GEORGIA TECH'S

CLIMATE ACTION PLAN
I am pleased to present Georgia Tech’s Climate Action Plan, which outlines innovative and practical strategies for the Institute to reach net-zero emissions by 2050. A collaborative effort with input from our entire community, this plan responds to the commitments in our strategic plan to lead by example and create solutions to some of humanity’s most pressing challenges.

From rising sea levels and disrupted ecosystems to increasingly frequent extreme weather events, climate change continues to affect communities in our state and all over the world. As one of the world’s leading research universities, Georgia Tech has the opportunity, and the obligation, to create and share solutions that can help curb climate change and mitigate its harmful impact on our planet and our lives.

Our Climate Action Plan is bold and ambitious, aiming for 100% clean ground transportation by 2030 and 100% clean energy by 2050. These goals are not easy, but they reflect the seriousness of the challenges before us.

A key element of Sustainability Next, Georgia Tech’s first comprehensive sustainability plan, this Climate Action Plan is aligned with the United Nations Sustainable Development Goals, which break down the most consequential and complex problems facing our world. These goals inform our mission to develop leaders who advance technology and improve the human condition, and we specifically call them out as vital objectives in the Institute’s strategic plan.

I extend my gratitude to our students, faculty, staff, and partners for their dedication and invaluable contributions to this plan. I would also like to acknowledge the Office of Sustainability for their unwavering commitment to driving this initiative forward.

Together, we will build a better, stronger, and more resilient Georgia Tech — and make a profound impact on our world.

In Progress and Service,
Ángel Cabrera
President, Georgia Institute of Technology

As one of the world’s leading research universities, Georgia Tech has the opportunity, and the obligation, to create and share solutions that can help curb climate change and mitigate its harmful impact on our planet and our lives.

— Ángel Cabrera,
President, Georgia Institute of Technology
Dear Yellow Jackets:

The Office of Sustainability is pleased to present Georgia Tech’s Climate Action Plan (CAP). The CAP is an initiative of Sustainability Next, Georgia Tech’s Institute Sustainability Plan. Sustainability Next provides a road map for developing cross-cutting sustainability partnerships that increase collaboration across operations, research, and education.

Under the executive sponsorship of Infrastructure and Sustainability, the Office of Sustainability launched the CAP process in Fall 2022. The process included the development of a Greenhouse Gas (GHG) Inventory, extensive engagement with diverse stakeholders across the Georgia Tech community, strategy development, and emissions modeling.

Georgia Tech’s staff, faculty, and students developed the mitigation and adaptation strategies, which allowed for multiple perspectives and subject matter expertise on the best path forward.

The collaborative process led to a CAP that is grounded in equity, adaptability, and innovative strategies. The results provide a clear pathway to upgrade our campus infrastructure while ensuring the most efficient use of our resources.

The CAP addresses climate impacts from an interdisciplinary, multisector approach while supporting and engaging our local and global communities.

The Office of Sustainability is committed to climate action at Georgia Tech.

The CAP is an Institute-wide plan that addresses the changing climate, sets forth strategies to achieve net-zero emissions by 2050, and advances climate action initiatives within research and education.

We invite every member of the Georgia Tech community to join us in implementing the CAP. Together, we will strive to ensure a cleaner, more sustainable planet for all.

In Partnership,
Georgia Tech’s Office of Sustainability
As a higher education institution, Georgia Tech’s plan recognizes the importance of growing our teaching, research, and partnerships to advance climate solutions locally and globally.

The Georgia Tech CAP was intentionally aligned with the broader goals of the United Nations Sustainable Development Goals (SDGs), the Institute’s strategic plan (ISP), Sustainability Next, and the Comprehensive Campus Plan, as well as other related plans that have potential impacts on climate action. The CAP guiding principles were grounded in this alignment.

A Greenhouse Gas (GHG) Inventory was developed at the beginning of the CAP process using the GHG Protocol to ensure accuracy and consistency. The inventory included an analysis of Georgia Tech’s Scope 1-3 emissions.

As detailed in this report, Georgia Tech’s GHG emissions were 201,682 metric tons (mt) of CO2e in FY 2022, a 36% decrease from FY 2010 baseline levels (314,835 mt CO2e). To achieve the 50% reduction by 2030, Georgia Tech must lower emissions below 157,417 mt CO2e.

The Climate Action Plan (CAP) was developed in collaboration with hundreds of members of the Georgia Tech community. It provides concrete mitigation (reducing carbon emissions) and adaptation (adjusting to anticipated changes in temperature, rainfall, drought, and beyond) strategies to cut emissions in half by 2030 and achieve net-zero emissions by 2050.

In addition, it provides strategies for integrating climate education, advancing climate research, and ensuring equitable, cost-effective solutions. A critical component of this plan is the recognition that those who experience the biggest impacts of climate change are often those least responsible for contributing to it.

**TABLE I: FY 2022 EMISSIONS BY SCOPE**

<table>
<thead>
<tr>
<th>SCOPE</th>
<th>DESCRIPTION</th>
<th>2022 EMISSIONS (metric tons of CO2 equivalent)</th>
<th>PERCENTAGE OF TOTAL EMISSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope 1</td>
<td>Direct emissions created by sources that are owned or controlled by Georgia Tech, such as natural gas or gasoline burned and refrigerant leaks from cooling equipment.</td>
<td>41,491</td>
<td>21%</td>
</tr>
<tr>
<td>Scope 2</td>
<td>Indirect emissions associated with purchased electricity for Georgia Tech.</td>
<td>103,238</td>
<td>51%</td>
</tr>
<tr>
<td>Scope 3</td>
<td>Emissions indirectly due to Georgia Tech’s activities: employee and student commuting to campus, business travel, materials procurement, building construction, emissions from landfill of waste, emissions due to electrical losses or fugitive emissions in natural gas distribution systems upstream from campus.</td>
<td>56,953</td>
<td>28%</td>
</tr>
<tr>
<td><strong>TOTAL EMISSIONS</strong></td>
<td><strong>201,682</strong></td>
<td><strong>100%</strong></td>
<td></td>
</tr>
</tbody>
</table>
To meet the 2030 GHG reduction targets and net-zero emissions by 2050, nine working groups from across the Institute, led by members of the CAP Advisory Task Force and involving faculty, staff, and students with technical and subject matter expertise, developed the CAP strategies.

The working groups focused on climate justice, building energy, renewables, mobility, water, materials management, carbon sequestration, education, and research.

The mitigation strategies for building energy, renewables, mobility, water, and materials were modeled for potential emissions reductions. Estimated costs, timelines, and equity considerations were analyzed for each strategy.

While some strategies are "low-hanging fruit" (low-cost/no-cost), others require a substantial investment up front but offer an attractive return on investment.

**EXECUTIVE SUMMARY**

**EMISSION REDUCTION STRATEGIES CAN BE SUMMARIZED AS FOLLOWS:**

**SCOPE 1: ELECTRIFY**
- Move toward replacing campus steam and building heat based on natural gas combustion with a hot water system employing heat pumps or other electric heating.
- Electrify the vehicle fleet.

**SCOPE 2: TRANSITION TO 100% CLEAN ELECTRICITY**
- Deploy more on-site solar generation across the Institute with key locations coupled with storage to provide several "Resilience Hubs."
- Procure electricity from renewable and zero-emissions sources through participation in Power Purchase Agreements (PPAs) and Virtual PPAs.

**SCOPE 3: CLIMATE-SMART PLANNING AND POLICIES**
- Reduce Georgia Tech’s commuting footprint through the promotion of mass transit, zero-emission vehicles, and micromobility.
- Reduce air travel footprint through improved virtual meeting tools and preference for lower emission flights.
- Reduce building construction emissions through more efficient use of existing space, renovation over new construction, and selection of building materials with lower embodied carbon emissions.
- Reduce carbon emissions and improve water resilience by deploying on-campus wastewater reclamation and further reductions in stormwater runoff.
- Reduce landfill emissions through zero waste initiatives.
- Develop an Institute-wide sustainable procurement policy.
- Promote carbon sequestration through landscaping and off-campus initiatives.
- Offset the remaining Scope 3 emissions that are difficult or unfeasible to eliminate through other mitigation strategies.

Adaptation and resilience planning is still in its preliminary stages at Georgia Tech, but many of the initiatives identified for climate mitigation are compatible with climate adaptation. For example, efficient buildings with on-site renewable energy, along with water capture and storage, contribute less to climate change while offering enhanced resilience.

This plan also explores how Georgia Tech can advance its Living Campus initiative, integrating awareness of climate change and potential solutions into education and research. Georgia Tech faculty, staff, and students are already leading the way in innovative climate curriculum, programming, and research. This plan provides recommendations for building upon and expanding this strong foundation through leadership opportunities and community partnerships.

*By pursuing climate action thoughtfully, it is possible to accelerate the transition to a world that is both more sustainable and equitable.*
Georgia Tech is committed to sustainability and the environmental stewardship of our campus community. The CAP was developed internally in partnership with leadership and with our own experts from within Georgia Tech. As we move toward implementation, it will require a whole-community approach, and we will continue to work together to reach our goal of net-zero emissions by 2050.

— Jennifer Chirico, Associate Vice President of Sustainability

EXECUTIVE SPONSORS

- Ángel Cabrera, President, Georgia Institute of Technology
- Shantay Bolton, Executive Vice President, Administration and Finance
- Jim Stephens, Interim Vice President and Deputy Facilities Officer, Infrastructure and Sustainability, Co-Chair

ADVISORY TASK FORCE

Chairs and Project Leads

- Jennifer Chirico, Associate Vice President of Sustainability, Chair
- Daniel Matisoff, Professor, School of Public Policy, Ivan Allen College of Liberal Arts, Co-Chair
- Jim Stephens, Interim Vice President of Infrastructure and Sustainability, Co-Chair
- Jermaine Clonts, Associate Director of Utilities, Office of Sustainability, Project Lead
- Greg Spiro, Intern Executive Director of Infrastructure, Infrastructure and Sustainability, Project Lead

Members

- Shain Arora, Director, The Kendeda Building for Innovative Sustainable Design
- Ross Bongiovi, Director of Facilities and Capital Planning, College of Sciences; former Associate Director of Support Services, Georgia Tech Research Institute
- Marilyn Brown, Regents’ Professor, School of Public Policy, Ivan Allen College of Liberal Arts
- Christopher Burke, Executive Director of Community Relations, Institute Relations
- Michael Chang, Former Deputy Director and Senior Research Scientist, Brook Byers Institute for Sustainable Systems
- Sherry Davidson, Assistant Vice President, Campus Services Business and Finance
- David Eady, Senior Manager, Industry Engagement, Scheller College of Business
- Jairo Garcia, Lecturer, School of City and Regional Planning, College of Design
- Kasey Helton, Associate Vice President, Campus Services, Student Engagement and Well-Being
- Lusluo Hong, Vice President, Student Engagement and Well-Being
- Rebecca Watts Hull, Assistant Director, Faculty Development for Sustainability Education Initiatives, Center for Teaching and Learning, Education and Learning
- Carmen Jordan, Administrative Manager I, Education and Learning
- Jennifer Levesy, Assistant Dean for Faculty Mentoring, College of Sciences
- Timothy Lieuwen, Executive Director, Strategic Energy Institute
- Jon Palumbo, Executive Deputy Athletics Director/DOD, Athletics
- Aiy Patel, Executive Director, Procurement and Business Services
- Kiera Tran, Executive Vice President, Graduate Student Government Association
- Valerie Thomas, Anderson Interface Chair of Natural Systems and Professor, H. Milton School of Industrial and Systems Engineering, College of Engineering
- Athena Verghis, Joint Vice President of Sustainability and Infrastructure, Student Government Association
- Emma Blandford, Sustainability Next Portfolio Manager, Office of Sustainability
- Abby Bower, Program Support Coordinator, Office of Sustainability
- Drew Cutright, Director of Sustainability Engagement, Office of Sustainability
- Pragadeesh Muthiah, Former Utilities Analyst, Office of Sustainability
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- Lusluo Hong, Vice President, Student Engagement and Well-Be
Climate action plan, Sustainability Next, calls for the development of a Climate Action Plan (CAP) to guide the Institute in addressing climate impacts. The goal of the CAP is to reach a 50% reduction in emissions by 2030 and net-zero emissions by 2050. In addition, the plan calls for thinking beyond emissions reductions on campus and addressing the broader impacts of climate change through education, research, and community engagement, both locally and globally.

Climate change is the long-term shift in patterns of weather and temperature over extended periods of time. It has happened historically through natural causes, though it is currently accelerating at unprecedented rates.

When fossil fuels are burned, greenhouse gases (GHGs) are released into the atmosphere, where they trap heat. This is largely due to GHG emissions of carbon dioxide (CO₂) and methane (CH₄) from the burning of fossil fuels for energy, industry, transport, buildings, and agriculture. These effects are more than environmental, with impacts on human health and well-being in the form of increased economic challenges, food insecurity, water supply issues, and migration of populations away from affected areas.

Georgia Tech’s first sustainability plan, Sustainability Next, calls for the development of a Climate Action Plan (CAP) to guide the Institute in addressing climate impacts.

As the planet continues to warm, the consequences can include more intense storms and hurricanes, longer droughts, more wildfires, rising sea levels, flooding, melting polar ice, and declining biodiversity.


INTRODUCTION

The increase of GHGs in the atmosphere has resulted in about a 2°F (1.1°C) increase in the Earth’s overall temperature since the Industrial Revolution. Earth was the warmest in recorded human history between 2014 and 2023, and each year it has continued to set records. While a 2°F (1.1°C) increase may seem small, it is enough to disrupt the global ecosystem and environmental balance.6

Since the changes in temperature are not evenly distributed, the impacts are different based on local geography. For example, in the state of Georgia, current projections expect the number of days above 95°F to double by 2050.6 This increase could produce longer drought periods followed by more intense weather events and have a severe impact on state agriculture.

Prior to the development of the CAP, Georgia Tech signed the Presidents’ Climate Leadership Commitments in 2007, which later committed Georgia Tech to the United Nations (UN) Race to Zero campaign, Sustainability Next launched in 2020 with its plan published in 2023.

The interdisciplinary nature of climate action offers a unique opportunity to leverage the Georgia Tech community’s expertise and leadership to advance innovative climate solutions. Hundreds of staff, faculty, and students were involved in the development of strategies and in providing feedback throughout the process. The result is a plan that provides a road map for Georgia Tech to reach zero emissions and amplify our impact as an anchor institution, partner, and catalyst in Atlanta and beyond.

The recommended strategies developed by the Georgia Tech community are aligned with the UN Sustainable Development Goals (SDGs), Georgia Tech’s strategic plan, Sustainability Next, and the Comprehensive Campus Plan.

The following guiding principles were developed at the beginning of the CAP process to guide the direction of solutions and ensure they are in alignment with the broader goals at Georgia Tech.

**CAP GUIDING PRINCIPLES:**

- We are committed to reaching net-zero emissions by 2050.
- We prioritize clean energy technologies to eliminate emissions.
- We optimize mobility through a variety of modes that are accessible, affordable, and low- to no-emissions, considering environmental and human health impacts when determining and implementing transit and land use decisions.
- We expand support for faculty and students to further innovative research and student projects to address climate-related issues.
- We prepare all students, regardless of discipline, to address climate-related challenges in their personal and professional lives.
- We seek to ensure that fair and just climate policies and strategies are in place at Georgia Tech and that those policies and strategies prioritize affordable climate change solutions that support our internal and external community.
- We support a thriving circular economy that focuses on upstream systems for achieving zero waste, ensures sustainable procurement, and supports our local community.
- We adapt our infrastructure to be resilient to the effects of climate change.
- We elevate Georgia Tech as a recognized global leader in climate action.

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Georgia Tech is committed to addressing climate change by decreasing emissions on campus and working with local and global partners to advance solutions.
INTRODUCTION

Heat

Despite its substantial tree cover, Atlanta is a large urban city with large-scale paved areas and buildings that retain heat. The concentrated areas of buildings create heat islands in the city, where the temperature can be significantly higher than surrounding areas and retain heat longer into the night. Increasing temperatures require additional cooling, leading to an increased energy demand.1

Increased utility costs create a higher economic burden on the most vulnerable populations.2 Further, heat islands often correlate strongly with areas of increased poverty, multiplying the effect.3 Georgia Tech researchers are working on ways to better understand urban heat islands and their impacts.4


Drought

Overall, precipitation patterns are increasingly swinging between extremes. Georgia is more prone to drought and extreme rainfalls.1

Droughts stress water supplies and the local economy, including losses in agricultural productivity, leading to the additional use of water for irrigating campus landscaping and community gardens.


Storms and Flooding

Storms are bringing more rain over shorter periods of time.1 In Georgia, each decade from 1990 to 2010 set records for storms producing more than 3 inches of rain. Heavier, more intense storms can overwhelm the stormwater infrastructure, flooding homes and streets and leading to loss of life and property, ecosystem damage, and pollution of water resources.2


ALIGNMENT & COLLABORATION
ALIGNMENT WITH BROADER GOALS

The CAP leverages existing Institute initiatives and supports campuswide action. The overarching goals reviewed included the United Nations Sustainable Development Goals, Georgia Tech’s strategic plan, Sustainability Next, and the Comprehensive Campus Plan.

Additional details on existing initiatives and the broader alignment of the CAP goals and these plans can be found in Appendix A.

The CAP is a key element of Georgia Tech’s commitment to advance the UN SDGs, including SDG 13: Climate Action. The plan will enable Georgia Tech to “Lead by Example” by reducing emissions, advancing transdisciplinary climate research, and empowering students to lead climate action on campus and in their future workplaces and communities.

— Rebecca Watts Hull, Assistant Director, Faculty Development for Sustainability Education Initiatives, Center for Teaching and Learning

FIGURE 1: CAP STRATEGIC ALIGNMENT
Stakeholders and subject matter experts from across the Institute were invited to participate in the CAP Advisory Task Force (ATF). The ATF supported the development of the CAP by attending monthly meetings, providing feedback, and developing strategies to guide Georgia Tech in reaching net-zero emissions. Members of the ATF agreed upon four overarching goals.

**CAP ATF Goals:**
- **Eliminate Emissions.** Achieve the Paris Accord goal of a 50% reduction in emissions by 2030 and net zero by 2050.
- **Illustrate Leadership.** Amplify Georgia Tech’s position as a global leader in research to establish itself as a global leader in climate action.
- **Strengthen Community.** Emphasize the impact of climate action on the individuals and organizations the Institute serves.
- **Demonstrate Stewardship.** Include an achievable timeline with realistic financial expectations and identify implementation responsibility for major recommendations.

*Georgia Tech’s Climate Action Plan deploys new technology and new thinking about how we can organize ourselves as an institution of higher learning embedded in community, reducing carbon emissions by using our resources more effectively. We interpret the challenge of reducing greenhouse gas emissions as both cutting existing emissions and as looking to the future, in the scale and scope of Georgia Tech’s education, effectiveness, innovation, contribution to the state of Georgia, and inspiration to others.*

— Valerie Thomas, CAP ATF Member, Professor, and Anderson Interface Chair of Natural Systems, H. Milton School of Industrial and Systems Engineering, College of Engineering

**ENGAGEMENT ACROSS THE INSTITUTE**

The CAP process included extensive stakeholder and community engagement that guided the development of the plan. In addition to the ATF, a broader audience of staff, students, faculty, and the local community was invited to provide input and feedback on core focus areas, strategies, and recommendations. The CAP project management team hosted multiple information sessions, town halls, and active student engagement events in 2022 and 2023.

The largest engagement portion of the process involved the convening of nine working groups that aligned with the guiding principles and focused on specific areas of climate action. Each working group was led by a member of the ATF, with member nominations from across the Institute based on expertise, leadership, and interest. The working groups included five to 15 members and met regularly over three months to develop recommended strategies toward reaching the Institute’s goals.

The nine CAP working groups:
- Building Utilities
- Renewables and Offsets
- Mobility
- Climate Change Research and Policy
- Education
- Climate Justice, Equity, and Community
- Materials Management
- Resilient Infrastructure
- Students

*The students have been phenomenal in participating in CAP development. Many of them were members of multiple working groups, where they put time and effort into providing input, doing background research, and proposing ideas and solutions for climate actions on campus and in the Atlanta area. In addition, they worked hard to find ways that they can make an impact as students. It is such a wonderful thing at Georgia Tech that students are always ready and eager to take action.*

— Kiera Tran, Ph.D. Student, School of Earth and Atmospheric Sciences, Student Working Group Lead
To determine the most appropriate and ambitious climate goals, Georgia Tech reviewed recommendations from the foremost global convening authorities on climate action, the United Nations Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC).

The United Nations has established two organizations that now underpin the global response to the threat of climate change:

- The UNFCCC convenes representatives of countries around the world annually to discuss mechanisms to reduce global GHGs.
- The IPCC is tasked with advancing scientific knowledge of anthropogenic climate change.

While there are slight variations between the UNFCCC and IPCC, both underscore that rapid mitigation efforts are required to limit the impacts of climate change.

The UNFCCC has assembled global convenings, titled “Conference of the Parties” (COPs), around the world since 1995. During COP21, which took place in 2015 in Paris, 193 parties or states and the European Union committed to reducing global GHGs to limit the global temperature increase in this century to 2°C and to pursue efforts to limit the increase even further to 1.5°C. According to the IPCC, to limit the increase of global temperature below 1.5°C from pre-industrial levels, global anthropogenic emissions must be reduced by 43% by 2030 and reach net zero by 2050.1

These leading bodies on climate action have coalesced around similar pathways to ensure global temperatures do not exceed 1.5°C above pre-industrial levels.2 Global emissions need to be halved from a 2015 baseline by 2030, and global emissions should be near zero within the period of 2040 – 2050.3

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Any remaining emissions need to be balanced out through GHG removals or sinks — anything that collects and stores GHGs from the atmosphere, such as oceans, forests, and soil. Sinks play a vital role in mitigating climate change.

Defining Net Zero

The United Nations defines Net Zero as “cutting greenhouse gas emissions to as close to zero as possible, with any remaining emissions reabsorbed from the atmosphere, by oceans and forests.”

The concept includes a “like for like” requirement that sources and sinks of emissions correspond in terms of their warming impact and the time scale and durability of carbon storage.

For example, using a forest to balance emissions from fossil fuel extraction is not valid with a Net Zero target; the methane emissions from extraction do not match forest carbon removals in terms of warming impact and duration.

Additionally, the time scale in this example does not match, as unextracted fossil fuels are stable and can persist as a source for periods that far exceed a forest’s ability to persist as a sink.

Georgia Tech’s Race to Zero

Georgia Tech is a signatory of the Race to Zero for Universities and Colleges campaign, Powered by the UN Environment Programme, the Alliance for Sustainability Leadership in Education, and Second Nature, Race to Zero is a global effort to rally leadership and action in the education sector toward a zero-emissions planet. Presently, more than 500 worldwide institutions representing more than 11 million students have made this commitment.

The campaign is part of the United Nations' Race to Zero campaign, a global initiative to rally leadership and support from organizations around the world to build a healthy, resilient, zero-carbon economy that prevents future climate threats, creates decent jobs, and unlocks inclusive, sustainable growth.

The Race to Zero campaign has mobilized more than 70 countries and 11,309 non-state actors, including 8,307 companies, 595 financial institutions, 1,136 cities, 52 states and regions, 1,125 educational institutions, and 65 healthcare organizations. To accelerate this transition to Net Zero, over 1,000 educational institutions have pledged to take rigorous and immediate actions to halve emissions by 2030.

By joining the Race to Zero for Universities and Colleges campaign, Georgia Tech will implement the following:

PLEDGE: Pledge by the president of Georgia Tech to reach net-zero GHGs as soon as possible, and by 2050 at the latest, in line with the scientific consensus on the global effort needed to limit warming to 1.5°C, recognizing that this pledge requires phasing down, and out, all unabated fossil fuels as part of a global just transition. The pledge also requires Georgia Tech to set an interim target of 50% reduction in CO2 by 2030. Targets must cover all GHG emissions, including Scopes 1, 2, and 3.

PLAN: Disclose publicly the Climate Action Plan, which outlines how the Race to Zero criteria will be met, including what actions will be taken within the next 12 months, within 2-3 years, and by 2030.

PROCEED: Take immediate action through all available pathways toward achieving net-zero emissions, consistent with delivering interim targets.

PUBLISH: Report publicly the progress against both interim and longer-term targets, as well as the actions being taken, at least annually.

PERSUADE: Within 12 months of joining, align external policy and engagement, including membership in associations, to the goal of halving emissions by 2030 and reaching Net Zero by 2050.

By transparently evaluating progress along international measures, Georgia Tech can assess benchmarks and work with universities across the globe to develop best practices and solutions to pressing climate concerns.


The CAP addresses the importance of working with students, faculty, staff, researchers, and community partners to identify opportunities in education, research, and partnerships that shine light on the societal impacts of a changing climate and help identify pathways to alleviate these impacts where possible.

It also ensures that every strategy is evaluated for its impact on Georgia Tech’s surrounding community. As part of this effort, Georgia Tech developed a Climate Vulnerability Assessment to identify who and what are most vulnerable to climate change impacts. Vulnerabilities exist from air quality (AQ) issues, heat and droughts, floods, strong winds, and exposure to vector-borne diseases, all of which can affect the health and well-being of students, faculty, and staff.

As an example, smoke from wildfires in Canada traveled through the eastern United States in July 2023, producing a Code Orange AQ Alert in Atlanta and 17% higher than expected hospital visits for asthma across the country. Further, in September 2023, unprecedented rainfall in Atlanta flooded and caused electrical outages at more than a dozen Georgia Tech buildings.

These vulnerabilities require a greater emphasis on community engagement and resilience planning to decrease or eliminate the burdens of climate change on the Georgia Tech community.

In addition to the urgent need to reduce our carbon footprint, we must identify our vulnerabilities and implement immediate measures to be resilient to present and future climate impacts.

— Jairo Garcia, Lecturer, School of City and Regional Planning

CLIMATE VULNERABILITY ASSESSMENT

Climate hazards identified were based on the National Climate Assessment and related publications. Potentially affected areas of infrastructure and operations on Georgia Tech’s Atlanta campus included: utilities, buildings, transportation, health, safety, food systems, emergency services, and community. These areas were assessed for how they affected people and vulnerable populations.

Our Greenhouse Gas Inventory is the foundation of Georgia Tech’s Climate Action Plan. Understanding where our emissions are coming from and how much we are emitting is essential for both quantifying the problem and taking action.

— Jermaine Clonts, Associate Director of Utilities

A GHG Inventory is a tool used to track GHG emissions generated from different activities and sources. It is an essential step toward setting reduction targets, developing mitigation strategies, and reporting progress toward climate goals.

The first stage of developing the Georgia Tech GHG Inventory is establishing the scope and boundary. The boundary defines the emissions over which an organization claims responsibility, thereby delineating the scope of the organization’s climate action. The boundary of Georgia Tech’s GHG Inventory includes the main campus in Atlanta and surrounding satellite locations within the metro Atlanta area.1

The scope of the inventory was determined using the internationally recognized GHG Protocol to classify, measure, and manage GHG emissions. Through this framework, GHGs are organized into Scopes 1-3.2

- **Scope 1** includes direct emissions created by sources that are owned or controlled by Georgia Tech.
- **Scope 2** includes indirect emissions associated with purchased electricity for Georgia Tech.
- **Scope 3** includes all emissions that fall outside of Scopes 1 and 2, or indirect emissions generated by the Georgia Tech community.

The baseline year for tracking GHGs was 2010, and data was collected through 2022. The primary GHGs tracked in the inventory include carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O)—plus several gases used in refrigeration.2

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1 This includes the main campus in Atlanta and the satellite locations in Cobb and Clayton counties. It does not include emissions from its international campuses.

2 Greenhouse Gas Protocol. [n.d.] About GHG protocol. About Us - GHG Protocol. [https://ghgprotocol.org/about-us](https://ghgprotocol.org/about-us). Note: Emissions can also be organized by category, including stationary energy (for building energy), fugitive emissions (e.g., emissions leaked from natural gas production, refrigeration, storage, and transport), waste, transportation, and procurement.
GEORGIA TECH'S GHG EMISSIONS INVENTORY

Georgia Tech's GHG emissions were 201,682 metric tons (mt) of CO2e in FY 2022, a 36% decrease from FY 2010 baseline levels (314,835 mt CO2e).

Once the GHG data was collected for Scopes 1-3, it was converted into a metric referred to as the carbon dioxide equivalent, or CO2e, which considers the differing global warming potential of each gas over 100 years (GWP 100).

The GHG Inventory results indicate that Georgia Tech’s largest source of emissions is within Scope 2 (51%), followed by Scope 3 (28%), and Scope 1 (21%). See Appendix B for additional details on emissions by Scope.

Data was unavailable for fertilizer data in Scope 1 and procurement, embodied carbon for construction, and student travel to and from campus for breaks in Scope 3. Going forward, the GHG Inventory will be updated on an annual basis to include additional categories as data becomes available.

FIGURE 3: FY 2022 EMISSIONS BY SCOPE (mt CO2e)

FIGURE 4: FY 2010 EMISSIONS (BASELINE) BY SCOPE (mt CO2e)
GEORGIA TECH’S GHG EMISSIONS INVENTORY

Scope 1 Emissions
Scope 1 emissions are created by sources that are owned or controlled by Georgia Tech. Data for Scope 1 was collected from direct usage records of fuels and other chemicals used on campus, known in the GHG Protocol as “activity data.” Scope 1 emissions included the following sources:

- **Stationary Energy** – Combustion of stationary fuel sources, including natural gas and propane used for campus heating.
- **Vehicle Fleet** – Campus vehicle fleets, equipment used in campus operations, vehicle maintenance, landscaping equipment, and machinery.
- **Fugitive Emissions** – Escaped emissions from campus operations, such as natural gas leakage from pipes or systems on campus. This differs from fugitive emissions counted in Scope 3, which includes escaped emissions before gas enters the campus. (Refrigerants used for cooling campus buildings are a special class of fugitive emissions, so they are depicted separately).

**FIGURE 5: FY 2022 SCOPE 1 EMISSIONS (mt CO2e)**

Georgia Tech’s Scope 1 emissions accounted for 21% of total emissions in 2022. Scope 1 emissions decreased by 9% overall between 2010 and 2022, which was driven by a 6,624 mt CO2e drop in stationary sources (natural gas and propane consumption).

Scope 2 Emissions
Scope 2 includes emissions associated with purchased electricity. This scope made up 51% of Georgia Tech’s overall emissions in FY 2022. Data for Scope 2 was collected from purchased electricity records from Georgia Power. It includes:

- **Stationary Energy (Electricity)** – Electricity purchased from Georgia Power. In FY 2022, emissions associated with purchased electricity made up 100% of Scope 2 emissions.³

The majority (82%) of Georgia Tech’s electricity use is for buildings (i.e., lighting, plug loads, ventilation, cooling, etc.). The remaining 18% of campus electricity is consumed at the campus central plants, mostly for making chilled water for cooling buildings.

**FIGURE 6: FY 2022 SCOPE 2 EMISSIONS (mt CO2e)**

Since 2010, Georgia Power has increased its use of renewables and decreased its use of coal. This grid shift, along with energy efficiency efforts on campus, contributed to about a 50% decline in Scope 2 emissions between 2010 and 2022 (206,667 mt CO2e in 2010 to 103,238 mt CO2e in FY 2022).

³ Georgia Tech does not purchase steam, heating, or cooling.

Purchased Electricity From Georgia Power
100%
Scope 3 Emissions

Scope 3 includes emissions that are indirectly generated by Georgia Tech but are not directly controlled. It accounted for about 28% of Georgia Tech’s total emissions in FY 2022 and included the following sources:

- **Commuting** – Students and employees who commute to and from campus.
- **Air Travel** – Business and study abroad travel.⁴
- **Waste** – Management of solid waste and wastewater generated on campus.
- **Electricity Transmission and Distribution (T&D) Losses and Fugitive Emissions (Upstream)** – Electricity losses or escaped emissions that occurred off campus, such as methane leaking from a pipeline before it reached campus.⁵
- **Procurement and Capital Goods** – Emissions due to the production of materials used on campus, such as embodied carbon from building construction.⁶

Commuting made up the largest portion of emissions (43%) within Scope 3, followed by fugitive emissions (17%), business air travel (13%), student air travel (11%), landfill waste (5%), and wastewater (1%).⁷

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⁴ This category does not include student travel home for breaks, such as summer break and winter recess.
⁵ This differs from Scope 1 because it occurs off campus.
⁶ Data was not available for FY 2022. Efforts are in place to report on this data as it becomes available.
⁷ Data for Scope 3 was collected from commuting surveys, flight records, campus waste data, water utility data, and procurement data.
CLIMATE ACTION STRATEGIES

The CAP working groups developed strategies for climate action across the Institute. Community, Equity, and Accessibility strategies are presented as an initial framework and integrated throughout the other focus areas to ensure equitable access and impact. The remaining strategies were organized into eight focus areas:

- COMMUNITY, EQUITY & ACCESSIBILITY
- MITIGATION & ADAPTATION
  - BUILDING ENERGY
    - Strategies that reduce Scopes 1 and 2 emissions, increase energy efficiency, and reduce energy consumption in buildings.
  - RENEWABLE ENERGY & OFFSETS
    - Strategies for implementing renewable energy sources and offsets.
  - MOBILITY
    - Strategies that support fossil fuel-free mobility within campus and to and from campus.
  - MATERIALS MANAGEMENT
    - Strategies that address how materials are bought, used, recovered, and disposed.
  - WATER MANAGEMENT
    - Strategies that increase the efficiency and conservation of water management, including potable water, greywater, blackwater, and stormwater.
  - CARBON SEQUESTRATION
    - Strategies that increase the amount of carbon dioxide sequestered through natural resources on campus.

- INNOVATION
- RESEARCH
  - Strategies that support and expand current climate-related research and solutions.
- EDUCATION
  - Strategies that advance Georgia Tech’s academic programs to prepare staff and students for climate action.
- INNOVATION
  - COMMUNITY, EQUITY & ACCESSIBILITY

How to Read These Pages

PRIORITY

It is important to assess the priority of each strategy for reaching 50% reduction in carbon emissions by 2030 and 100% by 2050. Estimated costs are based on assumptions in the GHG model. Strategies that were not modeled are estimated for cost based on time and resources necessary for successful implementation. The estimated cost for each strategy is indicated by dollar symbols.

- $$$: High Cost
- $$: Medium Cost
- $: Low Cost

COST OF IMPLEMENTATION

A cost analysis was developed to estimate expected implementation costs through 2050. Estimated costs are based on the combustion of fossil fuels with technologies that use electricity. Strategies that were not modeled are estimated for cost based on the combustion of natural gas. The largest contribution to Georgia Tech’s campus greenhouse gas emissions is the burning of natural gas to generate steam and hot water for the purpose of heating buildings and domestic water.

The estimated cost for each strategy is indicated by dollar symbols.

- $$$: High Cost
- $$: Medium Cost
- $: Low Cost

TIME FRAME

Strategies will be implemented at varying start dates and require different timelines between 2024 and 2050. Some can be implemented quickly while others require ongoing implementation. Time frames are based on expected implementation dates.

- Short-term: by 2030
- Medium-term: by 2040
- Long-term: by 2050

Each focus area provides an overview of the climate action strategies and details how each strategy aligns with:

- United Nations Sustainable Development Goals (UN SDGs): A full overview of how the CAP strategies align with the UN SDGs is found in Appendix E.
- Institute’s strategic plan.
- Georgia Tech’s Sustainability Next plan.

STRATEGY

Icons indicate if certain criteria were met:

- Strategy modeled for emissions reduction potential.
- Strategy met the criteria for "low-hanging fruit" based on low-cost, high-priority, and high-emission reduction potential.
- Strategy had significant contributions from students or was developed by the student working group.

N/A: Strategy was not modeled since potential GHG reduction is unknown.

The CAP working groups designed strategies for climate action across the Institute. Community, Equity, and Accessibility strategies were presented as an initial framework and integrated throughout the other focus areas to ensure equitable access and impact. The remaining strategies were organized into eight focus areas:

- COMMUNITY, EQUITY & ACCESSIBILITY
- MITIGATION & ADAPTATION
  - BUILDING ENERGY
  - RENEWABLE ENERGY & OFFSETS
  - MOBILITY
  - MATERIALS MANAGEMENT
  - WATER MANAGEMENT
  - CARBON SEQUESTRATION
- INNOVATION
- RESEARCH
- EDUCATION

How to Read These Pages

PRIORITY

It is important to assess the priority of each strategy for reaching 50% reduction in carbon emissions by 2030 and 100% by 2050. Estimated costs are based on assumptions in the GHG model. Strategies that were not modeled are estimated for cost based on time and resources necessary for successful implementation. The estimated cost for each strategy is indicated by dollar symbols.

- $$$: High Cost
- $$: Medium Cost
- $: Low Cost

COST OF IMPLEMENTATION

A cost analysis was developed to estimate expected implementation costs through 2050. Estimated costs are based on assumptions in the GHG model. Strategies that were not modeled are estimated for cost based on the combustion of natural gas to generate steam and hot water for the purpose of heating buildings and domestic water.

The largest contributor to Georgia Tech’s campus greenhouse gas emissions is the burning of natural gas to generate steam and hot water for the purpose of heating buildings and domestic water.

- Without exceptions, most of Georgia Tech’s campus heat is dependent on the combustion of natural gas.
- Approximately half of Georgia Tech’s campus heating load is served by steam from its central heat plant or “condensed” heating plants, while the other half is served by individual heat or otherwise gas-fired equipment. While steam is used to transfer heat from the central plant to the buildings, most buildings connected to the central plant shift this to hot water once inside the building—meaning the buildings do not need steam, only hot water.

In the same time, building cooling for the most campus is unnecessary and overuse of cooling technologies are contributing to higher carbon emissions from power plants that produce and distribute cooled, chilled water. The process of making chilled water requires the extraction of waste heat from cooling towers. For every ton (12,000 lb) of steam to create chilled water, 3.5,000 lb of heat must be vented into the atmosphere.

By coordinating campus heat and cooling in the form of large central heat pumps, Georgia Tech can recover rejected waste heat from the cooling process and transform it to usable energy to serve the campus heating needs.

Heat pumps will significantly improve the efficiency of both the heating and cooling systems, taking full advantage of both sides of the heat transmission cycle, and will be distributed to the campus to serve both the heating and cooling requirements.

This transition can replace over 80% of Georgia Tech’s heating load and will operate at an efficiency of about five times greater than that of the current heating systems.

Additionally, minimizing the use of cooling towers to treat heat will save millions of gallons of water annually.

CUMULATIVE GHG REDUCTION POTENTIAL

Strategies modeled were noted as low, medium, or high for potential emissions reductions by 2050.

- Strategy met the criteria for "low-hanging fruit" based on low-cost, high-priority, and high-emission reduction potential.
- Strategy resulted in emissions reductions between 50,000 and 100,000 mt CO2e.
- Strategy resulted in emissions reductions between 0 and 50,000 mt CO2e.
- Strategy was not modeled since potential GHG reduction is unknown.
The effects of climate change are often magnified in socioeconomically disadvantaged areas, and low-income communities are often more likely to bear the brunt of increasingly severe and longer heat waves, extreme heat, and flooding.\(^1\)

In addition to emissions impacts, proposed climate solutions and investments must consider how history shaped present conditions and address the systemic roots of poverty, disadvantage, and disparities in power and resources. These considerations must be recognized and embedded in planning strategies.

The development of Atlanta’s urban environment has resulted in a range of vulnerabilities to climate change, with low-income populations at far greater risk. Low-income communities often have fewer resources to manage and recover from the impacts of climate-related events, are more likely to suffer from higher energy costs, and are more likely to be uninsured.

Scientists project that climate-related economic damages will affect counties in Georgia that already struggle with high poverty rates.\(^2\)

Georgia Tech’s core mission is to improve the human condition. This includes recognizing and addressing the disproportionate impacts of climate change on vulnerable communities and ensuring that all members of our community benefit equitably from our climate action initiatives. Georgia Tech’s work in the UN SDGs and with the greater Atlanta community offers clarity and insight into the importance of weaving justice tightly into climate action.

The Climate Justice, Equity, and Community Action working group, composed of faculty, staff, and students with expertise from across the Institute, made recommendations for evaluating the recommended Climate Action Plan: Community and Accessibility.

Climate solutions must be rooted in collaboration across disciplines and communities, breaking down traditional barriers to access in the process.

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We recognize that GHG reduction is not the only end goal, but also an opportunity to ensure social equity, inclusivity, and environmental sustainability.

CAP strategies to ensure that disproportionate impacts were addressed and that positive impacts were embedded throughout the plan. The following resulting concepts will be integrated throughout the plan’s implementation.

Increase support and engagement around community-driven work for climate solutions.

To ensure environmental and climate justice, Georgia Tech will seek to support community-led efforts and collaborate with local organizations already leading these initiatives. There is an opportunity to engage with, support, and learn from the community on local climate issues and potential solutions. As Georgia Tech implements the CAP, it will be important to work with these organizations to ensure that there are no adverse impacts and that the climate action strategies provide equal benefits to all parties affected.

Prioritize evidence-based practices that incorporate equity and accessibility in managing the built environment.

Georgia Tech is a leading research institute in the U.S., and promoting evidence-based equal, inclusive, and sustainable design, development, and management of the built environment is essential to its success. Incorporating these concepts demonstrates Georgia Tech’s commitment to evidence-based solutions for the built environment.

Integrate inclusivity and cost effectiveness into Georgia Tech’s climate action implementation, policies, practices, and procedures.

During the planning phase of the CAP, all working groups were provided with a framework to review how their recommended strategies could adversely affect populations and encouraged to assess what could be done to eliminate any negative impacts. The working group also recommended this framework for the implementation stage of the CAP.

Set an internal social price on carbon.

Setting a social cost on carbon can enable Georgia Tech to inform decisions across the Institute that consider the costs of our actions on society. It can also help Georgia Tech incorporate the health impacts related to climate into the financial modeling of large projects.

As a public university, we have a responsibility to work toward solutions that ensure all our stakeholders, across the state and afar, equally benefit from the contributions Georgia Tech makes to advance climate solutions through research and practice.

— Chris Burke, Executive Director, Community Relations, Institute Relations

Drawdown GA Business Compact

The Ray C. Anderson Center for Sustainable Business at Georgia Tech’s Scheller College of Business launched the Drawdown GA Business Compact in 2011, working collectively with local businesses on increasing climate solutions in the state.

The companies share a goal of reaching net zero carbon emissions in Georgia by 2050. The Compact is focused on scaling solutions to also address other societal priorities, such as equity, health, environmental quality, and economic opportunity.

https://www.drawdownga.org/initiative/drawdown-georgia-business-compact/

By working together, we foster engagement and create positive, transformative change.

Georgia Tech

Climate Action Plan
Building Energy

Guiding Principle
We are committed to reaching net-zero emissions by 2050.

Alignments
- SDGs
- Institute’s Strategic Plan: Lead by Example, Champion Innovation
- Sustainability Next: Lead by Example in the Practice and Culture of Sustainability

Georgia Tech’s mission demands a significant amount of energy to power student housing and activities, laboratories, classrooms, maintenance facilities, and other campus buildings. With the student population and campus space expected to increase, Georgia Tech will face higher energy service demands.

The increased demand does not have to result in greater energy consumption. Existing energy-efficient technologies continue to improve and become financially competitive. To take advantage of energy-efficient technologies and optimize campus efficiency, buildings require comprehensive energy management policies that inform capital investment, maintenance upgrades, and operations to maximize efficiency.

The Building Energy focus area combined strategies from the Building Utilities, Resilient Infrastructure, and Student working groups. Strategies were developed and modeled for emissions. The Building Energy focus area included stationary energy, fugitive emissions, and refrigerants that contributed to approximately 78% (158,202 mt CO2e) of Georgia Tech’s total emissions (201,682) in FY 2022.

Building Energy represents the largest source of emissions at Georgia Tech.

The strategies in this section provide pathways for reducing emissions in Scopes 1 and 2.

Notably, Building Energy accounts for 96% of Georgia Tech’s Scope 1 emissions, primarily from natural gas used for heating, and 100% of Georgia Tech’s current Scope 2 emissions since all purchased electricity is utilized in the built environment.

The Georgia Tech Climate Action Plan transforms the campus infrastructure with more sustainable systems, including electrification of the utilities. The question is not just whether we should invest in the CAP for infrastructure upgrades, but whether we rethink the needed capital improvement we must do anyway and ensure we support our sustainable goals.

— Jim Stephens, Interim Vice President, Infrastructure and Sustainability

ElectrifyGT

Georgia Tech students are moving the needle on electrification at Georgia Tech.

A team from ElectrifyGT, a student-led club focused on the “economical electrification of Georgia Tech’s campus,” won first place in the Carbon Reduction Challenge competition during Summer 2023.

Their project was focused on electrifying Georgia Tech’s district energy system. The team found that electrifying Georgia Tech’s Holland Plant (one of two on-site district energy plants at Georgia Tech) would save 15,000 mt CO2e each year and result in significant cost savings for the Institute. Since the club’s founding in 2022, ElectrifyGT has worked on other projects that led to the implementation of electric landscaping equipment on campus and a pilot program for electric vehicles with the Georgia Tech Police Department.
Building electrification is the process of replacing equipment that relies on the combustion of fossil fuels with technologies that use electricity.

The largest contributor to Georgia Tech’s Scope 1 emissions is the burning of natural gas to generate steam and hot water for the purpose of heating buildings and domestic water.

With few exceptions, most of Georgia Tech’s campus heat is dependent on the combustion of natural gas.

Approximately half of Georgia Tech’s campus heating load is served by steam that is generated at a district or “centralized” heating plant, while the other half is served by local boilers or other gas-fired equipment. While steam is used to transfer heat from the central plant to the buildings, most buildings connected to the central plant shift this hot water to the buildings — meaning the buildings do not need steam, only hot water.

At the same time, building cooling for the main campus is predominantly served by two district chilled water plants that produce and distribute piped chilled water. The process of making chilled water requires the rejection of waste heat via cooling towers. For every ton (12,000Btu/hour) of cooling, the system rejects 15,000Btu/hour of heat into the atmosphere.

By electrifying campus heat generation in the form of large industrial heat pumps, Georgia Tech can recover rejected waste heat from the cooling process and transform it to usable energy to serve the campus heating needs.

Heat pumps will simultaneously produce chilled and hot water, taking full advantage of both sides of the refrigeration cycle, and will be distributed to the campus to serve both the cooling and heating requirements.

This transition can replace over 80% of Georgia Tech’s heating load and will operate at an efficiency of about five times greater than that of the current heating systems.

Additionally, minimizing the use of cooling towers to reject heat will save millions of gallons of water annually, as cooling towers currently account for approximately 100 million gallons of water use each year, making it the largest use of potable water on campus.

Further, mitigation of Scope 1 emissions related to campus heating can be achieved through ground source heat pumps, air source heat pumps, sewage heat exchange, and/or renewable natural gas. Electrification can eliminate Scope 1 emissions from campus heating systems related to combustion.

In doing so, this strategy prioritizes emissions that Georgia Tech most directly controls (Scope 1) and leverages the decarbonization of the grid (Scope 2) so that carbon savings increase over the life of the systems.

In addition, electrification allows for the renewal of both the campus heating and cooling systems that need upgrades. Since refrigerants are a substantial portion of the campus reported stationary emissions, system upgrades also provide an opportunity to transition to refrigerants with lower global warming potential.

Climate Action Plan modeling demonstrates that electrification of campus heating systems is the single most effective strategy that Georgia Tech can employ to reach its goal of zero emissions. When considering the cost savings inherent in the use of waste heat and the need for infrastructure renewal, I believe this can be accomplished in a cost-neutral manner over a 20-year period while providing safer, more resilient, and more maintainable systems that serve as an example to our peers and our region.

— Greg Spiro, Interim Executive Director, Infrastructure and Sustainability
Current State

The largest contributor to Georgia Tech’s Scope 1 emissions is the burning of natural gas to generate steam and hot water for the purpose of heating buildings and domestic water. With few exceptions, most of Georgia Tech’s campus heat is dependent on the combustion of natural gas.

Future State

By electrifying campus heat generation in the form of large industrial heat pumps, Georgia Tech can recover rejected waste heat from the cooling process and transform it to usable energy to serve the campus heating needs. Heat pumps will simultaneously produce chilled and hot water, taking full advantage of both sides of the refrigeration cycle and distributed to the campus to serve both the cooling and heating requirements.
This strategy includes benchmarking, evaluating, prioritizing, and implementing Energy Conservation Measures (ECM) to decrease Energy Use Intensity (EUI) and increase operational efficiencies in existing infrastructure.

It also entails establishing an ongoing commissioning program, which is a process for using real-time or near real-time data to continuously monitor both the physical components of an energy system and the human behavior needed to optimize energy use.

Such monitoring enables quicker diagnostics and fault detection so that problems can be solved quickly, saving money, and improving the comfort and well-being of the campus community. Implementing this strategy will enhance current energy systems, increase cost savings, and reduce GHG emissions.

As an urban campus, space efficiency is essential to Georgia Tech’s growth in education and research. Currently, Georgia Tech is working toward modifying workspaces to support more remote and hybrid work, which has shifted the operational needs within buildings. This strategy will also help optimize space to reduce emissions, energy, and water use.

Energy Use Intensity (EUI)

Energy Use Intensity (EUI) is the national recommended benchmark for building performance. EUI = Energy Use (kbtu)/Square Footage.


1 Georgia Tech’s Enterprise Innovation Institute/Georgia Manufacturing Extension Partnership is home to subject matter experts who helped develop the ISO 50001 standard and implemented it throughout the state of Georgia.
Prioritizing energy efficiency in the design of new buildings and renovations of existing buildings is important for ensuring the optimal use of resources, saving money over the lifetime of the building, and increasing the environmental health of buildings.

This strategy proposes standards that meet or exceed Leadership in Energy and Environmental Design (LEED) certification requirements. Key actions include evaluating industry best practice frameworks, such as Passive House, LEED, and the Living Building Challenge, to develop or adopt standards best suited to Georgia Tech. This strategy would also include developing standards specific to laboratories informed by Georgia Tech’s current participation in the Guaranteed Energy Savings Performance Contract Smartlab program.

The best time to plan for energy efficiency is prior to construction.

Energy Efficiency in The Kendeda Building for Innovative Sustainable Design

The Kendeda outdoor air handler (with heat recovery, demand-controlled ventilation, and overhead fans) was designed to rigorous building standards through the International Living Future Institute’s Living Building Challenge. Some of the building’s energy efficiency measures include a high performing envelope consistent with passive house principles including triple pane glass, a water source heat pump connected to the campus chilled water system, a dedicated range of comfort control, and a radiant floor system.

These measures have resulted in an 18 kBTU/square foot/year energy use intensity (EUI) without including the building’s on-site solar, which makes the building 80% more efficient than a comparable new, conventionally built higher education building in Atlanta. When including the on-site solar, the building produced more power than it consumed by a factor of 200% in 2022.

Targeted deferred renewal in buildings addresses buildings that have deferred maintenance over time. It refers to the replacement or refurbishment of assets that have exceeded their useful life.

The importance of targeted renewal cannot be underestimated. This strategy is a high priority because it not only contributes to reaching net-zero emissions, but it is also critical to ensuring that Georgia Tech has state-of-the-art buildings to support its research and education priorities and needs across the Institute.

This strategy highlights the important connection between deferred renewal and climate action. It links Strategies 1.1 and 1.3 to ensure responsible use of the Institute’s resources and ensures that Georgia Tech is providing safe and healthy buildings to stakeholders.

Implementation of this strategy includes developing a systemwide plan to guide the order in which infrastructure needs to be improved and identifies the funding and capital needs to execute renewal for deferred maintenance. While it requires significant upfront funding, the long-term savings and return on investment are positive.
Students at Georgia Tech support and want to be engaged in actions that reduce GHG emissions from campus operations.

Part of strengthening student-administration relationships includes communicating progress on emissions reductions and modeling for future projects that promote and improve energy sovereignty. This strategy involves engaging students as a key stakeholder in conversations around energy usage and sourcing on campus. It includes working with students to guide campus behavioral changes around energy and engaging students to provide suggestions for energy efficiency improvements.

It also supports the Living Campus initiative in increasing opportunities for students to use campus as a living laboratory for academic and research projects.

As a student, I see climate action at Georgia Tech as vital for securing our future. It is an opportunity to engage, advocate, and equip students with knowledge and skills relevant to our careers. Georgia Tech’s commitment to sustainability aligns with our sense of social responsibility, encourages innovation, and offers a platform for collaboration, fostering a more engaged and empowered student community.

— Athena Verghis, Graduate Student, Student Government Association

### BUILDING ENERGY: Measures of Success

<table>
<thead>
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<th>MEASURE</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
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<tr>
<td>Percentage of electrified buildings not connected to the centralized campus heating and cooling system</td>
<td>10% of non-district buildings</td>
<td>60% of non-district buildings</td>
<td>100% of buildings</td>
</tr>
<tr>
<td>Percentage of heating and chilling equipment in district energy systems electrified</td>
<td>10% of chillers and coolers</td>
<td>60% of chillers and coolers</td>
<td>100% of chillers and coolers</td>
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<td>Implement an energy policy and EMS</td>
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<td>✔</td>
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<tr>
<td>Develop and implement standards that promote low energy buildings</td>
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<tr>
<td>Reduce EUI in buildings</td>
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<td>Reduce campus EUI 10%</td>
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<tr>
<td>Reduce campus EUI 20%</td>
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</table>
CLIMATE ACTION STRATEGIES

RENEWABLE ENERGY & OFFSETS

GUIDING PRINCIPLE
We prioritize clean energy technologies to eliminate emissions.

ALIGNMENTS

Transitioning to renewable energy sources is one of the most important opportunities to reduce GHG emissions.

This focus area includes strategies developed by the Renewables and Offsets working group. The strategies center on increasing renewable energy sources and exploring options for offsetting fossil fuel use.

As Georgia Tech advances plans to electrify the campus and vehicle fleet, its electricity and fuel mix must transition from gas, coal, and oil to renewable sources. This includes increasing on-site renewable energy, integrating energy battery storage into renewable projects, procuring electricity from clean energy sources, and investing in potential offsets.

If Georgia Tech continues with business as usual, it would rely solely on Georgia Power to continue adding more renewables to the grid. In 2022, Georgia Power’s energy mix included gas and oil (48%), nuclear (23%), coal (15%), and renewables and hydro (9%).

Strategies in this section also include resilience planning for designing, building, and operating infrastructure that can withstand, respond to, and recover from climate disruptions to centralized power systems. This means ensuring backup storage to reduce the likelihood of power outages and decrease the recovery time from outages that do occur.

Integrating renewable energy sources and energy storage increases the resilience of the campus grid by decentralizing electricity sources.

In the event of a natural disaster, the combination of renewable energy and energy storage can maintain essential services such as building lighting, heating and cooling, and municipal water services.

1 Georgia Power refers to the remaining 5% of the energy mix as null energy output from renewable energy credits. https://www.georgiapower.com/company/about-us/facts-and-financials.html.
Increasing the amount of on-site renewable energy contributes to Georgia Tech’s net-zero emissions goal while decreasing reliance on fossil fuels and increasing resiliency and the ability to respond to natural and other disasters.

Solar Photovoltaic (PV) systems are currently the most established and compatible renewable energy sources for Georgia Tech. Solar PV can be installed on building rooftops and over parking decks, parking lots, and sidewalks.

In addition, solar thermal systems for heating water and waste-to-energy systems that capture heat from waste streams can be considered to diversify the renewable energy portfolio. Alternative fuels from waste products, including biodiesel, biogas, and renewable natural gas that can be derived from food waste, wastewater, and other organic materials, can also be explored, and considered as potential options.

Georgia Tech produces about 1 Megawatt (MW) of renewable energy through rooftop PV that produces approximately 1.4 million kWh per year. By maximizing PV on existing rooftops and parking lots, it has the potential to reach 7 MW of renewable energy. Additional PV can be added by implementing solar arrays over open parking lots, sidewalks, and outdoor seating areas. These implementations serve a second purpose by providing increased shade during hot weather. Further, by 2050, it is likely that additional renewable technologies will become commercially viable and can further support on-site renewable energy opportunities.

Implementing energy storage, the practice of capturing and storing energy for later use, allows for the increased use of intermittent renewable energy sources.

For example, when used in conjunction with solar PV, energy storage provides a mechanism for storing excess energy on sunny days and then using it on cloudy days. In addition, energy storage helps increase Georgia Tech’s resilience to potential natural disasters by providing an additional source of backup power.

By employing next-generation technologies and strategies, Georgia Tech can amplify the impact of its emissions reduction efforts by improving our understanding of the performance of these technologies, reducing uncertainty, and building capacity throughout the region to implement the sustainability transition.

— Daniel Matisoff, Professor, School of Public Policy

Energy storage technologies include traditional batteries and other chemical, thermal, and gravity-based systems. Buildings or central energy plants can also store chilled water, ice, or hot water for later use when it is generated at times of increased renewable or low-carbon electricity availability. Key actions to implementing this strategy include identifying optimum locations for energy storage systems, ensuring safety and regulatory guidelines are met, and identifying cost-effective financing mechanisms.
To meet its net zero emissions goal, Georgia Tech must consider investing in Power Purchase Agreements (PPAs) and Virtual Power Purchase Agreements (VPPAs).  

PPAs provide on-site renewable energy implementation, delivery, and maintenance of systems without requiring upfront capital. VPPAs are financial agreements that fund off-site clean energy projects, allowing the project funder to take ownership of the clean energy attributes, even if the electricity is not directly used by the purchasers. Both options provide viable opportunities for decreasing emissions. (Note: PPAs and VPPAs were modeled separately since they have different cost models.)

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**FIGURE 9: VIRTUAL POWER PURCHASE AGREEMENTS AND POWER PURCHASE AGREEMENT**

<table>
<thead>
<tr>
<th>Power Purchase Agreement (PPA)</th>
</tr>
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<tbody>
<tr>
<td>Purchaser - GT</td>
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<td>FIXED RATE</td>
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<td>ROIs</td>
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<tr>
<td>ELECTRICITY</td>
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<td>Renewable energy producer</td>
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<table>
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<tr>
<th>Virtual Power Purchase Agreement (VPPA)</th>
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</thead>
<tbody>
<tr>
<td>Purchaser - GT</td>
</tr>
<tr>
<td>FIXED RATE</td>
</tr>
<tr>
<td>ROIs</td>
</tr>
<tr>
<td>ELECTRICITY</td>
</tr>
<tr>
<td>Renewable energy producer</td>
</tr>
</tbody>
</table>

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2.4 Explore carbon offsets as needed for remaining emissions

Carbon offsets are activities that aim to reduce GHG emissions through the removal of carbon from the atmosphere.

Examples of offsets include reforestation, carbon sequestration, methane capture at landfills, and renewable energy. Offsets must have a validated impact of reducing carbon emissions. They must adhere to recognized standards and cannot be used as an offset activity for another project. Georgia Tech will use carbon offset projects as a secondary strategy to account for the remaining Scopes 1 and 3 GHG emissions that are difficult to eliminate through other mitigation strategies.

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1 A Power Purchase Agreement (PPA) is an arrangement in which a third-party developer installs, owns, and operates an energy system on a customer’s property. Source: U.S. DOE Better Buildings. (n.d.) What is a power purchase agreement? https://betterbuildingssolutioncenter.energy.gov/financing-navigator/option/power-purchase-agreement.

2 Fossil fuels used to supply generators that produce emergency power and life safety functions are among Georgia Tech’s emissions that are difficult to eliminate. Other difficult to eliminate emissions include Georgia Tech’s use of refrigerants to support cooling demand and Scope 3 emissions from air travel, upstream natural gas leakage, and commuting.

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**FIGURE 10: CARBON OFFSETS**

- EMISSIONS
- OFFSETS
- GHGs
A Resilience Hub is defined as a "community-serving facility augmented to support residents and coordinate resource distribution and services before, during, or after a natural hazard event."1

Campus hubs would serve as a utility-independent resource center where students, staff, and faculty could go in the case of a natural or human-caused disaster. This strategy involves implementing at least three Resiliency Hubs on Georgia Tech's campus that support on-site renewables, battery storage, and potable water systems.2

Protecting our planet is not a choice; it is a responsibility. Georgia Tech's Climate Action Plan is our commitment to a prosperous future, where every action we take today ensures a thriving tomorrow for generations to come.

— Shan Arora,
Director of The Kendeda Building for Innovative Sustainable Design

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2 Key areas for consideration include The Kendeda Building for Innovative Sustainable Design, McCamish Pavilion (and its parking lot), and the John Lewis Student Center.
CLIMATE ACTION STRATEGIES

MOBILITY

GUIDING PRINCIPLE
We optimize campus mobility through a variety of transportation modes that are accessible, affordable, and low- to no-emissions, considering environmental and human health impacts when determining and implementing transit and land use decisions.

ALIGNMENTS

The Mobility working group focused on developing strategies for decreasing transport emissions on campus, commuting to and from campus, and air travel to and from campus.

This set of strategies includes transitioning the Institute to zero-emission vehicles, implementing infrastructure required to support zero-emission vehicles, and increasing options for net-zero commuting and air travel. Micromobility — transportation options such as walking, bicycles, and scooters — is also included.

The strategies in this section seek to reduce the carbon footprint associated with mobility by implementing more sustainable and inclusive mobility options for the Georgia Tech community.

In addition, it includes incentivizing other sustainable transportation options, such as working with local community organizations to increase and improve public transit options.

"Parking and Transportation Services is excited to be a key piece of the Georgia Tech fabric dedicated to improving and increasing sustainability initiatives. We continue to strive for greater heights by electrifying our fleet, increasing our regional transit commuter ridership, improving bicycling options, and incorporating campus micromobility programs."

— Derrick Walker, Director of Transportation, Campus Transportation
### 3.1 Transition the campus vehicle fleet to zero-emission vehicles and equipment

<table>
<thead>
<tr>
<th>Priority: <strong>HIGH</strong></th>
<th>GHG Reduction Potential:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Cost: <strong>$$</strong></td>
<td>Time Frame: <strong>Short-term</strong></td>
</tr>
</tbody>
</table>

Transitioning campus vehicle fleets to zero- or low-emission alternatives is a current Institute priority.

This strategy focuses on increasing the number of vehicles that have low or no tailpipe emissions, with an emphasis on electrification. Key actions for success include analyzing charging needs and habits, adding charging infrastructure, factoring in lead time for transformers, and developing procurement contracts for implementation.

The transition to zero-emission vehicles will contribute to improving air quality and noise reduction on campus.

The transition to a zero-emission transportation system requires modifications to campus infrastructure and resources to accommodate innovative technologies and methods of transportation. Evaluating bus routes, securing necessary resources, instituting a clean transportation policy, and assessing the impact of heavier electric equipment on staff efficiency and health are important for ensuring infrastructure changes that are sustainable in the long term.

In addition, the use of micromobility options, such as bikes, scooters, and skateboards, has increased on campus.

Updating infrastructure to include these alternatives is important to ensure greater accessibility and safety. Potential improvements include implementing covered bike parking, e-bike charging, and installing showers and lockers in buildings to support the increased use of these vehicles.

### Air Quality

In addition to GHGs that have global warming impacts, vehicles emit other criteria air pollutants, including carbon monoxide (CO), particulate matter (PM), sulfur dioxide (SO2), and nitrogen dioxide (NO2). These pollutants decrease air quality at the local level and can be harmful to human health. Historically, many parts of Atlanta have been considered “non-attainment zones” for meeting air quality regulation.1

Electric vehicles (EVs) and other low-emission technologies eliminate tailpipe emissions, providing an important co-benefit to this strategy by supporting improvements to Atlanta’s overall air quality.


### 3.2 Increase sustainable and affordable commuting options

<table>
<thead>
<tr>
<th>Priority: <strong>HIGH</strong></th>
<th>GHG Reduction Potential:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Cost: <strong>$</strong></td>
<td>Time Frame: <strong>Long-term, ongoing</strong></td>
</tr>
</tbody>
</table>

Commuting represents Georgia Tech’s highest source of Scope 3 emissions. Increasing sustainable commuting options is key to reaching Georgia Tech’s net-zero goals, but it is also an important strategy for supporting employees and students in getting to and from campus.

This strategy represents an opportunity to increase affordable and equitable transportation options. While public transportation is available, collaborating with local community partners such as Atlanta’s primary public transit agency, MARTA, to improve accessibility and affordability is essential to the success of this strategy. Additional components include adding mobility hubs around campus to increase access.

### Mobility Equity Considerations

#### Commuting

The cost of housing in Atlanta has increased in recent years, requiring Georgia Tech students and employees to either pay more for housing or move further away from campus. While commuting increases emissions and air pollution, it also leads to negative financial, physical, and mental impacts.2 Increasing the availability of affordable housing for students and staff on campus, or close to campus, can make walking, biking, and transit more equitable and provide healthier mobility options.

#### Inclusivity and Safety

While some community members may easily adopt alternative modes of transportation, updating micromobility systems and campus infrastructure to include individuals of all physical abilities is a high priority. Safety must also be prioritized as micromobility options are increasingly sharing the roads with cars.

**References**


3.3 Reduce emissions from airline travel

Air travel is included in Scope 3 and represents the second highest emissions source for mobility.

It is often essential for Georgia Tech students and employees to further educational and research pursuits. Emissions from air travel include travel to and from conferences, other related business travel, and study abroad programs for students.

Implementing an emissions tracking method for air travel is a key action for measuring the success of this strategy since it can be hard to track when students and employees purchase flights independently. Other actions include providing resources and education for stakeholders to understand options for lower-emission flights and alternatives, monitoring air travel related to Institute activities, and considering carbon offset purchases.

MOBILITY: Measures of Success

TABLE 4: MOBILITY MEASURES OF SUCCESS

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% zero-emission vehicle fleet and supported infrastructure</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased percentage of zero-emission commuting</td>
<td>10%</td>
<td>30%</td>
<td>50%</td>
</tr>
<tr>
<td>Air travel emissions tracking platform</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CLIMATE ACTION STRATEGIES

MATERIALS MANAGEMENT

GUIDING PRINCIPLE
We support a thriving circular economy that focuses on upstream systems for achieving zero waste, ensures sustainable procurement, and supports our local community.

ALIGNMENTS

SDGs

Institute’s Strategic Plan: Lead by Example
Sustainability Next: Lead by Example in the Practice and Culture of Sustainability

Emissions from materials are embedded in every product that comes into campus and leaves campus.

From the resources used to construct campus buildings to the food served in dining halls, all materials, goods, and products have emissions associated with their production and use. Additional emissions are generated by the processing and disposal of these materials at the end of their useful life.

This section includes strategies developed by the Materials Management and Student working groups. The strategies address Scope 3 emissions, which include indirect emissions from waste management, procurement, and the supply chain.

Strategies for decreasing Scope 3 emissions include developing a sustainable procurement policy, implementing zero waste practices, and integrating circular economy approaches into building design and construction.

“Scope 3 includes all other indirect emissions that occur in a company’s value chain.”

— GHG Protocol

The Materials Management working group considered the following GHG Protocol categories for strategy development:

- **Purchased Goods and Services** – Resources bought and used on campus.
- **Capital Goods** – Construction materials and large equipment.
- **Waste Generated in Operations** – Waste management activities.
- **Sold Products (broken into three distinct categories)** – Materials processed and sold by the organization. This category applies to limited activities at Georgia Tech.

Zero waste is defined as “the conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health.” Sending materials to landfills is a barrier to reaching zero waste at Georgia Tech.

Diverting materials from landfills is critical to reducing emissions and promoting sustainability on campus. Landfill diversion can be accomplished through source reduction, reuse, recycling, composting, and energy recovery. Almost 96% (2,579 mt CO2e) of emissions from waste disposal at Georgia Tech are from landfill methane gas emissions. This illustrates the importance of increasing landfill diversion practices to reduce Georgia Tech’s contribution to landfill emissions and improve materials stewardship.

The responsibility of my team is to ensure that the campus is giving back to the community and environment with clean and reusable material. With the help of the Georgia Tech community, I believe we can reach zero waste for our Institute.

— Shawn Dunham, Operational Manager, Solid Waste Management and Recycling

KEY ACTIONS TO SUPPORT BECOMING A ZERO WASTE CAMPUS INCLUDE:

• Developing an Institute-Wide Zero Waste Policy: A zero waste policy will create a solid foundation and key guidelines for working toward waste minimization and landfill diversion across the Institute.

• Developing Source Reduction Guidelines: Reduce consumption of high-emission and hard to recycle materials by providing guidelines for the Institute.

• Implementing a Campus Reuse Center: Promote programs for reusable materials and implement a campus reuse center.

• Increasing Recycling: Assess current infrastructure and contracts for recycling and implement infrastructure and service contracts that support increased recycling.

• Increasing Composting: Reduce landfilling of organic waste through composting and green waste collection.

• Providing Zero Waste Education and Training to Students and Employees: Providing education on zero waste campus initiatives and how campus stakeholders can support diverting materials from the landfill.

In addition, this strategy includes exploring options for sending municipal solid waste to landfills that capture methane gas to use as an energy source rather than releasing it into the atmosphere, which further reduces Scope 3 emissions.

Beyond GHG emission reduction potential, diverting materials out of landfills is a step toward environmental justice. Landfills are disproportionately located near socioeconomically disadvantaged communities, where, in addition to emitting GHGs, they contribute to groundwater pollution and release air pollutants with known negative human health impacts.

1 Vasarhelyi, K. (2021, April 15). The hidden damage of landfills. University of Colorado Environmental Center Division of Student Affairs. https://www.colorado.edu/ecn/2021/04/15/hidden-damage-landfills
Emissions associated with materials bought and used at Georgia Tech are reflected in Scope 3 emissions.

Developing a Sustainable Procurement Policy is one of the most cost-effective and useful approaches for decreasing Scope 3 emissions.

A Sustainable Procurement Policy guides an organization in adopting a cleaner supply chain and purchasing products that have a lower environmental impact in their production, use, and end of life. It provides vendors guidance on delivering sustainable materials and packaging that can be recirculated at the end of a product’s life rather than disposed of in a landfill.

This helps reduce emissions and increase resource stewardship throughout the supply chain. In addition, a Sustainable Procurement Policy supports the local economy by prioritizing local businesses in procurement practices.

An example of Georgia Tech’s environment of innovation and ingenuity, Raccoon Eyes is a student sustainability startup that uses software and data analytics to reduce food waste.

Disappointed by the amount of food wasted at campus dining halls, Nathanael Koh, CmpE 2022; Ivan Zou, CmpE 2023; and Bowen “Bruce” Tan, a second-year computer science major, stepped up to the challenge and created an extension for the dining hall trash cans that weighs and photographs food waste and asks students to provide a reason for their food waste.

The software sends that data back to dining hall managers and chefs to identify opportunities to modify portion sizes and food preparation.

The Raccoon Eyes team develops their software.
4.3 Integrate lifecycle approaches into campus design and planning

This strategy focuses on evaluating potential emissions in the design and planning stages of buildings and new projects. When new construction is necessary, lifecycle greenhouse gas emissions can be minimized by considering both the estimated energy use during the lifetime of the building and the benefits of procuring low- to zero-emission building materials, as well as planning for reuse and deconstruction during the building’s design.

This approach creates a hierarchy that values preserving existing structures before building new ones, which is among the most effective ways to reduce GHG emissions from material consumption at the source. Using building materials that have less embodied carbon, such as mass timber, and choosing lower-emission furnishings, such as recycled carpet, are options that lower overall emissions.

Integrating a lifecycle approach also promotes planning for the end of a building’s life and how the building materials can be returned to the economy as a positive resource.

According to the EPA, more than 600 million tons of construction and demolition C&D waste was generated in the U.S. in 2018, an amount that is “more than twice the amount of all generated municipal solid waste in the U.S. that year.” Waste from demolition is 90% of total waste, making it the largest waste category in the U.S.

Integrating a lifecycle approach also promotes planning for the end of a building’s life and how the building materials can be returned to the economy as a positive resource.

MATERIALS MANAGEMENT: Measures of Success

Table 5: Materials Management Measures of Success

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfill diversion rate</td>
<td>40%</td>
<td>65%</td>
<td>90%</td>
</tr>
<tr>
<td>Institute-wide Zero Waste Policy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Institute-wide Sustainable Procurement Policy</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LEADING THE WAY on Mass Timber

Georgia Tech researchers are at the forefront of learning how to use and quantify the environmental benefits of mass timber, a structural material made by joining smaller pieces of lumber into structural beams.

Mass timber serves as both a carbon sink and reduces the need for carbon-intensive materials, such as concrete and steel. Furthering mass timber research and use has the potential to support Georgia’s timber industry — one of the largest industries in the state — and introduce wood building products into the state’s carbon sequestration registry.

CLIMATE ACTION STRATEGIES

WATER MANAGEMENT

GUIDING PRINCIPLE
We adapt our water infrastructure to be resilient to the impacts of climate change.

ALIGNMENTS

SDGs
Institute’s Strategic Plan: Amplify Impact, Cultivate Well-Being, Lead by Example
Sustainability Next: Lead by Example in the Practice and Culture of Sustainability

Water supports all life on Earth. It is integrated into everything we do, and its availability and quality can have significant public health impacts. As such, water is also affected by climate change.

Water patterns are changing, from unprecedented droughts and flooding to rising sea levels. Identifying more sustainable water management strategies is essential for increasing resiliency and addressing climate action. Georgia Tech is committed to being a steward of water resources and therefore must adapt water strategies to meet the changing environment.

At Georgia Tech, water is used for domestic purposes (62%), energy production (31%), and irrigation (7%). The water-energy nexus illustrates how energy relies on water, and water treatment requires substantial amounts of energy. Water is pumped to Georgia Tech’s district energy plants and used for steam production. About 100 million gallons of water per year are used to support energy needs.

Strategies for improving water management include increasing water reuse through greywater and blackwater projects, continued reduction and reuse of stormwater runoff, and implementing efficient water technologies in buildings.

1 Blackwater is the wastewater from bathrooms and toilets containing biological waste. Greywater is wastewater that comes from sinks, washing machines, bathtubs, and showers. It contains lower levels of contamination than blackwater and no biological waste, making it easier to treat and process.

FIGURE 12: WATER CONSUMPTION ALLOCATION

In a region that gets more rainfall than Seattle, it is critical to think holistically about stormwater use, storage, and reuse in a way that considers impacts from upstream and minimizes impacts downstream. Reusing non-potable water on campus for irrigation, heating, cooling, and toilet flushing reduces the amount of water the city must treat, while also saving energy.

— Jason Gregory, Institute Landscape Architect
Implementing greywater and blackwater reuse systems increases resilience and decreases emissions associated with pumping and using water for energy production.

Greywater is water from sinks and showers, and blackwater is from toilets, which can be collected from the sanitary sewer line. Treated greywater and blackwater can be used for cooling towers, toilet flushing, and potential irrigation.

Initial studies have been developed to install a treatment facility at Georgia Tech to support the campus cooling plants. It has the potential to reduce approximately 30% of potable water use on campus (400,000 gallons per day). It also indirectly benefits the local community since the city does not have to treat this volume of water.

In addition to increasing water conservation and efficiency and decreasing cost, blackwater reclamation systems support the reduction of Scope 3 emissions, as well as reduce the volume of wastewater entering the Atlanta sewer system that is eventually released into the Chattahoochee River, which flows downstream to the Gulf of Mexico.

A key action of this strategy is partnering with local environmental agencies and regulatory bodies to increase opportunities and ensure alignment with broader environmental objectives and standards.

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Water-efficient technologies have increased over the last decade, from sink and shower fixtures to low-flow toilets.

These technologies help reduce the amount of water needed for indoor uses and decrease the amount of energy needed for pumping water.

LEED building certification is required for new buildings at Georgia Tech. LEED certification requires indoor water use reduction and building level water metering. For older buildings at Georgia Tech that were not built under the LEED guidelines, newer technologies provide low-cost options for increasing efficiency and saving water. Implementing more water-efficient systems across campus can reduce potable water use from buildings, decrease the amount of energy required for water pumping, and increase cost savings.
Initially planned in 2004 as a significant part of the campus master plan, the Georgia Tech EcoCommons has been a remarkable success story.

The EcoCommons concept is a zoning overlay across campus that follows the existing and historic drainage patterns, requiring a higher level of stormwater management and tree canopy to reestablish the ecological systems within the defined area. It was designed along the contours of the original water system prior to Georgia Tech. Its stormwater management system was modeled to reduce stormwater runoff by 50% across campus. This approach allows for the natural capture of water back into the soil. For larger storms, water is captured in underground cisterns to be reused.

Reducing stormwater runoff keeps excessive water from draining into the Atlanta public sewer system, helps prevent sewage overflows, provides water reuse opportunities, and nourishes and restores the soil on campus. This strategy focuses on expanding the reduction of stormwater runoff by increasing the EcoCommons footprint, implementing permeable pavement across campus where applicable, and maximizing green space for capturing rainwater. It supports climate action on multiple fronts by increasing the resiliency of campus during floods and droughts, increasing water conservation, and providing more opportunities for water reuse.

Georgia Tech’s water use is tied to Atlanta’s combined stormwater sewer system.

Stormwater runoff and potential sewage overflows lead to downstream contamination of public water sources. Georgia Tech’s EcoCommons provides an example of water stewardship that helps filter water back into the soil and can be reused for campus needs.

**WATER MANAGEMENT: Measures of Success**

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implement blackwater reuse system</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase water-efficient technologies in buildings</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Percent of stormwater capture</td>
<td>30%</td>
<td>40%</td>
<td>50%</td>
</tr>
</tbody>
</table>
CLIMATE ACTION STRATEGIES

EDUCATION

GUIDING PRINCIPLE
We prepare all students, regardless of discipline, to address climate-related challenges in their personal and professional lives.

ALIGNMENTS

SDGs
Institute’s Strategic Plan: Champion Innovation, Lead by Example
Sustainability Next: Catalyze Innovation Through Education and Research, Lead by Example in the Practice and Culture of Sustainability

The core focus of Georgia Tech’s strategic plan is that “students are our top priority.”

As an institution of higher education, Georgia Tech’s commitment to climate action extends beyond reducing emissions. In alignment with Sustainability Next, it includes advancing education for students to be climate leaders in the workforce and in their communities. In addition to providing curricular and co-curricular opportunities for current students, this focus area prioritizes providing robust resources for climate education, lifelong learning, and collaboration on climate action.

This section includes six strategies developed by the Education and Student working groups to advance CAP educational goals. Each strategy below envisages significant expansion of curricular, co-curricular, and extracurricular opportunities for students, alumni, and lifelong learners.

“Georgia Tech is a leader in climate solutions research and, through this plan, will extend leadership into solutions implementation. Even more importantly, this plan outlines how our academic programs empower our students to make an impact on climate change through their disciplines, whatever they may be.”

— Jennifer Leavey, Assistant Dean for Faculty Mentoring, College of Sciences
This strategy prioritizes expanding climate and sustainability education in every degree program to ensure all students are equipped to advance climate solutions, and the UN SDGs more broadly, within their chosen professions.

In addition to key concepts and skills associated with the science of climate change, incorporating social change theory, frameworks, and transdisciplinary climate action case studies equips students to apply their knowledge and skills to advance change on campus, in future workplaces, and in their communities.

This strategy is coordinated with Sustainability Next. The Undergraduate Sustainability Education Committee and the Center for Teaching and Learning can provide professional development opportunities for instructors engaged in sustainability and SDG teaching to incorporate climate action concepts and key competencies.

Other actions include developing student learning outcomes related to climate that can be adopted or adapted for courses and degree programs, assessing current distribution and characteristics of current climate education across schools and colleges, and hiring a cluster of sustainability-related faculty members with expertise in education for climate action to lead interdisciplinary academic programming.

Understanding and taking action to mitigate climate change requires transdisciplinary perspectives and the ability to work effectively with people from a wide range of backgrounds with diverse forms of expertise.

Instruction that incorporates multi-disciplinary and transdisciplinary learning helps students develop a more sophisticated understanding of complex challenges and solutions. Experiential and community-engaged learning can enhance learning outcomes and help students develop the skills needed for teamwork on climate change.

This strategy supports advancing Georgia Tech’s Living Campus by developing a formal framework that enables instructors across disciplines to include course modules and student projects that contribute to the CAP implementation.

It supports students in using Georgia Tech data on emissions and operations for class projects and working with the Center for Sustainable Communities Research and Education (SCoRE) to engage in community partnered climate research.

In addition, this strategy has a focus on creating new climate-related Vertical Integration Programs (VIPs) that include students, faculty, and staff on campus as well as community partners (e.g., community-based organizations, Drawdown Georgia, government, business) that work together to develop and explore research questions and support climate action.

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1. This action is part of the Association for the Advancement of Sustainability in Higher Education’s Sustainability Tracking, Assessment, and Rating System (AASHE STARS) criteria.
6.3 Expand climate-related credential offerings

Priority: MEDIUM
Estimated Cost: $$
Time Frame: Short-term
GHG Reduction Potential: N/A

This strategy involves increasing the number of degrees, certificates, and co-curricular opportunities to offer greater opportunities for in-depth exploration of climate science and solutions.

It proposes that Georgia Tech evaluate and expand internships with nonprofit, governmental, and business organizations engaged in climate action.

It requires evaluating climate action components of existing minor and certificate programs, including the sustainable cities and energy minors, collaborating with leadership and faculty associated with the new environmental science major to enhance and expand academic offerings related to climate action, and working with the Graduate Sustainability Steering Committee to bolster climate-related graduate programs.

Potential outcomes of this strategy might include opportunities for students to earn a certificate in GHG reporting and climate modeling.

6.4 Support student engagement around community-driven work outside the classroom

Priority: HIGH
Estimated Cost: $
Time Frame: Short-term
GHG Reduction Potential: N/A

This strategy focuses on providing education and training to students to support broader emissions reduction. Key actions include incorporating sustainability and climate emissions reduction on campus into student orientation and early GT1000 courses.

This would support student projects that advance carbon reduction on campus. Additional actions for this strategy include expanding the sustainability ambassador program (in Georgia Tech housing), supporting student competitions for carbon reduction, and hosting conferences and panel discussions that provide opportunities for students to further engage in climate action.

Climate action is crucial for Georgia Tech due to its responsibility to the environment, commitment to academic excellence, pursuit of sustainability, engagement with students, and the potential for community partnerships. Students participated in Climate Action Plan development through advisory groups, public engagement and workshops, contributions from student organizations, research involvement, and efforts for integration into the curriculum. This ensures that student voices and priorities are considered in shaping sustainability initiatives.

— Athena Verghis, Graduate Student, Student Government Association
6.5 Engage all staff, alumni, faculty, and students in lifelong learning and collaboration centered on sustainability and the SDGs, including climate action

Priority: HIGH
Estimated Cost: $
Time Frame: Short-term

Georgia Tech can "amplify its impact" by engaging with alumni, as well as staff, faculty, and students, on climate action through lifelong learning and collaboration opportunities.

This includes working with the Georgia Tech Alumni Association to develop a strategy for climate education and connecting students with alumni and community partners.

It expands student engagement by hosting campuswide events and broader network events such as the University Global Coalition, the Regional Centres of Expertise (RCE) Greater Atlanta, and RCE Americas on campus. It also rewards leadership in climate action by offering institutional awards for students, staff, faculty, and alumni.

6.6 Engage with other institutions to advance climate education

Priority: HIGH
Estimated Cost: $
Time Frame: Short-term

Partnering with other institutions allows leveraging, developing, and sharing best practices in climate education by growing networks of contacts and engaging in joint initiatives — locally, nationally, and internationally.

Georgia Tech is already collaborating with organizations such as the Georgia Climate Project and the RCE Greater Atlanta and will continue to engage with other academic institutions to compare, improve, and disseminate climate change-related curricula. This strategy also supports sharing best practices by meeting with other academic institutions to compare programs, tactics, and technologies, and how those are leveraged into academics to advance climate education and action.
### EDUCATION: Measures of Success

#### TABLE 7: EDUCATION MEASURES OF SUCCESS

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracking of (and increase from baseline) climate-inclusive course offerings</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Established network for faculty members teaching climate-inclusive courses</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Tracking of (and increase from baseline) number of collaborative climate education projects, resources, and conference presentations with other institutions</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Tracking of (and increase from baseline) number of local community climate engagement student projects and internships</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Tracking of (and increase from baseline) number of students reporting engagement with climate-oriented projects and partnerships, on and off campus</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
Georgia Tech will strategically invest in climate research and policy work to advance local, regional, and global climate action.

Working with local and global community partners, big and small businesses and industries, government at all levels, and the best and brightest minds, Georgia Tech researchers are leading in the discovery of climate science, the brokering of trust, the defining of problems, the development of solutions, and calls to action. This section focuses on further increasing and improving support for use-inspired climate research, building connections that integrate climate research across the Institute, and working with partners on strategy to increase the discovery and utility of climate research that improves the human condition.

Implementing strategies will involve working closely with Georgia Tech’s Research Next strategic initiative, particularly within the focus area “Research That Matters.”

The CAP will not only reduce our campus’s climate impact, but also have much broader global impacts as we utilize our physical and digital assets as test beds and living labs for research, development, and demonstration.

— Timothy Lieuwen,
Regents’ Professor, David S. Lewis Jr. Chair, and Executive Director,
Strategic Energy Institute

**Guiding Principle**
We expand support for faculty, staff, and students to further innovative research and projects to address climate-related issues.

**Alignments**

<table>
<thead>
<tr>
<th>SDGs</th>
<th>Research at Georgia Tech encompasses all 17 SDGs</th>
</tr>
</thead>
</table>

Institute’s Strategic Plan:
*Amplify Impact, Champion Innovation, Connect Globally*

Sustainability Next:
*Be a Global Thought Leader*

**Sustainability Next: “Be a Global Sustainability Thought Leader” Strategies**

- Increase the breadth and depth of sustainability research and strengthen transdisciplinary research efforts across Georgia Tech, commensurate with its role as a global leader in sustainability research.

- Grow, diversify, and cultivate doctoral, postdoctoral, and faculty talent dedicated to scientific discovery, the development of business, policy, and technology solutions; and humanistic approaches to addressing critical local and global challenges.

- Develop deep and sustained local community, government, and industry collaborations that center community expertise, equity, and the public good in solution development and adoption.

- Convene and coordinate diverse partnerships that connect research, education, and economic development to define and implement tomorrow’s solutions for climate mitigation, resilience, sustainability, and regeneration.

- Develop, validate, and disseminate innovative and effective course design and pedagogy in Education for Sustainable Development.
7.1 Increase investment into Georgia Tech's existing strengths in climate-related research

Priority: HIGH
Estimated Cost: $
Time Frame: Long-term, ongoing

Georgia Tech is already a leader in climate research. This strategy seeks to build on existing climate research by increasing internal support. This requires assessing the current landscape, improving coordination, and increasing financial support of future efforts. Increasing collaboration and identifying interdisciplinary connections across the Institute will help advance and strengthen climate-related research.

THE NEW YORK CLIMATE EXCHANGE AND THE EXCHANGE AT GEORGIA TECH

The New York Climate Exchange (NYCE) is a collaborative model for developing and demonstrating climate solutions. Located on Governors Island in New York, the design and operations of NYCE facilities will serve as a sustainability model and include a Living Building, expected to be the world’s largest regenerative building.

Georgia Tech is a Core Partner, bringing a long history of environmental stewardship to the collaborative. Georgia Tech researchers, academics, and graduates were, and continue to be, globally recognized as innovators in fields such as solar, materials, and sustainability policy.

As a counterpart of the NYCE, The Exchange at Georgia Tech is an embodiment of Georgia Tech’s duties as a Core Partner. Across 12 inaugural program areas, Georgia Tech researchers, academics, staff, and students will perform research and identify best practices that lead to immediate climate action on the regional, national, and global levels.

This effort advances Georgia Tech’s commitment to lead by example, showing partners and peers across the Southeast the pivotal role of this region in advancing equitable and innovative climate solutions.

7.2 Identify and shape future climate research opportunities in which Georgia Tech aspires to lead

Priority: HIGH
Estimated Cost: $
Time Frame: Short-term

Georgia Tech will strive to contribute to the future of climate research proactively and strategically.

In this strategy, Georgia Tech investigators will identify and prioritize topics in climate research and use their influence to help shape the decisions of external organizations that sponsor climate research.

As a vehicle for improving the human condition, the Institute’s vision for climate research is not only about securing more research opportunities, but about a conviction and responsibility to be the leader in defining and solving the grandest of grand challenges: global climate change.

Key actions include internal strategizing on research priorities and convening with, learning from, and giving back to partners across academia, industry, nonprofits, government, and various communities, from local to global.
7.3 Leverage Georgia Tech’s unique geographical location as a platform for climate-related discovery

**Priority:** MEDIUM  
**Estimated Cost:** $$  
**Time Frame:** Long-term  
**GHG Reduction Potential:** N/A

This strategy capitalizes on Georgia Tech’s place in the Southeast and its status as the preeminent technological research university in the region to conduct novel research that engages with, is relevant to, and is inspired by the socioeconomically diverse communities in which it resides.

Georgia Tech will take steps to strengthen connections between regional stakeholders and the Institute’s world-class researchers, allowing them to help local communities, especially those nearby and most vulnerable to the dangers of climate change. This strategy focuses on providing financial, logistical, and administrative support for infrastructure to advance climate research adoption through agreements, data sharing, proliferation of community-led efforts in workforce development and other climate-focused areas, and collaboration across Georgia Tech’s research, administration, teaching, and service initiatives.

7.4 Accelerate the transition from climate research and theory to action

**Priority:** HIGH  
**Estimated Cost:** $$$  
**Time Frame:** Medium-term  
**GHG Reduction Potential:** N/A

This strategy prioritizes the translation of research from concepts to implementable actions by bolstering relationships with decision-makers and improving the transfer of knowledge and technology to the public and private sectors.

Key actions for advancing this strategy include providing funding and support for climate startups; nominating faculty for advisory roles in government, industry, and NGOs; the placement of students and alumni in leading organizations that affect climate; and creating infrastructure to support the dissemination of Georgia Tech’s climate research.

“Georgia and metro Atlanta are gearing up to produce preliminary and then comprehensive climate action plans over the next two years. Georgia Tech’s jump-start with the production of emissions and solutions trackers is already helping them to identify priority measures to reduce climate pollution.”

— Marilyn Brown,  
Regents’ Professor and Brook Byers Professor of Sustainable Systems,  
School of Public Policy

Georgia Tech researchers associated with Drawdown Georgia helped to support the development of the state of Georgia’s first-ever climate action plan.

Working with the Department of Natural Resources’ Environmental Protection Division, Georgia Tech researchers worked with partners across Georgia to help the state develop its greenhouse gas inventory, develop a plan to address the most important immediate opportunities the state can take to reduce its greenhouse gas emissions, and potentially help develop policies and programs to reach those goals.

**RESEARCH: Measures of Success**

**TABLE 8: RESEARCH MEASURES OF SUCCESS**

<table>
<thead>
<tr>
<th>MEASURE</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop climate research and partnerships inventory</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tracking of (and increase from baseline) climate-related research¹</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tracking multisector partnerships in climate research and action</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

1 Tracking metrics include number of employees and departments engaged in climate-related research, number of research proposals submitted and awards received, amount of external awards/funding, and number of peer-reviewed academic publications including Georgia Tech authors.
Carbon sequestration is a step toward regeneration. Rather than only "sustaining" the land, sequestration helps to regenerate it. Regenerative practices give back more resources than they take. Planting trees that pull carbon dioxide out of the atmosphere is an example of a regenerative practice.

The Carbon Sequestration Analysis (CSA) conducted during the CAP process illustrates how Georgia Tech can promote regeneration through the management of the campus environment. Future work will continue to build on the foundation of the campus tree canopy and assess the role of campus soils and other vegetation.

One of Georgia Tech's most incredible resources is our campus's natural environment. The way we interact with and preserve the trees, soils, and vegetation on campus can help us move beyond reducing the emissions we generate to a state where we can focus on removing carbon dioxide from the atmosphere. This is a key step for moving toward regenerative land management.

— Abby Bower, Sustainability Coordinator, Office of Sustainability

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**What Is Carbon Sequestration?**

Carbon sequestration is the practice of capturing and storing atmospheric CO2, which is one of the main planet-warming greenhouse gases.

The process of sequestration involves extracting CO2 from the atmosphere via photosynthesis, with a portion being stored in soil, plants, or trees. As a plant captures CO2, it emits oxygen into the atmosphere and synthesizes sugars by combining carbon and water. Natural carbon sinks are reservoirs that absorb and retain atmospheric carbon, such as forests, urban trees, soils, and oceans. Preserving and enhancing carbon sinks is an effective strategy for mitigating climate change by removing carbon dioxide from the atmosphere.

A Carbon Sequestration Analysis (CSA) measures how much carbon is absorbed and stored within a defined area.

---


**How It Works**

Sequestration can occur in different “carbon pools” in an ecosystem. A carbon pool is a component of the Earth’s climate system that can store, accumulate, or release carbon. These pools include various natural reservoirs, such as oceans, soils, forests, and the atmosphere.

Collectively, the carbon stored in pools constitutes the carbon stock of the specified ecosystem, representing the total amount of carbon sequestered. This interplay between plants and soil forms a dynamic carbon sink.

**KEY COMPONENTS OF CARBON SEQUESTRATION**

**SOILS**

The ability of soils to sequester carbon depends on a range of factors, including soil type, fungi, organic matter content, and land management practices. Healthy soils can sequester carbon for centuries, acting as a natural buffer against climate change. Carbon sequestration involves complex interactions between plants, soil, and organisms.

Fungi play a vital role in carbon sequestration, breaking down organic matter in the soil and storing carbon in their tissues. Mycorrhizal fungi form symbiotic relationships with plants, helping them to absorb nutrients and water from the soil. In exchange, the plants provide the fungi with carbohydrates, which the fungi use to grow and store carbon.


**ANIMALS**

Animals also contribute to carbon sequestration by consuming plants and storing carbon in their bodies, as well as dispersing seeds needed to spread carbon-sequestering vegetation.


**VEGETATION**

Plants and trees play a continuous role in this cycle, absorbing carbon dioxide from the atmosphere and storing it within their tissues.

When trees and plants burn, are eaten, or when land undergoes changes from one cover type to another (such as transitioning from a forest to urban development), a portion of the stored carbon gets released back into the atmosphere. Trees and plants also naturally release some carbon through leaf senescence or other natural losses in biomass.

The release of carbon in the atmosphere, often in the form of carbon dioxide, contributes to fluctuations in the ecosystem’s carbon stock. The annual change to the carbon stock is called the carbon flux. The CSA measured carbon flux from trees at Georgia Tech.

This diagram of the fast carbon cycle shows the movement of carbon between land, atmosphere, and oceans. Yellow numbers are natural fluxes, and red are human contributions in gigatons of carbon per year. White numbers indicate stored carbon. [Diagram adapted from U.S. DOE, Biological and Environmental Research Information System.] Source: https://earthobservatory.nasa.gov/features/CarbonCycle
An Urban Forest

Georgia Tech’s home campus is located within Atlanta’s city limits, meaning the trees on campus contribute to the city’s overall canopy coverage.

Trees are both a major feature of Atlanta’s landscape and a primary contributor to biological carbon sequestration on Georgia Tech’s campus. In 2023, Georgia Tech’s campus tree canopy coverage was 22%.

It is an important part of the campus design, and plans are in place to continue preserving and expanding it. For example, the 2010 Campus Landscape Plan has a goal to expand canopy coverage to 55% of campus.

In addition to beautifying the Tech campus, forests and trees have many co-benefits, including:

1. Reducing the urban heat island effect.
2. Reducing stormwater runoff.
3. Reducing the amount of air pollution.
4. Supporting biodiversity and pollinators.
5. Sequestering carbon.
6. Improving property values.
7. Improving mental and physical health of surrounding communities.


8.1 Increase Georgia Tech’s tree canopy coverage and biodiversity

<table>
<thead>
<tr>
<th>Priority: MEDIUM</th>
<th>GHG Reduction Potential:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Cost: $</td>
<td>Time Frame: Long-term, ongoing</td>
</tr>
</tbody>
</table>

Increasing Georgia Tech’s tree canopy and biodiversity serves multiple purposes. It is a mitigation strategy that helps to sequester carbon on campus, creating emissions offsets for the Georgia Tech GHG inventory. It is also an adaptation strategy to increase biodiversity of native species while decreasing non-native and invasive species. Trees and plants also provide cooling shade for campus stakeholders and help reduce the urban heat island effect, air pollution, and stormwater runoff.

CARBON SEQUESTRATION: Measures of Success

<table>
<thead>
<tr>
<th>TABLE 9: CARBON SEQUESTRATION MEASURES OF SUCCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MEASURE</strong></td>
</tr>
<tr>
<td>-------------------------------</td>
</tr>
<tr>
<td>Increase tree canopy coverage: % of campus area</td>
</tr>
</tbody>
</table>

Georgia Tech Tree Canopy Awards

Georgia Tech’s tree canopy has resulted in multiple designations and honors, including:

1. Tree Campus USA certification: Awarded for the past 15 years.
STRATEGY MODELING RESULTS

BUSINESS-AS-USUAL (BAU) MODEL

A Business-As-Usual (BAU) model* was developed to estimate how emissions will change if Georgia Tech does not implement climate mitigation strategies. A BAU provides a useful baseline for comparison. Projection factors included planned campus growth from the Georgia Tech Comprehensive Campus Plan, predicted changes from Georgia Power’s commitment to adding more clean energy to the grid, and rates of expected electric vehicle (EV) adoption over time.

* Modeling assumptions and references can be found in Appendix C.

Based on mid-level scenarios for grid-greening and EV adoption, Georgia Tech’s total emissions are forecasted to decrease 54% from FY 2010 levels by 2050 (see Figure 14). The forecast will change depending on which factors are selected.

Although the BAU model shows overall emissions decreasing over time, it signals that without action Georgia Tech will not reach the Intergovernmental Panel on Climate Change’s recommended targets for curbing global warming and Georgia Tech must proactively work to implement climate action strategies to meet its net-zero emissions goal.

In the BAU model, Scope 1 emissions are expected to increase by 2050 due to a rising demand for natural gas in Georgia Tech’s expected growth scenario. The model shows Scope 1 increasing by 56% from 2010 to 2050.

By contrast, Scopes 2 and 3 are expected to decrease. Scope 2 emissions decrease by 90% in the BAU model based on Georgia Power’s plans to continue decarbonizing its energy mix. Scope 3 emissions are projected to decrease by 14% based on the expected growth in the number of electric vehicles used by employees and students for commuting.

While there is some decrease in emissions from continuing business as usual, the model illustrates the importance of implementing mitigation strategies to reach Georgia Tech’s net-zero emissions goal.

The forecasted 54% decrease in total emissions is the probable case under the ‘NREL Cambium mid-level with 95% decarbonization’ scenario, which forecasts emissions factors for purchased electricity.
EMISSIONS STRATEGY MODEL

Following the BAU analysis, Georgia Tech developed a GHG emissions model to forecast the results of the recommended mitigation strategies identified by the CAP working groups. The model helped to estimate emissions reduction potential, prioritize strategies, and forecast total emissions if certain strategies were successfully implemented.

The GHG model assessed mitigation strategies that affect Scopes 1, 2, and 3 emissions and included operational baseline data and quantifiable emissions impacts, such as transitioning to electrification for all buildings, implementing energy efficiency measures, adding on-site renewable energy, transitioning the campus vehicle fleet to zero-emissions, diverting 90% of waste from the landfill, implementing sustainable purchasing guidelines, and improving infrastructure for micromobility (e.g., bicycles, electric bikes, electric scooters, and other lightweight vehicles operating at low speeds by single users).

Modeling assumptions included the following guidelines:

- **Implementation Timeline**: Some strategies have already begun or will begin implementation soon, while others require capital and longer time frames. The model assumed estimated target years based on Georgia Tech priorities, potential funding, and ease of implementation.
- **Implementation Scale**: Scale was based on the potential breadth of strategy impacts — for example, the portion of buildings expected to receive energy upgrades or the number of buildings with viable rooftops for added solar PV.
- **Implementation Efficacy**: Projecting the future efficacy of certain strategies required synthesizing peer-reviewed research and empirical data from industry to understand the expected impacts of implementing decarbonization technologies and sustainability standards such as LEED.

Appendix C contains a full list of assumptions and data sources used for the BAU and the strategy model.

1 Strategies without sufficient data (i.e., procurement) and qualitative strategies, such as those in the research and education sections, were not modeled. All projections were aligned with the Georgia Tech Comprehensive Campus Plan.

2 Modeling assumptions and references can be found in Appendix C.

OVERALL MODELING RESULTS

Georgia Tech’s climate action strategies provide a clear pathway for Georgia Tech to decrease emissions by 50% by 2030 and to reach net-zero emissions by 2050. These goals are consistent with science-based, internationally accepted guidelines for curbing global warming to mitigate the worst effects of climate change.

If Georgia Tech pursues the strategies outlined in the CAP, the results of the strategy model show that the Institute can halve emissions by 2030 (from the 2010 baseline) and reach net zero by 2050.

*Modeled* strategies are listed in Table 10 (individual strategy modeling results are in the following sections).

<table>
<thead>
<tr>
<th>TABLE 10: MODELED STRATEGIES BY FOCUS AREA</th>
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</thead>
<tbody>
<tr>
<td><strong>FOCUS AREA</strong></td>
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<tr>
<td><strong>Building Energy</strong></td>
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<td></td>
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<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td><strong>Renewable Energy &amp; Offsets</strong></td>
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<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td><strong>Mobility</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Materials Management</strong></td>
</tr>
<tr>
<td><strong>Water Management</strong></td>
</tr>
<tr>
<td><strong>Carbon Sequestration</strong></td>
</tr>
</tbody>
</table>
Figure 15 shows the results of the strategy emissions model. The strategy model projects that in 2050, Georgia Tech’s remaining emissions will decrease to 0 mt CO2e, representing a 100% (314,835 mt CO2e) reduction from the 2010 baseline. Impacts from Georgia Tech's modeled strategies contribute 46% (145,647 mt CO2e) of these reductions. The other 54% (169,188 mt CO2e) of reduced emissions are from expected reductions in a BAU scenario. BAU reductions are attributable to external influencing factors that affect Georgia Tech’s emissions regardless of the implementation of any strategies.

BAU reductions in the Georgia Tech strategy model depend primarily on Georgia Power’s plans to clean the grid and expected industry growth in EV adoption (see Appendix C: Modeling Assumptions for more information).

The CAP mitigation strategies will reduce Georgia Tech’s emissions by 145,647 mt CO2e in 2050. Figure 16 shows that the Building Energy strategies had the most significant impact on emissions reductions, contributing 60.4% (88,021 mt CO2e) to the overall reductions. The Renewable Energy and Offsets strategies had the second largest impact on emissions (35.7%; 51,997 mt CO2e), followed by Materials Management (1.9%; 2,721 mt CO2e), Mobility (1.3%; 1,824 mt CO2e), Carbon Sequestration (0.6%; 879 mt CO2e), and Water Management (0.1%; 204 mt CO2e).

The modeling results show projected results in 2050, which is the target year for meeting Georgia Tech’s climate goals. Emissions were also modeled cumulatively for each strategy, meaning emissions reductions were added together for each year between FY 2022 and FY 2050. Results for cumulative emissions modeling vary slightly from impacts in the year 2050 when isolated (see Cumulative Emissions modeling section).
After expected BAU reductions, implementing the Building Energy strategies provides the largest reduction in overall emissions at Georgia Tech, almost eliminating Scope 1 emissions and significantly decreasing Scope 2 emissions. Of these strategies, transitioning the campus to electrification of combustion-based heating systems contributes to most of the emissions reductions (93.5%). It is followed by increasing operational energy efficiency and conservation (4.2%), developing standards for decarbonizing new buildings and renovations on campus (1.8%), and investing in targeted renewal (0.4%).

The Renewable Energy and Offsets focus area contributed to the second largest portion of emissions reductions. It accounted for 35.7% (51,997 mt CO2e) of total reductions from all modeled strategies. These strategies decrease Scope 2 emissions from purchased electricity and provide a pathway for offsetting the remaining Scopes 1 and 3 emissions that cannot be eliminated by other climate mitigation strategies. The renewable energy strategies were modeled with the expected BAU reductions by Georgia Power to clean the grid and fully eliminate Georgia Tech’s Scope 2 emissions by 2050. Implementing renewable energy strategies while the grid is fossil fuel-reliant will have a greater GHG impact.

Strategy 2.1 (increase on-site renewable energy production) contributed to 0.8% of emissions reductions, mostly due to the limited capacity for new rooftop solar PV on existing Georgia Tech buildings. However, on-site renewables also increase campus resiliency and provide potential long-term cost savings.

Further, as new renewable technologies become more feasible for Georgia Tech, more on-site capacity can be added to future projections. Strategy 2.3 (procure electricity generated from renewable and zero-emission sources) was modeled for both PPAs and VPPAs. These represent 2.5% and 34.5% emissions reductions, respectively.

Some strategies in this focus area were broken down into sub-strategies for more detailed modeling results. For example, Strategy 2.4 (explore carbon offsets as needed for remaining emissions) was modeled separately for Scopes 1 and 3 emissions due to slight variations in how emissions in these scopes must be addressed with offsets.
**MOBILITY MODELING RESULTS**

The Mobility strategies contribute 1.3% (1,824 mt CO₂e) of total emission reductions.

Within this focus area, Strategy 3.1 (transitioning the campus fleet to zero-emissions vehicles and equipment) and Strategy 3.2 (increase sustainable and affordable commuting options) were modeled for emissions. Most emission reductions were achieved through Strategy 3.1 (79.5%). The remaining reductions (20.5%) were from Strategy 3.2.

Although emissions associated with mobility represent a substantial portion of the Georgia Tech’s emissions inventory, their reduction potential is smaller than expected. Programs and incentives to promote sustainable commuting choices are important, but it requires community partnerships to address the broader transportation infrastructure beyond Georgia Tech’s boundary. Additionally, the model assumed that commuters would adopt electric vehicles over time, without Georgia Tech’s intervention, which was accounted for in the BAU.
Within the Materials Management focus area, Strategy 4.1 (become a Zero Waste campus) was the only strategy that was modeled for emissions due to the availability of data and quantifiable results from sustainable procurement and materials management. Modeling results showed that this strategy accounted for 2.4% of overall emissions reductions (2,721 mt CO2e).

Modeling results showed that this strategy accounted for 2.4% of overall emissions reductions (2,721 mt CO2e). While the emissions reduction is low compared to other areas, these strategies are important due to the larger impacts they have on the supply chain, environmental justice, and the local community.

Within the Water Management focus area, Strategy 5.1 (implement campus greywater and blackwater reuse systems) was the only strategy modeled for emissions reductions due to the difficulty in quantifying emissions for stormwater and water efficiency upgrades.

It assumed blackwater reuse systems were modeled for the replacement of potable water used for cooling and irrigation. Results indicated that a treatment plant would decrease emissions by 204 mt CO2e by 2050.

While water management had the smallest contribution to Georgia Tech’s overall emissions reductions, these strategies have serious and important contributions to resiliency, health, safety, and the local community.
In 2022, Georgia Tech had more than 15,000 trees, covering 85 acres (22% of campus), that sequester carbon. Since 2016, Georgia Tech’s tree canopy has declined slightly, representing a canopy “loss.” The loss of trees represents added emissions (+113 mt CO₂e).

However, since there is still a large tree canopy, Georgia Tech’s existing trees removed 489 mt CO₂e from the atmosphere, resulting in a net removal of 376 mt CO₂e in 2022.

The analysis found that if Georgia Tech reached a 55% canopy coverage, an additional 876 mt CO₂e would be sequestered by 2050 and increase total campus sequestration to approximately 1,256 mt CO₂e per year.

Over time, this means enhancing carbon sequestration supports climate mitigation at Georgia Tech.

The modeling results described above offer snapshots of emissions reductions in the year 2050 in comparison to the 2010 baseline. Emissions reductions from a strategy can vary over time due to differences in implementation timeline or external factors included in the BAU.

As such, some strategies may provide greater emissions reductions in 2030 compared to 2050. Cumulative emissions reductions for each strategy were calculated to highlight strategies with greater overall impact. This method sums the total emissions reductions for each strategy area year-over-year from strategy implementation through 2050.

Cumulative emissions are important for understanding strategies with GHG impacts that change over time. For example, on-site renewable energy strategies have a greater impact on mitigating Georgia Tech’s emissions prior to Georgia Power implementing efforts to decarbonize the grid.

Any on-site renewable energy that offsets purchased electricity from the grid will have a greater impact while the grid is more fossil fuel-reliant. As the grid is decarbonized, the on-site renewable energy impact decreases.

Although the impact of renewable energy strategies is less pronounced with a cleaner grid, its contribution remains significant between now and 2050. In short, renewable energy strategies are more effective when implemented sooner rather than later.

The implementation date of each strategy also affects cumulative emissions reductions. Not all strategies will be implemented on the same timeline, and they will have varying start dates. For the modeled strategies, start dates ranged from 2024 to 2045. Additionally, some strategies were modeled with slow implementation over time through 2050, while others were modeled for implementation within the next decade.

Figure 23 (next page) demonstrates that transitioning to electrification of combustion-based heating systems outperforms all other strategies. Enrolling in a VPPA had the second highest emissions reduction potential, followed by carbon offsets and energy efficiency improvements. Although becoming a Zero Waste campus had a smaller impact when viewed through the lens of a single year, it had more impact cumulatively if zero waste is achieved by 2030.
**FIGURE 23: CUMULATIVE EMISSIONS REDUCTIONS FROM GEORGIA TECH’S CLIMATE ACTION STRATEGIES BETWEEN STRATEGY IMPLEMENTATION DATES AND 2050**

**TABLE II: STRATEGIES SORTED BY CUMULATIVE GHG EMISSIONS REDUCTION POTENTIAL**

<table>
<thead>
<tr>
<th>STRATEGY</th>
<th>CUMULATIVE GHG EMISSIONS REDUCTION POTENTIAL (mt CO₂e)</th>
<th>GHG IMPACT</th>
<th>ESTIMATED COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition to electrification of combustion-based heating systems</td>
<td>883,235</td>
<td>HIGH</td>
<td>HIGH</td>
</tr>
<tr>
<td>Procure electricity from renewable and zero-emission sources: VPPA</td>
<td>366,892</td>
<td>HIGH</td>
<td>LOW</td>
</tr>
<tr>
<td>Increase operational energy efficiency and conservation</td>
<td>221,557</td>
<td>HIGH</td>
<td>LOW</td>
</tr>
<tr>
<td>Explore carbon offsets as needed for remaining emissions: Scope 3</td>
<td>194,455</td>
<td>HIGH</td>
<td>LOW</td>
</tr>
<tr>
<td>Procure electricity from renewable and zero-emission sources: PPA</td>
<td>98,320</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>Develop standards for decarbonizing new buildings and renovations</td>
<td>74,372</td>
<td>MEDIUM</td>
<td>LOW</td>
</tr>
<tr>
<td>Become a Zero Waste campus</td>
<td>59,930</td>
<td>MEDIUM</td>
<td>LOW</td>
</tr>
<tr>
<td>Increase sustainable and affordable commuting options</td>
<td>33,802</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>Transition the campus fleet to zero-emissions vehicles and equipment</td>
<td>31,526</td>
<td>LOW</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>Invest in targeted renewal for existing buildings</td>
<td>30,447</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>Increase on-site renewable energy production</td>
<td>30,078</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>Explore carbon offsets for remaining emissions: Scope 1</td>
<td>24,163</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>Increase Georgia Tech’s tree canopy coverage and biodiversity</td>
<td>13,950</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>Implement campus greywater and blackwater reuse systems</td>
<td>4,278</td>
<td>LOW</td>
<td>MEDIUM</td>
</tr>
</tbody>
</table>
STRATEGY MODELING RESULTS

SUMMARY OF EMISSIONS MODELING

The results of the strategy model demonstrate that Georgia Tech can reach net zero by 2050. Strategy implementation may vary from what is assumed in the model due to economic and policy changes, and as new technologies become available.

While all future conditions cannot be predicted, modeling each strategy and developing a cost analysis provided an implementation framework between now and 2050 for how Georgia Tech can reach its goals.

The renewable energy and offset strategies have the second greatest impact and will support the reduction of Scopes 2 and 3 emissions. Further, as Georgia Power continues to decarbonize the grid, emissions reductions from building and vehicle fleet electrification will be maximized. Mobility, materials management, water, and carbon sequestration strategies support reductions in Scopes 1 and 3 emissions.

While these strategies have lower reduction potential compared to building energy and renewable energy, they target key campus operations that are important to broader sustainability goals and Institute goals.

Overall, the implementation of all modeled strategies provides a clear path for Georgia Tech to reach net zero emissions by 2050.

In summary, implementing the CAP building energy strategies will have the greatest impact on reducing emissions, nearly eliminating Scope 1 emissions.
CAP IMPLEMENTATION

Implementation Road Map

The implementation of the CAP will require a whole community approach and a dedicated commitment through 2050, or until Georgia Tech reaches net-zero emissions.

Community partnerships will be an essential component of success. Implementation committees will be established to carry out the strategies within the CAP and include faculty, staff, students, and community members with expertise or interest in each area.

Committees will be charged with tracking progress, planning budgets, and setting micro targets. The committees will be based on the nine focus areas within the CAP and members will be tasked with leading the implementation of the strategies in each area.

An implementation road map was developed to identify milestones, interim targets, monitoring, and reporting.

The road map begins at the baseline year of 2010 with milestones in 2030, 2040, and 2050 for targeted emissions. Key milestones are to reduce emissions by 50% by 2030 and reach net-zero emissions by 2050. All strategies are scheduled for implementation during that time frame.

FIGURE 24: IMPLEMENTATION ROAD MAP
**Monitoring and Reporting**

Monitoring implementation progress is important for ensuring that Georgia Tech stays on track to meet its goals.

Measures of success were developed by the strategy working groups for key milestone years (2030, 2040, 2050).

Interim targets were integrated into the emissions modeling tool to adjust for data and externalities. The measures of success listed in Table 12 provide progressive yet realistic targets for CAP implementation.

**TABLE 12: CAP MEASURES OF SUCCESS**

<table>
<thead>
<tr>
<th>MEASURE OF SUCCESS</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of electrified buildings not connected to the centralized campus heating and cooling system</td>
<td>10%</td>
<td>60%</td>
<td>100%</td>
</tr>
<tr>
<td>Percentage of heating and chilling equipment in district energy systems electrified</td>
<td>10%</td>
<td>60%</td>
<td>100%</td>
</tr>
<tr>
<td>Implement an energy policy and EMS</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop and implement standards that promote low-energy buildings</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce EUI in buildings</td>
<td>Reduce 10%</td>
<td>Reduce 15%</td>
<td>Reduce 20%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MEASURE OF SUCCESS</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% zero-emission vehicle fleet and supported infrastructure</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased percentage of zero-emission commuting</td>
<td>10%</td>
<td>30%</td>
<td>50%</td>
</tr>
<tr>
<td>Air travel emissions tracking platform</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MEASURE OF SUCCESS</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfill diversion rate</td>
<td>40%</td>
<td>65%</td>
<td>90%</td>
</tr>
<tr>
<td>Institute-wide Zero Waste Policy</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Institute-wide Sustainable Procurement Policy</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RENEWABLES**

- **Increase the amount of on-site renewables**
  - 2030: 2MW
  - 2040: 5MW
  - 2050: 7MW

- **Implement energy storage projects**
  - 2030: 300 kWh
  - 2040: 1 MWh
  - 2050: 2 MWh

- **Implement Resiliency Hubs**
  - 2030: 1 Hub
  - 2040: 2 Hubs
  - 2050: 3 Hubs

**MOBILITY**

<table>
<thead>
<tr>
<th>MEASURE OF SUCCESS</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institute-wide Zero Waste Policy</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MATERIALS MANAGEMENT**

- **Landfill diversion rate**
  - 2030: 40%
  - 2040: 65%
  - 2050: 90%

- **Institute-wide Zero Waste Policy**
  - ✔️

- **Institute-wide Sustainable Procurement Policy**
  - ✔️
### STRATEGY MODELING RESULTS

#### WATER MANAGEMENT

<table>
<thead>
<tr>
<th>MEASURE OF SUCCESS</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implement greywater and blackwater reuse system</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Increase water efficient technologies in buildings</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Percent of stormwater capture</td>
<td>30%</td>
<td>40%</td>
<td>50%</td>
</tr>
</tbody>
</table>

#### RESEARCH

<table>
<thead>
<tr>
<th>MEASURE OF SUCCESS</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop climate research and partnerships inventory</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tracking of (and increase from baseline) climate-related research</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tracking multisector partnerships in climate research and action</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

#### CARBON SEQUESTRATION

<table>
<thead>
<tr>
<th>MEASURE OF SUCCESS</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase tree canopy: % of campus area</td>
<td>25% of campus area</td>
<td>40% of campus area</td>
<td>55% of campus area</td>
</tr>
</tbody>
</table>

#### EDUCATION

<table>
<thead>
<tr>
<th>MEASURE OF SUCCESS</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tracking of (and increase from baseline) climate-inclusive course offerings</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Established network for faculty members teaching climate-inclusive courses</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tracking of (and increase from baseline) number of collaborative climate education projects, resources, and conference presentations with other institutions</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tracking of (and increase from baseline) number of local community climate engagement student projects and internships</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tracking of (and increase from baseline) number of students reporting engagement with climate-oriented projects and partnerships, on and off campus</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Georgia Tech will provide reports on the implementation progress to its stakeholders on an annual basis and provide a full comprehensive report on target progress at each milestone year. The Georgia Tech Office of Sustainability will update the GHG Inventory and report it to Second Nature, the formal representative entity to the Race to Zero for Universities and Colleges, every year. As policies change and new technologies come on the market, the CAP may need additional analyses and iterations. A review of market changes and other elements that could affect implementation is planned for 2030, 2040, and 2050. The purpose of any new iterations will be to:

- Assess and adjust strategies, interim targets, and metrics.
- Incorporate new technologies, information, and policies.
- Reevaluate strategies and targets.
- Determine updated best practices and make respective adjustments and corrections.
CALL TO ACTION

In the Sustainability Next plan, President Cabrera states that Georgia Tech has the responsibility to lead on complex and critical global challenges, including climate change. Developing Georgia Tech’s first CAP was a primary goal within the Sustainability Next’s focus area: “Lead by Example in Practice and Culture.” Completing the CAP is an important achievement for demonstrating Georgia Tech’s commitment to sustainability and joining thousands of other institutions that are part of the United Nations Race to Zero campaign.

Georgia Tech’s CAP was developed internally in collaboration with staff, faculty, and students, utilizing the expertise of our campus community and the deep knowledge of campus operations personnel. Going forward, it will require continued collaboration across academic, operational, and research units. Georgia Tech has a wealth of expertise in climate innovation, and the CAP provides an opportunity to cross-collaborate and learn from each other to ensure the best practices and approaches are put forward to support the goals of the Institute.

This commitment requires more than a pledge.

It is a dedicated and equitable process and collaborative journey over the next several decades. Georgia Tech is committed to the implementation of this plan. Every member of our community is invited to join us in our Race to Zero.

Climate change is a threat to human well-being and planetary health. There is a rapidly closing window of opportunity to secure a livable and sustainable future for all...

The choices and actions implemented in this decade will have impacts now and for thousands of years.

— Intergovernmental Planet on Climate Change, AR6 Synthesis Report Headline Statements: Climate Change 2023

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- Greg Spiro, Interim Executive Director of Infrastructure, I&S - Lead
- Jermaine Clonts, Associate Director, Utilities Management, I&S - Co-Lead
- Ross Bongiovani, Associate Director Facilities, Director of Facilities and Capital Planning, College of Sciences; former Associate Director of Support Services, GTRI
- Marilyn Brown, Regents’ Professor and Brook Byers Chair of Sustainable Systems, School of Public Policy, Ivan Allen College of Liberal Arts
- Randy Green, Group Manager, Georgia Manufacturing Extension Partnership
- Philip Johnston, former Mechanical Engineer III, I&S
- Jung-Ho Lewe, Research Engineer, Daniel Guggenheim School of Aerospace Engineering, College of Engineering
- Tim Lieuwen, Executive Director, Strategic Energy Institute
- Jim Stephens, Interim Vice President, I&S
- Tameka Wimberly, Former Senior Campus Planner, I&S
- Catherine Wong, Utilities Analyst, GTRI

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- Jennifer Chirico, Associate Vice President, Sustainability - Co-Lead
- Shan Arora, Director, The Kendeda Building for Innovative Sustainable Design
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- Marilyn Brown, Regents’ Professor, School of Public Policy, Ivan Allen College of Liberal Arts
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- Daniel Matrisoff, Professor, School of Public Policy, Ivan Allen College of Liberal Arts
- Luke Rutherford, Graduate Student
- Jim Stephens, Interim Vice President, I&S
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- Lorie Johns Páulez, Director of Education Abroad, International Education
- Jason Juang, Undergraduate Student
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- Z Smith, Principal and Director of Sustainability, EskewDumezRipple
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- Derrick Walker, Director of Transportation, Campus Transportation

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- Allison Bridges, Program Manager, Ray C. Anderson Center for Sustainable Business
- Kevin Caravati, Manager, Energy and Sustainability Research Program, GTRI
- Oliver Chapman, Fellow, Brook Byers Institute for Sustainable Systems
- Joe Hagerman, Director, EPICenter, Strategic Energy Institute
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- Jairo Garcia, Professor, School of City and Regional Planning, College of Design
- Daniel Matisoff, Professor, School of Public Policy, Ivan Allen College of Liberal Arts

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- Abby Bower, Program Support Coordinator, Office of Sustainability, I&S - Co-Lead
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- Ashling Devins, Graduate Student
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• Laurence Brennan, Planner, Capital Planning and Space Management, I&S
• Brian Clarke, Senior Electrical Engineer, I&S
• Bridget Mourao, Georgia Tech Fire Safety Manager
• Z Smith, Principal and Director of Sustainability, EskewDumezRipple
• Spenser Wipperfurth, Graduate Student
• Eunhwa Yang, Assistant Professor, School of Building Construction, College of Design

STUDENT TEAM
• Kiera Tran, EVP, Graduate Student SGA - Lead, Student Group
• Rebecca Watts Hull, Assistant Director, Faculty Development for Sustainability Education Initiatives, Center for Teaching and Learning, E&L - Co-Lead, Student Group
• Abby Bower, Program Support Coordinator, Office of Sustainability - Co-Lead, Student Group
• Jessica Borden, Graduate Student
• Rohan Datta, Undergraduate Student
• Derek McNutt, Graduate Student
• Tony Tan, Undergraduate Student
• Luke Rutherford, Undergraduate Student

• Athena Verghis, Undergraduate Student
• Cindy Huynh, Office of Sustainability Student Assistant
• Nicole Nunez, Office of Sustainability Student Assistant
• Paige Suk, Office of Sustainability Student Assistant
• Bettye (Grace) Kilgore, School of Public Policy Undergraduate Research Assistant

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• Anne Rogers, former Associate Director of Campus Sustainability, I&S
• Michael Shannon, former Executive Vice President, Administration and Finance (A&F)
The CAP leverages existing Institute initiatives and supports campuswide action. The overarching goals reviewed included the United Nations Sustainable Development Goals, Georgia Tech’s strategic plan, Sustainability Next, and the Comprehensive Campus Plan.

SUSTAINABLE DEVELOPMENT GOALS (SDGS)

“The 2030 Agenda for Sustainable Development provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 SDGs, which are an urgent call for action by all countries in the global partnership.” The UN SDGs underpin Georgia Tech’s Sustainability Next framework for catalyzing action and advancing the public good at a global scale.

Climate action, the core of our CAP, is UN SDG Goal #13. Each strategy in the CAP references UN SDGs.

APPENDIX A: CAP Alignment

GEORGIA TECH’S STRATEGIC PLAN

In 2019, President Ángel Cabrera initiated a university-wide planning effort to reimagine and redefine Georgia Tech’s future. The resulting 2020 – 2030 strategic plan presents Georgia Tech’s shared vision for the next decade: to continue developing leaders who advance technology and improve the human condition.

Georgia Tech vowed to become an example of inclusive innovation, relentlessly committed to serving the public good; breaking new ground in addressing the biggest local, national, and global challenges of our time; making technology accessible; and developing exceptional leaders from all backgrounds ready to produce novel ideas and create solutions with human impact. The strategic plan references the UN SDGs throughout its objectives as global guideposts, helping to tie our strategies to the world’s greatest challenges. The Sustainability Next plan is the output of the Sustainability Next initiative, and the Climate Action Plan is a key deliverable of Sustainability Next.

SUSTAINABILITY NEXT

Building on more than 30 years of sustainability efforts at Georgia Tech, the Sustainability Next plan presents a newly unified vision for coalescing, implementing, and measuring cross-cutting sustainability initiatives within the Institute. The aim of Sustainability Next is to provide a path toward establishing Georgia Tech as a leader in equitable, economic, and environmental sustainability. It establishes a broad, comprehensive approach to Institute-wide sustainability, from waste diversion to advancing sustainability research and increasing educational partnerships in the larger Atlanta metropolitan area.

The CAP is an important strategy within the Sustainability Next plan. While Sustainability Next defines an expansive, transdisciplinary scope for the Institute’s sustainability work, the CAP focuses on climate change and GHG mitigation. The CAP supports the critical connection between global sustainability and climate action.

COMPREHENSIVE CAMPUS PLAN

The Comprehensive Campus Plan (CCP) is a living document that will inform how Georgia Tech’s physical space can be utilized to support the growing and changing campus community for the next 10 years and beyond. Steeped in the strategic plan and a commitment to people, research, and teaching, the CCP envisions how Georgia Tech will lead and inspire by example in creating a road map for the sustainable development and management of the campus.

The CAP will support efforts to ensure that campus adapts to changing climatic conditions and minimizes our GHG emissions.
### APPENDIX B: GHG Emissions by Scope

#### TABLE 13: TOTAL FY 2022 GHG EMISSIONS BY SCOPE

<table>
<thead>
<tr>
<th>Scope</th>
<th>Category</th>
<th>Source</th>
<th>Emissions (in CO2e)</th>
<th>% of Scope</th>
<th>% of Total Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stationary Energy (Fuels)</td>
<td>Main Campus Natural Gas</td>
<td>16,977</td>
<td>40.9%</td>
<td>8.4%</td>
<td></td>
</tr>
<tr>
<td>Stationary Energy (Fuels)</td>
<td>Holland District Energy Plant Natural Gas</td>
<td>10,222</td>
<td>44.2%</td>
<td>9.1%</td>
<td></td>
</tr>
<tr>
<td>Stationary Energy (Fuels)</td>
<td>Main Campus Property</td>
<td>-</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Vehicle Fleet</td>
<td>Gasoline</td>
<td>207</td>
<td>2.2%</td>
<td>0.4%</td>
<td></td>
</tr>
<tr>
<td>Vehicle Fleet</td>
<td>Ethanol</td>
<td>1</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Vehicle Fleet</td>
<td>Diesel</td>
<td>355</td>
<td>2.3%</td>
<td>0.5%</td>
<td></td>
</tr>
<tr>
<td>Vehicle Fleet</td>
<td>Electricity</td>
<td>-</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Refrigerants</td>
<td>District Energy Leaksage</td>
<td>9,265</td>
<td>9.1%</td>
<td>19.9%</td>
<td></td>
</tr>
<tr>
<td>Refrigerants</td>
<td>Other Leaksage</td>
<td>4</td>
<td>0.1%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Fugitive Emissions (On Campus)</td>
<td>Local Distribution Leaksage</td>
<td>226</td>
<td>0.8%</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>Fugitive Emissions (On Campus)</td>
<td>Downstream of Meter Leaksage</td>
<td>223</td>
<td>0.0%</td>
<td>0.1%</td>
<td></td>
</tr>
<tr>
<td>Total Scope 1</td>
<td></td>
<td>16,977</td>
<td>40.9%</td>
<td>8.4%</td>
<td></td>
</tr>
<tr>
<td>Scope 2: Purchased Energy — All purchased electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stationary Energy (Electricity)</td>
<td>Main Campus Electricity</td>
<td>84,511</td>
<td>21.9%</td>
<td>43.9%</td>
<td></td>
</tr>
<tr>
<td>Stationary Energy (Electricity)</td>
<td>Holland District Energy Plant Electricity</td>
<td>12,200</td>
<td>10.0%</td>
<td>5.6%</td>
<td></td>
</tr>
<tr>
<td>Stationary Energy (Electricity)</td>
<td>7,527</td>
<td>7.3%</td>
<td>3.7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Scope 2</td>
<td></td>
<td>100,238</td>
<td>26.2%</td>
<td>52.7%</td>
<td></td>
</tr>
<tr>
<td>Scope 3: All other emissions - indirect emissions generated from GT’s activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Air Travel</td>
<td>Short Haul</td>
<td>189</td>
<td>0.3%</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>Business Air Travel</td>
<td>Medium Haul</td>
<td>1,093</td>
<td>8.8%</td>
<td>2.2%</td>
<td></td>
</tr>
<tr>
<td>Business Air Travel</td>
<td>Long Haul</td>
<td>2,388</td>
<td>4.1%</td>
<td>1.2%</td>
<td></td>
</tr>
<tr>
<td>Student Air Travel</td>
<td>Short Haul</td>
<td>38</td>
<td>0.1%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Student Air Travel</td>
<td>Medium Haul</td>
<td>111</td>
<td>0.3%</td>
<td>0.1%</td>
<td></td>
</tr>
<tr>
<td>Student Air Travel</td>
<td>Long Haul</td>
<td>5,326</td>
<td>11.2%</td>
<td>5.2%</td>
<td></td>
</tr>
<tr>
<td>Fugitive Emissions (Upstream)</td>
<td>Upstream Natural Gas Leakage</td>
<td>3,806</td>
<td>16.5%</td>
<td>4.7%</td>
<td></td>
</tr>
<tr>
<td>Commuting</td>
<td>Drive Alone Fossil Fuel Vehicles</td>
<td>32,485</td>
<td>59.5%</td>
<td>11.2%</td>
<td></td>
</tr>
<tr>
<td>Commuting</td>
<td>Drive Alone Electric Vehicles</td>
<td>223</td>
<td>0.4%</td>
<td>0.1%</td>
<td></td>
</tr>
<tr>
<td>Commuting</td>
<td>Carpool Fossil Fuel Vehicles</td>
<td>646</td>
<td>1.5%</td>
<td>0.4%</td>
<td></td>
</tr>
<tr>
<td>Commuting</td>
<td>Carpool Electric Vehicles</td>
<td>13</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Commuting</td>
<td>Electric Scooters</td>
<td>1</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Commuting</td>
<td>Commuter Rail</td>
<td>736</td>
<td>1.3%</td>
<td>0.4%</td>
<td></td>
</tr>
<tr>
<td>Commuting</td>
<td>Public Bus</td>
<td>160</td>
<td>0.3%</td>
<td>0.1%</td>
<td></td>
</tr>
<tr>
<td>Waste</td>
<td>Landfilled Waste</td>
<td>2,510</td>
<td>4.4%</td>
<td>1.2%</td>
<td></td>
</tr>
<tr>
<td>Waste</td>
<td>Landfilled Landfill Gas</td>
<td>61</td>
<td>0.1%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Waste</td>
<td>Composted Waste</td>
<td>18</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Waste</td>
<td>Recycled Waste Transportation</td>
<td>95</td>
<td>0.2%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Waste</td>
<td>Recycled Waste</td>
<td>604</td>
<td>0.8%</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>Transmission and Distribution (T&amp;D)</td>
<td>Electricity T&amp;D losses</td>
<td>5,180</td>
<td>10.1%</td>
<td>3.9%</td>
<td></td>
</tr>
<tr>
<td>Total Scope 3</td>
<td></td>
<td>53,953</td>
<td>13.2%</td>
<td>18.2%</td>
<td></td>
</tr>
</tbody>
</table>

**Total FY 2022 GHG Emissions**

| | 209,682 | 100% |
BUSINESS AS USUAL (BAU) ASSUMPTIONS

These assumptions include the business-as-usual forecast, which estimates emissions for Georgia Tech through 2050 if no further actions were taken to reduce emissions.

BAU ASSUMPTIONS:

1. 2010 is the baseline year from which Georgia Tech compares all changes in emissions. Several methodological changes from the 2010 inventory were implemented in the FY 2022 GHG Inventory, including:
   • Accounting for fugitive natural gas emissions both upstream and on campus.
   • Adding detailed waste emission calculations that include emissions from flared landfill gas due to waste sent to the landfill by Georgia Tech and accounting for emissions associated with the transportation of recycled materials.
   • Accounting for vehicle fleet emissions by vehicle type to provide a more accurate estimate of total emissions.

2. Stationary energy fuel use is forecasted based on expected campus building growth. Energy consumption from new construction is estimated based on the energy use intensity of each building type based on an internal analysis. Energy use intensity by building type is used to determine total kBtu consumed by new construction. kBtu is attributed to each fuel type based on the total share of each fuel type across campus. No data was available to split kBtu by fuel type at more detail than the overall campus. This also assumes the same share of existing buildings connected to district energy will be applied to new construction.

3. On-site solar generation is assumed to decrease slightly over time due to losses in panel efficiency. No new solar is included in the BAU.

4. Downstream fugitive natural gas emissions from gas consumed at the Holland district energy plant were reported by the Environmental Protection Agency FLIGHT tool. The FY 2022 values were forecasted based on the expected change in total natural gas consumed at the plant.

5. The vehicle fleet is assumed to remain the same size through 2050. The BAU accounts for improvements in bus fuel efficiency as vehicles are replaced.

6. Student study abroad travel miles are projected based on student population. No study abroad data was available prior to FY 2022. Study abroad travel miles are back cast to FY 2010 from FY 2022 based on the change in student population.

7. Propane is used as an emergency auxiliary fuel. No propane was used from FY 2019 through FY 2022.

8. Air travel emissions include a radiative forcing factor of 2.7 applied to CO₂ emissions.

9. Population growth was taken from the Georgia Tech Comprehensive Campus Plan. Total population was provided. The Comprehensive Campus Plan indicated that student, faculty, and staff populations are expected to increase at the same rate through 2031.

10. The annual campus population growth factor is used to forecast campus population from 2032 through 2050. This factor was taken from the National Center for Education Statistics Condition of Education Study 2023. This report projected a 9% total increase in undergraduate enrollment through 2031. This value is converted to the annual average growth rate and applied to Georgia Tech’s population from 2032 through 2050. This assumes that from 2032 through 2050 enrollment will continue to increase at the same rate and that increased student enrollment will correspond with increased faculty and staff.

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2 Georgia Institute of Technology. (2023). Georgia Tech building energy use intensity analysis: Internally generated resource. 
7 Georgia Institute of Technology. (2023). Georgia Tech Comprehensive Campus Plan. https://campusplan.gatech.edu/
11. Commute emissions were forecasted based on the annual campus population growth factor and were split by students, faculty, and staff. This assumes that the mode share for commuting remained the same through 2050. It included a medium scenario for EV adoption based on EV stock forecast data for Georgia from NREL’s Electrification Futures Study.¹

12. The following assumptions were made to estimate the expected Georgia Power emission rate through 2050 based on the 2022 Georgia Power integrated resource plan and the NREL Cambium tool.

   - The Georgia Power IRP included plans for additional renewable resource deployment and coal retirement through 2035.¹ The IRP was used to forecast the emission rate through 2035 and NREL Cambium was used to forecast the emission rate from 2036 to 2050.¹¹
   - The Georgia Power IRP was used to estimate the Georgia Power emission rate through 2035 with the following steps:
     - Accounts for a planned additional 2,356 MW of natural gas capacity.
     - Assumes a 0.7% annual growth in capacity through 2035 per the integrated resource plan. This growth rate is applied across all resources.
     - Assumes a linear annual growth in renewable energy and natural gas capacity until the target values and years are reached.
     - Adds new renewable energy and natural gas capacity to each year. Subtracts the difference to reach the expected total capacity with the 0.7% growth from coal capacity first, then natural gas capacity once coal capacity reaches zero.
     - Estimates total generation by resource for each year through 2035 based on the capacity share of each resource and a 0.8% growth rate taken from the integrated resource plan. No actual generation information was available, so this assumes each resource will be utilized an equal amount.
     - Estimates total pre-combustion and combustion emissions produced by resource for 2022 and 2035.
     - Calculates the emission rate per MWh for 2022 and 2035 and estimates the annual rate of change between 2022 and 2035.

   - Applies the annual rate of change from the estimated emission factor to the actual emission factor provided by Georgia Power for 2022.
   - The type of renewables to be added were not specified in the integrated resource plan.
   - The growth rates from the estimated emission factors are applied to the known Georgia Power 2022 emission factor, as this methodology does not account for other resources and activities that influence Georgia Power’s emission factor. The estimated emission factors should not be directly used for electricity emissions, as they primarily represent fuel combustion emissions.
   - NREL Cambium was used to forecast the emission rate from 2036 through 2050 using the following steps:
     - Used the mid-case with 95% decarbonization scenario for the state of Georgia.
     - Used the emission rate for combustion and pre-combustion.
     - Used the emission rate that represents the induced generation by Georgia. This includes the emissions from all generation allocated to Georgia, even if it is generated out of state.

STRATEGY MODELING ASSUMPTIONS

Of the 30 climate action strategies included in the final CAP, 12 were modeled for their emissions reduction potential. For a strategy to be modeled, it had to meet the following criteria:

1. The strategy must have direct emissions impacts: Operational strategies in the Building Energy, Renewables and Offsets, Mobility, Materials Management, and Water Management focus areas were modeled because most strategies in these areas have the potential to directly reduce emissions. Strategies in the Education and Research sections were not modeled.

2. The strategy must have sufficient baseline data available at Georgia Tech: Some strategies recommended in the CAP have known emissions impacts, but sufficient baseline data was not available at Georgia Tech. For example, although it is known that building materials have GHG emissions impacts, Georgia Tech does not have a record dating back to 2010 of all emissions associated with building materials used in construction projects.

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APPENDIX C: MODELING ASSUMPTIONS AND REFERENCES

TABLE 14: MODELED GHG REDUCTION STRATEGIES

<table>
<thead>
<tr>
<th>FOCUS AREA</th>
<th>MODELED STRATEGIES</th>
</tr>
</thead>
</table>
| Building Energy    | 1.1 Transition to electrification of combustion-based heating systems.  
|                    | 1.2 Increase operational energy efficiency and conservation.  
|                    | 1.3 Establish standards for decarbonizing new buildings and renovations on campus.  
|                    | 1.4 Invest in targeted renewal for existing buildings.                                                                                                                                                               |

| Renewable Energy & Offsets | 2.1 Increase on-site renewable energy production.  
|                            | 2.3 Procure electricity generated from renewable and zero-emissions sources.  
|                            | 2.4 Explore carbon offsets for as needed for remaining emissions.                                                                                                                                                   |

| Mobility            | 3.1 Transition the campus vehicle fleet to zero-emission vehicles and equipment.  
|                    | 3.2 Increase sustainable and affordable commuting options.                                                                                                                                                         |

| Materials Management | 4.1 Become a Zero Waste campus by 2050.                                                                                                                                                                                |

| Water Management    | 5.1 Implement campus greywater and blackwater reuse systems.                                                                                                                                                    |

| Carbon Sequestration | 8.1 Increase Georgia Tech's tree canopy coverage and biodiversity.                                                                                                                                                   |

GHG STRATEGY MODELING ASSUMPTIONS

1. Building Energy

1.1. Transition to electrification of combustion-based heating systems.

1.1.1. Assumes that as new construction occurs, the same share of existing buildings that are connected to the district energy plants versus buildings with their own heating and cooling systems will be applied to the new construction.¹

1.1.2. Assumes a new district energy plant would be constructed with the same baseline efficiencies and energy consumption as the Holland Plant in a BAU scenario. Assumes the same upgrades and new equipment would be applied to a new district energy plant in the electrification scenario.

1.1.3. Assumes a 70% thermal efficiency for the existing steam boilers. Based on default efficiencies from the U.S. Green Building Council. Accounts for reductions in thermal energy distribution losses due to lower operating temperatures in a heat pump system.²

1.1.4. Assumes a heating seasonal performance factor of 17 for the replacement heat pumps.³

1.1.5. Assumes a 70% thermal efficiency for the existing steam boilers. Based on default efficiencies from the U.S. Green Building Council. Accounts for reductions in thermal energy distribution losses due to lower operating temperatures in a heat pump system.²

1.1.6. The share of natural gas used for space heating, water heating, and other uses is based on the share of natural gas used by educational institutions.⁴


buildings in the 2018 Commercial Building Energy Consumption Survey from the Energy Information Administration.5

1.1.7. The additional electricity consumed by replacement equipment is calculated based on reported efficiencies for standard natural gas equipment and the replacement electric equipment (heat pumps, heat pump water heaters, and electric stoves) taken from the 2021 International Energy Conservation Code or as specified by Georgia Tech Infrastructure and Sustainability staff.6


1.2. Increase operational energy efficiency and conservation.

1.2.1. Modeled based on minimum energy performance improvement requirements over a 10-year period for the International Organization for Standardization 50001 certification through the Department of Energy’s Superior Energy Performance Program.7 Assumes Georgia Tech will reach a 16% improvement over baseline energy consumption by 10 years after the implementation of this strategy.8

1.2.2. Savings are calculated for the entire campus and not split out by building type, as the minimum standard applies to total energy consumption.

1.2.3. Operational improvements are assumed to be applied across all existing buildings that would not already be accounted for in the targeted renewal strategy.

1.2.4. New buildings are not accounted for in this strategy, as it is assumed that any efficiency measures would be implemented for new buildings as part of the low-energy building standard strategy.


1.2.5. Energy savings are calculated based on the available maximum cost-effective potential as determined by a Georgia Tech led analysis. The expected savings are 2.1% reduction from baseline through 2040 and 1.05% reduction from baseline from 2041 through 2050.

1.2.6. Energy savings are calculated separately for parking structures and other buildings. Parking structure energy savings are calculated assuming most electricity is used for lighting and ventilation.9

1.2.7. Electrification is accounted for in this strategy. The baseline energy use for existing buildings is adjusted to account for the change in fuel source due to electrification strategies.10


1.3. Establish standards for decarbonizing new buildings and renovations on campus.

1.3.1. This strategy is focused only on new construction, which is estimated in the BAU based on data from the Georgia Tech Comprehensive Campus Plan.

1.3.2. New construction square footage was provided, split by building type.

1.3.3. Calculates savings from parking decks separately from other buildings.10

1.3.4. Tech Square 3 (TS3) is currently under construction and is excluded from this strategy. TS3 has been designed as an all-electric high efficiency building and the energy savings have already been accounted for in the BAU.

1.3.5. Electrification is considered separate from this strategy. The new buildings may be connected to district energy and rely on the electrification of the district energy system to achieve any savings from electrification. Assumes that buildings not connected to district energy will have equipment replaced in accordance with the timeline of the electrification strategy for all other buildings.

The targeted renewal strategy is modeled based on the total square footage of buildings that received a D or F rating as defined in Georgia Tech’s Facility Condition Assessment report.\footnote{Georgia Institute of Technology. (2023). Georgia tech facility condition assessment report: Internally generated resource.}

Solar generation is calculated based on NREL’s PV Watts tool and the expected kWh generated per kW of solar capacity added in Atlanta.\footnote{National Renewable Energy Laboratory. \url{https://pvwatts.nrel.gov/}}


2.2. Procure electricity generated from renewable and zero-emission sources.

2.2.1. Georgia Tech can enroll in a power purchase agreement through Georgia Power-provided programs. The subscription amount is determined by Georgia Power and is expected to be active by 2028. The model assumes 20 MW of renewable energy can be made available to Georgia Tech through a PPA.

2.2.2. Georgia Tech can enroll in a wholesale virtual power purchase agreement, whereby Georgia Tech procures renewable energy from sources outside of Georgia Power’s territory.

2.2.3. Note that the capacity added through the virtual power purchase agreement can exceed the actual needed capacity each year. This strategy is modeled to cap avoided emissions from all renewable energy strategies to the point where reductions from these strategies would lead to zero Scope 2 emissions. Emission reductions below zero Scope 2 emissions are not included.

3. Mobility

3.1. Transition the campus fleet to zero-emission vehicles and equipment.

3.1.1. 2022 vehicle fuel efficiencies by vehicle type taken from the Environmental Protection Agency state inventory and projection tool.\footnote{United States Environmental Protection Agency. (2023, November 27). Energy resources for state and local governments: State inventory and projection tool. \url{https://www.epa.gov/stateandlocalenergy/state-inventory-and-projection-tool}}

3.1.2. Projected bus fuel efficiencies based on the Energy Information Administration 2022 Annual Energy Outlook projections. The average MPG for the U.S. vehicle stock through 2050 is used to forecast vehicle type fuel efficiencies. This assumes that efficiency in each vehicle type will follow the overall trend of fuel efficiencies of the entire vehicle fleet.
Note: It is known that efficiency improvements are likely to happen faster for passenger and light-duty gasoline vehicles. However, the Energy Information Administration does not provide fuel efficiency data for vehicles other than passenger, light-duty, or the entire vehicle stock. MPG values are taken from the reference case, including low impacts from the Inflation Reduction Act.

Projected electric bus, heavy-duty, and light-duty truck plug-in hybrid electric vehicle efficiency projections are taken from the National Renewable Energy Laboratory electrification futures study. Values are provided every 10 years. Assumes a linear change in efficiency between decades.17

All diesel buses operating were purchased in 2022 and all hybrid buses in 2023. The expected service life of each type of bus was also provided by Georgia Tech Parking and Transportation Services (seven years for diesel and 12 for hybrid). BAU fuel consumption is estimated for each type of bus based on the replacement schedule and expected fuel efficiencies.

The model assumes 100% fleet electrification by 2030.

Avoided vehicle miles traveled (VMT) are calculated based on the expected vehicle miles traveled per vehicle. This assumes that each vehicle of each type will be used the same amount.

Fuel efficiency for fleet vehicles other than buses is held constant over time. The model accounts for improvements in electric vehicle efficiency over time, assuming that new vehicles purchased each year will have a slightly higher efficiency than previous years as forecasted based on National Renewable Energy Laboratory’s Electrification Futures study.16

Avoided fuel consumption and additional electricity consumption are calculated based on the fuel efficiencies described above.

3.2. Increase sustainable and affordable commuting options.

3.2.1. Commuting activity is projected to increase at the same rate as the student, faculty, and staff population.

3.2.2. Electric vehicle adoption by commuters is modeled based on three scenarios from the NREL’s Electrification Future’s study. Included in the study is a reference case with limited adoption, a medium case with electrification focused on easy to electrify vehicles and short distances, and a high case with significant adoption across the board. The medium case is selected for this model.

3.2.3. The Electrification Future’s study provides electric vehicle and total vehicle stock data projected by state for each scenario. Data specific to Georgia was pulled for this analysis. Stock data is provided as the number of vehicles on the road by type, year, and technology. The total electric vehicle share through 2050 in each scenario is used to project commute activity. The moderate technology acceleration case is used for this model.

3.2.4. Electric vehicle VMT is the only indicator collected from the employee commute survey. The electric vehicle VMT will increase in accordance with the vehicle stock increase of electric vehicles for each adoption scenario.

3.2.5. It is assumed that all commuters who drive alone use either passenger or light-duty vehicles. No electrification of medium or heavy vehicles is considered.

3.2.6. Modes of commuting aside from driving alone or carpooling are projected by campus population with no changes in electrification due, as emission factors are in terms of passenger-miles traveled and no emission factors exist for electrified forms of these transportation modes.

18 Ibid.
This model combines two strategies identified by the task force. These strategies include: 1) Promote sustainable commuting by providing information, incentives, and support to decrease the number of students, faculty, and staff driving alone to campus, fostering a vibrant and eco-friendly community; and 2) Improve bicycle and micromobility infrastructure on and outside of campus.

Electric vehicle adoption is accounted for in the BAU, and it is assumed Georgia Tech has limited control over whether commuters purchase electric vehicles. This model assumes that any changes in the share of people who drive alone follows the same electric vehicle versus fossil fuel vehicle split as calculated for the BAU scenario.

This model accounts for changes in fossil fuel vehicles and electric vehicle efficiency improvements over time.

Telecommute "miles" are included to correctly account for changes in the carbon-free mode share. An increase in the telecommuting share corresponds to a decrease in the miles that would be traveled by commuters. "Miles" associated with telecommuting (the distance each commuter would have traveled) were calculated based on the results of Georgia Tech’s 2021 commute survey.

3.2.7. This model combines two strategies identified by the task force. These strategies include: 1) Promote sustainable commuting by providing information, incentives, and support to decrease the number of students, faculty, and staff driving alone to campus, fostering a vibrant and eco-friendly community; and 2) Improve bicycle and micromobility infrastructure on and outside of campus.

4. Materials Management


4.1.1. This strategy includes three sub-strategies discussed during stakeholder engagement: 1) Limit high-emission, hard-to-recycle materials from campus; 2) Pursue a campus zero waste events policy; and 3) Eliminate landfilting of organic waste at Georgia Tech.

4.1.2. All three sub-strategies contribute to the goal of reaching a 90% diversion rate in the overall strategy. All strategies are modeled together and not broken out.

4.1.3. The model assumes 50% of landfilted waste is recyclable and 50% of landfill waste is compostable. The savings calculations can update these values if more information becomes known.

4.1.4. Assumes a linear change in diversion rate from FY 2023 to the selected target year. Adjust the target year and target diversion rate on the Impact Summary tab.

4.1.5. This strategy includes a sub-strategy for sending Georgia Tech waste to landfills that capture and use landfill methane and convert it to energy:

4.1.5.1. Based on the remaining tonnage of waste sent to the landfill after the diversion rate strategy, if selected. Avoided flared landfill gas from diverted waste is attributed to the waste diversion strategy. Only avoided flared gas emissions from waste that reaches the landfill is attributed to this strategy.

4.1.5.2. The actual landfill gas amount and emissions produced from waste requires significant calculations and assumptions. The average mt CO2e of flared gas per ton of waste was calculated based on Georgia Tech’s FY 2022 inventory. This value is multiplied by the total waste that reaches the landfill to get avoided emissions from sending waste to a landfill that utilizes landfill gas.

5. Water Management

5.1. Implement campus greywater and blackwater reuse systems.

5.1.1. Based on plans for an on-site treatment facility (Dalney) that would capture wastewater for use in the chilled water system. This facility would prevent 100,000,000 gallons of wastewater from reaching a wastewater treatment facility per year.  

6. Carbon Sequestration

6.1. Increase Georgia Tech’s tree canopy coverage and biodiversity.

6.1.1. To understand how much carbon Georgia Tech’s trees sequester, the number of trees on Georgia Tech’s campus was considered.

6.1.2. To determine the carbon sequestration potential of Georgia Tech’s campus, the total area covered by trees was multiplied by region-specific emission and removal factors. These factors account for the varying carbon emission and removal rates of different tree species and growing patterns in different environments, such as forests, non-forested areas, and areas converted to forests. Calculations were conducted using the U.S. Community Protocol’s Land Emissions and Removals Navigator (LEARN) tool.[20]

6.1.3. Georgia Tech’s changes in tree coverage over time was also considered. The analysis was performed using 2022 data with a baseline year of 2016. This calculation facilitated an assessment of both the emissions caused by tree loss and the removals of carbon (or carbon sequestered) through canopy preservation or restoration — in other words, the carbon flux resulting from land use changes. Both components are essential for a CSA to be a valid component of a GHG inventory.

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