupancy-vehicle commuting to campus by 20 percent by 2025 and reduce transportation-related GHG emissions by 40 percent by 2030.

10. Integrate the Climate Action Commitment into Virginia Tech's educational mission through the Climate Action Living Laboratory beginning in 2021.

11. Establish climate justice as a core value of the Virginia Tech Climate Action Commitment.

12. Diminish barriers to sustainable behaviors through institutional change, education and social marketing.

13. Implement the Virginia Tech Climate Action Commitment at a high level of university administration and governance; by integrating goals for facilities, education, and campus culture; and with stakeholder engagement for evaluation of goals and progress.

14. Develop innovative budgeting and financing mechanisms to generate funding and staffing to achieve Climate Action Commitment goals.

15. Develop Pathways after 2030 to eliminate fossil fuels and carbon offsets by 2050.

2020 Virginia Tech Climate Action Commitment:
SUMMARY OF GOALS AND PATHWAYS

1. Carbon Neutral Virginia Tech Campus by 2030.

VIRGINIA TECH GHG EMISSIONS PROGRESS

Carbon neutral equals net-zero emissions of CO_2, CH_4, and NO_2 from Virginia Tech operations at Blacksburg campus based on the geographic and GHG scope of the 2020 Climate Action Commitment.

POTENTIAL PATHWAYS:

- 100 percent renewable electricity by 2030 can reduce emissions by 50 percent below 2019 levels.

- Total conversion from coal to natural gas in steam plant by 2025 can reduce GHG by 10 percent below 2019.

- Reduction of energy use in existing and new buildings can result in further emissions reductions of 10 percent, despite campus growth.

- Reduction of GHG from waste/recycling, transportation, and agriculture, forestry, and land use described below can reduce emissions by 10 percent.

- In 2030, remaining emissions can be negated by carbon offsets.

2. 100 Percent Renewable Electricity by 2030.

POTENTIAL PATHWAYS:

- 2020: achieve 30 percent renewable electricity via purchase of 20 percent renewable energy certificates (RECs) from APCO + APCO 10 percent renewable portfolio.

- 2020-2030: Achieve 100 percent renewable electricity by 2030 via combination of Virginia Tech rooftops/lands solar (15 MW), 3rd party owned PPA, and APCO owned SWVA PPA solar capacity (130 MW+15 MW=145 MW) to serve campus (95 MW) and town customers (50 MW) for 60 percent of needs plus 30 percent APCO renewable portfolio and 10 percent RECs to cover steam plant cogeneration.

- Integrate solar development into the Climate Action Living Laboratory (CALL) of academic instruction and research, including dual-use solar-farm production agrivoltaics; a 10-MW storage testbed/showcase project for smart micro-grid reliability and resilience research through Virginia Tech Electric Service and the Virginia Tech Power and Energy Center; and other instruction/research initiatives.

- As with all components of this Climate Action Commitment, full lifecycle analysis of renewables procurement should include the environmental and social justice costs and benefits of procured systems.

- The siting of renewable energy systems should employ best practices in public engagement to identify the most appropriate locations.

3. Complete the total conversion of steam plant fuel to natural gas by 2025, plan for full transition to renewable steam plant fuel after 2025, and continue to improve efficiency of campus energy systems.

POTENTIAL PATHWAYS:

‣ Addition of gas boiler #12 provides natural gas thermal capacity for all steam plant demand.

‣ VT's new natural gas service contract signed in summer 2020 and effective until 2025, provides favorable price and reliability terms and prospects for renewable gas.

‣ For reliability and resilience, a plan is needed for backup fuel (such as liquefied natural gas (LNG), biochar, or other fuel) when natural gas is unavailable, and boiler redundancy (so-called "n+1") in case of a boiler outage at a critical time.

‣ Improve chiller efficiency: By 2023 the Chiller Plant Phase II capital project will reduce central chiller energy usage by 20% from 2020; future campus growth needs for chilled water will be met from central plants where possible.

‣ Ten-year 2021-30 Energy Management Plan will improve efficiency of stand-alone chilled water plants

‣ Establish an online Climate Action Living Laboratory (CALL) Energy Dashboard for faculty, staff, and students to access and analyze campus facilities energy use data for instruction and research.

‣ After 2025, plan for transition to renewable energy in heating systems, considering renewable gas, geothermal and ground source heat pump systems, and other non-fossil-fuel options for heating existing and new districts of campus.

‣ Beginning with the CAC 2025 revision, develop a plan for full transition to renewable energy for campus heating systems. To promote zero emissions energy options in the plan, refine GHG inventory estimates of methane leakage from VT natural gas sources and include those estimates of methane leakage in the carbon neutral goal for 2035.

4. Reduce Building Energy Consumption to Enable Carbon Neutrality by 2030.

‣ By the end of 2022, reduce electricity consumption (kWh) by 10 percent and electricity intensity (kWh/gsf) by 20 percent below 2006 levels.

‣ By 2030, employ energy management retrofits to reduce total energy consumption in all buildings by 10 percent and energy use intensity (Btu+kWh/gsf) by 20 percent below 2020 levels.

POTENTIAL PATHWAYS:

‣ Implement an aggressive 2021-30 ten-year energy management plan updated annually to reduce total energy consumption in all buildings including auxiliaries by 10 percent.

‣ For leased buildings owned by the Virginia Tech Foundation, work with the Foundation to develop financial arrangements to improve efficiency and reduce emissions.

‣ By 2021, develop a campus-wide Climate Action Living Laboratory Green Lab program based on a pilot test-bed Green Lab to reduce energy, emissions, and materials in our most energy-intensive facilities.

‣ Reduce building energy and GHG emissions by smart operations, such as demand response, digital controls, thermostat settings, occupant behavior, and innovative space scheduling, especially in summer.

‣ Achieving these goals will require sufficient staffing in energy management.
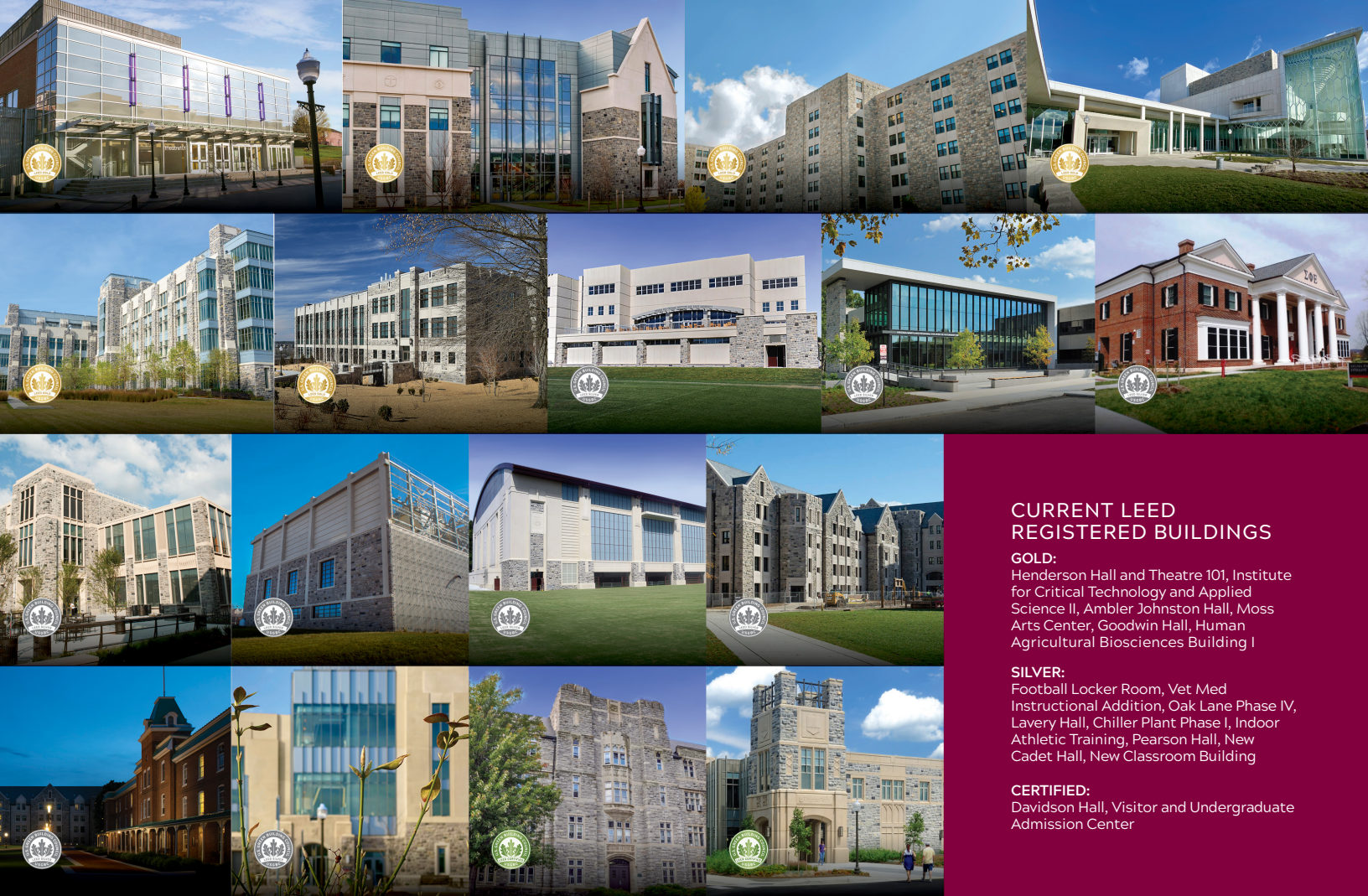
CURRENT LEED REGISTERED BUILDINGS

GOLD:
Henderson Hall and Theatre 101, Institute for Critical Technology and Applied Science II, Ambler Johnston Hall, Moss Arts Center, Goodwin Hall, Human Agricultural Biosciences Building I

SILVER:
Football Locker Room, Vet Med Instructional Addition, Oak Lane Phase IV, Lavery Hall, Chiller Plant Phase I, Indoor Athletic Training, Pearson Hall, New Cadet Hall, New Classroom Building

CERTIFIED:
Davidson Hall, Visitor and Undergraduate Admission Center

5. Operations of New Buildings Initiated by 2030 will be Carbon Neutral.

‣ New building efficiency will conform to latest adopted LEED-Silver standards and ASHRAE 90.1 energy performance standards + 10 percent.

‣ By 2022, reduce total energy use intensity (EUI) in newly initiated buildings by 20 percent compared to 2020 existing buildings.

‣ By 2026, build a signature zero-net-energy (ZNE) building on campus as a showcase and learning model for the Climate Action Living Laboratory.

‣ By 2028, newly initiated buildings' efficiency improvements will reduce total energy use intensity (EUI) in new buildings by 40 percent compared to 2020 existing buildings.

POTENTIAL PATHWAYS:

‣ In 2021, identify candidate new buildings for a showcase zero-net-energy (ZNE) building and begin fundraising to attract donors to help fund the project to be completed by 2026.

‣ Electricity currently contributes 50 percent of total GHG emissions. One hundred percent renewable electricity by 2030 will reduce building CO_2 emissions by more than 50 percent.

‣ By 2030, all newly initiated building design will have carbon neutral operations through 100 percent renewable electricity, improved energy efficiency, and carbon offsets.

‣ Post-occupancy evaluation (POE) should become standard practice to fine tune building operations and engage occupants to better serve users and reduce emissions.

‣ New buildings offer opportunities for campus Climate Action Living Laboratory research and instruction by faculty and students through field testing and use of emerging technologies, monitoring energy use, air quality, and occupant perceptions, and other projects.

‣ Achieving these goals will require sufficient engineering and design staffing.

6. Agricultural, Forestry, and Land Use Operations Go Carbon Neutral by 2030.

POTENTIAL PATHWAYS:

‣ Develop the University Compost Facility at Kentland to provide benefits to campus organic waste management, help reduce animal waste GHG emissions, support soil health, and reduce need for new land for future land application of animal wastes.

‣ Adopt Campus Tree Policy to increase canopy cover from 16-to-25 percent and manage Virginia Tech trees, forests and woodlands to increase carbon sequestration and provide additional environmental benefits.

‣ Reduce agricultural and forestry net GHG emissions through more efficient operations, reduced animal enteric fermentation emissions, improved energy and fuel efficiency, possibly an anaerobic digester to produce usable methane, and other means.

‣ Use Virginia Tech agricultural lands to develop solar farms toward renewables goal, including co-use solar and farmland agrivoltaics for Climate Action Living Laboratory instruction and research.

‣ In 2030, offset any remaining net GHG emissions from agricultural/forestry operations with solar production from Virginia Tech agricultural land and/or by purchasing carbon offsets.

7. Virginia Tech to become a Zero-Waste Campus by 2030.

POTENTIAL PATHWAYS:

‣ Hire a zero-waste consultant to conduct a waste audit study and plan to evaluate organization, procedures, and staffing to enhance campus waste management.

‣ Based on consultant recommendations, consider hiring a campus waste manager.

‣ Engage personnel involved in campus waste management on a Waste/Recycling Council to help streamline operations and reduce redundancies.

‣ Develop University Compost Facility at Kentland to process campus organic waste from dining halls and athletics, veterinary and agriculture animal waste, yard trimmings, wood waste, non-recyclable soiled paper, and other compostables.

‣ Engage faculty, students, and staff in greater use of recycling/compost behavior using social marketing and media, incentives, and innovative approaches to advance Circular Economy and Pollution Prevention (P2) principles as part of the Climate Action Living Laboratory.

‣ Evaluate and improve as needed the management of specialty wastes, such as e-waste, laboratory waste, construction debris, and wastes from major sporting and other events.

8. Establish the Sustainability Procurement Policy and Procedures by 2022.

POTENTIAL PATHWAY:

‣ On a pilot basis, adopt, implement, and evaluate the 2020 Sustainable Procurement Policy.

‣ In 2022, the Energy & Sustainability Committee will assess the pilot project and work with the Procurement Department to formulate the Sustainability Procurement Policy v.2.

9. Reduce Single-Occupancy Vehicle (SOV) Commuting to Campus by 20 percent by 2025 and Reduce Transportation Related GHG Emissions by 40 percent by 2030.

POTENTIAL PATHWAYS:

‣ Promote walking/biking/transit as the preferred means of commuting to campus: Use parking policies, alternative transportation programs, campus mobility planning in collaboration with Town of Blacksburg, and encourage Blacksburg Transit (BT) programs to improve the safety and convenience of and promote walking, biking, and transit.

‣ Promote sustainable mobility choices through marketing, including social media, parking permit literature, gaming, university promotion literature and website, and student orientation.

‣ Promote non-commuting work and learning opportunities such as telecommuting, innovative online instruction, Internet conferencing, and other means.

‣ Improve infrastructure and traffic management to improve mobility choices and safety by reducing speed limits, improved bike and pedestrian path lighting, limiting/restricting vehicles in core campus, implementing current transportation plans, and coordinating with Town of Blacksburg plans.

‣ Improve vehicle efficiency and promote low-carbon emissions vehicles through Motor Pool purchases and development of electric vehicle charging stations on campus.

‣ Promote social equity in mobility and parking policies by developing effective and efficient commuting options for lower wage employees who cannot afford to live in Blacksburg, sliding-scale parking fees based on salary/wage, and collaboration with the Town of Blacksburg to provide affordable workforce housing proximate to campus.

‣ Reduce and negate business travel GHG emissions with carbon offsets.

‣ Establish an alternative mobility subcommittee of the Transportation and Parking Committee to recommend strategies to increase the non-SOV mode share on campus.

10. Integrate the Climate Action Commitment into Virginia Tech's Educational Mission through the Climate Action Living Laboratory (CALL) Beginning in 2021.

POTENTIAL PATHWAYS:

‣ Recognize the excellent opportunities for student learning, faculty and student technical research, and staff development. Benefits include learning from and innovating creative solutions in-house for Virginia Tech's climate initiatives and better engaging the entire university both in Blacksburg and other Virginia Tech locations in our quest for sustainable and just climate action.

‣ Establish the Climate Action Living Laboratory (CALL) in the new University Office for Climate Action and Sustainability (OCAS) to enhance offerings and build bridges between facilities and academic departments, facilitating and supporting opportunities.

- Alter norms and incentives to overcome traditional barriers and nurture cooperation between academic units (research and teaching) and operations units such as Division of Campus Planning, Infrastructure, and Facilities and auxiliary units including Dining Services, Housing and Residence Life, and Athletics. Greater collaboration between university units will help implement the Climate Action Commitment and integrate physical plant climate action with academics and campus life.

- Integrate Climate Action Living Laboratory (CALL) initiatives in other goals/pathways for renewables (2), energy materials, devices and systems (3), buildings (4, 5), agriculture (6), waste (7), transportation (9), climate justice (11), sustainable behaviors (12), and community engagement (13).

- Engage the university's land grant extension and outreach programs to reflect the principles of the Climate Action Commitment and help implement them throughout the Commonwealth.

- Integrate the physical infrastructure elements of the Climate Action Commitment into the fabric of the university's educational and research programs to expand funding opportunities for campus innovation from state and federal sources as well as foundations.

11. Establish Climate Justice as a Core Value of the Climate Action Commitment.

POTENTIAL PATHWAYS:

- Encourage an accelerated transition to carbon-neutral status as a climate-justice imperative.

- Ensure that the social impacts of Virginia Tech's climate mitigation choices (e.g. energy, land use, and waste) are identified and addressed to the greatest extent possible.

- Establish a Climate Justice Subcommittee of the revised Climate Action, Sustainability, and Energy (CASE) Committee by 2021 with representation from students, faculty, and community members from frontline groups.

- Ensure that Virginia Tech climate action implementation plans recognize and assist vulnerable or frontline groups adversely affected by those plans, including low-wage Virginia Tech employees, tuition-paying students, VTES town ratepayers, historically marginalized people of color and Indigenous communities, coalfield communities, and others.

- Establish education, research, and outreach programs to assist vulnerable and historically marginalized groups mitigate and adapt to climate change and thrive in the new energy economy. These efforts should specifically target Virginia Tribes, African Americans in the New River Valley, coalfield communities in southwest Virginia, and coastal Virginia communities threatened by climate-related hazards.

12. Diminish Barriers to Sustainable Behaviors through Institutional Change, Education, and Social Marketing.

POTENTIAL PATHWAYS:

- Implement infrastructural changes–from waste management to transportation to building operation–to make sustainable choices easier.
  - Identify structural, social and institutional barriers to sustainable behaviors.
  - Develop educational programs to foster pro-environmental behavior change.

- Design and implement choice architecture or "nudges" to promote sustainable behavior, while allowing for individual choice, using social media, gaming, and other means.

- Develop a shared toolkit of best practices in social marketing, rooted in behavioral sciences, for campus groups initiating sustainability initiatives.

- Nurture cross-campus partnerships to coordinate climate action and enhance sustainability initiatives.

13. Implement the Virginia Tech Climate Action Commitment.

... at a high level of university administration and governance;

... by integrating Climate Action goals for facilities, education, and campus culture; and

... with ongoing stakeholder engagement for evaluation of goals and progress.

POTENTIAL PATHWAYS:

- **Governance:** By fall 2021, restructure the university Energy and Sustainability Committee (E&SC), renaming it the Climate Action, Sustainability, Energy (CASE) Committee, and revising its charge, membership, and reporting, to oversee the implementation and review of the Climate Action Commitment goals and progress involving student, faculty, and staff stakeholders.

- **Implementation/operations:** Appoint a new university Chief Climate Action and Sustainability Officer (CCASO) to direct a reconstituted University Office of Climate Action and Sustainability (OCAS) to oversee Climate Action Commitment implementation and other campus sustainability initiatives. The CCASO would jointly report to the Senior Vice President and Chief Business Officer and to the Executive Vice President and Provost. The CCASO would chair the CASE Committee. The Facilities Division would, in parallel, appoint a director of strategic success to oversee a range of strategic Facilities issues including climate action and sustainability.

- **Learning:** Establish the Climate Action Living Laboratory (CALL) in the new OCAS to enhance offerings and build bridges between facilities and academic departments, facilitating and supporting opportunities (Goal 10).

- **Duties of Operations and Governance units:**
  - Collect data relevant to the Climate Action Commitment including GHG inventory and prepare an Annual Report of Climate Action Commitment progress each fall semester for the previous fiscal year.
  - Establish mechanisms to engage and educate the Virginia Tech community on the Climate Action Commitment and climate action.
  - Establish ad hoc committees to develop instructional, research and outreach programming for the Climate Action Living Laboratory (CALL).
  - Evaluate Climate Action Commitment goals according to best practices in light of new information and standards and direct update of the Climate Action Commitment on a five-year cycle.
  - Broaden the geographic scope of the Climate Action Commitment to all Virginia Tech properties in future iterations to include the entire university.
  - Advocate for allocation and prioritization of resources to support the Climate Action Commitment.

- **Annual review:** Conduct an in-depth annual review of the Climate Action Commitment goals and implementation, progress that involves student, staff, faculty, and community stakeholders. The results of this review will be shared publicly in an accessible and easy-to-read format.

14. Develop Innovative Budgeting and Financing Mechanisms to Generate Funding and Staffing to Achieve Climate Action Commitment Goals.

POTENTIAL PATHWAYS:

- Strategically invest university E&G and auxiliary funds to implement the 10-year Energy Management Plan at a level of $5 million/year in energy efficiency projects with a cumulative 8-year financial payback or 12 percent return on investment.

- Major investment is needed to implement the pathways for renewable electricity both on Virginia Tech buildings/lands and in the Southwest Virginia region, including the following options:
  - Virginia Tech-owned and developed projects on Virginia Tech buildings/land and
  - Utility or third party owned and developed projects on Virginia Tech buildings/land and in SWVA with Virginia Tech power purchase agreement (PPA).

The first option requires major Virginia Tech capital investment but provides greater long-term return and control, while the second requires no Virginia Tech capital but provides less long-term financial return. A combination of the two options may be used to meet the Climate Action Commitment renewables goal.

- As a unique power utility, VTES has opportunities for investment in renewable energy serving both campus and its town customers.

- The Virginia Tech Foundation helps the university achieve its goals and may be a valuable partner in implementing the Climate Action Commitment:

> As owner of most of the leased academic space off campus, the Foundation has already agreed to provide funding for an energy efficiency retrofit pilot project in Corporate Research Center buildings on a revenue neutral basis.

> Campus solar development provides another opportunity for Foundation investment with appropriate return on that investment.

‣ Additional sources of funds to implement the Climate Action Commitment include, federal and state grants, research funding in connection with the Living Laboratory, advancement donations, philanthropic organizations and foundations, and low interest revenue bonds by VTES and auxiliaries.

‣ In addition to project funding, implementation of the Climate Action Commitment will require upgrading the staff to rise to the needs of the commitment, especially in energy management, energy and utility systems, building analysis and design, waste management, university compost facility operation, and campus sustainability.

15. Develop Pathways After 2030 to Eliminate Fossil Fuels and Offsets by 2050.

POTENTIAL PATHWAYS:

‣ A long-term Utilities Master Plan should fully incorporate the goals of this Climate Action Commitment

‣ It is difficult to anticipate how technology, the economy, and public policy will evolve in the next 10-30 years, necessitating revisions along the way:

> 2025: 5-year Climate Action Commitment revision review explore options for 2030-2040 timeframe.

> 2030: 5-year Climate Action Commitment revision review explore options for 2040-2050 timeframe.

‣ Beginning with the CAC 2025 revision, develop a plan for full transition to renewable energy for campus heating systems. To promote zero emissions energy options in the plan, refine GHG inventory estimates of methane leakage from VT natural gas sources and include those estimates of methane leakage in the carbon neutral goal for 2035.

‣ Eliminating offsets and fossil fuels would require significant changes in Virginia Tech's physical plant. The university is dependent on natural gas in the steam plant and eliminating natural gas will require replacement by a non-carbon fuel (e.g. biogas, hydrogen, biochar) or a new heating system based not on steam but on hot water perhaps generated by renewable electricity and geothermal ground-source heat pump systems. Some universities are moving in that direction, and Virginia Tech will have much to learn from them about the prospects.

IMPLEMENTATION MILESTONES

The 15 goals and pathways include many target dates for actions or achievement as part of their implementation. They are summarized in the table below, with date, relevant goal number and action milestone.

DATE	ACTION MILESTONE	GOAL
2020	BOV approves 2020 Virginia Tech Climate Action Commitment	
	30 percent renewable electricity	2
2021	E&SC renamed Climate Action, Sustainability & Energy (CASE) Committee	13
	Operation plan for Climate Action Living Laboratory (CALL)	11
	Candidate identified for zero-net-energy new building to be built by 2026	5
	First year of 10-year 2021-30 Energy Management Plan	3,4
	Fishburn Forest student-led assessment	2
2022	2.3 MW solar PV on Virginia Tech rooftop and land	2
	VTES Solarize Program for Town customers, 250 kW net metered	2
	Electricity use 10% below 2006 (Governor's E.O. 43)	4
	Newly initiated buildings EUI 20% below 2020 existing average	5
	Sustainable Procurement Policy v.2. implemented	8
2023	Virginia Tech Foundation energy efficiency plan for leased buildings (CRC)	14
	VTES Community Solar project for Town customers 0.5-1 MW	2
2024	Chiller Phase II Upgrade complete	3
2025	Complete conversion of steam plant fuel to natural gas	3
	Begin planning transition to renewable steam plant fuel	3
	Five-year Climate Action Commitment update: Explore options for 2030-2040	15
	Recycling rate 55%; waste diversion rate 85%; reduce trash to landfil/capita by 25%	7
	Reduce single-occupancy-vehicle commuting by 20%	9
	10 MW solar PV on Virginia Tech lands	2
	Explore geothermal heat pump hot water heating options for new districts	3
2026	Signature Zero-Net-Energy (ZNE) building on campus	5
2027	10 MW battery storage for Virginia Tech Smart Grid research by VT PEC-VTES partnership	2
	35 MW solar PPA with APCO/third party in SWVA including coalfields	2
2028	Newly initiated buildings EUI 40% below 2020 existing average	5
2029	100 MW solar PPA with APCO/third party in SWVA including coalfields	2
2030	Five-year Climate Action Commitment update: Explore options for 2040-50	15
	Carbon neutral campus operations	1
	100% renewable electricity	2
	Total building energy use down 10%; EUI down 20% below 2020	4
	Newly initiated buildings carbon neutral operations	5
	Carbon neutral agriculture/forestry operations	6
	Zero-waste campus	7
	Transportation emissions reduced 40% from 2020	9
2050	Fossil fuel-free campus	15

COSTS AND BENEFITS OF 2020 VIRGINIA TECH CLIMATE ACTION COMMITMENT GOALS AND PATHWAYS

The Working Group assessed the impacts of the 2020 Virginia Tech Climate Action Commitment goals and pathways including GHG emissions, fiscal costs and benefits, and implications for Virginia Tech's educational mission, operations, policies and governance, and culture. These implications are far-reaching and are presented in Chapter 3.

Major benefits are reduction of GHG and enhanced university reputation, culture, and educational programs linked to campus climate action and sustainability.

To implement the Climate Action Commitment goals, there will be costs and benefits for the university:

‣ Some initiatives (e.g., upgrades to the steam plant) are part of the cost of doing business, and the added costs to incorporate climate action goals may be small.

‣ Others, such as energy efficiency retrofits, have a positive return on investment.

‣ Others, including solar electric projects, will require major investment; however, creative power purchase agreements can reduce capital cost and achieve cost-effective results.

‣ Finally, some projects (e.g., the proposed University Compost Facility at Kentland) require capital and operating expenditures but provide substantial operational and educational benefits.

Effective Climate Action Commitment implementation will require changes in operations and governance. Goal 13 recommends establishing a University Office for Climate Action and Sustainability (OCAS) directed by a Chief Climate Action and Sustainability Officer that reports jointly to the Senior Vice President and Chief Business Officer and the Executive Vice President and Provost.

The university's financial uncertainties resulting from the Covid-19 pandemic require flexibility in implementing the Climate Action Commitment. As presented on the next page, much can be done with limited investment.

IMMEDIATE NEAR-TERM INITIATIVES (2020-22)

Although the 2020 Virginia Tech Climate Action Commitment focuses on 2030 as the target date for its goals, the pathway to those goals begins the day the Climate Action Commitment is officially adopted by the university, if not before. The Working Group has identified a number of initiatives and projects that can and should be acted on in the short term from now until 2022 with full understanding of the current budget constraints of the university. The "shovel ready" initiatives aim to get a jump start on necessary action and to demonstrate the university's commitment. They are listed below sorted by (a) low-cost/no-cost/revenue-neutral initiatives, (b) ongoing and budgeted projects, and (c) new priorities in need of funding and/or approval. These initiatives are described in Chapter 9.

a. Low/no cost/revenue neutral project/policy/planning initiatives

‣ Establish framework for Climate Action Living Laboratory (CALL) through the Office of the Provost and Executive Vice President, college deans, and the Division of Campus Planning, Infrastructure, and Facilities.

‣ Restructure the Energy and Sustainability Committee to oversee 2020 Virginia Tech Climate Action Commitment, renaming it the Climate Action, Sustainability, and Energy (CASE) Committee.

‣ Establish an alternative mobility subcommittee of the Transportation and Parking Committee.

‣ Develop plan for steam plant resilience/redundancy needs to complete conversion to natural gas by 2025.

‣ Develop a Utility Master Plan.

‣ Develop a Campus Energy Dashboard.

‣ Initiate Student Project for Fishburn Wind Energy Assessment.

‣ Promote partnership between Virginia Tech Electric Service and the Virginia Tech Power and Energy Center as part of Climate Action Living Laboratory.

‣ Initiate partnership with APCO on renewable electricity development.

‣ Initiate community relations with VTES Town of Blacksburg customers.

‣ Identify candidates for a zero-net-energy building on campus and develop fundraising plan.

‣ Engage Virginia Tech Foundation in energy efficiency retrofit plan for leased buildings.

‣ Adopt a Campus Tree Policy.

‣ Seek external funding for agrivoltaics test array at Catawba Sustainability Center.

‣ Implement and evaluate Sustainable Procurement Policy.

b. Ongoing budgeted projects

‣ Implement ongoing steam plant and chiller upgrade projects.

‣ Evaluate new natural gas contract on implications for Climate Action Commitment goals and pathways.

‣ 2020 RECs for 30 percent renewable electricity, continue through 2022 as needed.

‣ Implement Design and Construction Standards in light of Climate Action Commitment Goals.

‣ Fill the Virginia Tech energy manager position and supplement staff as needed.

‣ Implement budgeted projects in the Parking and Transportation Plan.

c. New priority projects in need of funding/approval

‣ Establish the University Office of Climate Action & Sustainability (OCAS) and appoint a university Chief Climate Action and Sustainability Officer (CCASO).

‣ Develop University Compost Facility at Kentland.

‣ Initiate 10-year energy management plan, 2021-30, and develop first year projects.

‣ Develop solar projects on campus: 2.3 MW by 2022: Sterrett and other rooftop projects.

‣ Implement zero-waste management consultant study.

‣ Implement a Green Lab Program.

‣ Dedicate consistent, annual funds to maintain existing trails, sidewalks, bicycle infrastructure.

‣ Implement transportation infrastructure plans (e.g., MMTF).

COMMUNITY ENGAGEMENT

Engaging the university community in the Climate Action Commitment update was part of the Working Group's charge and a critical component of our effort. The process overall–with its robust network of subcommittees–may be considered a true 'collaborative' enterprise, with over 130 students, staff, faculty, and community members involved. In terms of wider outreach, the Engagement Subcommittee originally planned on holding a major half-day town hall event on campus. Unfortunately, COVID-19 made that impossible.

The group responded by deploying a range of 'physically distanced' engagement activities:

‣ Dedicated website portal introducing the Climate Action Commitment process and sharing committee materials.

‣ Dedicated email address for the initiative.

‣ A series of 10 videos sharing progress of the Working Group and the subcommittees.

‣ A survey distributed widely throughout the community with 242 respondents.

‣ A series of 12 hour-long Zoom "convenings," attended by at least 226 participants.

Each of these streams of engagement is detailed in Chapter 5, and insights and information collected through them is summarized. Key findings from these various engagement efforts include:

‣ The vast majority of participants/respondents believe that climate change is a serious threat, and thus support aggressive action on the part of the university. In fact, many feel that Virginia Tech is not doing enough.

‣ The importance of setting ambitious goals and sticking to them was emphasized.

‣ Emphasis was placed on systemic or "upstream" solutions rather than placing the onus on behavior change of individuals, given that many of the barriers to action are infrastructural and institutional (e.g., poor cycling infrastructure).

‣ The above notwithstanding, many did see individual actions as important and needing of attention. Creative ideas emerged around how to, for example, 'gamify' desired actions.

‣ Key champions are important for propelling further action, including potentially a higher-level champion within university administration. This may be achieved through a stronger OCAS (see recomendation #13).

‣ There is strong support for taking a more holistic view of understanding our greenhouse gas emissions, accounting for emissions associated with community behaviors like commuting.

‣ There is broad support for key actions proposed through the Climate Action Commitment update process, including:

› A shift to carbon neutrality and 100 percent renewable energy, including integrating renewable energy infrastructure into campus design.

› Alternative transportation and reductions in private automobile usage, including a ban on freshmen car parking permits.

› Improved waste management, including a new compost facility, and reductions at the source through purchasing decisions that minimize waste and promote sustainability

› The creation of a 'living laboratory' to foster partnerships between campus operations, local partners, and the academic (teaching and research) enterprise.

› A green lab system, and similar programs to promote sustainable behaviors within work and student life spaces.

› Optimize building design, including with energy, water, and waste monitoring.

› The need to account for climate justice in any and all actions taken.

› Stronger partnerships with other institutions, including the Town of Blacksburg.

› There is a strong desire to see engagement continue as the university shifts to implementation.

COMPARISON WITH PEER UNIVERSITIES

One of the Working Group's deliverables is a comparison of Virginia Tech progress in climate action to peer universities, and this is presented in Chapter 8. There are three good reasons for doing this:

1. To offer an evaluative reference point (i.e., to see how we are doing),

2. To adopt effective plans and avoid ineffective ones (i.e., to borrow good ideas), and

3. To demonstrate that what the university is proposing is feasible and in line with similar universities (i.e., to show it is not far-fetched to have a bold and aggressive climate action plan).

Knowing that our perspective is comprehensive and that other universities have different strengths in different areas, the Working Group decided to have our thematic subcommittees select the peer and exemplary universities to assess in their specific areas.

Those areas include:

- Buildings
- Renewable Energy
- Energy Systems
- Transportation
- Carbon neutrality and GHG inventory
- Budget and Finance
- Climate Justice
- Waste-Recycling-Composting
- Agriculture, Forestry, Land Use
- Community Engagement

In most areas the Working Group selected 3-8 universities that they consider to be peers or to be exemplary in that area. Some are from Virginia, some are Land Grants, some are from the Atlantic Coast Conference, some are far away, but all offer good examples and benchmark our progress to-date and our aspirations for the 2020 Climate Action Commitment.

All in all, our peer reviews told us that, while our 2009 Climate Action Commitment was right for its time and has led to improved energy efficiency and reductions in GHG emissions, it now lags behind the actions of many of our peers. This deficiency is most notable in the quest for carbon neutrality, for renewable energy, for zero-waste, for zero-net-energy buildings, for alternative transportation, and for community engagement to advance climate action and sustainable behavior.

Many of our related programs do standup well in comparison to others, but if Virginia Tech is to regain its leadership role in climate action and sustainability, it needs to move to a new Climate Action Commitment that is right for this time. Of course, that is what it has set out to do, and the Working Group believes that it has found the right balance of aggressive, yet pragmatic, climate action. The group's goals are to achieve carbon neutrality by 2030, 100 percent renewable electricity by 2030, investment in energy efficiency in existing and new buildings, carbon neutral agriculture, a zero-waste campus, sustainable procurement practices, sustainable mobility, climate justice as a core value, community engagement, and the establishment of a Climate Action Living Laboratory that will integrate these goals into the fabric of the university.

Relative to the peer and exemplary universities reviewed in this analysis, this 2020 Virginia Tech Climate Action Commitment sets the stage for Virginia Tech to shine as an exemplar and leader in university climate action. Beyond our climate neutrality and zero-waste campus goals, six areas of the 2020 Climate Action Commitment stand Virginia Tech above the rest:

1. The detail and specificity of the pathways developed to achieve the Climate Action Commitment goals

2. Our own unique utility VTES leading our way to 100 percent renewable electricity, while most other universities are totally dependent on private utilities and companies.

3. Using our considerable land resources not only to manage our agricultural climate impacts, but also to sequester carbon and develop renewable energy.

4. Incorporating in our carbon neutral goal scope 3 GHG emissions relating to behavior (e.g., commuting, waste/recycling, water/wastewater, business travel), while most others include just scope 1 and 2.

5. Integrating our physical climate action into the university's educational mission through the Climate Action Living Laboratory (CALL).

6. Specifically addressing community engagement, sustainable behaviors, and social equity and justice as core elements of our climate action.

LEARN MORE

View the full Virginia Tech 2020 Climate Action Commitment Working Group Report and associated appendices at **svpoa.vt.edu/index/VTCACRevision**.

Questions may be addressed to **climateaction@vt.edu**.

VT
VIRGINIA TECH™

Commonwealth of Virginia
Locality Recycling Rate Report
For Calendar Year 2022

Reporting Solid Waste Planning Unit: Virginia Tech

Person Completing This Form: Teresa Sweeney   **Title:** Waste & Recycling Manager, Campus Planning, Infrastructure & Facilities
Address: Virginia Tech, Sterrett Center, 180 Sterrett Drive, Blacksburg, VA 24061
Office Phone Number: (540) 231-9916   **Email Address:** msrecycle247@vt.edu.

Summary: Virginia Tech, the Town of Blacksburg, the Town of Christiansburg, and Montgomery County represent the four jurisdictional members of the Montgomery Regional Solid Waste Authority (MRSWA). Located in Christiansburg, MRSWA operates a transfer facility that receives the majority of our principal recyclable materials (PRMs), and all of our municipal solid waste (MSW). Our region uses a "single stream recycling system" with Recycling & Disposal Solutions (RDS) in nearby Salem, Virginia serving as the "hub." Food waste is collected at all on campus dining facilities and stored, transported and processed into composting material by Royal Oak Farm (ROF) at their facility in Evington, Virginia. The New River Resource Authority (NRRA) located in Dublin, Virginia operates the local landfill. Virginia Tech owns and operates a Quarry that produces our famous "Hokie Stone," the Limestone-Dolomite stone for the exterior of most campus buildings. Calendar Year 2022 was somewhat normal after two years of the COVID-19 pandemic, however recycling and trash collection operations, at all levels, continues to be impacted, to some degree, due to the continuation of take out options in dining facilities and the growing business of Uber Eats and Grub Hub. Trash tonnages increased from the previous year. Recycling saw a significant increase in tonnage due to the abundance of wood waste that we made into mulch and use for various projects on campus. Our food waste collection saw in increase for 2022 as well as the collection of grease from all dining facilities university wide.

Virginia Tech achieved a 60% Recycling Rate and a 78% Waste Diversion Rate (percentage of waste kept out of the local landfill) for Calendar Year 2022 (page 2).

Data in this report was collected from our recycling and solid waste facilities and other campus stakeholders. I certify that I have personally examined, and am familiar with, the information submitted in this form, and that based on my inquiry of the individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete.

WM Halsey _____   28 MAR 2023
Assistant Vice President for Facilities Operations

PART A: Recycling Rate Calculation - Using the formulae provided below and the information reported on Pages 3, 4 and 5 to calculate your recycling rates.

Step 1: $[(\text{PRMs}) / (\text{PRMs} + \text{MSW Disposed})]$ **X 100 = Base Recycling Rate %**

| 6430 | / | 6430 | + | 4631 | X 100 = | 58 | % |
| TONS | | TONS | | TONS | | | |

Step 2: CREDITS calculation

  a. **Total Recycling Residue**   0 **tons**
  b. **Total Solid Waste Reused**   20 **tons**
  c. **Total Non-MSW Recycled**   10,038 **tons**

                    CREDITS   10,058 **tons**

                                    Adjusted
Step 3: $[(\text{PRMs} + \text{CREDITS}) / (\text{PRMs} + \text{CREDITS} + \text{MSW Disposed})]$ **X 100 = Recycling Rate #1***

| 6430 | + | 10,058 | / | 6430 | + | 10,058 | + | 4631 | X 100 = | 78 | % |
| TONS | | TONS | | TONS | | TONS | | TONS | | | |

Step 4: ☐   **Source Reduction Credit does not apply; or**

        ☒   **Adjusted Recycling Rate #1 + 2% SRP Credit = Adjusted Recycling Rate #2***

| 58 | % | + 2% | = | 60 | % |

Step 5: Final Recycling Rate* for Solid Waste Planning Unit = | 60 | %

* Total credits resulting from Steps 3 and 4 may not exceed 5 percentage points above the Base Recycling Rate achieved by the Solid Waste Planning Unit.

Part I: Principal Recyclable Materials (PRMs): Report only PRM material generated within the reporting SWPU and recycled, NOT imported PRMs for recycling.

PRM TYPE	RECYCLED AMOUNT (TONS)
Paper	287
Metal	56.56
Plastic	146.58
Glass	0
Commingled (also known as Single Stream)	242.04
Yard Waste (composted or mulched)	150
Waste wood (chipped or mulched)	5163.14
White Goods	1.32
Tires	4.67
Used Oil	9.96
Used Oil Filters	0.12
Batteries	5.5
Electronics	4.6
Fluorescent Bulbs & Ballasts	10.4
Food Waste Organic – Composting	304.83
Waste Cooking Oil	43.44
TOTAL PRMs	**6430.16** (PRMs)

(Enter Total on Page 2, Step 1)

Listing of sources for PRM data

1. Solid waste facilities from Virginia Tech which MSW disposed/recycled data was collected:
   a. Office of Sustainability – Campus Planning, Infrastructure & Facilities (CPIF) Division
   b. Facilities Operations (Buildings & Grounds) – CPIF Division
   c. Capital Construction & Renovation – CPIF Division
   d. Dining Services – Division of Student Affairs
   e. Housing & Residence Live – Division of Student Affairs
   f. Environmental Health & Safety Department
   g. Fleet Services – Parking & Transportation
   h. Library Services

2. Other facilities/operations (not included in #1 above) from which MSW disposed/recycled data was collected:
   a. Montgomery Regional Solid Waste Authority (MRSWA) – Christiansburg, VA
   b. YMCA at Virginia Tech – Blacksburg, VA
   c. Campus Kitchens Food Donation Program – VT Engage – Blacksburg, VA
   d. Royal Oak Farm, LLC
   e. Valley Proteins, Inc.
   f.
   g.
   h.
   i.

Part II: Credits by Category (see Credits Worksheet, Page 5)

A. Recycling Residue – "Recycling residue" means the (i) nonmetallic substances, including but not limited to plastic, rubber, and insulation, which remain after a shredder has separated for purposes of recycling the ferrous and nonferrous metal from a motor vehicle, appliance, or other discarded metallic item and (ii) organic waste remaining after removal of metals, glass, plastics and paper which are to be recycled as part of a resource recovery process for municipal solid waste resulting in the production of a refuse derived fuel. (§ 10.1-1400 of the *Code of Virginia*) (use only SWPU generation)

MATERIAL DESCRIPTION	FACILITY/OPERATION	TONS OF MATERIAL
_____ from	_____	_____
_____ from	_____	_____
_____ from	_____	_____
TOTAL RECYCLING RESIDUE		**0**

(Enter Total on Page 2, Step 2 a)

B. Solid Waste Re-Used

MATERIAL DESCRIPTION	REUSE METHOD	TONS OF MATERIAL
Furniture/Appliances	YToss? Program (Collected – Student Move-Out)	10.8
Food Donation Prgm	Partnership w/Dining Services & VT Engage Grp	9.5
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
TOTAL SOLID WASTE REUSED		20.3

(Enter Total on Page 2, Step 2 b)

C. Non-Municipal Solid Waste (MSW) Recycled

MATERIAL DESCRIPTION	RECYCLING METHOD	TONS OF MATERIAL
Hokie Stone Gravel "Overburden" (Cuttings) from VT Quarry Ops		9255.14
Asphalt	Milled Asphalt from Vet Med	352.99
Masonry,Concrete, etc.	Construction Projects (BT Transit, Science, etc	430.00
TOTAL NON-MSW RECYCLED		**10,038.13**

(Enter Total on Page 2, Step 2 c)

D: A credit of two (2) percentage points may be added to the Adjusted Recycling Rate #1 if the Solid Waste Planning Unit has implemented a Source Reduction Program (SRP). Examples of SRPs include Grass-cycling, Home Composting, Clothing Reuse, Office Paper Reduction (duplexing), Multi-Use Pallets, or Paper Towel Reduction. The SRP must be included in the Solid Waste Management Plan on file with the Department:

    SRP description: Campus Kitchens Program is a partnership with VT Engage & Dining Svcs (Division of Student Affairs) to donate excess food to local community.

    SRP description: YMCA at Virginia Tech's YToss Program collects reusable items from our students in residence halls during Spring Move Out for sale in the Fall 2022.

    SRP description: The Procurement Department's Sustainable Procurement Policy introduced in Spring 2020 and focuses on waste reduction at the front of the waste stream.

                                           (Certify on Page 2, Step 4)

Exclusions: **For the purposes of this report, the following materials are not considered solid wastes, and should not be included in any of the data categories utilized in calculating the recycling rate.**
1. **Biosolids –industrial sludge, animal manures; or, sewage sludge (unless composted)**
2. **Automobiles – unless part of the Inoperable Vehicle Program (DMV)**
3. **Leachate**
4. **Soils – contaminated soils, soil material from road maintenance**
5. **Household hazardous waste**
6. **Hazardous waste**
7. **Medical waste**
8. **Rocks or stone**
9. **Woody waste derived from land clearing for development, VDOT or easement tree trimming/clearing.**

Part III: Total Municipal Solid Waste (MSW) Disposed** - Report only MSW generated within the reporting jurisdiction(s), NOT imported wastes or industrial wastes.

MSW TYPE	TOTAL AMOUNT of MSW DISPOSED (TONS)
Household	_____
Commercial	_____
Institutional	_____
Other (DO NOT INCLUDE INDUSTRIAL WASTES)	_____
TOTAL MSW DISPOSED	**4631.29**

                                        (Enter Total on Page 2, Step 1 and Step 3)

Note: MSW DISPOSED for the purpose of this report means delivered to a permitted sanitary landfill, delivered to a waste-to-energy facility, or managed at a transfer station for transport to a landfill or waste-to-energy facility.

Locality Recycling Rate Report   For Calendar Year 2022

Credits Worksheet

I.   Reuse of any Solid Waste

√		Material description	Tons
___	PRM	_____	____
___	PRM	_____	____
___	PRM	_____	____
___	Industrial	_____	____
___	Construction	_____	____
___	Demolition	_____	____
___	Debris	_____	____
___	Other	_____	____
_X_	YToss? Program	Reusable Residence Hall Items_	10.5
_X_	Campus Kitchen	Food Donation w/ Dining Svcs	9.5
		TOTAL TONS	**20.0** **(enter data on Page 4, Solid Waste Re-Used)**

II.   Recycling of any Non-Municipal Solid Waste

√		Material description	Tons
_X_	Roadwork	Asphalt Milling (Vet Med)_	353
_X_	Construction	Construction Projects (BT Transit, _ Science Lab, VT D&DS, Stanger St.	
_X_	Quarry Ops	Hokie Stone "Overburden"_____	9255
___	Projects	Masonry_____	430
___	Other	_____	_____
		TOTAL TONS	**10,038** **(enter data on Page 4, Non-MSW Recycled)**

III.   **Inoperable Vehicles Removed and Demolished** – include number of vehicles that the localities received reimbursement from DMV under §46.2-1207 of the Code of Virginia.

# of vehicles removed/reimbursement received	0	
Average tonnage per vehicle	X 1 Ton each	
Total Tons	**0**	**(enter data on Page 3, PRMs, as Inoperative Motor Vehicle Program)**

NOTE: Check "Exclusions" on Page 5 to avoid listing of those materials on this worksheet and/or in the data fields of this report.

Part C: Recycling Rate Report Instructions

Amended Regulations for the Development of Solid Waste Management Plans (9 VAC 20-130-10 et seq.) require that Solid Waste Planning Units (SWPUs) in the Commonwealth develop complete, revised solid waste management plans. Section 9 VAC 20-130-120 B & C of the Regulations requires that a minimum recycling rate of the total municipal solid waste generated annually in each solid waste planning unit be maintained. It also requires that the plan describe how this rate shall be met or exceeded and requires that the calculation methodology be

included in the plan. Section 9 VAC 20-130-165 D establishes that every solid waste management planning unit with populations over 100,000 shall submit to the department by April 30 of each year, the data and calculations required in 9 VAC 20-130-120 B & C for the preceding calendar year. SWPUs with populations of 100,000 or less are only required to report every 4 years (CY years 2016 and forward).

NOTE: ONLY RECYCLING RATE REPORTS FROM AN APPROVED SOLID WASTE PLANNING UNIT (SWPU) WILL BE ACCEPTED FOR PROCESSING. JURISDICTIONS WITHIN A SWPU MUST SUBMIT THEIR RECYCLING DATA TO THE SWPU FOR INCORPORATION INTO THE ANNUAL REPORT.

It is requested that all amounts included on the form be listed in **tons (2,000 pounds)**. If actual weights are not known, volumes can be converted to weight estimates. To assist you with these estimates, a standardized volume-to-weight conversion table is attached.

Contact Information Section: Please provide information on the Reporting SWPU and information on the individual completing this form. Under Member Governments, please list the local governments identified in the applicable solid waste management plan.

Calculated Recycling Rate Section: Using the formulae provided, calculate your recycling rates for the reporting period from information identified in the Recycling Rate Calculations Section.

Signature Block Section: Please provide an authorized signature prior to submitting the completed form. Authorized signatories include Executive Officer, Administrator, or other legally designated representative of the SWPU reporting entity.

Recycling Rate Calculations Section: Please provide the requested information:

Part I: Principal Recyclable Material (PRM) - Report the amount in tons of each PRM collected for recycling in the named jurisdiction(s) during the reporting period. PRMs include paper, metal, plastic, container glass, commingled, yard waste, waste wood, textiles, tires, used oil, used oil filters, used antifreeze, batteries, electronics, and other materials approved by the Director taken from the Municipal Solid Waste (MSW) generation. A one ton credit may also be entered for each inoperable motor vehicle for which a locality receives reimbursement from the Virginia Department of Motor Vehicles under §46.2-1207 of the *Code of Virginia*. The total weight in **TONS** of all PRMs collected for recycling is represented as **PRMs** in the Recycling Rate Calculation. **New for CY 2015: Provide source information for the PRMs reported on the report (permitted and unpermitted facilities).**

Part II: Credits - Report the amount in **TONS** of each material for which recycling credit is authorized in §10.1-1411.C of the *Code of Virginia*: (i) one ton for each ton of recycling residue generated in Virginia and deposited in a landfill permitted under §10.1-1408.1 of the *Code of Virginia*; (ii) one ton for each ton of any solid waste material that is reused; and, (iii) one ton for each ton of any non-municipal solid waste that is recycled. The total weight in **TONS** of all material for which credits are authorized is represented as **CREDITS** in the Recycling Rate Calculation. A credit of two percentage points of the minimum recycling rate mandated for the Solid Waste Planning Unit (SWPU) may be taken for a source reduction program that is implemented and identified in its Solid Waste Management Plan. Total credits may not exceed five percentage points above the Base Recycling Rate achieved by the SWPU.

Part III: Total Municipal Solid Waste (MSW) Disposed: Report the total amount in **TONS** of MSW that was disposed of by the Solid Waste Planning Unit (SWPU) during the reporting period for each of the source categories (Household, Commercial, Institutional, and Other). For the purpose of this report, "disposed," means delivery to a permitted sanitary landfill or waste incinerator for disposal, and excludes industrial wastes. Industrial waste and by-products should not be included in the MSW or Recycling calculation. The total weight in tons of MSW disposed is represented as **MSW Disposed** in the Recycling Rate Calculation.

Locality Recycling Rate Report Volume to Weight Conversion Table

Material	Volume	Weight in Pounds
Metal		
Aluminum Cans, Whole	One cubic yard	50-74
Aluminum Cans, Flattened	One cubic yard	250
Aluminum Cans	One full grocery bag	1.5
Ferrous Cans, Whole	One cubic yard	150
Ferrous Cans, Flattened	One cubic yard	850
Automobile Bodies	One vehicle	2,000
Paper		
Newsprint, Loose	One cubic yard	360-800
Newsprint, Compacted	One cubic yard	720-1,000
Newsprint	12" stack	35
Corrugated Cardboard, Loose	One cubic yard	75-100
Corrugated Cardboard, Baled	One cubic yard	1,000-2,000
Plastic		
PETE, Whole, Loose	One cubic yard	30-40
PETE, Whole, Loose	Gaylord	40-53
PETE, Whole, Baled	30" x 62"	500
Film, Baled	30" x 42" x 48"	1,100
Film, Baled	Semi-Load	44,000
Film, Loose	Standard grocery bag	15
HDPE (Dairy Only), Whole, Loose	One cubic yard	24
HDPE (Dairy Only), Baled	32" x 60"	400-500
HDPE (Mixed), Baled	32" x 60"	900
Mixed PET & Dairy, Whole, Loose	One cubic yard	32
Mixed PET, Dairy & Other Rigid (Whole, Loose)	One cubic yard	38
Mixed Rigid, No Film	One cubic yard	49
Glass		
Glass, Whole Bottles	One cubic yard	600-1,000
Glass, Semi-Crushed	One cubic yard	1,000-1,800
Glass, Crushed (Mechanically)	One cubic yard	800-2,700
Glass, Whole Bottles	One full grocery bag	16
Glass, Uncrushed to Manually Broken	55 gallon drum	125-500
Arboreal		
Leaves, Uncompacted	One cubic yard	200-250
Leaves, Compacted	One cubic yard	300-450
Leaves, Vacuumed	One cubic yard	350
Wood Chips	One cubic yard	500
Grass Clippings	One cubic yard	400-1,500
Other		
Battery (Heavy Equipment)	One	60
Battery (Auto)	One	35.9
Used Motor Oil	One gallon	7.4
Used Oil Filters (Uncrushed)	55 gallon drum	66 Lbs./Used Oil + 110 Lbs./Ferrous Metal
Used Oil Filters (Crushed)	55 gallon drum	16.5 Lbs./Used Oil + 368 Lbs./Ferrous Metal
Tire - Passenger Car	One	20
Tire - Truck, Light	One	35
Tire – Semi	One	105
Antifreeze	One gallon	8.42
Food Waste, Solid & Liquid Fats	55 gallon drum	412
Electronics: CRT/CPU/LapTop/TV	Each (avg wt from NCER)	38/26/8/49 respectively

**This Table For General Guidance Only.**

Assistant Vice President for Infrastructure and Sustainability and Chief Sustainability Officer
Sterrett Center
230 Sterrett Drive, Suite 20
Blacksburg, Virginia 24061
P: (540) 231-4135
maryann@vt.edu

MEMORANDUM

TO: Student Organizations

FROM: Mary-Ann O. Ibeziako
Assistant Vice President for Infrastructure and Chief Sustainability Officer
Chair of the Climate Action, Sustainability, and Energy Committee

DATE: September 11, 2022

SUBJECT: Academic Year 2022-23 Request for Proposal for Climate Action, Sustainability, and Energy Initiatives by Student Organizations Program (Green RFP Program)

Student engagement is an important factor in advancing climate action, sustainability, and energy initiatives at Virginia Tech. The university has created the Request for Proposal for Climate Action, Sustainability, and Energy Initiatives from Student Organizations Program (called the "Green RFP Program") to solicit proposals from recognized student organizations that support the goals of the Virginia Tech 2020 Climate Action Commitment. Since its initiation in academic year 2010-11, the Green RFP Program has provided funds in excess of $1.75 million for 133 approved student sustainability proposals.

The purpose of this memorandum is to present the proposal submission process, timeline, format, contacts, and review criteria. Recognized student organizations should identify sustainability initiatives that are directly targeted to specific projects and therefore limited in size and scope. The university is especially interested in projects focused on energy reduction and conservation that produce achievable savings. Requests for one-time support are generally preferred over those requiring ongoing support.

The process and key dates for proposal submission are shown in Attachment 1. The process begins with this memorandum and continues through the current academic year. Approved proposals will be formally announced during Spring Semester 2023.

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Student organizations will submit their proposal(s) using the form titled "Green RFP Submission Form" shown in Attachment 2. All four parts of the form must be completed in detail. Part III, "Supporting Information" should be completed prior to addressing Part II, "Project Cost Information." As shown in Part IV, all proposals must have an appropriate university official's participation and concurrence prior to submission. The participation of the appropriate university official is essential, particularly if a proposal involves the purchase and installation of new equipment, a modification to an existing facility or grounds, or a new program.

The completed form must be signed and electronically submitted to Nathan King in the Office of Climate Action, Sustainability, and Energy at naking@vt.edu by 4 p.m. on November 11, 2022. If students have questions, need assistance in completing the form, or need assistance with identifying the appropriate university official for their proposal, please contact Mr. King via email or office telephone at 540-231-7358. If technical assistance is needed in preparing a proposal, please see our subject matter contact list in Attachment 3. For a list of previously approved Green RFPs, please visit the Office of Climate Action, Sustainability, and Energy website:
http://facilities.vt.edu/sustainability/sustainability-programs/green-rfp-program.html.

The Office of Climate Action, Sustainability, and Energy will present select proposals to the university's Climate Action, Sustainability, and Energy Committee (CASEC) for review and prioritization. This committee is a part of our university governance system and is comprised of faculty, staff, graduate students, and undergraduate students. The committee will consider and evaluate proposals based on the following criteria:
- Does the proposal help to achieve the goals of the Virginia Tech 2020 Climate Action Commitment? See: https://vt.edu/sustainability/background.html
- Does the proposal generate savings that exceed the cost of implementation?
- Does the proposal reduce/conserve energy or enhance social/ecosystem services?
- Does the funding request address a one-time or an ongoing need?
- Does the proposal leverage other sources of funding or volunteer effort?

Select proposals meeting these criteria will be prioritized and submitted by the Climate Action, Sustainability, and Energy Committee to the Office of Budget and Financial Planning (OBFP) for further consideration. OBFP will assemble a budget committee to review proposals and determine potential funding strategies for those recommended for approval. The Vice President for Finance will announce the list of approved proposals and funding sources. The Division of Campus Planning, Infrastructure, and Facilities will oversee implementation.

Thank you for your interest in the university's environmental stewardship efforts. I encourage your participation in this very popular student program.

c:	Wendy M. Halsey	Christopher H. Kiwus	Nathan T. King
	James S. Hillman	Jamie D. Lau	
	Timothy L. Hodge	Kenneth E. Miller	
	Travis W. Hundley	Angela S. Page	
	Frances B. Keene	Jonathan C. Teglas	

Attachment # 1

STUDENT ORGANIZATIONS SUSTAINABILITY INITIATIVE PROPOSAL
PROCESS AND TIMELINE

DATE	ACTIVITY
Sep 11, 2022	Assistant Vice President for Infrastructure and Chief Sustainability Officer announces the AY 2022-23 Green RFP Program and the Office of Climate Action, Sustainability, and Energy (CASE) notifies student organizations.
Nov 11, 2022	Proposal submission deadline to CASE.
Dec 1, 2022	CASE coordinates a proposal review for feasibility and completeness.
Jan 31, 2023	Climate Action, Sustainability, and Energy Committee receives select proposals and appoints Subcommittee to review and recommend a priority order.
Feb 27, 2023	Subcommittee presents proposed priority recommendations to the Climate Action, Sustainability, and Energy Committee for approval.
Mar 6, 2023 (estimated)	Climate Action, Sustainability, and Energy Committee presents proposals to the Office of Budget and Financial Planning for review and funding consideration.
Mar 2023 (estimated)	Office of Budget and Financial Planning, in coordination with other university offices, determines potential funding options for proposals and seeks the appropriate approvals.
May 2023 (estimated)	Vice President for Finance announces the approved proposals and funding sources.
July 2023 (estimated)	The Office of Budget and Financial Planning transfers funds to the appropriate Green RFP funding codes for proposal implementation.
July 2023 (estimated)	CASE initiates Green RFP implementation.

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GREEN RFP SUBMISSION FORM

Part I– General Information:

Name of Student Organization	
Contact/Responsible Person	
Contact Office Held/Title	
Contact Email Address	
Contact Telephone Number	

Part II– Project Cost Information

Estimated Cost of this Proposal		See III.C. below
Estimated Savings -		See III.D. below
Net Cost of this Proposal =		

Part III– Supporting Information

A. Please describe your climate action, sustainability, and/or energy initiative and attach supporting documentation.

B. How does this initiative help to achieve the goals of the Virginia Tech 2020 Climate Action Commitment Resolution and Sustainability Plan?

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C. What is the cost of your proposal? Please describe in adequate detail the basis for your cost estimate. Also, include a line item for any ADA accessibility considerations, if applicable for your project. Also, include a 15 – 20% contingency cost estimate (based on total cost) to account for labor/material cost fluctuations or other unforeseen expenses.

D. Will your proposal produce cost savings for the university or enhance social or ecosystem services? If so, how much? Please describe in adequate detail the basis for your savings estimate.

E. Is this funding request for a one-time need or an ongoing need (please mark one)?

One-Time _____   Ongoing _____

F. Is funding available for this request from another source? If yes, describe the funding (source, amount, etc.).

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GREEN RFP SUBMISSION FORM
(Continued)

Part IV- Requestors/Reviewers
Prepared By (Name of Contact for Student Organization)   Date
Reviewed By (Name of Appropriate University Official)   Date
Reviewed By (Name of Office of Climate Action, Sustainability, and Energy Representative)   Date

GREEN RFP SUBMISSION
CONTACT LIST

In the preparation of your Green RFP form, student organizations are encouraged to seek input and guidance from the following list of university employees. These individuals are familiar with the form and the process. They can address the feasibility of your proposal, provide a technical review, and evaluate the cost & potential savings.

Area of Expertise	Name	Title	Email Address
Engineering & Operations, Energy Management	Steve Durfee	Campus Energy Manager	sdurfee@vt.edu
Facilities: Housing & Residence Life	Todd Pignataro	Associate Director of Facilities Management	ptodd@vt.edu
Facilities: Buildings & Grounds (Small Renovations)	Jim McDaniel	Minor Modifications Manager	jmcdani@vt.edu
Exterior Lighting	Matt Hagy	Interim Associate Director of Utilities	mhagy1@vt.edu
Student Engagement & Campus Life	Spencer Stidd	Assistant Director of Event Services	sstidd@vt.edu
Dining Services & Housing (Student Affairs)	Blake Bensman	Sustainability Manager	bensman@vt.edu
Alternative Transportation (Bus, Bike, & Walk/EVs)	Nick Quint	Transportation Network Manager	nquint@vt.edu
Landscape Architecture	Jack Rosenberger	Campus Landscape Architect	jrosenb@vt.edu
Hahn Horticulture Garden	Scott Douglas	Director/Instructor	dsd1@vt.edu
Recycling & Waste Management	Teresa Sweeney	Waste and Recycling Manager	msrecycle247@vt.edu
Other Sustainability Topics	Nathan King	Campus Sustainability Manager	naking@vt.edu