Virginia Tech 2020 Climate Action Commitment Working Group

Final Technical Report

Appendix A: Working Group Subcommittee Reports Contents and Executive Summaries

Full Subcommittee reports available in WG report Volume II

Virginia Tech 2020 Climate Action Commitment Working Group
Agriculture, Forestry, Land Use Subcommittee Report

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Executive Summary: Agriculture, Forestry, and Land Use

The VT CAC Subcommittee on Agriculture, Forestry and Land Use explored opportunities for these Virginia Tech operations to reduce GHG emissions, improve efficiency, produce clean energy, and promote climate action and sustainability educational programs. The subcommittee developed an aggressive goal to **achieve carbon neutral agriculture, forestry and land use operations by 2030** in the Blacksburg region.

Virginia Tech owns and manages **considerable land area** in the Blacksburg region and in the Commonwealth. In the region, in addition to the main campus footprint , VT owns and manages 3,500 acres of agricultural lands including the 1,950-acre Kentland Farm. There are about 1,300 acres of additional VT forested land in the area including the 1,150-acre Fishburn Forest on Price Mountain. The 377-acre Catawba Sustainability Center in Roanoke County is included in our inventory.

Campus trees, including several old growth stands like Stadium Woods, play an important role in the campus environment with educational, recreational, environmental, and aesthetic benefits. Canopy cover is currently 14.7%, lower than average among peer universities in our region.

Campus lands play an **historic and important part of the university**'s educational programs especially in agriculture and forestry, as well as the natural and physical sciences, engineering, and other disciplines. Incorporating these lands and operations in the Climate Action Commitment can enhance another of our CAC goals, the campus Climate Action Living Laboratory.

Agricultural and forestry operations GHG emissions were not included in 2009/2013 CAC but are part of the 2020 VT CAC GHG inventory.

- In 2019, emissions totaled 11,297 metric tons (MT) CO_2e and came from animal enteric fermentation CH_4 (58%, 45% from dairy cows), manure management CH_4 (31%), land application of manure and fertilizer N_20 (6.5%), and equipment and vehicle fuel and electricity CO_2 (4.8%).
- Conservation tillage in VT cropland sequesters an estimated 1,271 MT and VT forested land has carbon sequestration benefit of 1,980 that is well documented. Total net A/F/LU GHG emissions in 2019 are 8,046 MT CO_2e or about **3.3% of 2019 VT GHG emissions**.

Animal enteric fermentation emissions amount to 58% of total VT agriculture emissions, about 2% of total VT GHG, and 3% of global emissions. Animal scientists at Virginia Tech are investigating practices that reduce methane generation, such as increasing ruminant digestion efficiency by adjusting feed rations and provision of dietary additives that reduce metabolism of rumen CH_4-producing bacteria. Such scientific breakthroughs have the potential to reduce not only VT CH_4 emissions but also global animal GHG emissions.

Manure management CH_4 amounts to 31% of agricultural GHG emissions and 1% of total VT GHG. Two options for reducing GHG manure emissions that could be used in combination are composting and anaerobic digestion (AD) to produce usable methane.

- AD of VT livestock manure could produce about 200,000-220,000 m^3/year of CH_4 (7 billion Btu). If combusted for heat or a micro-turbine, this would offset the GHG emissions from the estimated 225,000 m^3 CH_4 from manure handling or 1% of VT GHG.

Composting would reduce GHG emissions from, not only agriculture, but also from campus dining hall and other compostable organic waste. The GHG reduction value of composting depends on its landscape application, from 0.036 to 4.58 $MTCO_2$ per MT compost. Based on an assumed

reduction of 0.42 MT CO_2e per MT of food composted, composting the current 550 MT of VT dining hall food waste would yield a reduction of 230 MT CO_2e, 0.1% of VT GHG. If compost were applied to disturbed, marginal soils the estimated reduction could be as high as 1% of VT GHG.

Agriculture, Forestry, and Land Use CAC Goal and Pathways

CAC Goal #6. Carbon neutral agricultural, forestry, and land use operations by 2030

Pathways

a. Develop the University Compost Facility at Kentland

- Developing and operating the University Compost Facility at Kentland will reduce net animal waste GHG emissions, support soil health, relieve the need to purchase new land for future land application of animal wastes, and support sustainable agriculture education and research. The Facility will also provide significant benefits in management of campus organic wastes from dining halls, athletics, the vet school, and campus tree trimmings. Capital cost is estimated at $1.4-1.8 million with net operating cost of about $165,000/year.
- Composting campus dining hall food waste at the facility would yield a reduction of GHG of 0.1-1% of VT emissions depending on type of land applied, with the higher estimate for disturbed, marginal soils.

b. Adopt Campus Tree Policy

- Campus trees, including several old growth stands like Stadium Woods, contribute benefits to the campus environment. Forested cover comprises about 1300 acres of VT land, including 1150 acre at Fishburn Forest on Price Mountain. Canopy cover, currently at 14.7%, could be expanded to 25% through a Campus Tree Policy for additional environmental benefits.

c. Reduce agricultural and forestry net GHG emissions

- The source of most VT agriculture/forestry/land use emissions is enteric fermentation from livestock, especially from the dairy herd. Animal emissions of methane are a global problem, and animal science research can increase ruminant digestion efficiency via adjusting rations and the use of additives that reduce metabolism of rumen CH_4-producing bacteria.
- Agricultural and forestry programs can reduce net GHG emissions by increasing C sequestration; reducing manure GHG emissions via composting and, possibly, anaerobic digestion with methane recovery; increasing efficiency of operations; improving energy and fuel efficiency; and implementing agrivoltaics solar production.
- Expand the collection of manure data (volume/mass and composition) to provide more accurate estimates of GHG contributions from animal operations and GHG reductions via the adoption of composting and/or anaerobic digestion.

d. Develop solar energy projects on VT agricultural lands

- The 2020 VT CAC goal #2 is 100% renewable electricity by 2030, which it expects to achieve with at least 15 MW of solar capacity on Virginia Tech buildings and lands in the area. Land area on campus, Kentland Farm, Fishburn Forest, and Catawba Sustainability Center are prime candidates for solar development. 15 MW would require about 75-100 acres.
- Develop solar farms on VT agricultural land to provide "agrivoltaic" multiple use solar and usable grazing/cropland. These agrivoltaic farms would provide unique research and educational opportunities, part of the campus Climate Action Living Laboratory.

e. Employ agricultural and forestry CAC projects as living laboratories

- Increase climate awareness and implementable actions of students through sustainable agriculture experiential education programs at Catawba Sustainability Center and Kentland's Homefield Farm.
- The University Composting Facility at Kentland will provide a living climate action research and education laboratory for VT students and hands-on educational programming for waste management and composting professionals from Virginia and nearby states.

f. Expand the use of outreach and Virginia Cooperative Extension (VCE) to address educational and implementation of climate action commitments

- VCE programming to elicit beneficial economic, ecological, and environmental changes draws upon science-based results through proven research. VCE should hire additional faculty and agents to promote sustainable cropping and animal agricultural practices that enable VT and Virginia State University to facilitate climate action change throughout the state and region. Adoption of such practices will reduce the vulnerabilities of our food systems and environment to climate change and associated crises, e.g., plant and human and other animal disease development and spread.

g. Offset any remaining net GHG emissions

- In order to achieve zero net GHG emissions by 2020, credits developed by the agriculture and forestry sectors via solar agrivoltaic adoption, energy generated from anaerobic digestion of manure and other wastes, and C sequestration may need to be supplemented by purchasing carbon offsets.

Proposed Immediate Initiatives and Projects

The Subcommittee has identified two initiatives and projects that can and should be pursued between now and 2022 to jump start action that demonstrates the university's commitment. Understanding the current budget constraints of the university, the Buildings Opportunities subcommittee identified five actions to implement as soon as practicable, including the following agriculturally-related:

- **University Compost Facility at Kentland**: the compost facility will provide a needed organic waste management system with benefits to agricultural operations and several campus organizations.
- **Agrivoltaic Solar/Farmland Project** at Catawba Sustainability Center should be part of VT's initial stage of solar development because of its visibility and educational benefits.

Virginia Tech 2020 Climate Action Commitment Working Group
Budget & Finance Subcommittee Report

John Randolph, Tim Hodge, Debbie Greer,
Jim Hillman, Nancy McGehee, Allie Kahl

Executive Summary

The 2020 Climate Action Commitment (CAC) prescribes substantial action to address climate change. Achieving the CAC will require financial and staffing resources. With limited university resources, especially as a result of the Covid-19 pandemic, CAC financial needs will be in competition with other needs and priorities of the university, including health, safety and security; academic excellence; quality student experience; affordable tuition and fees; competitive faculty salaries; and others. Concurrently recognizing these challenges and the need to act, CAC Goal #14 specifically focuses on the budget and finance issues associated with CAC implementation:

CAC Goal #14: Develop innovative budgeting and financing mechanisms to generate funding and staffing to achieve Climate Action Commitment goals

Various **potential pathways** have been identified for meeting this goal:

- Strategically **invest university E&G and Auxiliary funds to implement the 10-year Energy Management Plan** targeting academic and auxiliary buildings at a level of $5 million/year in energy efficiency projects with a cumulative 8-year financial payback.
  - The 2015-2020 Five-year Energy Management Plan invested nearly $3 million/year of academic (E&G) funds that resulted in efficiency improvements that averaged about a 5-year payback with energy cost savings. More creative funding mechanisms can address energy efficiency needs in auxiliary buildings (e.g., residence halls, dining halls, athletics). These buildings account for 45% for campus gross square footage.

- Major investment is needed to implement the **pathways for renewable electricity** both on VT buildings/lands and in the SWVA region. Options for development include:
  1. **VT owned** and developed projects on VT buildings/land, and
  2. **Utility or 3rd party owned** and developed projects on VT buildings/land and in SWVA with VT power purchase agreement (PPA).
     - Option (1) provides major VT capital investment but greater long-term return and control, while option (2) requires no VT capital but less long-term financial return. A combination of the two options may be necessary to meet the CAC renewables goals.

- As a unique **power utility, VTES** has opportunities, in partnership with APCO and 3rd parties, to invest in renewable energy projects that serve both campus and town customers.

- The **Virginia Tech Foundation** helps the university achieve its goals and can be a valuable partner in adopting and implementing the CAC in the following ways:
  - The VT Foundation should assess efficiency opportunities in its properties **leased to VT operations** and invest in cost-effective energy efficiency measures in these properties, lowering university utility bills to offset increased lease cost to finance improvements.
  - The VT Foundation should **invest in projects to implement the VT CAC** that provide a return to the Foundation. These may include solar projects on Foundation buildings, and/or solar projects on VT or Foundation-owned land.

- As the university moves toward carbon neutrality and the economy turns toward clean energy, the VT Foundation should assess the **fiduciary risk associated with its investment in fossil-fuel-reliant industries** as part of its portfolio.
- The Foundation should broaden its investments to achieve **triple-bottom-line goals (financial, social, environmental)**. It is noteworthy that the CAC Working Group vigorously debated the issue of Foundation divestment from fossil fuels and different opinions are held among group members and the wider university community. However, consensus was reached among the WG on the need to strongly consider triple bottom line values in investment and other decisions.

- **Additional sources of funding** to implement the CAC should be pursued, including:
  - **Federal and state grants and research funding** for the Climate Action Living Laboratory
  - **Development donor funds** are also a potential source for some of the initiatives and projects needed to implement the CAC. Naming rights for a signature Zero-Net-Energy (ZNE) building or a signature solar farm located at the entry to campus are options.
  - **State funding** is also available for university project development such as Virginia DMME's cost-sharing solar development fund to cover half the costs of solar projects.
  - Funding from **foundation and philanthropic organizations** can support implementation of the CAC especially elements related to innovation and academic programs.

- In addition to project funding, implementation of the CAC needs to **upgrade staff capacities** so that they can adequately tackle the needs of the commitment, especially in energy management, energy and utility systems, building design, waste management, compost facility operation, and campus sustainability.

Implementation: Short-Term Initiatives & Projects (2020-2022)

Although the 2020 VT Climate Action Commitment focuses on 2030 as the target date for its goals, the pathway to those goals begins the day the CAC 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 (i.e., from now through to 2022) to get a jump start on necessary action and to demonstrate the university's commitment with full understanding of the current budget constraints.

Proposed initiatives are listed below sorted by (a) ongoing and budgeted projects, (b) new priorities in need of funding and/or approval, and (c) low-cost/no-cost/revenue-neutral initiatives.

(a) Ongoing budgeted projects

- Implement ongoing steam plant and chiller upgrade projects
- Evaluate new natural gas contract considering implications for CAC goals and pathways
- Purchase renewable energy certificates (RECs) to reach the 30% renewable electricity target in 2020
- Implement Design & Construction Standards in light of CAC Goals
- Fill the VT Energy Manager position and supplement staff as needed
- Implement budgeted projects in Parking & Transportation Plan

(b) New priority projects in need of funding/approval

- Develop a University Compost Facility at Kentland Farm
- Initiate 10-year energy management plan, 2021-2030, and develop first year projects
- Develop solar projects on campus (2.3 MW by 2022), including the Sterrett and other rooftop projects
- Fund and implement a zero-waste management consultant study
- Fund and implement Green Lab Program
- Dedicate consistent, annual funds to maintain existing trails, sidewalks, bicycle infrastructure
- Fund and implement transportation infrastructure plans (e.g., Multi-Modal Transit Facility)

(c) Low/no cost/revenue neutral project/policy/planning initiatives

- Establish framework for Climate Action Living Laboratory (CALL) through Provost's Office, deans, and Facilities Department
- Revise mission and make-up of Energy & Sustainability Committee to oversee 2020 VT CAC
- Establish an alternative mobility subcommittee of the Transportation and Parking Committee
- Develop plan for steam plant resilience/redundancy needs to eliminate coal by 2024
- Develop a Utility Master Plan
- Initiate student project for Fishburn wind energy assessment
- Promote VT Electric Service (VTES)-Power and Energy Center (PEC) partnership as part of Climate Action Living Laboratory
- Initiate a partnership with Appalachian Power Co (our electricity provider) on renewable electricity development
- Initiate community relations with VTES Town customers
- Identify candidates for a new Zero Net Energy building on campus and develop fundraising plan
- Engage the VT Foundation in an energy efficiency retrofit plan for leased buildings
- Adopt Campus Tree Policy
- Seek external funding for agrivoltaics test array at Catawba Sustainability Center
- Implement and evaluate the 2020 Sustainable Procurement Policy

Virginia Tech 2020 Climate Action Commitment Working Group
Buildings Opportunities Subcommittee Report

John Randolph, Paul Ely, Scott Kerklo, Georg Reichard, Mike Vellines, Erin Hopkins, Kim Briele, Anamaria Bukvic, Julia Gohlke, Emma Lineberry, Christine Labuski, Catie Grayson, Erin Nuckols, Yasmine Sikder, Allie Kahl

Executive Summary: 2020 VT CAC Buildings Opportunities Subcommittee

At Virginia Tech, buildings are places where we work, teach, research, learn, live, eat, and play. They are the Campus, the physical home and symbol of the Hokie Nation.

In addition, VT buildings account for more than 90% of campus energy use and GHG emissions. And they continue to expand. Construction projects in the pipeline will increase the occupied space on campus by 20% in the next five years.

As a result, the climate action commitment must begin with buildings. Although our 2020 CAC aims to achieve 100% renewable electricity, eliminating coal, and improving energy systems, they all serve building operations, and the pathway to carbon neutrality by 2030 depends on building energy use.

The Buildings Opportunities subcommittee evaluated progress made since the original 2009 CAC, reviewed related initiatives at peer institutions, developed new CAC goals and pathways to achieve them, assessed their implications, and identified initiatives that can be implemented in the next two years. This report summarizes those findings.

Progress. Since 2009, Virginia Tech has made significant progress in building energy efficiency and related GHG emission reductions even as the campus has grown by 24%. It has built new buildings and major renovations to LEED-Silver standards and invested $14 million in efficiency upgrades from 2015-2020. This has been a strong response to the 2009 CAC. But the commitment was limited by not including leased buildings, which encompass 13% of department space. In addition, the efficiency upgrades successfully focused on academic E&G buildings, but did not include auxiliary buildings, which make up another 45% of campus space.

Peer Comparison. While we have made progress in reducing energy and GHG emissions in buildings, other universities appear to have done more. For example, UVA has a larger energy management staff, UC-Berkeley has an 80% reduction goal for building emissions, Pittsburgh has a 50% energy reduction goal for existing buildings, SUNY-Buffalo is building a zero-net-carbon-certified residence hall, Cornell is developing an Earth Source Heat geothermal system to heat the campus, and Illinois-Urbana-Champaign established a "no net increase in space" policy.

2020 VT CAC Building Goals & Pathways. There are two principal 2020 VT Climate Action Commitment goals related to buildings, which are Goal #4 for new buildings and Goal #5 for existing building upgrades. Each goal has subgoals and a number of pathway steps to implement them, described in summary form on the next page. More detail is provided in chapter 3.

Immediate Projects/Initiatives. To get a jump start on necessary action and to demonstrate the university's commitment, there are a number of initiatives and projects that can and should be acted on in the short term from now until 2022. Understanding the current budget constraints of the university, the Buildings Opportunities subcommittee identified six actions to implement as soon as practicable.

- Formulate projects for Year 1 of 2021-30 **10-year Energy Management Plan**
- **Fill the VT Energy Manager** Position and supplement staff as needed
- **Implement Design and Construction Standards** which incorporate CAC Goals
- **Identify candidates for a ZNE building** on campus and develop a fundraising plan
- **Engage VT Foundation** in energy efficiency retrofit plan for leased buildings
- Implement **Green Lab Program**
- Faculty and staff formulate **Living Laboratory educational program for buildings**

Goal #4. Reduce Building Energy Consumption to Enable Carbon Neutrality By 2030

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

4.2. By 2030 employ energy management retrofit to reduce total energy consumption in buildings by 10% and energy use intensity (Btu+kWh/gsf) by 20% below 2020.

Potential pathway:

- Implement an **aggressive 2021-2030 10-year Energy Management Plan** updated annually can reduce total energy consumption in all buildings including auxiliaries by 10%.
- For **leased buildings** owned by the VT Foundation, work with the Foundation to develop financial arrangements to improve efficiency and reduce emissions.
- By 2021, use buildings and labs in the CAC **Climate Action Living Laboratory,** such as using Energy Dashboard online building data for instruction and research and a Green Lab program 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 and to vacate space for invasive energy efficiency projects.
- Achieving these goals will require sufficient **staffing in energy management**.

Goal #5. Operations of new buildings initiated after 2030 will be Carbon Neutral

5.1 Continue to upgrade new building efficiency guidelines conforming to latest adopted LEED-Silver standards and ASHRAE 90.1 energy performance standards + 10%

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

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

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

Potential pathway:

- In 2022, identify candidate new buildings for **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% of total CO_2 emissions. **100% renewable electricity** by 2030 will reduce building CO_2 emissions by more than 50%.
- By 2030, all newly initiated building design will have **carbon neutral** operations through 100% 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 Living Learning Laboratory** research and instruction by faculty and students through 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**.

Virginia Tech 2020 Climate Action Commitment Working Group
Climate Justice Subcommittee Report

Shannon Bell (co-convener), Rachel Spector (co-convener), Jack Leff, Carl Zipper, Jason Chavez, John Shewchuk, Erin Nuckols, Amber Wendler, Alexandra Kahl, Brandon Burkey, Owen Callahan, Aparna Cheran, Heidi Hahn, Shayla Utzinger, Ryan Berotti.

Executive Summary: Climate Justice Subcommittee

Climate change will not impact all people equally. Historically marginalized and vulnerable groups will be (and indeed, already are) disproportionately burdened with the negative consequences of both climate change and also with the mitigation and adaptation approaches proposed to address the climate crisis. These groups, commonly referred to as "frontline communities," often include Indigenous communities, people of color, low-income individuals, and people living in Global South nations.

The inequitable distribution of harms related to the climate crisis was the rallying cry for Virginia Tech for Climate Justice (VT4CJ), a group of students and faculty which, in September of 2019, organized a climate strike and advocated for the University to revise its Climate Action Commitment. The Climate Justice Subcommittee was the first subcommittee to be created as part of the Climate Action Commitment Working Group, and many members of VT4CJ have participated in the work of this and the other eleven subcommittees. The Climate Justice Subcommittee urges the University to embrace climate justice as a core value of the Climate Action Commitment. Climate justice, broadly defined, is a set of actions taken to address the economic, social, and institutional injustices against communities most affected by climate change and climate-change mitigation. Specifically, following Harlan et al. 2015[1], we propose a four-pronged understanding of climate justice to be incorporated into the University's climate planning:

1. Sharing the benefits and distributing the burdens of climate change mitigation and adaptation efforts ***equitably*** within and among communities and nations.
2. Engaging currently or previously marginalized groups as ***participants*** in decision-making processes aimed at mitigating and adapting to climate change.
3. Maximizing ***opportunities*** for marginalized groups to survive and thrive now and in the future.
4. ***Repairing historical harms*** against marginalized groups in the development of climate mitigation and adaptation efforts.

Taken together, these four elements of climate justice constitute a guidepost for university planning. Each builds upon the previous point to create a holistic consideration for dealing with climate injustices. Adopting this definition of climate justice, and incorporating it into climate-related planning, will place Virginia Tech as a leader among its international peers. Very few colleges and universities consider climate justice in institutional level-planning, and we have found no other universities with as robust a community responsibility as we propose.

Below, we provide a summary of the pathways we propose to place climate justice as a core value of Virginia Tech's Climate Action Commitment. The body of our report further elaborates on and analyzes these pathways with specific recommendations. However, our recommendations represent only the beginning. Climate justice, like all forms of justice, must be an ongoing consideration, woven throughout the action plans of the other subcommittees, and built into future iterations of the Climate Action Commitment.

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[1] Sharon L. Harlan, David N. Pellow, J. Timmons Roberts, with Shannon E. Bell, William G. Holt, and Joane Nagel. "Climate Justice and Inequality: Insights from Sociology." Chapter 5 in Riley E. Dunlap and Robert J. Brulle (Eds.) *Climate Change and Society: Sociological Perspectives*, (New York, Oxford University Press, 2015).

Goal 11: Establish climate justice as one of the core values of the Climate Action Commitment

Pathways:

- Encourage an accelerated transition to carbon-neutral status as a climate-justice imperative.
  - Assess the viability of renewable energy sources, such as geothermal, solar, and wind, for heating and cooling new buildings constructed on Virginia Tech's campus.
  - Seek opportunities to transition the steam plant's primary fuel source away from natural gas to renewable energy sources.
- 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.
  - Consider the lifecycle impacts of all renewable energy procured systems to ensure they are sourced ethically and sustainably, manufactured with high standards for worker safety, and include a decommissioning plan for responsible, end-of-useful-life recycling.
  - For example, solar photovoltaic manufacturers should receive a score of 80 or higher on the Silicon Valley Toxics Coalition's annual Solar Scorecard.[2]
- By 2021 establish a Climate Justice Advisory Board or Subcommittee to the revised Committee on Climate Action, Sustainability, & Energy (formerly the Energy & Sustainability Committee) with representation from students, faculty, and community members from frontline groups.
- Ensure that Virginia Tech's climate action implementation plans recognize and assist vulnerable or frontline groups adversely affected by those plans.
  - Groups potentially affected by VT CAC plans include low-wage VT employees, tuition-paying students, Virginia Tech Electric Service (VTES) town-resident ratepayers, historically marginalized people of color and Indigenous communities, coalfield communities, and others.
    - Low-wage employees who cannot afford to live in Blacksburg should have access to affordable commuting options with low climate impact and local work-force housing.
    - VT CAC implementation should identify ways to mitigate potential increases of electricity costs for low-income VTES town customers and of tuition and fees for low-income students, should such increases result from the University's climate-action commitments.
    - VT CAC renewable energy development should work with coalfield communities to establish locations for utility or 3rd party owned solar farms for Virginia Tech power purchase agreements.
- Establish education, research, and outreach programs to assist vulnerable and historically marginalized groups in their efforts to 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.

Many of these recommendations can be initiated immediately, and we recommend that the first immediate action taken be the establishment of a Climate Justice Advisory Board as a subcommittee of the Committee on Climate Action, Sustainability, and Energy (formerly called the Energy & Sustainability Committee). This Climate Justice Advisory Board should then begin a plan for the implementation of these recommendations.

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[2] Silicon Valley Toxics Coalition, Annual Solar Scorecard. http://www.solarscorecard.com/2018-19/

Virginia Tech 2020 Climate Action Commitment Working Group
Community Engagement Subcommittee Report

Todd Schenk, Carol Davis, Bryan Hanson, Jessica Hardy, Ceara Redd, Alexa Briehl, Sarah Myers, Heidi Hahn, Rachel Spector, Catherine Piper, Hannah Pajewski, Alexandra Kahl, John Randolph

1. EXECUTIVE SUMMARY

The Engagement Subcommittee was established to lead the 2020 Climate Action Commitment update's outreach and engagement efforts. Outreach to the wider community--including students, staff, faculty, alumni, and our neighbors--was deemed critically important to devising the best possible recommendations that account for the various interests, needs, and ideas among different stakeholders. Engagement involved information sharing, the collection of feedback, and the involvement of at least some stakeholders in deeper deliberations. The subcommittee also took responsibility for devising how governance and engagement should be structured as implementation moves forward.

One of the first tasks of the Engagement Subcommittee was reviewing **progress to-date**, which focused on identifying stakeholder involvement in previous climate action efforts. We found that the Office of Sustainability has been doing a laudable goal of tracking progress, sharing the results, and supporting action, while successfully encouraging very strong student involvement. As expanded upon below, one recommendation is to elevate the Office to increase its profile and influence, particularly within VT governance. Student and community groups also play integral roles in advancing climate and sustainability initiatives on campus.

It is clear that Virginia Tech can **learn from other peers and exemplary institutions** as we move forward with climate action. To this end, activities at various peer institutions were examined, including the University of Virginia, UC Berkeley, the University of Michigan, the University of Maryland, and Pennsylvania State. Key lessons learned from this review include:

- Establish clear engagement goals and processes
- Prominently identify goals and processes on relevant websites
- Nurture student groups as a way to foster change and engagement
- Create prominent cross-campus committees that bring together faculty, staff, students, and others to deliberate and advance efforts
- Establish funding mechanisms including grants to support efforts
- Form partnerships with local (neighboring communities and organizations) climate and sustainability efforts
- Integrate climate and sustainability principles/lessons into curriculum, both across different subjects and with explicit climate and sustainability programs
- Create 'living laboratory' infrastructure to foster operations-academic collaborations for teaching and research
- Design infrastructure, programs, and policies to effectively foster behavior change
- Enlist university community members (students and faculty/staff) as 'ambassadors' to spread awareness and promote change
- Create a high-level position (like a Chief Sustainability Officer) to champion action and push for resources and attention at the highest levels
- Comprehensively measure and communicate progress in meeting climate and sustainability goals

Engagement Process, Findings, and Analysis

The primary activities of the Engagement Subcommittee centered around facilitating information sharing, feedback collection, and deliberation with the wider VT community (and our neighbors). To this end, the following activities were conducted:

- Created a dedicated website portal introducing the CAC process and sharing committee materials[1]
- Shared videos focused on progress updates regarding the work of the WG and the subcommittees
- Crafted VT News stories
- Managed a dedicated email address for the initiative
- Distributed a survey widely throughout the community, which received 242 unique responses
- Convened a series of 12 Zoom meetings, 3 general and 9 focused on subcommittee topics, which involved over 226 people[2]

Each of these streams of engagement is further detailed below in this subcommittee report. Many involved substantial work on the part of the Engagement Subcommittee, and in particular the organization of the Zoom convenings in short order when COVID-19 made an in-person town hall meeting impossible. It is also noteworthy that the CAC process itself was broadly collaborative with more than 100 students, staff, faculty, and community members involved in the working group and various subcommittees.

Various good ideas both emerged and were affirmed through these processes, underscoring their potential value to the community. **Key findings from these various engagement efforts include**:

- The vast majority of (survey) 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 VT 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 partnered with a **stronger Office of Sustainability**

- 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 CAC update process, including:
  - A shift to **carbon neutrality and 100% renewable energy**. This would include integrating renewable energy infrastructure into campus design (e.g., solar on all new buildings). Agrovoltaics (integrating solar panels and agriculture) was also a popular proposal
  - **Alternative transportation** and reductions in private automobile usage, including with a ban on freshmen cars
  - **Improved waste management**, including with a new compost facility, consistent waste management systems across campus, 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. This should be part of concerted academic efforts to integrate climate change and sustainability into the classroom

[1] The central engagement website is: https://svpoa.vt.edu/index/VTCACRevision.html
[2] These are not unique people, as many participated in more than one session

- 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, including accounting for and ameliorating differential impacts of actions taken
- **Stronger partnerships** with other institutions, including the Town of Blacksburg and other local governments (in particular with transportation and waste management)

- There is a strong desire to see **engagement continue as the university shifts to implementation**. In addition to the regular reporting already conducted, stakeholders are interested in ongoing engagement opportunities, yearly (or more frequent) flagship events like a 'town hall', and further ways to directly take ownership over actions.

Goal and Pathways

The engagement activities outlined above, research on peer institutions, collaborations with other subcommittees, and other research and brainstorming among the Engagement Subcommittee yielded the following recommendations. These recommendations are largely in service of **goal #13 of the 2020 Climate Action Commitment update,** which calls on the University to:

> *Establish the VT Climate Action Commitment as a dynamic process through deeper integration into university governance and operations at all levels, and regular evaluation of goals and progress with ongoing stakeholder engagement*

The **pathways recommended** to achieve this goal are:

Recommendation #1 - Governance: Restructure the current Energy and Sustainability Committee (E&SC) to emphasize responsibility for university-wide oversight of implementation and evaluation. We propose that the E&SC committee be renamed the **Climate Action, Sustainability & Energy (CASE) committee** to emphasize the attention that must be paid to climate change, and be restructured in terms of membership, working subcommittees, and its place in governance. As part of this update, we recommend a slightly revised committee charge:

> *To review and provide ~~advice~~ concrete guidance to all facets of the University Administration on broad policy and implementation opportunities and issues relating to the implementation of the university's Climate Action Commitment and pursuit of environmental quality and social sustainability through policy, infrastructural and operational changes, education, and broad engagement. ~~action, education, and engagement to address current needs without compromising the capacity and needs of future generations.~~*

We also recommend that a set of standing subcommittees be created to support the work of the CASE Committee, including: Implementation committee; GHG Inventory; Climate Justice; Town-Gown Collaboration; Engagement & Structuring Sustainable Choices; and Education & student involvement.

Recommendation #2 - Implementation/operations: Appoint a high-level Chief Climate Action and Sustainability Officer (CCASO) to oversee and coordinate all aspects of implementation across the entire university. This person would be responsible for:

- Leading the development and implementation of university-wide climate and sustainability action plans
- Leading efforts to monitor implementation of climate and sustainability action plans

- Leading engagement efforts to ensure wide participation in climate and sustainability planning and implementation
- Coordinating a network of key climate and sustainability actors across all university units
- Leading climate and sustainability educational initiatives (both in the classroom and extracurricular)
- Facilitating partnerships between operational and research and educational units
- Managing a grant fund to allocate resources for climate and sustainability enhancements
- Chairing the CASE Committee and overseeing the Office of Climate Action, Sustainability, and Energy (OCASE), which would be elevated to become a university-wide unit
- Fostering meaningful town-gown and wider regional collaborations to advance shared climate, sustainability, and energy goals

This person would report jointly to the Provost and the Senior Vice President and Chief Business Officer. It is notable that the creation of the new CASE Office and CCASO position should not be at the cost of attention within the various operational and academic units. The goal of the office and officer should be to support these various efforts, not replace them.

Recommendation #3 - Learning: Establish a new Climate Action Living Laboratory (CALL) to foster and support relationships between operational units implementing new climate and sustainability initiatives (including but not limited to Facilities departments) and academic and research units both developing and teaching new technologies and approaches. The goals of the new CALL should be to:

1. Support collaborative educational opportunities on campus in the areas of climate action and sustainability.
2. Build bridges between operational and academic departments, and external community partners, facilitating and supporting opportunities.

The CALL should be situated under the reorganized OCASE. It should be structured to provide resources and other forms of support to achieve the above two goals. The work of the CALL may extend into curriculum development (e.g., creation of a new 'pathways minor' or even a core sustainability-focused pathways requirement). It is expected that the CALL would provide templates and best-practice guidelines for collaborative projects.

Recommendation #4 - Annual Review: Conduct an in-depth annual review of the CAC 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. The newly reconstituted CASE committee will be charged with supporting the implementation of annual reviews. The GHG Inventory subcommittee will play a particularly important role by tracking emissions on an ongoing basis. However, other subcommittees are expected to play critical roles, and in particular those focused on engagement and outreach. A full-blown engagement process is not expected each year, but it is very important that the results of ongoing monitoring and assessment are widely disseminated. In addition to the traditional written assessment reports, we recommend that the CASE Committee and associated staff find novel ways to inform campus and the wider community, including through social media. Going beyond informing, the Committee should employ effective techniques to gather feedback from the community. Furthermore, we recommend that the university does consider holding more robust updates with some frequency - perhaps every five years.

These four pathway recommendations are outlined in further detail below in the Engagement Subcommittee report. As a next step, we recommend that the **current E&SC committee be tasked with creating two ad hoc committees charged with fleshing out more complete proposals.** One ad hoc committee would focus on how the new CASE committee and CCASO position could be structured and scoped. The other would focus on the design of the new CALL.

Virginia Tech 2020 Climate Action Commitment Working Group
Energy Opportunities Subcommittee Report

John Randolph, Rob Glenn, John Beach, Kim Briele, Mary-Ann Ibeziako,
Lowell Jessee, Shannon Bell, Amanda Morris, Gaurav Anand,
John Shewchuk, Ryan Berotti

Executive Summary: Energy Opportunities Subcommittee

Virginia Tech's direct energy use and consumption of electricity amounted to 90% of its GHG emissions in 2019. The campus centralized energy systems and electric utility date back to the founding of Virginia Tech and provide a proud history with continual improvement and integration within the university's educational mission. For the last five years, VT energy systems are being transformed, and the 2020 Climate Action Commitment (CAC) sets the stage for further innovation.

The VT CAC Energy Opportunities subcommittee evaluated the energy progress made in response to the 2009/2013 VT CAC; compared that progress to our peer universities; and developed new climate action goals and potential pathways to achieve them. It also identified some energy initiatives and projects that should be pursued in the short term between now through 2022.

Progress: Virginia Tech has made considerable progress in managing its energy systems, called for by items 3, 4, 5 and 7 of the 2009/2013 VT CAC. It has reduced GHG emissions by 24% from 2006 while campus space and enrollment have grown by 22%.

There are **three primary reasons** for this reduction of emissions:

1. **Fuel switching** from coal to natural gas in the steam plant. The 2015 natural gas pipeline shifted coal dependence (97% in 2009) to natural gas (80% in 2019) with a significant decrease in GHG emissions.
2. **Apco's electricity fuel mix** became less carbon-intensive, shifting from 90+% coal in 2006 to 63% in 2018. Apco electricity still amounted to 52% of VT GHG emissions in 2019.
3. **Investment in efficiency** has led to
    a. 36 new buildings and major renovations totalling 3 million square feet built to LEED green building standards; and
    b. Energy efficiency retrofit of energy systems and existing buildings through the 5-year 2015-2020 Energy Management Plan that invested $14.2 million in academic (E&G) buildings and resulted in energy savings estimated to pay back the investment in 5.3 years. E&G buildings reduced electricity use by 8% from 2015 to 2019 despite 1% space growth.

Still, the **2009/2013 VT CAC was limited** in both its GHG footprint and in its vision for necessary GHG emission reduction. The footprint did not include agriculture operations or leased building space and the vision still would leave us with considerable GHG emissions in 2050. Our 2020 VT CAC aims to correct these limitations by adding previously omitted operations in the GHG footprint and choosing a bold and aggressive goal of becoming carbon neutral by 2030.

Comparison to Peer Universities. For energy systems peer review, we selected the University of Virginia (UVA), Penn State University, and University of Maryland (UMD). UVA aims to be carbon neutral by 2030 and fossil fuel free by 2050, and Penn State and the UMD respectively aim to reduce GHG emissions by 35% by 2020 and 60% by 2025. Each university has a clear plan with completed projects. UVA and Penn State incorporate renewable energy Power Purchase Agreements into their climate action plans. UMD has 9,000 solar panels on their campus. All three have a designated energy management office, and UVA and Penn State have an energy center. UMD utilizes the Energy Dashboard and Solar Dashboard tools to help manage its energy and display data for faculty, students, and staff.

2020 VT CAC Energy Goals and Pathways (see also Goals 1, 2, 4, 5)

Goal 3: Eliminate Coal after 2024 and Improve Efficiency of Campus Energy Systems

- **2015 natural gas pipeline** enabled steam plant coal fuel to drop from 97% in 2009 to 20% in 2019. With addition of gas boiler #12, we will have natural gas thermal capacity to be coal free.
- **For reliability and resilience**, to eliminate coal, the steam plant will need
  - **Backup fuel** (such as liquefied natural gas (LNG), biochar, or other fuel) when natural gas market is tight or unavailable, and
  - **Boiler redundancy** (termed "n+1") in case of a boiler outage at a critical time. Converting a coal boiler to biochar or natural gas can provide this.
  - Scheduled upgrades to the steam plant will incur necessary costs of doing business. Eliminating coal and reducing GHG emissions should be part of those plans.
- VT's **natural gas service contract** will be renewed June 2020 and the new contract will determine the conditions and need for backup, price terms, and possibility of some renewable gas.

Potential pathway:

- By 2023, develop a **plan eliminating coal while providing resilience backup fuel** in cold weather or interrupted natural gas supply. The backup fuel need will be affected by the terms of the 2020 natural gas contract. Options include:
  - Liquefied natural gas (LNG). This can be provided by LNG storage at Old Southgate site where it can be tapped into the existing ATMOS pipeline ($1 million) or better yet at the steam plant if coal storage and baghouse emission control can be removed.
  - Renewable fuels, such as syngas or biochar.
- **Improve chiller efficiency**:
  - By 2023 the Chiller Plant Phase II project will reduce central chiller energy usage by 20% from 2020.
  - Ten-year 2021-30 Energy Management Plan will improve efficiency of stand-alone chillers.
  - Future campus growth needs for chilled water will be met from central plants where possible.
- By 2023, develop a plan for **boiler n+1 resilience** backup, dependent on decision for back-up fuel.
- Continue to explore **options for renewable gas** from service provider's contract as a means to reduce natural gas emissions and/or offset natural gas electricity from the steam plant cogeneration.
- As part of the Campus Climate Action Living Laboratory, engage faculty, staff and students to develop an online **Energy Dashboard** for users to obtain and analyze energy use data for campus facilities
- After 2025, explore geothermal and ground source heat pump systems and other **non-fossil-fuel options for heating new districts of campus**.

- In advance of moving toward a 2050 goal of being fossil-fuel free, the University should evaluate options for non-fossil fuel heating.
- New districts being considered on campus should evaluate hot water rather than steam heating systems. Understanding the extreme cost of extending steam tunnels, hot water systems sourced by the existing steam loop are already being explored for new districts.
- Conversion of steam to hot water central heating systems is being considered at other universities and offers the prospect of efficient geothermal and ground source heat pump heating and cooling systems in conjunction with renewable electricity.

Immediate Energy Initiatives/Projects. Although the 2020 VT Climate Action Commitment focuses on 2030 as the target date for most of its goals, the pathway to those goals begins the day the CAC is adopted, if not before. While understanding the current budget constraints of the university resulting from the Covid-19 pandemic, the Energy Opportunities subcommittee identified six actions to be considered for implementation as soon as practicable.

- Implement ongoing projects to improve steam plant and upgrade chiller system
- Evaluate new 2020 natural gas contract on implications for CAC goals and pathways
- Develop plan for resilience/redundancy in steam plant to eliminate coal by 2024
- Initiate the 10-year 2021-2030 Energy Management Plan, formulate Year 1 projects
- Develop solar projects on campus using PPA: 2.3 MW by 2022
- Develop a Utility Master Plan

VT GREENHOUSE GAS (GHG) FINAL REPORT: CLIMATE ACTION COMMITMENT PROGRESS REVIEW AND RECOMMENDATIONS

VT CAC WORKING GROUP - GHG SUBCOMMITTEE

SEAN MCGINNIS, JOHN RANDOLPH, KRAY LUXBACHER, ROB LOWE, LOWELL JESSEE, MARY-ANN IBEZIAKO, VALENTINA D'ATRI, OWEN CALLAHAN, ALEX DE JONG, CONOR DOANE, DREW HARRIS, ALEXANDRA KAHL, NATALIE KOPPIER, JACK LEFF, DANIEL WEBB

Spring 2020

EXECUTIVE SUMMARY

VT has completed a Greenhouse Gas (GHG) Inventory and Assessment since 2007 as part of its Climate Action Commitment (CAC). GHGs are chemicals which, when emitted into the atmosphere, absorb heat and lead to global warming. A GHG Assessment, often called a *carbon footprint*, is a critical component of the CAC since it sets a baseline for campus emissions and goals. It also provides a means to quantify the various sources of emissions so that detailed plans can be developed for future emissions reductions. Without a good GHG Assessment, plans and goals may or may not reduce emissions and there is no accountability. Claims of carbon neutrality, which requires reducing or offsetting all included scope emissions to zero, require a GHG assessment to confirm compliance.

It is important to acknowledge that all GHG assessments are incomplete at some level. It is not possible, nor a good use of time and energy, to compile all GHGs over the life cycle of campus operations. Difficult choices are required to select the campus elements which are considered in and out of scope for carbon neutrality goals. Selecting a scope that is too large requires time-consuming analysis and efforts for minimal emissions, while selecting a scope that is smaller can miss significant emissions and opportunities to highlight and reduce some emission sources. Historically, campus carbon footprints generally include all of so-called Scope 1 (direct campus fuel use and fugitive sources) and Scope 2 emissions (utility electricity generation carbon emissions), and some Scope 3 emissions (all other emissions due to campus activities as well as utility transmission & distribution losses and upstream methane leakage). A wide range of decisions have been made for Scope 3 campus emissions among the peer institutions researched.

In-scope elements in the VT GHG Assessments have included campus purchased electricity, steam plant and building fuels, faculty/staff/student commuting, fleet vehicle and aviation fuel, water, wastewater, and solid waste. Using this scope, the VT carbon footprint has been dominated by purchased electricity and steam plant and building fuels which have accounted for approximately 90% of the campus footprint. Through aggressive campus energy system improvements, the transition of the steam plant fuel away from coal to natural gas, and a similar fuel switch by our electricity utility, VT emissions have been reduced almost 24% while campus square footage and enrollment have increased by more than 20% since 2006.

These significant improvements, however, are based only on carbon dioxide (CO_2) emissions. They do not include any methane (CH_4) emissions from upstream leakage of natural gas. Methane is a much more powerful GHG than carbon dioxide, and its omission from the scope of these assessments is important to note since much of the reductions are attributed to the use of natural gas which has lower combustion emissions than coal. Estimates of the overall emissions, including leakage of 2.0 - 2.5%, suggest that including their effects would increase the VT carbon footprint by approximately 7 - 9%. Natural gas extraction/distribution and the associated methane leakage is a controversial topic, especially in East Coast communities near hydraulic fracturing sites or close to new natural gas pipelines as is the case for Blacksburg. However, most universities consider these emissions out of scope and do not include them for carbon neutrality goals.

Past VT GHG Assessments have also left out of scope several other emission sources. Only carbon dioxide emissions have been estimated while methane (CH_4) and nitrous oxide (N_2O), primarily from agricultural operations as well as natural gas leakage, have been omitted. Emissions from the BT bus system, business air travel, dining service food, upstream utility transmission and distribution losses, and VT Foundation properties occupied by VT have also been omitted. Including all of these elements in scope is estimated to increase the VT carbon footprint by 41 - 54%.
Based on the GHG Assessment and analysis, the 2020 CAC recommends a Carbon Neutral Virginia Tech Campus by 2030, where carbon neutral is defined as net-zero emissions of CO_2, CH_4, and N_2O by VT operations for all Virginia Tech owned lands and buildings on the main campus, all buildings leased by university departments in Blacksburg, and agricultural/forestry operations and lands in the Blacksburg region. The GHG scope for carbon neutrality will include all Scope 1 and 2 emissions. The following Scope 3 emissions will also be included based on the availability of data and feasibility of analysis: faculty/staff/student commuting, Blacksburg Transit (BT) bus fuel, waste/recycling/compost, water/wastewater, and commercial business travel.

Other Scope 3 emissions will not be included in 2030 carbon neutral scope, primarily due to challenges in and significant uncertainties in the accuracy of the data analysis. These include upstream leakage of methane from natural gas extraction and distribution and upstream emissions for dining hall food. These are the two emissions sources found to be excluded from the majority of peer institutions GHG assessments and carbon neutrality goals. However, since these emissions may be significant, can be controlled by operational or student choices, and are very important to some stakeholders on campus, these will be tracked and analyzed as part of the annual GHG inventory.

Emissions from other Virginia Tech locations across the state and in other countries will not be included in the 2030 carbon neutral scope. However, methods and protocols developed for the VT GHG Assessment will be shared by 2022 to other VT operations in the Commonwealth that will be encouraged to establish their own GHG reduction targets, goals, and pathways.

Feasible pathways to this 2030 carbon neutrality goal based on GHG analysis include:

- 100% renewable electricity by 2030 which can reduce emissions by 50% below 2019
- The elimination of coal use by 2024 can reduce GHG by 10% below 2019
- The reduction of energy use in existing and new buildings which can further reduce emissions by 10% despite campus growth
- The implementation of pathways in waste/recycling, transportation, agriculture, forestry, and land use which can reduce emissions by 10%

Remaining GHG emissions in 2030 can be negated by carbon offsets, preferably on campus or regionally.

Virginia Tech 2020 Climate Action Commitment Working Group
Peer Comparison Subcommittee Report

All Subcommittees, John Randolph, Allie Kahl

Executive Summary--Peer Comparison

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

1. to see how we are doing,
2. to borrow and steal good ideas, and
3. to show we are not crazy with our bold and aggressive climate action.

Knowing that our perspective is comprehensive and that other universities have different strengths in different areas, we decided to have our specialty subcommittees select the peer and exemplary universities to assess in their specialty area. Those areas include

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

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

All in all, our peer review 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 stand up well in comparison to others, but if Virginia Tech is to regain its leadership role in climate action and sustainability, we need to move to a new Climate Action Commitment that is right for this time.

Of course, that is what we have set out to do, and we believe that we have found the right balance of aggressive, yet pragmatic climate action. Our goals are for carbon neutrality by 2030, 100% renewable electricity by 2030, investment in energy efficiency in existing and new buildings, carbon neutral agriculture, zero-waste campus, sustainable procurement, sustainable mobility, climate justice as a core value, and community engagement and the Climate Action Living Laboratory to integrate these goals into the fabric of the university.

Relative to our peer and exemplary universities reviewed in this analysis, this 2020 VT Climate Action Commitment is not crazy, it does borrow and steal great ideas from those exemplars, and it not only compares well to others but actually sets the stage for Virginia Tech to be an exemplar and leader in university climate action.

Virginia Tech 2020 Climate Action Commitment Working Group
Renewables Opportunities Subcommittee Report

Rob Glenn, John Randolph, Chen-Ching Liu, Kim Briele, Mary-Ann Ibeziako, Lowell Jesse, Sean McGinnis, Shannon Bell, John Chermak, Ron Meyers, Carol Davis, Rachel Spector, Heidi Hahn, Paul O'Horo

Executive Summary

Virginia Tech is unique in having its own electric utility **Virginia Tech Electric Service (VTES)**, dating back to the 1890s when it made Blacksburg the first town in SWVA with electric power. The steam and power plant became instructional tools for electrical and mechanical engineering departments. The 2020 Virginia Tech Climate Action Commitment (CAC) calls for VTES to continue that role of advancing new technology integrated with the university's educational and research mission.

The CAC Working Group's Renewables Opportunities subcommittee of 14 faculty, staff, students and community members explored the possibilities for Virginia Tech to provide leadership in climate action by advancing renewable energy from non-carbon sources. It reviewed progress to-date; compared VT to peer universities; developed an aggressive goal and pathways to achieve it; and evaluated their impacts. The subcommittee also identified some energy initiatives and projects that should be pursued to demonstrate VT's commitment in the short term between now through 2022.

Our aggressive goal is to have 100% renewable electricity by 2030. **We have a long way to go.** We have done little so far to develop renewables, and we lag well behind our peers including the University of Virginia and the College of William & Mary. We are constrained by a long term purchase agreement with Appalachian Power Company (Apco, a part of American Electric Power (AEP)). And we have been dealt a financial blow as a result of the Covid-19 pandemic.

But our pathways to 100% renewable electricity recognize these constraints and provide a **realistic scenario for success in the next decade**, supported by new state mandates and initiatives, a mutually beneficial partnership with Apco, creative financing through power purchase agreements (PPAs), and instructional and research benefits of renewable energy projects for the campus Climate Action Living Laboratory (CALL). Already VTES has formed a partnership with VT Power & Energy Center (PEC) to collaborate on **VT Smart Grid research**.

A collaborative partnership with Apco is a key component of our strategy, since the utility is now mandated to achieve 100% renewable electricity by 2050 with interim requirements for 14% by 2025, 20% by 2027, 30% by 2030, and 65% by 2045. VTES believes it can negotiate the 100% goal prior to the expiration of the current 2027 contract with AEP for no more than it is currently paying. Various opportunities of mutual benefit are already being discussed by VTES and AEP.

VTES can utilize a Portfolio Approach to achieve the renewable energy goal that include campus-based, VT-owned or 3rd-party-owned solar; direct purchase of power or PPA from Apco/AEP renewable sources, solarized customers within the Town, and a financial tool called Renewable Energy Credits (RECs). ***As a first step toward VT's CAC leadership and renewables goal, VTES purchased RECs from Apco in March 2020 that achieved 30% renewable electricity for VT--two years ahead of the Governor's 2022 deadline for state agencies.***

Other short term initiatives recommended by the subcommittee include:

- 2020 RECs for 30% Renewable Electricity
- Implement Sterrett and other Rooftop Solar Projects
- Initiate student project for Fishburn Wind Energy Assessment
- Promote VTES-PEC partnership as part of Climate Action Living Laboratory
- Initiate partnership with APCo on renewables
- Initiate community relations with VTES Town customers
- Obtain external funding for agrivoltaics test array at Catawba Sustainability Center

Here is the 100% Renewable Electricity goal and pathways to achieve it:

VT CAC Goal #2: 100% Renewable Electricity by 2030

- **Solar energy projects on VT** lands and campus building rooftops. These can be VT owned or 3rd party owned with a VT power purchase agreement (PPA).
- **Power purchase agreements** (PPA) with utility or 3rd party-owned projects in Southwest Virginia
- Other PPAs or virtual PPAs.
- **Assist Appalachian Power's increasing of its renewable portfolio**, which is now 10% and by new state law is required to be 14% by 2025 and 30% by 2030.
- **Renewable energy certificates** (RECs) or purchased MWh credits from utility or 3rd party.

Achieving 100% renewable electricity by 2030 assumes **60% renewable generation** plus **30% APCO renewable portfolio** and **10% RECs** in recognition of steam plant cogeneration.

The pathways assume a combination of solar on **VT buildings and land (15 MW)** owned by VT or 3rd party PPA and 3rd party- owned and APCO-owned SWVA **PPA capacity (130 MW**+15 MW=145 MW). **Capital costs** of VT owned solar systems are assumed to be $2/W for <0.5 MW projects and $1.50/W for >1MW projects.

- Total capital cost for 15 MW on VT buildings/lands would be about $25-30 million.
- Total capital cost for 145 MW would be over $200 million.
- Best PPA contract rates on the market are 20-year, non-escalating flat rate of ~7¢/kWh.

While utility/3rd party PPAs are assumed to be preferred approach for off campus solar projects, on-campus projects can be either VT-owned or utility/3rd party owned with PPAs.

- Advantages of VT owned and managed renewable systems are greater control, reduced long-term electricity cost and greater financial return; and disadvantages are high initial capital investment and operation/maintenance requirements; i.e. where small campus-based systems make sense and large utility-scale systems do not.
- Advantages of PPAs are little or no initial capital costs and no operation/maintenance cost; and disadvantages are potentially higher electricity costs and less operational control.

Pathway: Potential development timeline and options:

2020: achieve 30% renewable electricity via purchase of 20% renewable energy certificates (RECs) from APCO + APCO 10% renewable portfolio. VT achieves 2 years early the Governor's E.O. 43 requirement that all state agencies procure 30% renewable electricity by 2030.

2020-22: 2.3 MW on VT bldgs/land including "signature" solar array perhaps on Old Southgate Dr.

- Option 1: VT finance and own: 2.3 MW @ $2/W $4.6 million
- Option 2: 3rd party PPA: no upfront cost, pay per kWh; 25-year contract, 5 year buyback option
- Option 3: Sterrett 0.33 MW and 2nd building 0.67 MW through 3rd party PPA, learn from experience then VT finance and own remaining 1.3 MW ($2.6 million) signature project

Beginning 2021: Incorporate campus and region VT renewable electricity development by Virginia Tech Electric Service (VTES) into VT educational mission through **Virginia Tech Climate Action Living Laboratory** with faculty, student, and staff instructional, research, and outreach opportunities.

2021: assess VT Fishburn Forest atop Price Mountain and other sites for cost-effective wind energy; engage students/faculty and partner with JMU to conduct a wind study.

2022-27: Continue to work with APCo to be a primary customer of their renewable capacity as they develop it to meet state requirements. APCO just completed an RfP solicitation for 250 MW of renewables in March and as this capacity is developed, VTES could contract for the output. Under Virginia Clean Economy Act, APCO is required to achieve a 14% renewable portfolio by 2025, 20% by 2027, 30% by 2030, 65% by 2049, and 100% by 2050.

2022: 0.25 MW net-metered solar town customers doubled VTES distributed capacity. Customers cover cost but VTES could facilitate/incentivize customers with VTES Solarize program. RECs owned by customers, but VTES could buy their RECs.

2023: 0.5-1.0 MW community solar for VTES customers, possibly located on airport land off of Hubbard Dr. VTES would own RECs.

- Customers buy shares in 100 kWh blocks for $10/block (10c/kWh) for 20 years.
- Production 500 kW = 500 kW*1,314 kWh/yr/kW = 670,000 kWh/yr (6,700 shares)
- Revenue = $67,000/yr * 20 yr = $1.34 million (present value = $1 million, 20 yr, 3%)
- Capital cost: 500 kW * $2/W = $1 million

2025: add 10 MW solar capacity on campus and on VT land in region in cooperation with APCo (still within 2027. Use solar installations at Kentland Farm and Catawba Sustainability Center to study "agrivoltaics," or agricultural production on solar farms. 10 MW @ 6 ac/MW= 60 ac.

- Option 1: VT finance and own: 10 MW@ $1.50/W = $15 million
- Option 2: 3rd party PPA: no upfront cost, pay per kWh; 25-year contract, 5 year buyback option

By 2027 (APCO contract renewal date), 50% renewable electricity via campus and VT land capacity (10 MW), APCo power purchase agreements (PPA) in southwest Virginia (including reclaimed mine land) (35 MW), APCo renewable portfolio (20%), and virtual PPA (VPPA) and/or RECs (10%) (e.g., 20% production (45 MW)) + 20% APCo portfolio + 10% purchased PPA/VPPA/RECs)

By 2027 or earlier, add 10 MW energy storage to campus renewable capacity and use VTES as a testbed and showcase for innovative smart micro-grid reliability and resilience research through a partnership between VTES and the VT ECE Power & Energy Center using shared SCADA data and in collaboration with APCo.

By 2029 add 95 MW solar capacity via campus and VT land capacity (+5 MW, total 15 MW) and PPA with APCo and/or 3rd party in southwest Virginia (+90 MW, total 120 MW).

By 2030, 100% renewable electricity with 60% renewable production (VT solar (15 MW) and APCo+3rd party PPA in southwest Virginia (130 MW)), 30% APCo renewable portfolio, and 10% VPPA and/or RECs

As with all components of this CAC, full **lifecycle analysis** should include the environmental and social justice costs and benefits of procured systems, including sources and decommissioning of photovoltaic systems, requiring end-of-life recycling.

Siting renewable energy systems should employ the best practices of public engagement to identify the most appropriate sites considering compatible uses and economic, environmental, and social effects

VT should **work closely with VDMME** to to take advantage of state grant programs for agencies and universities to meet the Governor's Executive Order 43 and 2020 legislation.

Virginia Tech 2020 Climate Action Commitment Working Group
Structuring Sustainable Choices Subcommittee Report

Todd Schenk, Blake Bensman, Nathan King, Jack Leff, Allie Kahl, Drew Harris

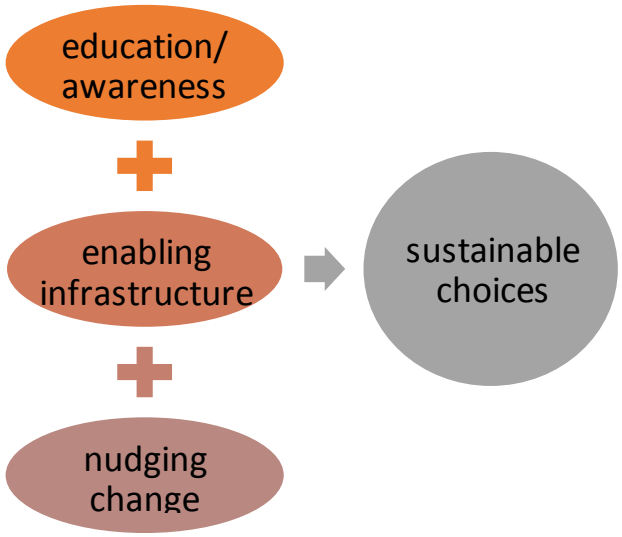
Executive Summary: 2020 VT CAC Structuring Sustainable Choices Subcommittee

The Structuring Sustainable Choices subcommittee was not one of the original groups created to support the 2020 Climate Action Commitment update. The idea of creating this subcommittee emerged later from the recognition that many of the challenges discussed during working group meetings involve, at their core, behavior change. That is to say, they are about the various choices individuals make that enhance or inhibit progress in meeting our climate and other sustainability goals.

Subcommittee members started by making a short list of "problematic" or unsustainable behaviors evident within the Virginia Tech community based on the Greenhouse Gas Inventory data. This list included: unnecessary car commuting, improper disposal of waste, unsustainable food choices in dining halls, and low return rates of reusable to-go containers in dining halls. The next step was to understand the *underlying structures* that enable or encourage these unsustainable behaviors. This is critically important because the group recognizes that behavioral choices are not just about individuals being educated and expected to make good decisions, but, perhaps more importantly, about how they are supported and *nudged* into making better or worse choices. The next step was thus to explore how structures could be changed to discourage unsustainable behavior, and more importantly, facilitate sustainable behavior.

Our model of understanding behavior change was informed by practice and scholarship in behavioral psychology and behavioral economics, and the associated domains of ***social marketing*** and ***choice architecture***. It recognizes that sustainable choices are rooted in three key pillars:

- **education** around *why* certain behaviors may be more or less sustainable and *what* the more sustainable choices entail;
- **infrastructure** to make it easier to engage in sustainable behaviors and harder to engage in unsustainable ones; and
- **timely prompts** that remind people of the (more) sustainable choices they can make at appropriate junctures (i.e., when they are making decisions between behaviors).



The work of the CAC Structuring Sustainable Choices Subcommittee is largely embodied by Goal #12 of the 2020 Climate Action Commitment.

Goal #12. Diminish Barriers to Sustainable Behaviors through Both Institutional Change and Persuasive Social Marketing

Most of the goals of the 2020 Climate Action Commitment deal with strategies to improve the efficiency of buildings and energy systems, replace coal and add renewable energy infrastructure, develop a compost system, and enhance sustainable mobility. However, achieving carbon neutrality also depends on ensuring students and university employees are able to carry out their business sustainably. Including considering how much they recycle, compost, turn off lights, commute using a bike, and make a litany of other choices that reduce the university's carbon footprint.

Recognizing this, the Climate Action Commitment Working Group has intentionally included several *scope 3* emissions in our greenhouse gas inventory and associated carbon neutrality goal. Many of the scope 3 emissions are those resulting from behaviors, such as waste, water, commuting, and business travel. As discussed in the greenhouse gas inventory subcommittee section, this inclusion of scope 3 emissions distinguishes Virginia Tech from its peers and taking them seriously through restructuring choices to be more sustainable further solidifies our role as an environmental leader.

Sustainable choices are about structuring institutions and infrastructure to facilitate sustainable individual behaviors. By leveraging structural changes, incentives, disincentives, educational programs, and games, these choices can and must be made much easier, cheaper, safer, and more enjoyable. The Structuring Sustainable Choices group has focused on how university units can 'nudge' community members towards adopting behaviors that will reduce our greenhouse gas emissions.

Potential Pathways

We have identified the following potential pathways to encourage more sustainable behaviors:

- **Modify structures**—from waste management to transportation—to **make sustainable choices easier**
- **Identify unsustainable behaviors** on campus, the **structures that support them**, and then **modify structures** to make **sustainable choices easier**
- Nurture **cross-campus partnerships** to coordinate climate action and enhance sustainability initiatives
- Establish the **Structuring Sustainable Choices Committee** as a working group of the new Climate Action, Sustainability, and Energy (CASE) Committee (currently the Energy & Sustainability Committee (E&SC) to **facilitate continued dialogue** on structures and programs to **enhance sustainable behavior**.
- Partner with Experience VT and Dining Services/ Housing and Residence Life Sustainability Managers to **integrate sustainability into the new Experience VT app**. Experience VT allows students to **learn more about** the university's commitment to **sustainability** and maximize their opportunity to **engage in sustainability at VT**.
- Craft an **ongoing** university survey that enables university departments to **submit their own** university **sustainability goals, aspirations, and current infrastructure challenges** that may prevent their goals/aspirations from being achieved.
- Develop a **shared toolkit** of best practices in social marketing, rooted in **behavioral sciences**, for campus groups **initiating** sustainability initiatives
- **Drive engagement** via social media and web pages using **call to action** opportunities, surveys, stories/interviews, facts/figures, event promotions, and ongoing reminders.

Virginia Tech 2020 Climate Action Commitment Working Group
Transportation Opportunities Subcommittee Report

Nick Quint, Mike Dunn, Durrelle Scott, Greg Tew, Janet Rankin,
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EXECUTIVE SUMMARY

The 2020 Climate Action Commitment (CAC) subcommittee on Transportation Opportunities included a group of 12 faculty, students, staff, and Town members seeking to enhance Virginia Tech's mobility patterns to reduce environmental effects and improve the livability of the campus community. The subcommittee assessed progress made to implement the 2009 VT CAC and Sustainability Plan (SP), compared the VT experience to peer universities, and developed a new set of transportation goals and pathways as part of the 2020 VT CAC.

The public guidelines in response to the COVID-19 pandemic will likely continue through fall 2020. They present a challenge across the transportation sector to facilitate safe, physically-distant movement through campus between classes and during daily commutes. An immediate priority for the health and safety of our students, faculty, and staff is to provide additional space beyond sidewalks and the limited bicycle lanes for walking and bicycling. Immediate actions taken to improve walkability and bikeability will go towards showing Virginia Tech's commitment to prioritizing health and safety during this crisis. Furthermore, this provides a longer-term platform for alternative transportation, which otherwise may decline if students see driving to campus as their only choice. It should also be noted that teleworking and on-line instruction became the norm in the spring and will be a mainstay for the fall. There are lessons to be learned about patterns of working and instruction that reduce needs for car commuting to campus and resulting reduction of traffic and emissions.

Transportation Greenhouse Gas (GHG) Emissions

The overall goal of the VT 2020 CAC is to achieve carbon neutral campus operations by 2020. How does transportation relate to that goal? Virginia Tech transportation-related GHG emissions for the 2020 VT CAC include:

- Scope 1 GHG: fuel for fleet vehicles and other campus vehicles, aviation fuel for VT airplanes.
- Scope 3 GHG: student, faculty, staff commuting to campus; Blacksburg Transit (BT) fuel; business air travel.

The 2009 VT CAC & SP did not include BT or business air travel. 2019 transportation GHG emissions under this more limited scope were about 20,000 MT CO_2e, 8.4% of total VT emissions. About 80% were from commuting, 13% from fleet vehicles, and 7% from aviation fuel.

The 2020 CAC addition of BT fuel adds 3515 MT CO_2e or 1.4% of total VT emissions and business air travel adds 5000-7500 MT CO_2e or 2-3%. Overall, transportation 2020 GHG scope will be about **12% of total VT emissions**.

Progress. Since the 2009 VT CAC & SP, Virginia Tech and Blacksburg have made considerable progress in developing alternative transportation choices, including

- A 50% increase in BT ridership;
- BT has nine hybrid-electric buses of its 53-bus fleet; BT has also ordered five electric buses;
- A 32% increase in campus bicycle rack capacity (since 2013);
- The launch of Roam NRV bike share (since 2018, 11,000 trips and 28,000 miles);
- Shuttles and bus service to Roanoke and Northern Virginia;
- Car- and ride-share programs; and
- Recognition as a *Best Workplace for Commuters* every year since 2009 (Best of the Best in 2014) and as a *Bicycle Friendly University* at the bronze level (2012-18) and silver level (2019-22).

The 2016 *Parking and Transportation Master Plan* calls for further improvements in bicycle infrastructure and parking management, and *Beyond Boundaries 2047: The Campus Plan* includes the Infinite Loop and Green Links to improve mobility for all users.

However,

- Single-occupancy vehicle (SOV) commuting increased 10% from 2014 to 2018;
- There is an oversupply of parking (2000 spaces sit empty on any given day);
- Parking permit prices are cheap and provide no incentive for alternative commuting;
- Student orientation and employee onboarding do not include education on transportation options;

- VT is one of only a few universities that allow freshman to bring cars to campus; and
- University motor pool vehicles do not use alternative fuels.

The subcommittee's guiding principles in developing goals and pathways were to:

- Prioritize moving the most people over moving the most cars;
- Emphasize safety;
- Consider equity issues;
- Emphasize collaboration with the Town of Blacksburg and other localities; and
- Develop cost-effective solutions.

The principal goal below relates to reduction of GHG emissions in accord with the overall CAC to strive for carbon neutrality by 2030. But the subgoal to reduce SOV commuting, and the pathways to enhance alternative transportation and pedestrian and bicycle mobility, speak more to making the campus a more livable environment.

Goal #9. Reduce Transportation-Related GHG Emissions 40% from 2020 levels by 2030

9.1 Reduce Single-Occupancy Vehicle Commuting To Campus 20% from 2020 levels by 2025

Potential Pathways to Achieve Transportation Goals

a. Make walking/bicycling/transit the preferred means of commuting to campus. Use parking policies, alternative transportation programs, campus mobility planning in collaboration with the Town of Blacksburg, and BT programs to improve safety and convenience and promote walking/bicycling/transit.

- By 2022, provide **better data on student and staff commuting behavior** and reasons for that behavior through surveys and other means to monitor progress.
- **Promote sustainable mobility choice** through good marketing including social media, parking permit literature, university promotion literature/website, student orientation materials, and other means.
- Follow other Virginia universities in **prohibiting freshmen** from being able to purchase a parking permit to help students develop less car-dependent culture and behavior.
- **Enhance BT** as a commuting choice through education, marketing, coordinating with other transit orientations, development of the Multi-Modal Transit Facility (MMTF), and other means.
- Upgrade VT's **Bicycle Friendly University ranking** from silver to gold.
- Parking demand management.
    - **Increase parking permit prices**. For employees, implement on a sliding income-scale. Use additional revenue to fund sustainable transportation improvements.
    - Consider moving away from annual and **toward automated daily fee parking permits** so people have to think about paying for parking every time they drive to campus.

b. Promote non-commuting work and learning opportunities

- Based on experience from COVID-19 pandemic, promote teleworking, innovative online instruction, video conferencing, compressed workweek schedules, and other means to reduce travel demand.
- Work with Human Resources to identify opportunities and barriers to increasing teleworking.

c. Improve infrastructure and traffic controls to improve mobility choices and safety

- **Improve safety** of vehicle, bicycle and pedestrian mobility on campus.
    - Reduce the speed limit on all core campus streets to 15 miles per hour.
    - Improve lighting on walking and bicycle paths.
    - Maintain shared-use paths and bicycle lanes.
    - Improve network connectivity and consistency throughout campus.
    - Limit/restrict vehicles in the core of campus by gating streets at strategic locations (consider Drillfield Drive, Alumni Mall, Kent Street, West Campus Drive, and Stanger Street).

- **Implement infrastructure recommendations** in the *Parking and Transportation Master Plan* and *Beyond Boundaries 2047: The Campus Plan*.
  - Infinite Loop, Green Links, Expand Bicycle Lanes on Kent Street and Washington Street
  - Multi-Modal Transit Facility
- **Coordinate with Town** transportation and corridor plans to improve connectivity and safety between campus and town.

d. Improve vehicle efficiency and promote low-carbon emissions vehicles

- Require **University fleet vehicle** purchases, and encourage BT, to emphasize fuel efficiency through zero-emission, hybrid, and electric vehicles.
- Although transportation emissions per vehicle-mile will naturally decline with improved vehicle efficiency and increased electric vehicle ownership, changes in commuting mode are necessary to achieve GHG reduction goals and a more livable and less car-oriented campus.
- **Support electric vehicle use** by installing a mix of charging station types in parking garages, at Fleet Services, and at other locations.

e. Promote social equity in mobility and parking policy

- Develop effective and efficient **commuting options for lower-wage employees** who cannot afford to live in Blacksburg, including vanpools, park & ride lots, and other means.
- Implement **sliding income-scale pricing** for parking permits.
- Collaborate with the Town to provide **affordable workforce housing** proximate to campus.
- Build **more residence halls on campus** to free up more off-campus housing for staff.

f. Reduce and negate business travel GHG emissions

- **Encourage car sharing and transit use** for business travel.
- By 2030, **negate business airline travel emission with carbon offsets**.

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

In addition the subcommittee recommended initiatives and projects that could be implemented in the short term (2020-2022) to get a jump-start on action and demonstrate the university's commitment.

1. **Follow through on Infrastructure and Policies Currently under Development**
   Several projects are under various stages of development and will go a long way toward helping to achieve the goals presented herein:
   - **Infrastructure**: Construct the **Multi-Modal Transit Facility**; Extend the **Kent Street bicycle lane** towards the Drillfield; Construct green **bicycle lanes in strategic areas** where known safety problems exist; Construct the **green link** from the Perry Street area to Burruss Hall; Replace 16 remaining substandard **bicycle racks**; Improve **lighting and accessibility** of existing trails, sidewalks, and crosswalks.
   - **Policy**: Update **Policy 5005**, regulating personal transportation devices on campus.

2. **Near-Term Priorities**
   - Establish an **alternative mobility subcommittee** of the Transportation and Parking Committee
   - Install/**improve bicycle lanes** on Washington Street and Kent Street.
   - Dedicate consistent, **annual funds to maintain trails**, sidewalks, bicycle lanes, bus stops, bike racks, etc.
   - Require University **fleet vehicle purchases to emphasize fuel efficiency**
   - **Parking permit restructuring**: Prohibit on-campus freshmen from purchasing a parking permit; Increase the price of a faculty/staff parking permit and implement an income-based sliding scale.

Virginia Tech 2020 Climate Action Commitment Working Group
Waste/Recycling/Composting and Procurement Subcommittee Report

Blake Bensman, Denny Cochrane, Brandon Hendricks, John Randolph, Annie Pearce, Greg Evanylo, Jody Booze-Daniels, Rob Lowe, Reed Nagel, Casey Underwood, Anthony Purcell, Anthony Watson, Jennifer Russell, Greg Canaday, Teresa Sweeney, Amy Klinger

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Executive Summary

Virginia Tech to become a Zero-Waste Campus by 2030!

The Climate Action Commitment Work Group's Subcommittee on Waste, Recycling, Composting and Procurement took a fresh look at all aspects of campus waste management and procurement with the intent of identifying opportunities to minimize waste, increase efficiencies, improve environmental effectiveness, and reduce costs. We wish to apply to Virginia Tech the concept of **Circular Economy** or systems that employ reuse, sharing, repair, refurbishment, remanufacturing and recycling to create a closed-loop, minimising the use of resource inputs and the creation of waste, pollution and carbon emissions. To do that we must look at our materials flow, what comes into the university (Procurement) and what goes out (Waste and Recycling).

We began by conducting a comprehensive assessment of Virginia Tech's current waste management program. We critiqued our progress towards meeting the waste management goals as outlined in the university's original 2009 Climate Action Commitment and subsequent revision in 2013. Using the Association for the Advancement of Sustainability in Higher Education's "Sustainability Tracking, Assessment, and Rating System (STARS)" protocol, we compared our progress to that of our peer/exemplary institutions, as well as to those in the Commonwealth of Virginia. The Procurement Department plays a vital role in materials management, and we include their new *Sustainable Procurement Policy*. This report presents the 2020 CAC Waste, Recycling, Composting and Procurement Goals and pathways to achieve them, describes the pathways benefits and costs, and proposes four related initiatives worthy of immediate action.

Waste management at Virginia Tech is functional but is complex and fragmented across a number of departments, including Facilities Building & Grounds (trash and recycling from all buildings), Dining Services (food waste composting from 11 dining halls), Environment Health & Safety (hazardous and electronic waste), animal waste by relevant departments, Procurement for disposition of surplus property, and construction contractors for construction waste.

Virginia Tech partners with local jurisdictions in the Montgomery Regional Solid Waste Authority (MRSWA), through which solid waste is sent to the New River Resource Authority's landfill near Dublin and principal recyclable materials (PRM) are sent to Recycling and Disposal Solutions in Roanoke. Food waste composting, considered a recyclable material, is transported 77 miles to Royal Oak Farm (ROF) near Lynchburg, the only state permitted facility within 100 miles of Blacksburg.

Progress since 2009: In 2004, Virginia Tech had a recycling rate of 18% and doubled it by 2009. The 2009 Virginia Tech Climate Action Commitment (VTCAC) Point #8 stated: "Virginia Tech will adopt a goal of 35% recycle rate by 2012 and 50% by 2025." By 2012, the rate had increased to 44% as a result of food waste composting, so the 2013 revision to the VTCAC moved up the target date for 50% recycling rate from 2025 to 2020.

The local recycling facility Poplar Manor Enterprises went out of business in 2015, resulting in a three-year dip in our recycling rate until the new composting contract with ROF in 2017. The recycling rate has averaged about 40% since 2013. In 2019, 2,000 tons of waste were recycled (including 566 tons of food waste composting), and 4,000 tons of trash sent to the landfill. We achieved a 38.8% Recycle Rate and a 79.9% Waste Diversion Rate (waste diverted from landfill).

The Waste Management Program at Virginia Tech is functional; however, there are notable opportunities for improvement. The Subcommittee recommends having a waste audit to explore options of more efficient organization and management of trash, recycling, food waste, and other wastes. It also recommends the University develop a compost facility to process all campus food waste and animal and other organic waste.

Comparison with Peer and Exemplary Institutions. Based on the Association for the Advancement of Sustainability in Higher Education's (AASHE) Sustainability Tracking, Assessment, & Rating System (STARS), recognized at the national level as the best sustainability management tool for colleges and universities, Virginia Tech compares very well to its peers. From 2011 to 2017 Virginia Tech has received four STARS Ratings (2 Silver and 2 Gold). We earned our second STARS Gold Rating on December 19, 2017, with a score of 71.94. To date, this score represents the highest achieved for all colleges and universities in the Commonwealth of Virginia, and at that time was the highest achieved for any institution in the Atlantic Coast Conference.

We used STARS ratings to compare our waste management with peer and exemplary institutions, including: Penn State, Ohio State, Auburn, North Carolina State, Maryland, Clemson, Florida State, and Tennessee. In addition, we compared our performance with several Virginia schools: University of Virginia, William & Mary, Virginia Commonwealth, James Madison, George Mason, and Radford. While we have made significant waste management progress in the past two decades, clearly we have room for improvement. Several of the peer universities have higher recycling rates, many are working toward becoming a zero-waste campus, and some have university compost facilities.

2020 VT CAC Goals and Pathways: Waste/Recycling/Compost + Procurement

2020 VT CAC Goal #7. Virginia Tech to become a Zero-Waste Campus by 2030

As defined by industry, a **"Zero-Waste Campus" has a 90% or greater Waste Diversion Rate** or waste kept out of the landfill (Source: Zero Waste Alliance).

7.1. Increase waste diverted from landfill-including construction waste- to 85% by 2025.

For CY 2019, Virginia Tech achieved an 80% waste diversion rate. For the past decade the rate has averaged 70%, with a low of 47% (2066), and a high of 84% (2011, 2012). The waste diversion rate takes credit for construction waste from new construction and major renovations. In a robust construction year, the waste diversion rate will increase significantly. The university owned quarry produces about 1,000 to 2,000 tons/month of Hokie Stone scrap material or overburden, which is crushed into useful gravel and can be included in diverted waste.

7.2. Increase waste recycling rate to 55% by 2025.

For CY 2019, Virginia Tech achieved a 39% recycle rate. Recycling rate has remained relatively constant at or near 40% for the past decade.
For CY 2019, Virginia Tech recycled a total of 2,000 tons of principal recyclable materials:

- 750 tons sent to MRSWA at a cost of $25,875 ($34.50 per ton) plus contractor cost for storage containers and collection and transport fees; and
- 566 tons of food waste for composting sent to ROF at a cost of $84,900 ($150 per ton) plus contractor cost for collection and transport of food waste to the ROF sledge container at Prices Fork Closed Landfill.
- 684 tons sent to a number of other organizations with varying costs

7.3. Reduce waste to landfill per faculty/staff/student by 25% by 2025.

For CY 2019, Virginia Tech sent 4,000 tons of trash (municipal solid waste) to the landfill or 200 pounds per person based on a university population of 40,000. The goal is to reduce this by 25% or to 150 pounds per person by 2025.

Pathways to Goals:

a. To enhance campus waste management, **hire a Zero-waste Consultant** to conduct a waste audit study and plan to evaluate current organization, equipment, procedures, and staffing.

A third-party zero waste consultant is critically needed to objectively evaluate waste operations for E&G facilities, auxiliaries, and the athletic department to identify opportunities to streamline operations, maximize efficiencies and reduce costs.

b. Improve Oversight of Waste/Recycling/Composting

Based on consultant recommendations, improve organization of waste management with options of hiring a waste manager to manage all aspects of campus waste management or coordinating existing personnel and activities through a Waste/Recycling Council to help streamline operations and reduce redundancies.

c. **Develop University Compost Facility at Kentland** to process campus organic food waste, veterinary and agricultural animal waste, yard trimmings and other compostables.

For CY 2019, 566 tons of food waste for composting was sent from our 11 dining facilities to Royal Oak Farm (ROF) at a cost of $150 per ton. ROF is the only state permitted composting facility within 100 miles of campus. The university continues to produce 600 tons of food waste for composting. A University Compost Facility at Kentland would provide composting of, not only dining hall waste, but also other campus organic wastes from athletics, the College of Veterinary, residence halls, and campus landscaping, and potentially local jurisdictions.. The capital cost of the facility is estimated at $1.4 -$1.8 million with net operating cost of $165,000 per year.

d. **Engage faculty, students, and staff in Campus Climate Action Living Laboratory** to promote Pollution Prevention (P2) concepts of reduce/reuse/recycle to achieve principles of Circular Economy. Include P2 and Circular Economy activities in Sustainability Internships, learning living centers, student orientation programs, and recycling/composting programs.

e. **Promote awareness of recycling/compost behavior** through marketing, social media, incentives, and innovative approaches. Include CAC sustainable choices pathways including web-based and smart-phone apps, student clubs, roundtables, 1st year experience app, and campaigns for Y-toss, green tailgating, and related programs.

f. **Evaluate and improve as needed management of specialty wastes,** such as e-waste, laboratory waste, construction debris, and wastes from major sporting and other events.
   - By 2021, pilot a campus-wide Green Lab program to better design and manage waste materials in research labs, with an ultimate goal of Green Lab certification of 80% of VT science and engineering labs.
   - Expand programs for reuse of materials, such as Surplus, Hokie-Swap, Y-Toss
   - Expand programs for Green Tailgating and related Athletics recycling/compost initiatives

2020 VT CAC GOAL #8. Implement and Evaluate the Procurement Department's *Sustainable Procurement Policy* 2020-2022

In April 2020, the Virginia Tech Procurement Department developed a Sustainable Procurement Policy that aims "to make procurement decisions that embody the university's commitment to sustainability whenever possible." The purpose of the Virginia Tech Sustainable Procurement Policy is to complement and strengthen our commitment to sustainability to include: identifying those sustainability factors that shall be incorporated into procurement decisions; encouraging vendors to promote products and services that they offer which are most suited to the university's sustainability principles; and reducing the environmental impacts of materials acquired.

The Policy reflected the elements of the 2009/2013 VT Climate Action Commitment and Sustainability Plan. This Policy is a significant development for Virginia Tech in procurement to reflect sustainability principles in all aspects of materials and equipment acquisition and contracting. Because the 2009/2013 CAC and plan will be superseded by the 2020 VT CAC, we recommend the new Policy be piloted for two years and then be evaluated by the Procurement Department in collaboration with the Energy & Sustainability Committee in 2022 for its conformance with the adopted 2020 VT CAC.

Pathway to goal:

a. On a pilot basis, the **Procurement Department will implement and evaluate** the 2020 Sustainable Procurement Policy for two years

b. By 2022, based on the evaluation, the Procurement Department, in collaboration with the Energy & Sustainability Committee, will assess the pilot project and **formulate the Sustainable Procurement Policy v.2.**

Four Immediate projects/initiatives 2020-2022. The Waste/Recycling/Composting and Procurement subcommittee identified four projects/initiatives below for immediate action in the next two years to demonstrate the university's commitment to climate action.

- Secure Funding and Develop University Compost Facility at Kentland
- Contract Zero Waste Consultant to conduct VT Waste Audit
- Implement and Evaluate Sustainable Procurement Policy 2020-2022
- Implement Campuswide Green Lab Program