

SUSTAINABLE COLUMBIA

*Columbia University
Sustainability Plan
2017–2020*



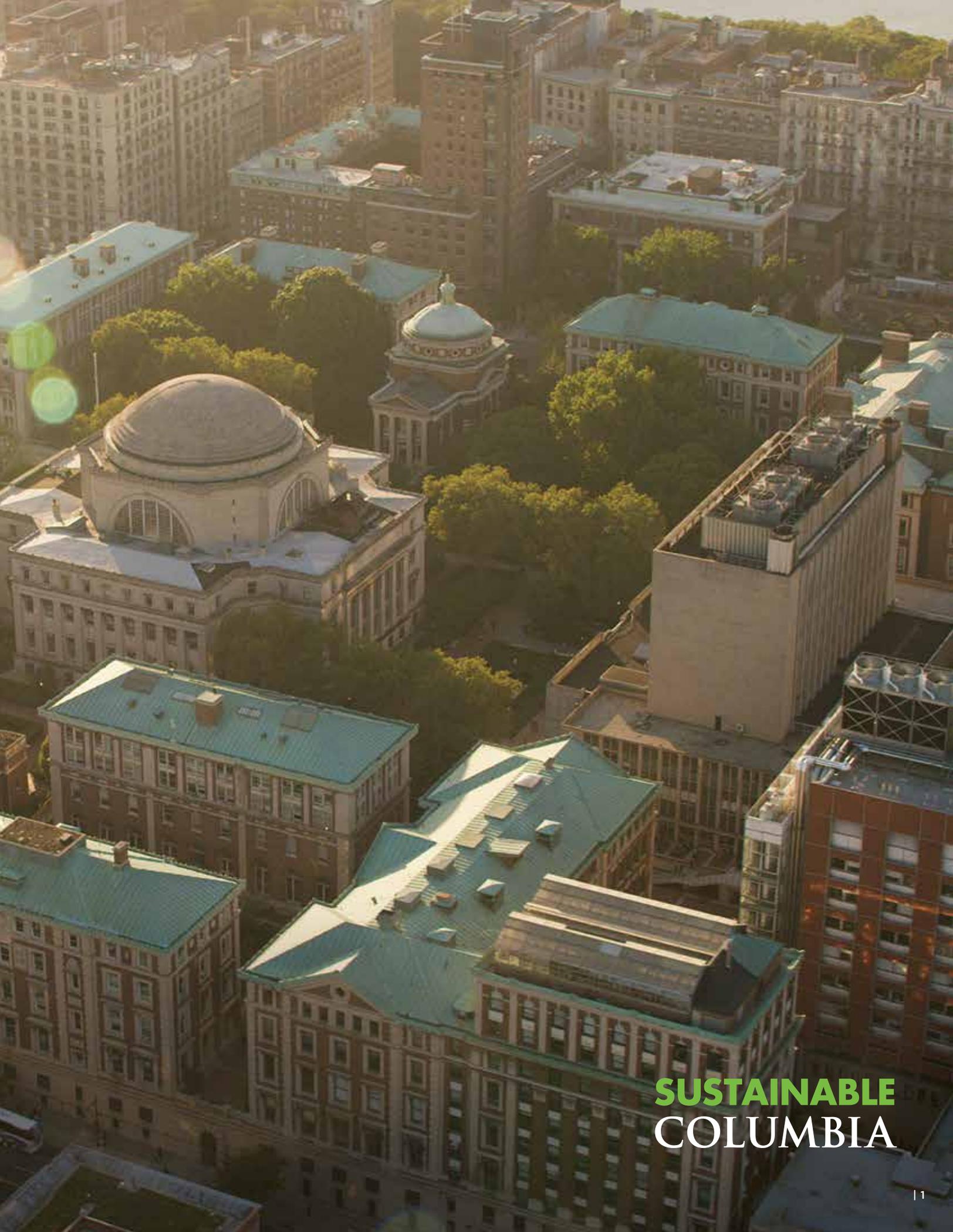
ABOUT THIS PLAN

The Columbia University Sustainability Plan is the University's first formalized document bringing together sustainability efforts from a myriad of departments around campus. It is the result of a 16-month focused collaboration with students, faculty, administrators, and scientists working across departments to create a three-year, operations-focused roadmap to create a more sustainable Columbia.

SUSTAINABLE COLUMBIA

Sustainable Columbia is the brand identity for Columbia University's campus sustainability initiative, centralized through the Environmental Stewardship office and executed by a variety of University departments and projects.

The Sustainable Columbia mark visually connects the many programs on campus that contribute to the success of our campus sustainability efforts by helping meet the goals set forth in this Plan.



SUSTAINABLE
COLUMBIA

A Look Back

COLUMBIA'S COMMITMENT TO THE ENVIRONMENT

1949

- **Lamont-Doherty Earth Observatory (LDEO)**, an institute dedicated to research in the earth sciences, is established

1975

- **Dr. Wally Broecker** coins the phrase "global warming"

1986

- Lamont-Doherty scientists develop the first model to accurately predict the extreme weather associated with an El Niño event

1988

- Dr. James Hansen testifies to Congress about the nature of climate change and the need to address it

1992

- United Nations Framework Convention on Climate Change is drafted at the Earth Summit in Rio de Janeiro

1994

- **Center for Environmental Research and Conservation (CERC)** is established to stem the loss of biological diversity

1996

- **The Earth Institute** is established to address complex issues facing the planet and its inhabitants, with particular focus on sustainable development and the needs of the world's poor
- Columbia is recognized with an EPA University Partner of the Year Award

1998

- Styrofoam and polystyrene are eliminated from undergraduate dining halls on Morningside campus

2000

- **Columbia's Advisory Committee on Socially Responsible Investing (ACSRI)** is established as a permanent addition to the University

2001

- Columbia becomes a member of the U.S. Green Building Council

2006

- Columbia becomes an Association for Advancement of Sustainability in Higher Education (AASHE) member

- Columbia University establishes the **Environmental Stewardship** office to work across Columbia—including individual schools, student groups, and offices—to spearhead campus programs and initiatives in the field
- **The Eco-Reps Program**, a joint initiative developed by the students of GEO (a student green group) and Housing and Dining Services administrators, is started to encourage green living in the residence halls

2007

- Columbia University President Bollinger signs the New York City Mayoral Carbon Challenge by committing to reduce greenhouse gas emissions 30 percent by 2017
- Columbia commits to a minimum LEED® Silver certification for all new buildings and reconstruction projects
- Memorandum of Understanding is signed between Columbia University and the Environmental

Defense Fund in an environmental stewardship cooperative effort

- Electric and natural gas energy procurement: Competitive bid from independent energy providers reduces energy cost

2008

- Columbia's Morningside campus submits its first **Climate Action Plan** as a participant in the New York City Mayoral Carbon Challenge

2009

- The Campbell Sports Center and the Allan Rosenfield Building, Floors 11-13 (Medical Center), receive LEED® Gold certification
- Knox Hall receives **LEED® Gold certification for its geothermal wells** that supply the building with 100 percent of its energy needs, even during summer peak energy loads for cooling
- University Facilities and Operations introduces Master Planning Elements for Central Utilities & Central Plants

2010

- **The Gary C. Comer Geochemistry Building** becomes the first LEED® Silver certified building at Columbia's Lamont-Doherty Earth Observatory campus and wins the 2009 **Lab of the Year Award**
- **Faculty House** receives LEED® Gold certification
- The **Master of Science in Sustainability Management** degree program is established to address the growing demand for sustainability professionals, including lawyers, engineers, marketers, communications professionals, policy-makers, and scientists
- The Studebaker Building (2nd Floor) and the Core Lab (Lamont) achieves LEED® Gold; Studebaker project is certified LEED® Silver
- The first **microturbines** are installed as a new energy-efficient technology on Columbia's Morningside campus
- All Dining locations offer organic, fair-trade certified, and locally roasted **coffee** from the Brooklyn Roasting Company

2011

- First phase of Central Chilled Water Plant Renewal & Optimization is completed
- Alumni Center Building Restoration achieves LEED® Gold certification

2012

- Columbia receives AASHE STARS Gold recognition
- Northwest Corner Building achieves LEED® Gold certification
- Columbia's Manhattanville campus achieves LEED® Platinum certification under the LEED® for Neighborhood Development (ND) rating system, making it the first LEED-ND Platinum certification for New York City

2013

- Environmental Stewardship office comes under new leadership and expands staff
- Electric charging stations are installed in the Morningside campus parking garages in order to promote the use of electric vehicles

2015

- Sustainability Strategic Process begins at Columbia
- Columbia receives AASHE STARS Gold recognition for the second time
- Residential Boiler Fuel Oil to Natural Gas Conversion is completed
- International District Energy Association (IDEA) cover article featuring Columbia University's campus Energy Renewal Project—Central Chilled Water Plant Improvement
- The Brown Institute for Media Innovation at the Columbia School of Journalism receives a LEED® Gold certification

2016

- Columbia formally adopts the University Sustainability Principles
- Columbia is registered as a participant at the "Leader" level in the State of New York's Reforming the Energy Vision (REV) Initiative
- Columbia is recognized by the Association of Energy Engineers with a Corporate Energy Management of the Year Award

- Columbia recognized by the Association of Energy Engineers with an Association of Energy Engineers—Young Energy Professional of the Year Award
- Central Chilled Water Plant: Installation of second high-efficiency steam chiller completed; \$1 million+ in Con Edison incentives awarded
- Environmental Stewardship office is recognized with a City and State Corporate Social Responsibility Award in Sustainability

2017

- Columbia launches its first Sustainability Plan
- Columbia's new Manhattanville campus opens to the public
- Columbia's central steam plant boiler renewal and optimization project is completed

Foreword



At Columbia, we have long understood the profound threat climate change poses to the future of our planet and the role our community should play in confronting it.

As part of that effort, at the beginning of this academic year we adopted a new set of principles aimed at improving the environmental sustainability of the University. Developed by a group of Columbia University Earth Institute faculty and University Facilities and Operations—and strengthened by students, faculty, and staff who participated in a series of town hall meetings—the principles focus on three areas: advancing our educational, research, and outreach missions; improving energy efficiency and reducing the environmental impact of campus operations; and fostering a University culture that embraces sustainability.

With this Sustainability Plan, we are taking a major step toward turning those principles into practice. Our University extends over 332 acres and 172 buildings and includes approximately 31,000 students and 16,000 employees. This large footprint describes the scale of our opportunity for lessening the impact we have on the environment, from reducing the energy we consume and the waste we produce, to minimizing the carbon dioxide we add to our warming planet. The first major step in turning the previously announced principles into practice will focus on improving the sustainability of the Morningside campus's operations through a targeted, three-year plan. Our other campuses will later be incorporated into the process. Columbia's leadership must continue to be reflected not only through the towering scholarship of our climate experts, but also through the ways in which we consume energy in—and travel to and from—the buildings where we live, learn, and conduct research.

This Sustainability Plan commits the University to a series of goals; here I will highlight a few of the most important ones: Starting in 2018, we will make public comprehensive data on our greenhouse gas emissions in accordance

with best international practices, providing critical information about our carbon footprint and how it is generated. By 2020 we will reduce by 35 percent, from 2006 levels, the University's greenhouse gas emissions in two critical areas: the stationary combustion of fuel for our buildings and purchased electricity. Ultimately, our long-term goal is to align with the New York City target to reduce greenhouse gas emissions by 80 percent by 2050.

The adoption of the Sustainability Principles and the creation of our first Sustainability Plan are parts of a University-wide approach to addressing the existential threat posed by climate change. Most significant in this effort is the basic research conducted by Columbia's faculty and actively engaged student body working in schools and departments across the University. In addition, through our actions, policies, and behavior, we provide a model for the kind of global response we seek. Examples include the University Trustees' decision last month to divest from companies substantially engaged in thermal coal production, and the Lamont-Doherty Earth Observatory's recent commitment to use solar power for 75 percent of its electrical energy needs.

I am grateful to the students, faculty, staff, and administrators who participated in the working groups that made this Plan stronger through their contributions. In particular, I want to thank Professor Michael Gerrard and Executive Vice President David Greenberg, who led this effort along with other members of the Senior Sustainability Advisory Committee and the Environmental Stewardship Office.

As with all plans, the true measure of this Sustainability Plan will be found not in the promises we make today, but through what we do in the months and years ahead to fulfill these commitments. I am confident that we will meet them.

Sincerely,
Lee C. Bollinger
President, Columbia University in the City of New York

Table of Contents

A Look Back	2
Foreword	4
Executive Summary	6
Acronyms and Definitions	8
Introduction	9
Columbia Sustainability Principles	10
Sustainability Planning and Governance	14
About the Plan	15
Formalizing Columbia’s Greenhouse Gas Program	16
Building Energy Supply and Demand	18
Transportation	24
Waste	30
Tracking Progress	34
Additional Focus Areas	36
Looking Beyond Morningside	38
Columbia University Medical Center	38
Lamont-Doherty Earth Observatory	42
Acknowledgments.	48
Appendix	49

Executive Summary

Over the course of a year and a half, Columbia's three main campuses collaborated in a facilitated process that for the first time centralized sustainability planning at the University. To pilot this cross-campus exercise, the efforts focused first on building a sustainability plan for the Morningside campus. The Columbia University Medical Center (CUMC) and Lamont-Doherty Earth Observatory (LDEO) helped shape the goals and strategies set forth for Morningside, and leveraged the process to align their own campus goals where possible, as outlined in their sections of this Plan.

Columbia University's Morningside campus spans 36 acres, with over 250 buildings, nearly 27,000 graduate and undergraduate students, and just under 9,000 employees. As one of the largest private employers in New York City, Columbia has long been a top destination for commuters traveling in from across the tristate area, and a significant waste generator and energy consumer. With such a sizeable profile in the city comes great responsibility to understand, in measurable terms, the environmental footprint of Columbia's vast operation, and take action to mitigate its impact. Columbia recognizes it must lead by example, in both its academic and administrative spheres, to shape the local and national sustainability conversation and promote sustainability leadership on campus.

The University has demonstrated long-standing sustainability leadership in the academic sphere through the Earth Institute. It also has supported a number of impressive initiatives underway for years to make the University's operations more sustainable, including a steady commitment as one of the original participants in the New York City Mayoral Carbon Challenge. Additionally, students, faculty, and staff have helped lead the charge in personal and department-level sustainability initiatives campus-wide, strengthening the University's commitment and enriching its success.

The sustainability planning process that resulted in this Plan grew from the University's Sustainability, Tracking, Assessment, and Reporting System (STARS) Gold reporting process, and the partnership between leadership of University Facilities and Operations and the Earth Institute faculty in 2015. Recognizing that the University's operational initiatives to advance sustainability were making an impact, there was strong support to create a roadmap toward a more sustainable Columbia.

Developing our Plan required two things: a set of principles to guide the long-term sustainability vision at Columbia, and a

sustainability plan that set measurable goals in key operational areas that affect the University's greenhouse gas (GHG) emission profile.

In September 2016, **President Bollinger endorsed the University's first set of Columbia Sustainability Principles.**

Columbia is committed to following these principles in all facets of planning and operations to improve environmental performance; ensure a healthy community; and contribute to local, regional, and global solutions. As part of this commitment, Columbia commits and strives to

- **advance Columbia's core educational, research, and outreach missions to demonstrate its leadership around the world;**
- **plan, develop, implement, and measure strategic sustainability initiatives; and**
- **foster a culture of sustainability.**

Now, in April 2017, aligned with the 47th annual celebration of Earth Day, Columbia announces the University's first Sustainability Plan. This Plan serves as a strategic blueprint to build upon Columbia's past accomplishments in advancing sustainability and to accelerate these initiatives into the future.

This Plan was created collaboratively by dozens of members of the campus community, including department representatives, facilities managers, faculty, and students. Through a number of work sessions over the course of one year, participants compiled information on the current state of the campus, best practices from peer institutions, and opportunities that Columbia is uniquely positioned to pursue. The University then consulted internal and external experts in energy, buildings, transportation, waste management, and procurement to develop each section of this Plan.

The end result is a plan that charts a course for maximum impact. The goals, strategies, and milestones set forth in this Plan over the next three years (2017-2020) are operationally focused around three key areas that contribute to the University's environmental and greenhouse gas (GHG) emissions impact at the Morningside campus: Building Energy Supply and Demand, Transportation, and Waste. All goals are interrelated with respect to Columbia's larger, aspirational GHG emissions reduction goal.

Columbia has committed to the following goals:

- Update GHG emission inventories already prepared for fiscal year (FY) 2006 through 2016 to more fully conform to internationally accepted accounting best practices. Those inventories include Scope 1 emissions related to the stationary combustion of fuels for buildings and Scope 2 emissions for purchased electricity. For this inventory boundary, start reporting annual emissions in The Climate Registry for calendar year (CY) 2017. Achieve a 35 percent absolute reduction in these types of emissions by 2020 from FY 2006.
- For CY 2018, provide a complete, consistent, transparent, and accurate annual reporting of all relevant GHG emissions applying internationally accepted accounting and reporting best practices. Relevant emissions include all Scope 1 and Scope 2 emissions and Scope 3 emissions at a minimum related to commuting, business travel, and waste from operations.
- Set goals for reducing absolute GHG emissions for the complete GHG inventory that are transparent, ambitious, and achievable and that align with the long-term NYC goal to reduce all GHG emissions by 80 percent by 2050.
- Develop baseline metrics for select waste streams and calculate the University's first waste diversion rate. This will allow the University to set a waste diversion and waste-to-landfill reduction goal. Columbia will work toward the longer-term aspiration of aligning with NYC's OneNYC waste-to-landfill goal by 2030.

This Plan is a starting point for Columbia University to enhance its global leadership in addressing the world's most pressing and important issues. The primary focus is the environmental sustainability of the Morningside campus operations. Moving forward, Columbia will continue to work together with its campuses at the Medical Center and Lamont-Doherty Earth Observatory, which were both very involved in this initial process, to align cross-campus goals and strategies wherever possible. As the Manhattanville campus evolves, it too will be gradually incorporated into the process. As well, Columbia will look to expand the scope of areas covered by the Plan in order to create a more holistic portrait of the University's footprint. As this is the first formalized Sustainability Plan for Columbia, a targeted, three-year, Morningside campus-specific plan has allowed the University to set effective yet reasonable goals and take subsequent actions. By 2020 Columbia will continue to build upon its foundation and set forth longer-term goals.

With this Plan, Columbia will continue to develop as a vibrant and sustainable campus for current and future generations, and to champion the actions needed to meet the global challenges of climate change.



Acronyms and Definitions

ACRONYMS

- **AASHE**
Association for the Advancement of Sustainability in Higher Education
- **BMS**
Building Management System
- **CUMC**
Columbia University Medical Center
- **CY**
Calendar Year
- **ECM**
Energy Conservation Measure
- **EUI**
Energy Use Intensity
- **FY**
Fiscal Year
- **GHG**
Greenhouse Gas
- **LDEO**
Lamont-Doherty Earth Observatory
- **LEED**
Leadership in Energy and Environmental Design
- **LEED-ND**
Leadership in Energy and Environmental Design - Neighborhood Development
- **RCM**
Retro-commissioning Measure
- **ROI**
Return on Investment
- **SOV**
Single-Occupancy Vehicle
- **SSAC**
Senior Sustainability Advisory Committee
- **STARS**
Sustainability, Tracking, Assessment, and Rating System
- **TCR**
The Climate Registry

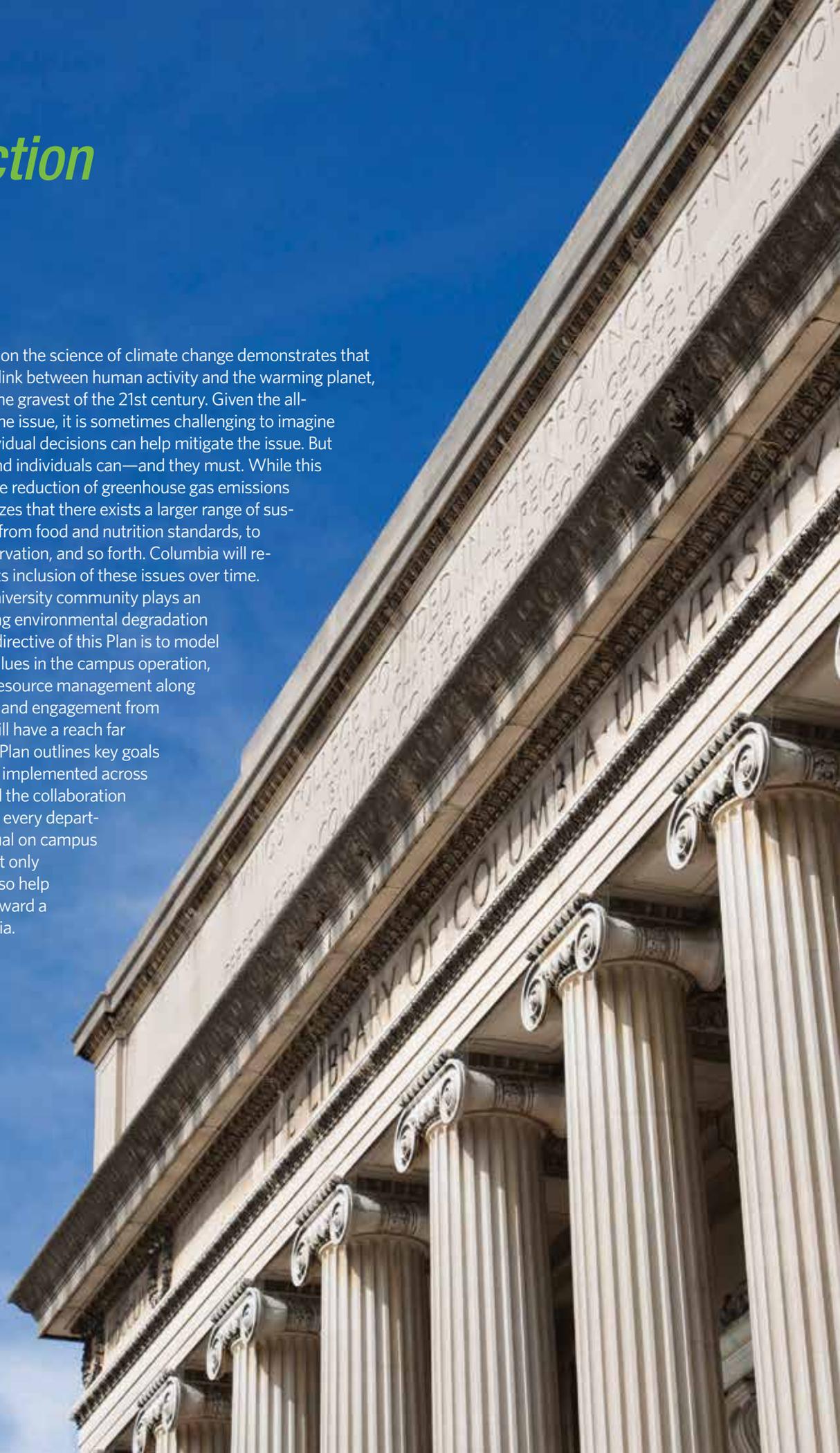
DEFINITIONS

- **Morningside campus:** Columbia's Morningside campus refers to all buildings and grounds from 114th to 119th streets, between Broadway and Amsterdam avenues, and all owned residential buildings. It also includes the Baker Athletics Complex in Inwood.
- **New York City Local Law 87 (LL87):** New York City law established in 2009 requires periodic energy audits and retro-commissioning (RCx) of certain buildings that exceed 50,000 gross square feet of floor area. The RCx process is focused on the evaluation and optimization of existing systems. The law requires that the performed energy audit be, at minimum, equivalent to a Level 2 American Society of Heating, Refrigeration, and Air-Conditioning Engineer (ASHRAE) audit. The law describes the minimum required retro-commissioning tasks to investigate, along with testing protocols and sample rates. RCx deficiencies identified are required to be implemented; energy audit recommendations are optional. Owners of designated impact buildings must submit an Energy Efficiency Report (EER) once every ten years, in the calendar year in which the last digit of the year coincides with the last digit of the building's tax block number. Designated deadline years are set by which organizations must evaluate a certain number of buildings and complete any recommended work identified to improve the operation, and ideally energy efficiency, of the building. The City often grants extensions at a small fee.
- **OneNYC:** As stated on its website, "Originally released in 2007 under the name 'PlaNYC,' One New York: The Plan for a Strong and Just City (OneNYC) is a groundbreaking effort to address New York City's long-term challenges: the forecast of 9 million residents by 2040, changing climate conditions, an evolving economy, and aging infrastructure." As part of this Plan, New York City committed to send **zero waste to landfills by 2030**.
- **Scope 1 GHG emissions:** Direct GHG emissions from sources within the organizational boundaries and that the reporting entity owns or controls. They generally derive from the use of fossil fuels or man-made chemicals and fall into four categories: (1) stationary combustion of fuels, (2) mobile combustion of fuels, (3) physical and chemical processes, and (4) fugitive sources.
- **Scope 2 GHG emissions:** Indirect emissions (i.e., occurring at sources owned or controlled by another entity) associated with the consumption of purchased electricity, steam, heating, or cooling.
- **Scope 3 GHG emissions:** All indirect emissions (i.e., occurring at sources owned or controlled by another entity) that are not Scope 2 emissions. They fall into the following categories: business travel; employee commuting; waste from operations; fuel- and energy-related activities (not included in Scopes 1 or 2*); purchased goods and services; capital goods; upstream transportation and distribution; upstream leased assets; downstream transportation and distribution; processing of sold products; use of sold products; end-of-life treatment of sold products; downstream leased assets; franchises; and, investments

Introduction

Groundbreaking research on the science of climate change demonstrates that there is a clear and direct link between human activity and the warming planet, making this issue one of the gravest of the 21st century. Given the all-encompassing nature of the issue, it is sometimes challenging to imagine that institutional and individual decisions can help mitigate the issue. But collectively, institutions and individuals can—and they must. While this Plan focuses heavily on the reduction of greenhouse gas emissions (GHG), Columbia recognizes that there exists a larger range of sustainability considerations from food and nutrition standards, to water and resource conservation, and so forth. Columbia will remain open to expanding its inclusion of these issues over time.

Each member of the University community plays an important role in mitigating environmental degradation and climate change. The directive of this Plan is to model Columbia's sustainable values in the campus operation, knowing that thoughtful resource management along with important education and engagement from Columbia's community will have a reach far beyond our campus. This Plan outlines key goals and strategies that will be implemented across University operations, and the collaboration and collective action from every department, school, and individual on campus will help the University not only achieve these goals but also help further shift the culture toward a more sustainable Columbia.



Columbia Sustainability Principles



Columbia University recognizes that for its commitment to sustainability to become embedded over the long term, policy must be set to formalize it as a leading value. To achieve this, **President Bollinger formally endorsed a set of Sustainability Principles** in September 2016 to set forth a high-level vision for sustainability for Columbia's campus communities in New York and across the globe. The principles were developed through a partnership between University Facilities and Operations—including Environmental Stewardship—and Earth Institute faculty leadership.

The Sustainability Principles highlight three key pillars, to which each campus of the University has a commitment to adhere through targeted policies, commitments, and standard practices, as well as individual daily actions. As part of this commitment, Columbia commits and strives to

- **advance Columbia's core educational, research, and outreach missions to demonstrate its leadership around the world;**
- **plan, develop, implement, and measure strategic sustainability initiatives; and**
- **foster a culture of sustainability.**

The University is committed to following a set of sustainability principles in all facets of planning and operations so that Columbia can improve environmental performance, ensure a healthy community, and contribute to local, regional, and global solutions.

These principles apply University-wide—not only to the Morningside campus, but also to CUMC, LDEO, Nevis Labs, Manhattanville, Baker Field Athletics Complex, the many residential properties owned by the University, and other facilities such as the Columbia Global Centers. Columbia recognizes that implementation may not occur in all places all at once, and that some of the principles will require more advance work than others; implementation will occur in as expedited a manner as practicable.

Each campus should adopt ways to adhere to these principles through targeted policies, commitments, and standard practices, as well as individual everyday actions. These will be essential to realize our vision of incorporating sustainability into every aspect of campus life.





SUSTAINABILITY PRINCIPLES

1. Advance Columbia's core educational, research, and outreach missions to demonstrate its leadership around the world

- Enhance education, research, and public outreach activity to promote sustainability and disseminate knowledge about how earth systems operate, how humans affect them, and how negative impacts can be reduced and reversed; prepare current and future generations to utilize and advance this knowledge.
- Enhance the sustainability of the physical operations of the University to improve its own environmental performance, and also to develop, test, measure, and improve methods that can be broadly applicable around the world.



2. Plan, develop, implement, and measure strategic sustainability initiatives

Columbia commits to adopt institutional practices that promote sustainability. All of these practices should apply to Columbia's own operations, and should be used as primary criteria for selecting suppliers of energy, food, materials, products, and services:

- Develop baseline measures of use and efficiency for energy, water, and other resources, and adopt periodic monitoring and reporting of these and other measures of Columbia's environmental performance.
- Using a consensus-building and participatory process, adopt and periodically update campus-specific measurable goals. Where applicable, goals should be science-based and take into consideration the appropriate city, state, federal, or international goals and standards, in the following areas:
 - reduce greenhouse gas emissions from campus operations, and reduce electricity and fuel purchases;
 - conserve resources and minimize waste through efficiency, conservation, reuse, recycling, source reduction, and composting;
 - maximize the use of renewable resources (including energy);
 - use water resources efficiently, and minimize total water demand;
 - construct, maintain, and renovate buildings to provide safe, healthy, and productive; indoor environments that use energy, water, and other natural resources efficiently;
 - seek mode shifts in order to reduce the number of drive-alone commuters by expanding the number of alternative mobility options such as bicycling, shared vehicles, shuttles, and mass transit; and
 - seek ways to reduce the need for travel, such as electronic communications.



- Take into consideration projections about future climate conditions, and adaptation in its capital and operational planning, and make appropriate preparations.
- Organize an inclusive sustainability governance model that centralizes sustainability reporting and decision-making around these topics.
- Develop publicly available sustainability indicators and planning tools, to enable monitoring, reporting, and continuous improvement; to enable comparative analysis of environmental performance; and to facilitate and support engagement of the University community.
- To ensure implementation of these principles, devote sufficient organizational and financial resources, put in place mechanisms of responsibility and accountability, and integrate the goals into management decision-making; consider the potential for operational cost savings (such as lower energy bills) in making decisions on capital projects.



3. Foster a culture of sustainability

Columbia commits to fostering a culture of sustainability. Targeted policies and practices as well as individual, everyday actions are essential to realizing the University's vision of incorporating sustainability into every aspect of campus life. The University should foster thinking and decision-making that persist even after students graduate and other members of the community move on.

The University encourages all members of its community to:

- Increase each other's level of awareness around sustainability, encouraging each other to personally take action to support the University's sustainability efforts and obligations
- Lead by example, exhibiting day-to-day behavior that minimizes environmental impacts on the campus grounds, local workspaces, living quarters, and recreation spaces
- Empower students, staff, and faculty to be agents of behavioral change who mobilize their knowledge in concrete ways on campus to build a sustainable campus community
- Collaborate to set goals around sustainability and provide transparency about progress on campus and beyond; seek ways to participate in events and teams that bring the campus community together around sustainability, including but not limited to school-based Green Teams, student energy challenges, donation fairs, and recognition events that celebrate success

Adherence to and adoption of these principles are essential to realizing Columbia's vision of incorporating sustainability into every aspect of campus life.

Sustainability Planning and Governance

A new governance model has been established to advance the new sustainability planning process, beginning with a focus on the Morningside campus.

Governance:

In support of the Sustainability Principles' call to "organize an inclusive sustainability governance model that centralizes sustainability reporting and decision making around sustainability," University leadership from both the administrative and academic realms collaborated in January 2016 to establish a new governance model that centralized the sustainability conversation between academic and administrative leaders on campus.

- Three focus teams were created to bring together key stakeholders on campus—including students, faculty, and administrators—to initiate a strategic planning process and set future goals for the University in areas including greenhouse gas emissions, building energy supply and demand, transportation, and waste. The focus team co-chairs helped lead group discussion and reported up on progress.
- A new Senior Sustainability Advisory Committee (SSAC) was formed, co-chaired by David Greenberg, Executive Vice President of Facilities and Operations, and Michael Gerrard, Chair of the Earth Institute Faculty and Director of the Sabin Center for Climate Change Law. The focus team co-chairs sit on the SSAC, along with any other focus team member that the chairs deem appropriate. This is the governing body for sustainability, where ideas are brought forth, reviewed, and discussed. It is also the body to which progress on the Sustainability Plan will be reported over time.
- Members of executive leadership on the SSAC form the Executive SSAC. This is the ultimate decision-making body for the sustainability program.
- Columbia's Environmental Stewardship office participates and contributes at each level.

Focus teams:

Columbia created three focus teams* around key impact areas that contribute most to Columbia's greenhouse gas emissions profile, with representation from administration, faculty and students from the Morningside campus: Building Energy Supply and Demand, Transportation, and Waste. Representatives from Lamont-Doherty Earth Observatory and the Columbia University Medical Center also participated on each focus team to keep the process transparent and inclusive should they decide to ultimately replicate a similar process on their campuses. While each campus at Columbia operates independently with different leadership and financial oversight, the Sustainability Principles unite Columbia around a common vision.

The focus teams met monthly over the course of a year, each meeting facilitated and coordinated by the Environmental Stewardship office. The focus teams:

- evaluated current impact area strengths and opportunities;
- generated proposed, high-level goals with measurable strategies and supporting steps to advance those strengths over the next three years;
- engaged in dynamic discussion to incorporate consideration for city, state, and federal environmental policy;
- highlighted where there is a need for deeper analysis to forecast current performance and measure future progress over time;
- drafted succinct recommendations documents for review by the SSA; and
- generated detailed, tactical action steps to keep focus teams on track over the course of the next three years.

**Full membership may be found in the Appendix.*



About the Plan

General Scope of the Plan

The scope of the goals, strategies, and steps set forth in this Plan is limited to the University's Morningside campus. This Plan has a three-year (2017-2020) temporal scope focused on strategies that will help advance the campus toward the outlined sustainability goals by 2020. Where applicable, goals look to align with city and state policy. All goals will be revisited over the next three years to determine if they need to be adjusted or re-aligned to meet the ever-evolving policy landscape.

Columbia Sustainability Plan: 2017-2020

Morningside Campus Plan:

The Columbia Sustainability Plan provides a high-level overview of three-year goals and the strategies that will enable the University to achieve them. Additionally, this Plan provides background information on prior successes that have allowed the University to progress to where a formalized plan was necessary to capture all past work and outline the road ahead.

Morningside Campus Progress Reports:

Over the next three years, Columbia will release at least one progress report per calendar year. Additional information about how this Plan will be tracked can be found in the Tracking and Reporting section.

Columbia Sustainability Plan: Beyond 2020

As mentioned in the Plan's principles, Columbia is committed to a long-term strategy to address sustainability. This Plan continues through 2020 with the expectation that another plan will be released closer to 2020 to move the University forward.

Inclusion of the Medical Center and Lamont Campuses

Representatives from the Medical Center and Lamont-Doherty Earth Observatory participated on the focus teams that generated these goals and strategies, and therefore helped shape them. At each of their campuses, they are advancing their own variety of initiatives, many of which align with the goals set forth in this Plan. Two dedicated sections in this Plan, one for each campus, highlight these details.

Formalizing Columbia's Greenhouse Gas Program

Columbia's Greenhouse Gas (GHG) Inventory: NYC Mayoral Carbon Challenge Reporting Methodology

Beginning in 2006, Columbia has tracked GHG emissions from its Morningside Heights campus building portfolio in accordance with the NYC Mayoral Carbon Challenge, using a Carbon Emissions Inventory spreadsheet tool and associated guidance provided by New York City. Columbia made a commitment to reduce its carbon intensity, measured as GHG emissions per square foot of building space, by 30 percent between 2006 and 2017. As of 2016 Columbia achieved a 25 percent reduction from the base year.

The NYC Mayoral Carbon Challenge inventory tool serves to measure and track Columbia's GHG emissions for the purpose of participation. To date, it has reflected Columbia's Scope 1 emissions from stationary sources and Scope 2 emissions from purchased electricity measured in carbon dioxide equivalents using grid coefficients frozen at 2005 levels.* The use of a static electricity coefficient is inconsistent with generally accepted accounting treatment and materially overstates Columbia's GHG emissions as the NYC grid carbon intensity has declined substantially since the start of the NYC Mayoral Carbon Challenge.

**Notably, New York City itself, administrator of the NYC Mayoral Carbon Challenge, reports its emissions using a more widely accepted protocol. See Appendix for GHG Protocol scopes.*

Adopting Best Practices for GHG Accounting and Reporting

As local and state governments continue to find new ways to decarbonize the energy grid, making it cleaner, Columbia must track these changes and use that tracking to inform decisions about sources of its Scope 1 and 2 emissions. Columbia commits to ensure a complete, consistent, accurate, and transparent reporting of all relevant GHG emissions and reductions over time. To this end, Columbia is determined to employ nationally and internationally accepted emissions accounting and reporting standards and methodologies.

The Climate Registry

After extensive analysis and research of best practices, Columbia has elected to join **The Climate Registry (TCR)** and will account for and report emissions in conformity with TCR's rigorous guidance, standards, requirements, and methodologies. This will provide Columbia with a more rigorous approach to manage its comprehensive GHG program and public inventory. Integration with TCR will take place over two years as described below.

Columbia will continue to also report its GHG emissions to New York City for the purposes of the NYC Mayoral Carbon Challenge using the unique conventions required for that purpose.

Phased Approach: Reporting Boundaries with The Climate Registry

FY 2006 TO CY 2016 EXISTING INVENTORIES

Existing inventories will be updated to reflect then current NYC grid intensity for purchased electricity.

CY 2017 TRANSITIONAL INVENTORY

It is Columbia's intention to become a member of TCR and implement its first independently verified transitional inventory with the following reporting boundaries for CY 2017:

- the Morningside Heights campus
- Scope 1 emissions from stationary combustion of fuels
- Scope 2 emissions from purchased electricity
- all six Kyoto gases

CY 2018+ TRANSITIONAL INVENTORY

Columbia will expand the 2017 transitional inventory boundary to include the following for CY 2018:

- all Scope 1 emissions
- all Scope 2 emissions
- Scope 3 emissions from business travel, commuting, and waste from operations

Absolute Emissions vs. Carbon Intensity

In alignment with TCR protocol, Columbia will track and report absolute GHG emissions. While other metrics may also be measured, the University will establish its primary GHG emissions goal to be a reduction in absolute emissions.

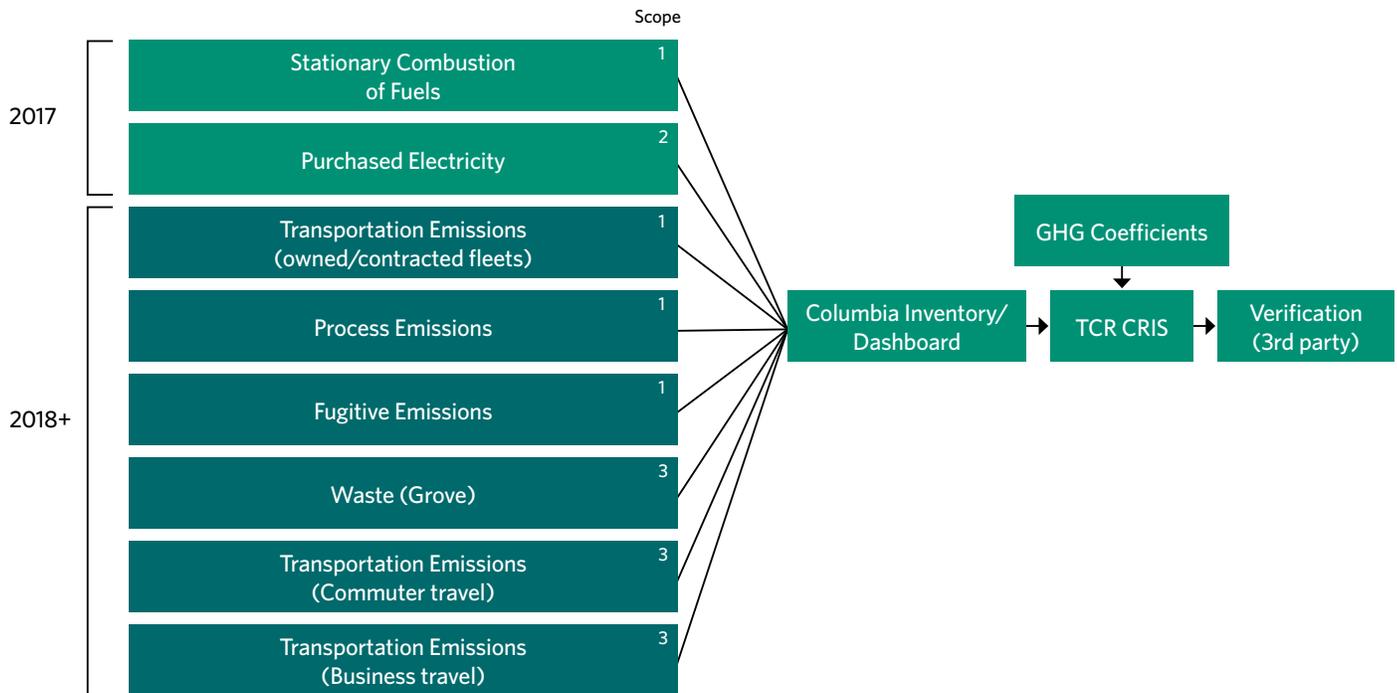
Columbia will continue to report progress toward the NYC Mayoral Carbon Challenge in terms of carbon intensity.

Columbia's Internal GHG Goals, 2017-2020

- Achieve a 35 percent absolute reduction in select Scope 1 and 2 emissions from a FY 2006 baseline applying TCR guidelines (*also referenced in the Building Energy Supply and Demand section*).
- Assess and establish new goals for 2020 and beyond for the expanded 2018+ inventory to align with NYC's goal of reducing all GHG emissions by 80 percent by 2050.
- Continue progress toward 30 percent carbon intensity reduction under the NYC Mayoral Carbon Challenge.



		<i>Progress Indicator</i>	2017	2018	2019	2020
Strategy	Employ internationally accepted emissions accounting and reporting standards and methodologies by joining The Climate Registry. Begin reporting absolute GHG emissions through transitional inventory over a two-year period.					
	FY 2006 to CY 2016 Existing Inventories—update to reflect then current NYC grid intensity for purchased electricity.	% reduction in absolute emissions	●			
	CY 2017 Transitional Inventory—MS campus, Scope 1 from stationary combustion of fuels, Scope 2 from purchased electricity, all six Kyoto gases.	% reduction in absolute emissions	●	●	●	●
	CY 2018+ Transitional Inventory—expand on 2017 transitional inventory to include all Scope 1, all Scope 2, Scope 3 for business travel, commuting and waste emissions from operations.	% reduction in absolute emissions		●	●	●
	Continue to report progress toward NYC Mayoral Carbon Challenge in terms of carbon intensity.	% reduction in carbon intensity	●	●		



Building Energy Supply and Demand

“New York City has over one million buildings that make up more than five billion square feet of built area. More than 90 percent of these buildings will still exist in 2050. The energy used in the city’s diverse building stock is the largest contributor of greenhouse gas (GHG) emissions, responsible for 68 percent of the citywide total in 2014.” (*New York City’s Roadmap to 80x50*, p. 54)

Columbia University has made GHG emissions reductions and energy efficiency central to its first Sustainability Plan in response to international, national, state, and local calls for action.

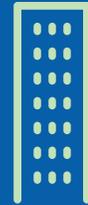
As a leading University in one of the most forward-looking cities in America, Columbia advocates for the United States’ continued support of the Paris Climate Agreement, signed in December 2015. Columbia is registered as a participant at the “Leader” level in the State of New York’s REV Campus Challenge and will benefit from New York State’s new Clean Energy Standard, which mandates that the state’s energy be sourced from 50 percent renewable sources by 2030. As a member of the New York City Mayoral Carbon Challenge since 2007, Columbia aims to align with New York City’s commitment to reduce emissions by 80 percent by 2050 from a 2005 baseline.

The focus team that led the research for this section of the Plan identified the emergence of an industry best practice to support GHG reduction goals. Many of Columbia’s peer institutions use a common framework for their short- and long-term planning. There are two parts to this best practice. The first is the development of a systematic and integrated approach to account for both energy needs and the emissions resulting from its energy use. The second is a unique financial mechanism—that sometimes sits outside the regular departmental budgeting process—that enables universities to invest large amounts in the short term so they can save larger amounts in the long term. The goals and strategies outlined later in this section aim to support an institutionalized framework at Columbia to better account for its energy use, and to have a financial mechanism to drive energy reduction programs on campus.

PROGRESS TO DATE

In 2007 Columbia University was one of the first universities in New York City to sign on to the NYC Mayoral Carbon Challenge, designed to promote an aggressive GHG reduction goal of 30 percent over a 10-year period, concluding in 2017.

The solutions and inherent challenges in meeting the diverse and demanding utility needs of a 120-year-old campus—spread across 36 acres and covering more than 250 buildings—are complex. More than 13 million square feet are managed by the engineers and professionals in Facilities and Operations responsible for this critical facet of supporting a leading research university. The team has addressed campus energy efficiency by taking a highly disciplined approach based on best practices and decades of collective experience. Energy efficiency improvements have resulted in significantly lower campus GHG emissions (Scope 1 and 2) as well as operational cost savings.



Through the NYC Clean Heat program, Columbia converted **113** buildings and **87** boilers from oil to gas, resulting in an annual energy reduction of **326,820** total MMBtu.



Over the past 10 years (2006 baseline), Columbia University has reduced gross energy consumption by **4 percent** while growing square footage by **7 percent**.



Since 2006, Columbia has reduced absolute carbon emissions by **29 percent**.

The solutions and inherent challenges in meeting the diverse and demanding utility needs of a 120-year-old campus are complex.

NYC Clean Heat

NYC Clean Heat was created by the City of New York in 2012 to address the public health hazard presented by heavy heating oil emissions. Between 2012 and 2015, NYC Clean Heat resulted in nearly 6,000 heating oil conversions from No. 6 or No. 4 oil to a cleaner, lower sulfur fuel. As a result, particulate matter (PM) 2.5 emissions from buildings previously burning these heavy heating oils have been reduced by 65 percent since 2011. Columbia University is the single-largest entity participating in the NYC Clean Heat program and initiated a nearly five-year process, in concert with our local utility Con Edison and the City of New York, to convert all of its residential buildings from distillate fuel oils to natural gas as the primary fuel source for heat and hot water. In all, 87 burners serving 113 residential buildings were converted as part of the project. This transition from reliance on heavy heating oil—as well as the reduced use of oil delivery trucks—is responsible for reducing the University's GHG emissions, creating more efficient and reliable source heating, and improving air quality in our community.

Results: 7,236 metric tons of CO₂e reduced annually

Chiller Plant Renewal and Optimization

As a major research institution, Columbia requires economical and reliable air conditioning on a 24-hour basis for a great number of its Morningside campus buildings. In order to meet the ever-growing cooling demands, the Facilities and Engineering teams dedicated significant capital investment to undertake a major expansion of its original Powerhouse—the central cooling plant on the Morningside campus.

The Powerhouse, which measures approximately 12,000 square feet, was renovated and received two new, ultra-energy-efficient chillers. One of the 2,800-ton chillers is driven by a steam turbine and the other chiller is an electric centrifugal. The flexibility to draw on either steam or electric power reduces stress on the electrical grid during the summer months, and allows the University to respond to changing energy costs and demand year-round.

Together these new refrigeration machines provide an additional 5,600 tons of cooling to the Morningside campus, which represents roughly half of the cooling capacity required to meet peak demand for the campus. They also produce chilled water 25 to 30 percent more efficiently, reducing the consumption of fossil fuels, GHG emissions, and energy costs. In addition to the upgraded Powerhouse and new chillers, older chillers that were previously scattered across the Morningside campus are now centralized within the University's renovated Powerhouse.

Working with Con Edison's Green Team, Columbia executed an initiative to optimize the production of chilled water in the central chilled water system. This resulted in significant annual energy cost savings and an energy efficiency incentive check for \$469,000 as a result of measured and verified energy savings through the Commercial & Industrial Energy Efficiency Program to offset part of the project's capital investment.

The upgrade has resulted in a reduction of electricity usage at Columbia's Morningside campus by 3.5 million kWh/year, and the University achieved payback on the investment in just over two years. The project, a key part of Columbia's ambitious campaign to reduce its energy consumption, consisted

of installing a comprehensive network of controls, metering, hardware, programming software, and other upgrades to the district energy system.

Results: 1,479 metric tons of CO₂e reduced annually

Building Energy Dashboard

A partnership between University Housing, Environmental Stewardship, and Facilities and Operations saw the installation of an online real-time energy dashboard in 2015. The first phase of this project has enabled students in undergraduate residential housing to go online and trend their energy consumption over time, and students participate in an annual energy challenge to highlight the impact that behavior change has to reduce energy demand on campus.

Building Energy Audits

In complying with New York City Local Law 87, which requires that buildings over 50,000 gross square feet undergo periodic energy audits and a review to make sure equipment is installed and operating correctly (a process known as retro-commissioning), Facilities has been advancing work for the buildings on campus impacted by the law while making recommendations for additional energy-saving measures in those buildings and other academic buildings.

In total, 104 Columbia buildings are impacted by this law.

	<i>Buildings Covered</i>	<i>Audits/ Report Complete</i>	<i>Audits Underway</i>	<i>Energy Efficiency Report to Be Submitted</i>
<i>As of end of 2016</i>	73	22	13	38
<i>Beyond 2016</i>	31	23	0	8 (Audits must first be completed)

Energy efficiency improvements have resulted in significantly lower campus GHG emissions as well as operational cost savings.

Columbia is fully compliant with applicable energy efficiency requirements where audits have been completed and reports submitted on the resulting work that has been done. While funding is being secured to complete the audits in the remaining buildings to put them into compliance, the City has granted Columbia extensions and Columbia is paying annual fees to the extent required.

The reports recommend a variety of work be implemented in the buildings, including installing energy meters for electricity, chilled water, steam, and domestic water for 30 academic buildings. Metering allows for a collection of energy data to inform decisions, which will help support the work of a new committee on sustainability that Columbia has formed. On the Morningside campus, in excess of 150 meters have been installed to date.

Once implemented, select energy audit and reduction measures are anticipated to reduce GHG emissions by 7,618 metric tons of CO₂e.

Community Recognition

The Columbia University Central Chilled Water Plant Improvement case study was published by *District Energy* magazine and featured as its cover article in the fourth quarter of 2015.

In 2016, the New York City Chapter of the Association of Energy Engineers (AEE) selected Columbia University as the winner of the Corporate Energy Management of the Year Award. Columbia's application has since been submitted to the Regional and International levels of the AEE for further recognition.

Summary of Results

- Over the past 10 years (2006 baseline), Columbia University has reduced gross energy consumption by 4 percent while growing square footage by 8 percent
- Absolute carbon emissions have been reduced by 29 percent, or approximately 42,000 metric tons
- Total MMBtu reduction annually (FY 2006 vs. CY 2016) is approximately 93,000 MMBtu
- Over the same timeframe, the University grew its square footage by about 973,000 SF
- Energy Intensity, expressed as MMBtu/SF, has been reduced by 11 percent
- Carbon Intensity, for the purpose of the NYC Mayoral Carbon Challenge, expressed as CO₂e/SF, has been reduced by 25 percent

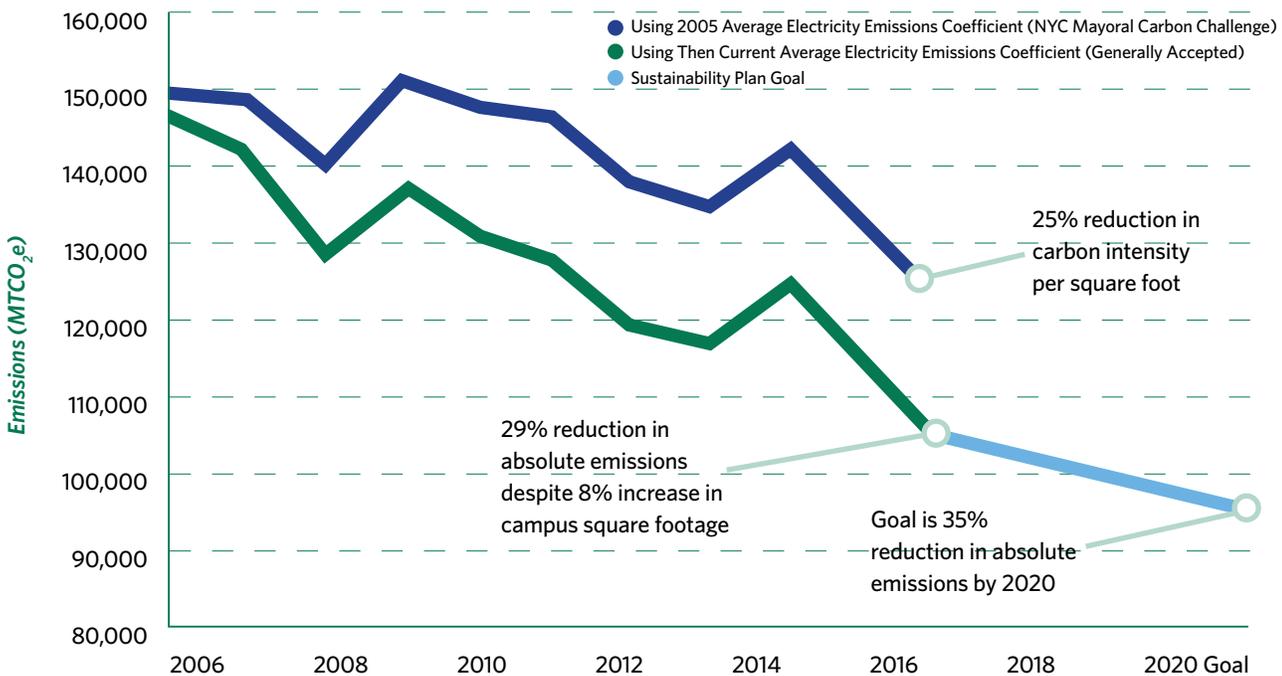


GOALS AND STRATEGIES:

Outlined below are the goals and corresponding strategies for the Morningside campus.

Goals	Reduce absolute Scope 1 and Scope 2 GHG emissions from stationary combustion and purchased electricity as calculated in FY 2006 base year inventory by 35 percent by CY 2020, using The Climate Registry protocol. Complete and report all emissions from stationary combustion and purchased electricity within The Climate Registry transitional inventory starting with CY 2017. Establish a detailed plan to meet 2020 goals and a roadmap to meet long-term goals.
Strategy 1	Implement identified energy conservation measures / retro-commissioning measures (ECM/RCM) to reduce energy intensity and therefore lower the campus building GHG emissions profile by 2020.
Strategy 2	Create a green revolving fund or some other financial mechanism to support a comprehensive energy conservation program over time, starting with ECM/RCM implementation in the short term. Ensure that the RCMs are prioritized to be completed first in compliance with NYC Department of Buildings Local Law 87.
Strategy 3	Develop a GHG master plan through 2050 that will incorporate a standardized rubric for evaluating supply and demand side energy decisions, outline anticipated carbon reduction, and enable Columbia to tap into clean and sustainable energy sources (including renewables) as they become available over time.
Strategy 4	Engage the Columbia community using the Sustainable Columbia Leaders Network as a platform to influence change through education and targeted outreach, in order to support the University's energy goals through behavioral changes.

Columbia University Greenhouse Gas Emissions Scope 1 Stationary Combustion and Scope 2 Purchased Electricity



The use of a static electricity coefficient, as required by the NYC Mayoral Carbon Challenge, overstates Columbia's GHG emissions as the NYC grid carbon intensity has declined since the start of the Challenge. Columbia will begin to report absolute GHG emission reductions through The Climate Registry to employ nationally accepted emissions accounting and reporting standards, and track toward the 2020 goal set forth in this plan. Columbia will continue to report its carbon intensity reduction under the NYC Mayoral Carbon Challenge using the unique grid coefficients required for that purpose.

BUILDING ENERGY SUPPLY AND DEMAND: STRATEGIES AND ACTIONS, 2017-2020

		Progress Indicator	2017	2018	2019	2020
Strategy 1	Implement identified energy conservation measures / retro-commissioning measures (ECM/RCM) to reduce energy intensity and therefore lower the campus building GHG emissions profile by 2020.					
	Identify energy conservation measures / retro-commissioning measures (ECM/RCM) projects to be completed before 2020.	List of projects, % complete	●			
	Install meters in University academic buildings.	% complete	●			
	Select company that will support the implementation of these projects.	Yes/no	●			
	Complete 25% select ECM/RCM projects.	% complete	●			
	Complete 50% select ECM/RCM projects.	% complete		●		
	Complete 75% select ECM/RCM projects.	% complete			●	
	Create final report to include in 2020 Progress Report to show energy savings (with associated GHG reductions) of Phase 1 ECM/RCM work.	Yes/no			●	●
Strategy 2	Create a green revolving fund or some other financial mechanism to support a comprehensive energy conservation program over time, starting with ECM/RCM implementation in the short term. Ensure that the RCMs are prioritized to be completed first in compliance with NYC Department of Buildings Local Law 87.					
	Research and select the best funding mechanism for Columbia to invest in long-term energy conservation programs at the University.	Yes/no	●			
	Identify seed money and work with key University partners to institutionalize the funding mechanism.	Yes/no	●			
	Draft overview of work accomplished, and ensure funding mechanism is fully in place (include in 2020 Progress Report).	\$ invested/ ROI	●	●	●	●
Strategy 3	Develop a GHG master plan through 2050 that will incorporate a standardized rubric for evaluating supply and demand side energy decisions, outline anticipated carbon reduction, and enable Columbia to tap into clean and sustainable energy sources (including renewables) as they become available over time.					
	Create a project team to develop outline of desired goals and desired usability of the GHG master plan.	Yes/no	●			
	RFP process and engage vendors to collaborate to build out the plan.	Yes/no	●	●		
	Build 25-year GHG master plan with clear, measurable tasks.	Yes/no		●	●	
	Draft review with key stakeholders to make final edits.	% complete			●	
	Final draft due of 25-year GHG master plan.	Yes/no			●	●
Strategy 4	Engage the Columbia community using the Sustainable Columbia Leaders Network as a platform to influence change through education and targeted outreach, in order to support the University's energy goals through behavioral changes.					
	Work with schools to develop a communications plan for each that helps increase education and engagement around energy usage.	Yes/no	●	●	●	●

Transportation

“New York City has the highest proportion of trips by modes other than private vehicles—walking, biking, and public transit—of any large U.S. city.¹ Achieving deep emission reductions from this already low base in the transportation sector, therefore, entails even more dramatic changes than might be required in a more car-dependent system. It will also require a holistic approach given the maturity and diversity of the New York metro region’s transportation network. There is no ‘silver bullet’.” (*New York City’s Roadmap to 80x50*, p. 78)

Transportation-associated GHG emissions and air pollutants are an issue that the federal, state, and local regulations seek to curb.

As part of Columbia’s transition to track and report GHG emissions through The Climate Registry (TCR), Columbia will track transportation related contributions to the Scope 1 and 3 emission categories in the inventory.

For the purpose of GHG accounting and reporting, the forms of transportation and associated emissions are grouped into three categories:

- 1. Mobile combustion** of fuels in transportation sources controlled by the University, for example fleet vehicles
- 2. Commuting**—the transportation of students and employees between their homes and their “worksites” in vehicles not owned or operated by the reporting company, and
- 3. Business travel**—transportation of students and employees for University-related activities in vehicles not owned or operated by Columbia.

The first is classified as direct, Scope 1 emissions; the last two as indirect, Scope 3 emissions.

Columbia has not yet accounted for transportation-related GHG emissions. In order to do so, a baseline of its current operations must be established and included in the GHG inventory. It must also integrate the University’s commitment to sustainability into vehicle purchasing decisions, including guidelines to make low-carbon vehicles preferential. This

approach must expand—to discussions with shuttle service contractors to talk about alternative fuel models, and with vendors that deliver products and supplies on campus to talk about low-emission delivery vehicles and/or decreased frequency. Additionally, Columbia must invest in attractive transportation options that incentivize commuters to choose alternatives to driving cars to get to campus.

These endeavors cannot be realized overnight, so the first steps in the goals and strategies outlined below are to focus on developing a more in-depth understanding of current practices, and outline protocols and policies that will create a more systematic approach to decrease transportation-related GHG emissions.

Ultimately, Columbia’s efforts in this area will also improve local air quality, which is a primary concern for residents of dense urban neighborhoods such as Morningside Heights. Studies have shown the link between human health and vehicle emissions, especially because mobile source emissions occur at ground level where human activity is the greatest.

The University is committed to enhancing a sustainable urban campus with innovative transportation options, serving as a model for New York City and beyond.

Ultimately, Columbia’s efforts in this area will also improve local air quality, which is a primary concern for residents of dense urban neighborhoods such as Morningside Heights.



The University is proud that only 10 percent of Columbia's affiliates have a drive-alone commute, and about 40 percent have an entirely walking commute.

PROGRESS TO DATE

On campus, the University has made significant strides toward reducing its GHG emissions from its transportation sector.

Columbia Shuttle Network

Columbia's shuttle network helps reduce the number of single-passenger cars on the road. Columbia's Fort Lee Shuttle transports commuters across the George Washington Bridge, moving approximately 300 commuters each day. The Columbia Intercampus Shuttle enables the University community to travel between the Morningside and Medical Center campuses. The Lamont Shuttle transports people between Morningside and the Lamont campus in Palisades, New York. Piloting new shuttle routes to reduce car dependency is underway.

Alternative Fuel Fleets

For on-campus operations, Columbia must take into consideration the fuel type for its owned and contracted vehicle fleet.

The University boasts an entirely hybrid-electric public safety car fleet. Out of Columbia's Morningside campus's total fleet of 54 vehicles, 40 percent are 100 percent electric or use a hybrid fuel type.

Sustainable Commutes

The University is proud that only 10 percent of Columbia's affiliates have a drive-alone



95 percent of Columbia's Morningside campus affiliates choose a sustainable commute mode, such as walking, transit, biking, or carpooling to campus.



Columbia received the highest score out of all participating institutions in the transportation section of the 2015 AASHE STARS Report, earning almost **90 percent**, and was recognized as a Top Performer for Transportation in AASHE's 2016 Sustainable Campus Index.



Every day over **1,100** passengers ride Columbia's shuttle system between campus locations in Manhattan, New Jersey, and Rockland County, helping reduce traffic congestion and Columbia's environmental footprint.

commute, and about 40 percent have an entirely walking commute. Columbia's investment into offering local housing and its accessibility to mass transit—as well as adding commuter and intercampus shuttles, bicycle incentives, and carpool matching tools—has yielded leading results.

In 2014, Columbia created its first Transportation Demand Management (TDM) position to develop initiatives that aim to reduce vehicle trips to the University, with a particular focus on commuters. The TDM program was created as part of a series of commitments that the University made to New York City when it began to build the new Manhattanville campus just north of the Morningside campus. Given the anticipated influx of travelers to Columbia as it expands, Columbia is taking action to minimize congestion by providing commute alternatives other than driving for students, faculty, and administrators traveling into Manhattan from the tristate area. The University hosted its first-ever “Car-Free Day” on Earth Day 2016, where myriad programs were available to commuters at discounted rates, as well as research initiatives led by Earth Institute faculty, designed to target air pollution data collection from commuters in the Morningside Heights area.

The University boasts an entirely hybrid-electric public safety car fleet.

Columbia's new 17-acre Manhattanville campus fosters compact land-use principles in a city environment, and will make sustainable modes of transportation an easy and obvious choice for University members. Additionally, Columbia will continue to roll out its transportation plan so that switching to a low-carbon travel mode is an obvious choice.

Biking Access on Campus

Columbia's support of a flourishing cycling community on, around, and between campuses not only supports wellness as a value, but also encourages reduced reliance on taxicabs or other vehicles to get around. Columbia currently holds both a silver business rating and bronze campus rating by the League of American Bicyclists and has scored 6.12 out of 7 possible points in the 2015 AASHE STARS Transportation section. Columbia's new on-campus bike share program means all Columbia affiliates now have access to a bicycle on campus, and the program facilitates recreational and intercampus trips by bike.



GOALS AND STRATEGIES:

Outlined below are the goals and corresponding strategies for the Morningside campus.

<p>Goals</p>	<p>For Fleet Vehicles, Commuting, Business Travel</p> <ul style="list-style-type: none"> ▪ Establish 2017 Base Year inventories for fleet vehicles and bring them into the inventory for CY 2018. ▪ Bring inventories for commuting and business travel into the inventory for CY 2018. ▪ Define an absolute GHG reduction goal for CY 2020 for forms of transportation. ▪ Identify specific strategies for meeting the 2020 goals and a roadmap to meet long-term aspirational goals. ▪ Track annual performance according to TCR guidelines including application of The GHG Protocol's "Corporate Value Chain (Scope 3) Accounting and Reporting Standard."
<p>Strategy 1</p>	<p>Measure and mitigate GHG emissions from owned and contracted fleet vehicles. This will include:</p> <ul style="list-style-type: none"> ▪ calculating transportation-associated GHG emissions from University-owned and contracted fleet vehicles (Scope 1 emissions), generating purchasing guidelines to guide Columbia toward the most efficiently fueled vehicle for the functionality of its purpose, and actively switching to more fuel-efficient options on a rolling basis; and ▪ reevaluating University shuttles to ensure ridership is matched with vehicle capacity, and investigating opportunities where transit subsidies can create efficiencies versus regular shuttle service.
<p>Strategy 2</p>	<p>Improve access to and education/engagement around bicycling.</p>
<p>Strategy 3</p>	<p>Incentivize commuter mode choice to reduce GHG emissions by developing new programs and infrastructure to support cleaner fuel types/transportation modes, e.g., walk, bike, shuttle bus, electric vehicle-charging, public transit subsidies, and ferry services between New Jersey and Harlem (impacts Scope 3 emissions).</p>
<p>Strategy 4</p>	<p>Reduce GHG from University-related travel beyond Columbia's campuses to neighboring cities or countries abroad, or offset what cannot be reduced (Scope 3 emissions).</p>
<p>Strategy 5</p>	<p>Engage the Columbia community using the Sustainable Columbia Leaders Network as a platform to influence change through education and targeted outreach, in order to support the University's transportation goals through behavioral changes.</p>



TRANSPORTATION: STRATEGIES AND ACTIONS, 2017-2020

		Progress Indicator	2017	2018	2019	2020
Strategy 1	Measure and mitigate GHG emissions from owned and contracted fleet vehicles. This will include: <ul style="list-style-type: none"> ▪ calculating transportation-associated GHG emissions from University-owned and contracted fleet vehicles (Scope 1 emissions), generating purchasing guidelines to guide Columbia toward the most efficiently fueled vehicle for the functionality of its purpose, and actively switching to more fuel-efficient options on a rolling basis; and ▪ reevaluating University shuttles to ensure ridership is matched with vehicle capacity, and investigating opportunities where transit subsidies can create efficiencies versus regular shuttle service. 					
	Finalize transportation indicators.	Yes/no	●			
	Inventory campus-owned fleet.	Yes/no	●			
	Analyze the shuttle route system.	Yes/no	●			
	Develop University-wide vehicle purchasing guidelines.	Yes/no	●			
	GHG emission mitigation policy for owned and contracted fleet vehicles is adopted across campus.	Yes/no		●		
Strategy 2	Improve access to and education/engagement around bicycling.					
	Look to progress "League of American Bicyclists" bike-friendly rating, which will include bicycle infrastructure, bike share, bike parking access, and engagement and education around bicycling on and around campus.	Yes/no	●	●	●	●
	Collaborate with local government and community boards to continue development of bicycle amenities surrounding and connecting to Columbia's campuses.	Yes/no		●		
	Release progress update on improvements made to improve access to bicycling and effect on Columbia's carbon footprint.	Yes/no				●
Strategy 3	Incentivize commuter mode choice to reduce GHG emissions by developing new programs and infrastructure to support cleaner fuel types/transportation modes, e.g., walk, bike, shuttle bus, electric vehicle-charging, public transit subsidies, and ferry services between New Jersey and Harlem (impacts Scope 3 emissions).					
	Incentivize and assist Columbia commuters to experiment and switch to low-emission commute types.	Yes/no	●			
	Explore the most cost-effective way to encourage commuters to use a ferry to travel to and from campus, with an eye toward serving the community (Ferry service to West Harlem).	Yes/no	●			
	Present recommendations for review. Moving forward with high-impact, high-probability programs for the first phase of implementation.	Yes/no		●		
	Provide commuters with access to tools that will help reduce drive-alone commuters, such as carpool, vanpool, park and ride, guaranteed ride home, etc.	Yes/no			●	

		Progress Indicator	2017	2018	2019	2020
Strategy 4	Reduce GHG from University-related travel beyond Columbia's campuses to neighboring cities or countries abroad, or offset what cannot be reduced (Scope 3 emissions).					
	Conduct best-practice research to evaluate how other institutions are tracking and/or off-setting GHG from related air and other types of travel.	Yes/no	●			
	Determine how Columbia may pilot best practices for travel to business-related venues (conferences, research, etc.).	Yes/no	●			
	Choose a few departments to pilot the program to be implemented (offsets / tracking with Columbia's new travel and business expense form).	Yes/no		●		
Strategy 5	Engage the Columbia community using the Sustainable Columbia Leaders Network as a platform to influence change through education and targeted outreach, in order to support the University's transportation goals through behavioral changes.					
	Work with schools to develop a communications plan for each that helps increase education and engagement around transportation.	Yes/no	●	●	●	●



Waste

“Every week, the average New Yorker throws out nearly 15 pounds of waste at home and another nine pounds of waste at work and in commercial establishments. Altogether, in New York City this adds up to more than three million tons of residential waste and three million tons of commercial waste generated per year. To manage all of this waste, the City has developed a complex system to collect, transport, and dispose of waste. It is a system with an enormous impact on our neighborhoods, our environment, and our economy.” (*OneCity Plan*, p. 176)

The historic rise of waste generation in New York City has forced the NYC Department of Sanitation (DSNY) to reevaluate waste management in the city and continually look for new opportunities to minimize and recycle, as well as divert, waste.

In 2012–2013, DSNY launched an organics pilot program for curbside collection of food scraps, food-soiled paper, and yard waste. Also, 2013 saw the expansion of plastic recycling collection to include all rigid plastics.

Columbia University has been working to align its waste management efforts with those of New York City.

The University acknowledges that waste reduction and diversion not only contribute to the preservation of resources, but also have cascading benefits both upstream and downstream through the local material management systems. Reducing or diverting material will save time, money, and other resources for Columbia, as well as eliminate many GHGs. The University is aware that reducing material quantity is only one dimension of a broader matrix. Accordingly, Columbia put forth a goal and outlined strategies to develop guidelines for socially responsible and environmentally preferable procurement that will empower members of the campus community to make purchasing decisions that are more aligned with the University's Sustainability Principles.

The disposal and treatment of waste generated from Columbia operations results in GHG emissions at facilities not owned or operated by Columbia. Such emissions are accounted for as Scope 3 indirect emissions, and will be included within Columbia's GHG inventory starting in CY 2018.

PROGRESS TO DATE

Columbia has made great strides to introduce many waste reduction and diversion initiatives on campus.

Diverting Recycling and Organics via Partnership with New York City Department of Sanitation (DSNY)

Waste management is a unique impact area in that so many department operations have a role. In a fruitful collaboration between Columbia Facilities and Operations and the DSNY, Columbia recycles all metal, glass, plastic, and paper products through receptacles placed throughout campus, including in laboratories. Columbia Undergraduate Housing and University Apartment Housing play a significant role in educating and engaging students and tenants to support these practices.

Universal and Chemical Waste Diversion

The Environmental Health and Safety Department (EHS) ensures that electronic waste and batteries are reclaimed and diverted from landfill, and proactively educates labs about ways to reduce environmental impact by both improving recycling and managing closely their chemical waste. EHS also manages an award-winning solvent recycling program that reduces chemical waste and annual expenses.



To date, the University has donated more than one million pounds of furniture to Columbia Community Service partners, as well as to disaster relief overseas.

Sustainable Dining

Columbia Dining has recently become a Level 1 Certified Green Restaurant for undergraduate dining halls, through initiatives such as tray-less dining, purchasing only recyclable/compostable to-go containers, and volunteering to be the first university in New York City to implement an organics composting pilot program in partnership with DSNY. Given its success, this pilot program has informed the continued expansion of the DSNY program on campus and elsewhere in the city.

Office Furniture Reuse Program

Over the course of about 10 years, Columbia Environmental Stewardship has built a grassroots reuse program to swap University-owned furniture between offices and schools in need, keeping thousands of pounds of usable and often historic pieces out of landfill. To date, the University has also donated more than one million pounds of furniture to Columbia Community Service partners, as well as to disaster relief overseas. The University manages another award-winning program, Clean + Go Green, biannually, in which members of the Columbia community can bring items for donation or proper disposal, with the goal of diverting these items from landfill.



EHS manages an **award-winning solvent** recycling program that reduces chemical waste and annual expenses.



Columbia Dining has recently become a **Level 1** Certified Green Restaurant for undergraduate dining halls.



To date, the University has donated over **one million pounds** of furniture to Columbia Community Service partners, as well as to disaster relief overseas.



Vendor Partner Engagement

University Procurement has collaborated with vendor partners to establish a host of programs that help reduce excess waste generation at the University. Some of these include setting minimum order values with vendors like Staples that helps to cut down on associated emissions from delivery as well as avoid excess shipment packaging; partnering with vendors like Steelcase who champion reusable and inter-

changeable products; and negotiating a price that equalizes the cost between 22 percent recycled content paper and virgin content paper to incentivize campus stakeholders to purchase the more environmental option.

GOALS AND STRATEGIES:

Outlined below are the goals and corresponding strategies for the Morningside campus.

<p>Goals</p>	<p>Columbia will develop baseline metrics for all waste streams and calculate the University's first waste diversion rate. This will allow the University to set a waste diversion and waste-to-landfill reduction goal, ultimately track additional Scope 3 emissions, and enhance programs to achieve these goals by 2020. Columbia will work toward the longer-term aspiration of aligning with NYC's OneNYC waste-to-landfill goal by 2030.</p> <p>With respect to GHG emissions, Columbia's goals within the 2017-2020 plan horizon are to:</p> <ul style="list-style-type: none"> ▪ establish CY 2018 Base Year GHG inventories for select waste streams; and ▪ define an absolute GHG reduction goal for CY 2020 Identify specific strategies for meeting the 2020 goals and a roadmap to meet long-term aspirational goals.
<p>Strategy 1</p>	<p>Develop baseline for all waste streams to calculate a comprehensive waste diversion rate in order to set a short-term goal. This will involve mapping out a process for streamlined data collection and looking to emerging technology to ensure a robust process to measure and track data centrally.</p>
<p>Strategy 2</p>	<p>Expand or create programs to increase waste diversion and minimize waste; set a short- and long-term goal.</p>
<p>Strategy 3</p>	<p>Engage preferred vendors to help support University waste reduction and other sustainability goals, with particular attention to reducing plastic bottle waste on campus; develop user guidelines for socially and environmentally responsible purchasing.</p>
<p>Strategy 4</p>	<p>Engage the Columbia community using the Sustainable Columbia Leaders Network as a platform to influence change through education and targeted outreach, in order to support the University's waste goals through behavioral changes.</p>

WASTE: STRATEGIES AND ACTIONS, 2017-2020

		Progress Indicator	2017	2018	2019	2020
Strategy 1	Develop baseline for all waste streams to calculate a comprehensive waste diversion rate in order to set a short-term goal. This will involve mapping out a process for streamlined data collection and looking to emerging technology to ensure a robust process to measure and track data centrally.					
	Finalize waste indicators to be tracked for the University baseline.	Yes/no	●			
	Build out matrix to map designating waste indicators for each stream, how measured (pounds, tons), and responsible party for each stream.	Yes/no	●			
	Audit "Grove" waste disposal area to determine waste disposal patterns from generators.	Yes/no	●			
	Calculate University diversion rate (baseline).	Yes/no			●	
Strategy 2	Expand or create programs to increase waste diversion and minimize waste; set a short- and long-term goal.					
	Conduct a gap analysis to prioritize which programs will have the highest impact.	Yes/no	●			
	Based on 2017 year end diversion rate calculation (baseline from strategy 1), set a 2020 waste reduction / diversion rate goal.	Yes/no	●			
	Continue to evaluate success of top programs implemented in June 2017; determine feasibility of improving, expanding, and or launching additional programs.	Yes/no	●	●		
Strategy 3	Engage preferred vendors to help support University waste reduction and other sustainability goals, with particular attention to reducing plastic bottle waste on campus; develop user guidelines for socially and environmentally responsible purchasing.					
	Bring together a work-team around procurement with the goal of developing a set of guidelines.	Yes/no	●			
	Reach out to University vendors and discuss greener product / packaging options.	Yes/no	●			
	Guideline for Purchasing developed and published on a University website.	Yes/no			●	
Strategy 4	Engage the Columbia community using the Sustainable Columbia Leaders Network as a platform to influence change through education and targeted outreach, in order to support the University's waste goals through behavioral changes.					
	Work with schools to develop a communications plan for each that helps increase education and engagement around waste generation.	Yes/no	●	●	●	●

Tracking Progress

Tracking and reporting the progress on Columbia University's goals, and its associated strategies and steps, will be critical in the success of Columbia's Sustainability Plan. Tracking the progress against the University's baseline years will allow Columbia to compare growth annually. The data will also be used to identify gaps and opportunities in the process—which strategies and steps are working and what may need to be revisited.

Tracking and reporting progress will be achieved through the following commitments:

INTERNAL ACCOUNTABILITY COORDINATION

The Environmental Stewardship office will be responsible for developing and managing the University-wide implementation

strategy and sustainability reporting for the Columbia Sustainability Plan. The focus teams will be responsible for implementing the action steps that support the strategies and larger goals in this Plan will take place through CY 2020.

LIVING DOCUMENT UPDATES

Columbia recognized in the development of this Plan that the outcome from some of the action steps will influence the direction of sequential steps. It is expected that this Plan will evolve and change over time, and updates will be a communication channel to review real-time updates and provide details on how these updates will influence the larger 2020 goals.



ANNUAL PROGRESS REPORT

Along with Living Document Updates, Columbia is committed to an annual report that will provide a high-level overview of the progress to date. This report will be made public to the Columbia community to promote transparency and open feedback, allowing the planning committee to learn, grow, and adapt to ensure the plan stays relevant.

THE CLIMATE REGISTRY REPORTING

The Environmental Stewardship office will be responsible for managing the process to report to The Climate Registry. Key department stakeholder will be responsible for submitting activity data in a designated worksheet format and collaborating with the Environmental Stewardship office as need be to submit accurate and timely information for each calendar year.

2020 REPORT AND NEXT STEPS

Goals and strategies in this Plan have a three-year temporal scope, although Columbia's sustainability commitment projects far into the future. This 2020 report will not only revisit the progress from 2017 to 2020, but will build off the momentum of the past three years by rededicating the University to a new set of goals and strategies to come.



Additional Focus Areas

CAMPUS COMMUNITY ENGAGEMENT

In September, when President Bollinger announced the creation of the University's first set of Sustainability Principles, he introduced a new forum called the Sustainable Columbia Leaders Network (SLN). The provost also announced the creation of the SLN at the Council of Deans meeting held on September 8, 2016.

The deans of Columbia's schools have identified three volunteers from each school to participate in this group: one faculty member, one student, and one administrator.

SLN OBJECTIVES

Over the past year, members of the administration, faculty, and students have collaborated to generate this Sustainability Plan, the University's first, complete with high-level goals. This Plan highlights a set of strategies that departments, including but not limited to Facilities and Operations, will advance over the next three years.

The role of school-based actions in the form of policy and behavior change will accelerate the University's ability to realize its sustainability goals. The primary objective of the SLN is to engage a wide range of stakeholders from across the campus to collaborate in developing and endorsing a set of these actions that can serve to guide Columbia's schools to foster a culture of sustainability.

The goal outcomes for the group include the following:

- Environmental Stewardship will share with SLN a draft set of "sustainable action guidelines" that highlight proposed actions for schools to reduce their footprint through internal behavior changes.
- The SLN will have the opportunity to further shape these guidelines with new ideas to create a Columbia-specific document that can be used to improve current practices and develop new opportunities at each school.
- Schools and their SLN representatives will be invited to select an opportunity area from the guidelines to drive measurable culture change in their schools over the course of the year. The experience gained will help other schools to utilize solutions and document progress.

Environmental Stewardship looks forward to sharing the progress Columbia is able to make over the course of the coming years through this energizing engagement platform.

AWARDS AND RECOGNITION

In just the last few years, seven Columbia buildings earned LEED® certifications. They include environmentally sustainable renovations of the Columbia Alumni Center (Gold), Faculty House (Gold) and Knox Hall (Gold) on the Morningside Heights campus; and individual floors of the Rosenfield Building (Gold) at the Mailman School of Public Health, and of the Studebaker Building (Silver) on the Manhattanville campus. Newly constructed, LEED®-certified buildings include Morningside's Northwest Corner Building (Gold) and the Gary C. Comer Geochemistry Building (Silver) on the Lamont-Doherty Earth Observatory campus.

Additional recognition has included the following:

- Columbia's Manhattanville campus was the first campus in the country to achieve a LEED®ND (Neighborhood Development) Platinum certification.
- Columbia University has been featured numerous times in The Princeton Review's annual Guide to Green Colleges
- BestColleges.com recognized Columbia as one of America's Greenest Universities
- Since 2012 Columbia has achieved STARS Gold
- 2012 U.S. EPA Environmental Quality Award for Columbia's Clean + Go Green bi-annual recycling program
- 2014 Environmental Excellence Award from the New York State Department of Environmental Conservation for Columbia's laboratory waste solvent recycling programs at CUMC and Morningside campuses
- 2015 AASHE STARS Top Performer Recognition in Transportation
- 2016 AASHE STARS Top Performer Recognition in Transportation & Research
- 2016 AEE Awards—Corporate Energy Management of the Year
- 2016 AEE Awards—Young Energy Professional of the Year
- 2016 Columbia won the City & State Reports Corporate Social Responsibility Award in Sustainability for its efforts to reduce its environmental footprint and advance sustainable initiatives on campus

WATER

Through this planning process, efforts to increase water conservation on campus has been identified as an opportunity area that Columbia will pursue in more detail as it advances its GHG master plan process.

FOOD/NUTRITION STANDARD GUIDELINES

Stakeholders at Columbia are driving progress forward in the area of food and nutrition; however, this effort has been independent from the sustainability planning process. In the spirit of inclusion, it is referenced here to recognize this forward movement.

The Nutrition Academic Advisory Committee was first convened in Fall 2014. At that time, there was a unanimous decision by members to proceed with the development of the

Columbia Recommended Food and Beverage Standard to meet the following high-level goal: Toward building a culture of health, foster the wellness of the Columbia community by

- providing access to healthful and sustainable food and beverages; and
- strengthening food and beverage environments where the affordable, informed, and convenient choice is the healthy choice.

Starting in 2017, the Office of Work/Life will be convening a number of Columbia administrators who contract with and/or oversee food operations provided to the Columbia community to create a Food and Nutrition Working Group.



Looking Beyond Morningside: Columbia University Medical Center

Overview of Sustainability at CUMC:

Columbia University Medical Center (CUMC) began its first major sustainability effort in 2008 with the introduction of a comprehensive, campus-wide recycling campaign. Recycling rates have since risen from a 1 percent average in 2008 to 26 percent at the conclusion of 2015, with CUMC's research buildings diverting more than 350 tons of recyclable materials from landfills annually.

In 2009, CUMC Facilities created the role of Campus Energy Manager in order to spearhead efforts to reduce the University's environmental footprint across electricity, natural gas, oil, and utilities purchased from the neighboring NewYork-Presbyterian Hospital. CUMC's Energy Manager and the Facilities Engineering team initiated a master plan that led to a campus-wide energy audit in 2011 and a related Local Law 87 compliance effort in 2014.

In order to expand community engagement, the CUMC Green Team was created in 2013 as a quarterly open forum to discuss sustainability projects and brainstorm new ideas for minimizing the campus's environmental footprint. Beginning in 2016, key CUMC staff participated in the Sustainability Planning Process led by Environmental Stewardship, with representatives serving on each of the Energy, Waste, and Transportation focus teams. In early 2017, CUMC introduced additional staff, student, and faculty members to the draft Sustainability Plan in order to ensure greater community input and awareness of CUMC's proposed strategies and actions.

CUMC has recently experienced an expansion, welcoming two additional buildings to the campus, the Vagelos Education Center and the under-construction Columbia University School of Nursing building.

Both buildings are targeting LEED®BD+C Gold certification.

I. Building Energy Supply and Demand

HISTORY AND CURRENT STATE:

After careful review, CUMC sought an alternative to direct participation in the NYC Mayoral Carbon Challenge. CUMC concluded that its research-focused facility profile was reliant on a wide range of energy intensive base-building and laboratory systems, which could not be updated in time for the 2017 carbon goal deadline without compromising productivity and safety in the research environment. Seeking to remain committed to carbon reduction, CUMC authorized an internal carbon reduction goal in 2010 of a 30 percent carbon reduction

by 2025. To date, CUMC's energy consumption and carbon reduction efforts have focused on improvements to chilled water and steam distribution systems, total phase-out of #6 heating oil, and expansion of centralized building management and automation capabilities.

PROGRESS TO DATE:

CUMC's Building Management System (BMS) is a computer-based automation system that allows for increased control and monitoring of energy consumption and comfort in CUMC-managed buildings. First implemented at the William Black Building in 2011, CUMC's BMS is now interconnected with building systems in Hammer Health Sciences Center, the College of Physicians and Surgeons Building, the Russ Berrie Pavilion, the Haven Residential Towers, the Vagelos Education Center, and the Irving Cancer Research Center. CUMC Facilities' aims to continue to increase the number of BMS-connected buildings and spaces.

In 2012, CUMC Capital Project Management completed construction of a LEED Commercial Interiors (CI) Gold-rated renovation project on the 11th, 12th, and 13th floors of the Allan Rosenfield Building. Resource-saving features include water-conserving bathroom fixtures and toilets as well as sophisticated lighting control systems that take into account occupancy and the presence of natural light. The CUMC campus' two largest current construction projects—the Roy and Diana Vagelos Education Center and the new Columbia University School of Nursing building are also targeted for LEED Gold Status.

The 100 Haven Avenue boiler plant conversion was a major renovation project kicked off by CUMC Housing Services in 2013. In addition to a comprehensive boiler tune up, the first phase of this project also included modifications necessary to support the transition from using No. 6 oil to cleaner No. 2 heating oil as the primary fuel. During the second phase, CUMC partnered with Con Edison to extend high-pressure gas service to the boiler plant, allowing the operation to switch to even cleaner natural gas as the primary fuel. In addition to reducing carbon emissions, the gas conversion has also had a positive impact on other aspects of local air quality and allows for greater fuel redundancy and reliability.



Goals and Strategies:

<p>Goals</p>	<p>CUMC plans to align with the Morningside campus plan and other Columbia campuses by setting an aspirational goal to reduce carbon emissions 80 percent by 2050. A review in the short term will be necessary to establish whether available data can also support aligning this goal with the 2005 baseline (as opposed to CUMC's currently used 2010 baseline).</p>
<p>Strategy 1</p>	<p>Implement a comprehensive set of energy efficiency measures identified by a recent campus-wide LL87 report. CUMC will also seek to expand efforts to reduce laboratory energy consumption via hardware improvements and behavioral outreach.</p>
<p>Strategy 2</p>	<p>Create a green revolving fund to support efforts to reduce campus utility costs and improve energy conservation.</p>
<p>Strategy 3</p>	<p>Explore inclusion of the CUMC campus with the 25-year master plan proposed in the Morningside campus plan.</p>
<p>Strategy 4</p>	<p>Engage the CUMC community using the Sustainable Columbia Leaders Network as a platform to influence change through education and targeted outreach, in order to support the University's energy goals through behavioral changes.</p>

II. Transportation

HISTORY AND CURRENT STATE:

The CUMC campus is in close proximity to several MTA bus and subway lines, and it receives internal extension to commuting options via Intercampus Shuttles and the Fort Lee Shuttle serving New Jersey-based members of the community.

Based on the makeup of campus resources and the small size of the CUMC fleets, the channels of focus for CUMC Operations include: (1) encourage electric and hybrid vehicle ownership among CUMC vehicle commuters; (2) support the community of cycling commuters and cross-campus usage; and (3) reduce the number of ride-alone vehicle commuters originating from surrounding counties.

PROGRESS TO DATE:

A free shuttle bus connects the Medical Center with the Morningside and Manhattanville campuses as well as CUMC's affiliate, Harlem Hospital. The inter-campus shuttle runs Monday through Friday, excluding University holidays.

Bike racks are located on the CUMC campus for daily use. Bike rack information, as well as safety and security tips, can be found on the CU Public Safety website which features specialized mapping to help identify bike rack locations. With new LEED-certified green buildings joining the CUMC landscape, bicycle parking resources are also being expanded in strategic academic locations. As construction progresses, new bike racks will become available at both the Vagelos Education Center and the new School of Nursing building.

Goals and Strategies:

Goals	CUMC will develop protocols and policies to support the measurement and subsequent decrease in GHG and particulate matter emissions associated with campus-related and commuter travel by 2020, with an aspiration to support the University's commitment to reach the NYC 80 percent reduction in carbon emissions goal by 2050.
Strategy 1	Measure and mitigate GHG emissions from owned and contracted vehicles. There is reduced emphasis on this strategy as the CUMC vehicle fleet is small. However, CUMC will plan to adopt relevant zero/low emissions fleet vehicle standards that are developed.
Strategy 2	Improve access to and education/engagement around bicycling.
Strategy 3	Encourage commuter switchover to low-GHG transportation by developing new programs and infrastructure to support cleaner fuel types/transportation modes, e.g., walk, bike, shuttle bus, electric vehicle-charging, public transit subsidies, and carpooling with members of CUMC's neighboring institutions.
Strategy 4	Reduce GHG from University-related travel beyond the CUMC campus to neighboring cities or countries abroad—or offset what cannot be reduced.



III. Waste and Materials Management

HISTORY AND CURRENT STATE:

CUMC’s waste management is handled by a private-sector hauler (the current contract is with Action Carting, one of the largest in the area). Because of this different partnership in waste collection, CUMC receives monthly site-specific metrics on waste and recycling tonnage. CUMC’s hauler collects recyclables as well as trash and sorts it at its facility in the South Bronx.

CUMC has set up a robust infrastructure of waste management of conventional trash and major recyclables. Labeling and bin selection is consistent with the Morningside campus, and waste streams are largely aligned with the residential waste sorting requirement in place in the homes of most members of the CU community. CUMC diverts approximately 26 percent of conventional waste to recycling rather than landfill, which is significantly greater than the NYC average of 17 percent. CUMC’s two new buildings, the Columbia University School of Nursing and the Vagelos Education Center, are registered LEED® projects under review by the U.S. Green Building Council. These projects have already diverted a combined 8,000 tons, or over 90 percent of construction waste.

PROGRESS TO DATE:

Since the launch of CUMC’s comprehensive recycling campaign in 2008, recycling rates across the campus have risen from a 1 percent average in 2008 to 26 percent in 2015, compared to the

New York City average of 17 percent over the same time period. Additionally, in 2015, CUMC’s research portfolio diverted over 350 tons of recyclable materials from landfills.

CUMC’s two new LEED buildings, the Columbia University School of Nursing and the Vagelos Education Center, have closely monitored and managed waste throughout the construction process. This has resulted in diversion of a combined 8,000 tons, or over 90 percent of construction waste.

In an effort to cut plastic bottle waste, CUMC Facilities, in partnership with the Lerner Center for Public Health Promotion, has installed water-bottle fill stations for members of the Medical Center community. These refill stations can be found on select floors of Bard Hall, the Hammer Health Sciences Center, Mailman School of Public Health, and Russ Berrie Medical Science Pavilion and on every floor of the Vagelos Education Center.

In coordination with CU Environmental Health & Safety, CUMC is piloting a comprehensive training and bin expansion program in order to reduce the generation of Regulated Medical Waste (“red bags”) in research environments. In addition to encouraging conventional disposal of minimally contaminated waste, participating labs are able to increase recycling diversion as well. Additionally, Lab Managers may request additional bins from CUMC Facilities to collect large quantities of #5 plastic waste resulting from pipette tip boxes and certain types of rigid plastic bottles.

Goals and Strategies:

Goals	CUMC will expand waste management efforts with the purpose of setting and achieving an aggressive waste reduction goal and calculating a more comprehensive waste diversion rate. CUMC will work toward the long-term aspiration of aligning with NYC’s OneNYC waste-to-landfill goal by 2030.
<i>Strategy 1</i>	CUMC’s baseline tonnages and diversion rates are currently collected for major waste and recycling streams. CUMC will identify key secondary waste streams lacking metrics and develop measurement methodologies in order to create a more complete waste baseline.
<i>Strategy 2</i>	Expand or create programs to increase recycling diversion and minimize waste, which include relevant short- and long-term goals.
<i>Strategy 3</i>	Engage preferred vendors to help support waste reduction and sustainability goals. Develop user guidelines for socially responsible purchasing.
<i>Strategy 4</i>	Engage the CUMC community using the Sustainable Columbia Leaders Network as a platform to influence change through education and targeted outreach, in order to support the University’s waste goals through behavioral changes.

Looking Beyond Morningside: Lamont-Doherty Earth Observatory

Overview of Sustainability at LDEO:

The Lamont campus of Columbia University, situated on roughly 180 wooded acres in Palisades, NY, is home to the Lamont-Doherty Earth Observatory (LDEO), a world-class Earth and Environmental Science research organization. Employing more than 200 scientists and graduate students, LDEO maintains a diverse portfolio of cutting-edge research exploring the processes of the Earth's core, mantle and crust, the circulation of the oceans and atmosphere and the flux between, and the solar effects on the globe due to the Earth's orbital and axial positioning. These processes are studied with varying perspectives, over long periods of time past, over the present term, and looking forward into the future. There are few institutions around the world with the depth and breadth of scope to compare with LDEO in its field. Perhaps none are so well poised to understand the causes and effects of climate change, and to provide the scientific basis for problem-solving that is so desperately needed.

LDEO is a foundational member of Columbia University's Earth Institute, housing two of its most prominent entities, the International Research Institute for Climate and Society (IRI) and the Center for International Earth Science Information Network (CIESIN). LDEO is the home of research offices and laboratories for the faculty and doctoral students of the University's Department of Earth and Environmental Science, the nation's top ranked graduate school in its field. Many LDEO scientists participate on the faculty of the Earth Institute, providing sustainability education to graduate and undergraduate students within the University, as well as other departments such as Engineering, Applied Physics and Mathematics, and the Ecology, Evolution and Environmental Biology. LDEO scientists collaborate with researchers at top ranked institutions around the world. The institution is primarily supported by public and private grants, with little to no burden on University resources.

LDEO fully supports the Sustainability Principles articulated by President Bollinger, and has participated in the Senior Sustainability Advisory Committee and its Focus Teams.

I. Building Energy Supply and Demand

HISTORY AND CURRENT STATE:

LDEO began tracking its energy use, along with other sources of carbon emissions and GHGs, in baseline year 2005. In 2006, LDEO established a goal of 30 percent

reduction by 2017. In the interim, however, it was necessary to replace all of the wet research labs on campus, which included the construction of a brand new laboratory building, greatly expanding the physical and carbon footprint in the process. These new LDEO laboratories have high ventilation requirements to protect the occupants from hazardous fumes, along with precise temperature, humidity, boron, cross contamination, spill prevention, and particle count requirements. Maintaining such environmental controls is energy intensive, and despite best engineering practice, replacing obsolete facilities in which these controls are lacking necessitates movement in the opposite direction on the energy demand curve.

In addition, there has been tremendous growth in Information Technology (IT) at LDEO over the same period as the bandwidth of the campus data network has increased by no less than one order of magnitude. State of the art research requires server clusters with the ability to manipulate large data sets and run global scale computational models. IT requires significant energy as a direct input, and nearly twice as much energy to remove the heat generated by high-performance computing within the data centers. Even modest renovations within office buildings, most of which were built prior to 1974, require an increase in energy intensity to meet modern expectations of comfort and healthful ventilation for the occupants. Such industrialization challenges have proved frustrating to meeting our sustainability goals and are expected to continuously frustrate in the future. Continuous innovation will be required to meet this challenge.

PROGRESS TO DATE:

Due to the tremendous modernization of Lamont laboratories over the past decade, a reduction in GHG emissions and Energy Use Intensity (EUI) was not obtained between 2005 and 2016. The construction of the Comer Geochemistry building alone, fully occupied in 2008, increased the campus square footage by 20 percent, and accounts for 44 percent of electric and 35 percent of natural gas usage on campus currently. Due to this expansion and the modernization of the Core Lab building, occupied in 2012, the GHG emissions on campus increased by 50 percent and EUI increased by 16 percent at their peaks in 2014. In 2014, Lamont added a Facilities Engineer to the staff, and charged him with exploring long-term projects and short-term countermeasures to meet our sustainability goals. Lamont is steadily decreasing

GHG emissions from their 2014 peak, and Lamont's EUI is nearly back to its 2005 baseline. These metrics point to the success of sustainability countermeasures employed to date including the replacement of all incandescent bulbs, replacement of all T-12 fluorescent bulbs with T-8 and T-5 bulbs, improved building management systems, occupancy sensors, commissioning and retro-commissioning measures, and replacement of heating and cooling equipment—at the end of useful life—with more energy efficient options. The campus has also engaged undergraduate students from

Barnard College to prepare informational posters and conduct a building energy challenge contest to elicit a behavioral response from the community. A number of major long-lead projects were explored, including rooftop and ground-based solar and cogeneration projects, but only the remote net metered solar farms have met the economic and operational challenges to date. While not timely enough to meet the 30 percent by 2017 reduction goal, Lamont is on track to exceed this goal by 2020.



Goals and Strategies:

<p>Goals</p>	<p>The Lamont campus will reduce GHG emissions by 50 percent from 2016 levels by 2020, with an aspiration to match the University's commitment to reach the NYC 80 percent reduction in carbon emissions goal by 2050.</p>
<p>Strategy 1</p>	<p>Replace 75 percent of electric energy purchased from the NY State grid with solar energy.</p> <p>LDEO has been working on this strategy since 2015, and recently concluded contracting to build two remote net metered solar farms each rated at 2 megawatts output, in Orange County, New York. These facilities have now entered the construction phase and are expected to be ready for interconnect by November 2017. This strategy alone is expected to accomplish a documented 50 percent reduction in GHG emissions by 2020.</p>
<p>Strategy 2</p>	<p>Replace gas-fired heating plants with geothermal systems providing both heating and cooling for buildings on campus. This strategy alone can accomplish an additional 25 percent reduction in GHG emissions.</p> <p>A renovation of Lamont Hall is in the planning and fundraising stage at this time, and it is anticipated that this will be LDEO's first geothermal building. It is recognized that the additional capital cost of a geothermal system, currently estimated at \$1 million for Lamont Hall, is a very significant upfront investment. It will be a considerable, long-term challenge to implement such improvements for the other 20 buildings on the Lamont campus, but this is the main strategy identified to accomplish the 80 percent reduction in carbon emissions goal by 2050.</p>
<p>Strategy 3</p>	<p>Implement measures to reduce energy demand and GHG emissions during all new construction, capital renovation, and State of Good Repair (SOGR) projects. Introducing LED lighting, additional insulation and replacement windows, high-efficiency heating and cooling appliances, variable speed drive controls for pumps and fans, occupancy sensors, and improved building management systems (along with enhanced commissioning and recommissioning efforts) is the principal way to offset demand creep caused by the expected increased industrialization of the campus, as scientific research will inevitably require higher-performance computing and higher-precision instrumentation.</p>
<p>Strategy 4</p>	<p>Identify creative financing and grant opportunities to introduce new infrastructure that requires little to no up-front capital outlay, reduces demand and GHG emissions, and self-funds through reduced operating costs.</p> <p>The solar farm projects are a prime example, delivering a \$16 million investment for Lamont under a 25-year Power Purchase Agreement expected to produce upwards of \$150,000 in utility cost savings each year. The projects leverage NYSERDA grants and tax incentives (valuable to the private industry provider, but not to the University) to provide low electric rates for the term, and require no up-front capital from LDEO. There is potential to use similar financial strategies to replace obsolete diesel fuel emergency generators, introduce gas fired cogeneration with absorption refrigeration to power data centers and high heat load labs, provide electric vehicle recharging stations, implement lighting and building management retrofits, and introduce on campus solar and geothermal systems.</p>
<p>Strategy 5</p>	<p>Engage the Lamont community through promotion of sustainability efforts and outcomes, and awareness-raising communications (such as posters and light switch, window, door and fume hood sash reminders) to support the University's energy goals through behavioral changes.</p>



II. Transportation

HISTORY AND CURRENT STATE:

While not required to report transportation emissions to the NYC Mayor's office, Lamont recognizes the value in collecting and publicizing this significant impact to constituents to effect positive changes in behavior. There are three components of particular interest: campus fleet operations, commuting, and business travel.

Lamont's campus fleet includes a backhoe, two dump trucks, and a number of utility vehicles used for building and grounds maintenance operations, including snow removal from campus roads and parking lots, and intercampus mail and package deliveries. These emissions are included in Lamont's carbon inventory based on the purchase of gasoline and diesel fuel.

LDEO is a suburban campus located outside of New York City, not especially well supported by public transportation. While approximately half of the employees live outside of NYC and commute to campus using single-occupancy vehicles, the other half employ an unusual reverse commute from the urban housing of NYC to the suburbs. This reverse commute is made practical by the Lamont Shuttle Service, which is operated by the Morningside Transportation department. The shuttle service consists of two motor coaches, each capable of carrying 72 passengers during peak times, which travel between the campuses hourly from 8:00 a.m. to 7:00 p.m. each weekday. On peak days, the shuttle service has grown to provide more than 500 rides to and from the Lamont campus. Not presently quantified are the additional rides provided between Morningside, the Medical Center, and Parker Plaza in Fort Lee, New Jersey. This shuttle service provides a vital link between these four campuses, and LDEO was recognized for the outstanding achievement of over 21,000 vehicle miles traveled by the New York Metropolitan Transportation Council in 2008, with the Regional Commuter Choice Award. In 2013, the shuttle service provided service to

nearly 86,000 passengers, for over 1.3 million miles, and offset over 550 metric tons of CO₂ equivalent attributable to single-occupancy vehicles.

While public transportation in the area is limited, there is local bus service between the Port Authority Terminal at the George Washington Bridge in NYC and Stony Point in Rockland County that passes by the Lamont campus entrance. While it is not heavily used by LDEO employees, Lamont has established a bus stop at the campus entrance and has erected a bus shelter.

Tracking business travel is a significant challenge for the University and LDEO, but it is desirable to do so. Because Lamont is an Earth Observatory, much of its research requires that the LDEO scientists travel to all continents on the globe, including Antarctica, and remote islands in between. To attempt to curtail this travel would also be analogous to requiring NASA to launch fewer spacecraft to reduce its GHG emissions. However, some behavioral changes might be inspired by raising awareness of the impact of business travel. Some travel might be avoided by teleconferencing, and some travel miles might be reduced by scheduling travel to multiple destinations without return trips home in between. Care will need to be taken to ensure LDEO travel is appropriately segregated from Morningside travel and not counted twice. This may be challenging as many employees and students at LDEO also have housing and offices at Morningside, and some entities, such as the Department of Earth and Environmental Sciences (DEES) and the Earth Institute (EI) are split between campuses.

PROGRESS TO DATE:

LDEO has significantly downsized its operational fleet, replacing pickup trucks for inter-building maintenance with smaller utility vehicles, and replacing the intercampus mail van with a smaller, more fuel-efficient vehicle. LDEO has also eliminated the use of fertilizers and watering to promote lawn growth, requiring less frequent mowing, and has allowed forest to overtake former



lawn areas to reduce the area requiring maintenance. New standards impose less frequent mowing, allowing lawns to grow to a greater height between maintenance intervals.

LDEO has tracked shuttle ridership to and from Lamont each day for over a decade, and reported outcomes to the University Transportation department to right-size the service and equipment. This data has helped Transportation make an informed choice to combine the midday Lamont Shuttle Service with the Fort Lee Shuttle Service, saving costs and reducing vehicle miles traveled. LDEO is also piloting a small program to permit Columbia University employees and students to park at Lamont and use the excess shuttle capacity for the direct commute into Morningside. If the pilot is successful, this may be expanded in the future to provide an alternative mode of transportation for suburban commuters, reducing single-occupancy vehicle commuting to Morningside.

The Lamont campus is bicycle-friendly, and in fair weather a number of employees bicycle between the campuses, and to

work from the suburbs. Bicycles also provide for recreational activity on campus, and it is permitted to transport bicycles between campuses in the cargo hold on the Lamont Shuttle. In addition to providing bicycle racks around campus, a number of new bathrooms built in recent years are equipped with private changing and shower facilities in support of bicycle and outdoor recreation enthusiasts. LDEO anticipates that a bicycle repair station will be installed on campus in the near future, as well as bike lockers, and it remains a goal to obtain a rating from the League of American Bicyclists for the Lamont campus.

Pursuant to obtaining LEED® Silver and Gold ratings on two significant construction projects, LDEO has identified preferred parking spaces for fuel-efficient vehicles and car pools. Lamont intends to make recharging stations available for electric vehicles in the future.

LDEO, in collaboration with the Earth Institute and the Environmental Stewardship office, is already engaging students in developing a project to track aviation miles and identify offsets.

Goals and Strategies:

Goals	LDEO will use protocols and policies developed by the University to support the measurement and subsequent decrease in GHG and particulate matter emissions associated with all University-related and commuter travel by 2020, with an aspiration to match the University's commitment to reach the NYC 80 percent reduction in carbon emissions goal by 2050.
Strategy 1	<p>Measure and mitigate GHG emissions from owned and contracted fleet vehicles. This will include:</p> <ul style="list-style-type: none"> ▪ calculating transportation-associated GHG emissions from University-owned and contracted fleet vehicles, analyzing the functionality of purpose for new vehicles purchased to procure more efficiently fueled vehicles, and actively switching to more fuel-efficient vehicles on a rolling basis; and ▪ evaluating the Lamont Shuttle to ensure ridership is matched with vehicle capacity, and exploring ways to use the available shuttle capacity for direct commuting to New York City, as the shuttle presently operates primarily in the reverse commuting mode.
Strategy 2	Improve access, education, and engagement for bicycle use.
Strategy 3	Incentivize commuter mode choice to reduce GHG emissions by developing new programs and infrastructure to support cleaner fuel types and transportation modes, e.g., walk, bike, shuttle bus, electric vehicle-charging, carpooling, and public transit subsidies.
Strategy 4	Reduce GHG from University-related travel beyond the Lamont campus to neighboring cities or countries abroad, or offset what cannot be reduced.
Strategy 5	Engage the Lamont community to influence change through education and targeted outreach in order to support the University's transportation goals through behavioral changes.

III. Waste and Materials Management

HISTORY AND CURRENT STATE:

LDEO has been tracking waste since 2005—and more than 20 different waste streams on campus since 2012. The segregated waste streams include trash, cardboard, paper, co-mingled bottles and cans, scrap metal, electronics, construction debris, lead-acid batteries, lithium batteries, NiCad batteries, alkaline batteries, hazardous waste, ethylene glycol, fluorescent bulbs, regulated soil, kitchen grease, motor oil, oil debris, PCB ballasts, mercury items, nonhazardous waste, and radioactive waste.

Conspicuously absent from quantified waste stream is yard waste, all of which is collected, composted, and reused on site. Grass cutting is primarily performed with mulching mowers to return nutrients to the soil and minimize material handling. Excess grass cuttings, along with mulched leaves and branch chippings, are passively composted at a remote reach of the campus. A small active compost bin is maintained on campus by volunteers to generate topsoil for the community garden.

LDEO is justifiably proud of its award-winning recycling program, recognized for its excellence by the Rockland County Office of Solid Waste in 2013. In 2007, the Lamont campus entered the EPA-sponsored Recycle-mania competition, a nationwide contest of 250 colleges and universities. LDEO won first place in two categories: the Per Capita Challenge and the Targeted Materials: Paper Per Capita. Lamont achieved a 56 percent recycling rate that ranked third place in the competition. The contest promoted and perfected Lamont’s recycling program on campus and has allowed LDEO to enjoy an average recycling rate of over 50 percent.

PROGRESS TO DATE:

LDEO has a few years of quality waste metrics to use for understanding the waste stream and identifying trends. LDEO has an outstanding program to segregate waste streams at the source and maximize diversion from landfills.

The Lamont campus can also use the ongoing EPA Recycle-mania contest to establish per-capita metric quantification standards for waste minimization.

LDEO has already identified opportunities for waste minimization and increasing postconsumer recycled content by purchasing Green Seal cleaning and custodial paper products. Other potential strategies include revisiting the procurement of copier paper to optimize recycled content if economically feasible. Negotiations have begun with the LDEO cafeteria vendor to install soft-drink dispensing stations to reduce bottle and can waste.

The Lamont campus aggressively and routinely reuses furniture until it reaches the end of its useful life, including laboratory casework during renovations.

Lamont benefits from University-wide Purchasing Agreements with organizations such as Staples, which understands the University’s desire to minimize packaging and emissions associated with deliveries, and Steelcase, which champions the use of recycled content in manufactured furniture. Major construction projects at Lamont seek to attain a LEED® Silver or better rating, and the LEED® process establishes targets for recycling, reuse, and waste minimization in construction.

Goals and Strategies:

Goals	LDEO will quantify its waste stream by both absolute and per-capita metrics, and benchmark its performance against peer institutions by 2020. It will also establish targets for per-capita waste minimization out to 2050.
Strategy 1	Using 2016 waste collection data, establish baseline per-capita waste performance metrics for waste-to-landfill and waste-to-recycling facilities with an eye toward minimizing these metrics in the future.
Strategy 2	Identify waste per-capita benchmarks from peer institutions and establish short- and long-term goals to beat the best of them.
Strategy 3	Expand and create programs to minimize waste.
Strategy 4	Engage the Lamont community through education and targeted outreach to influence behavioral change in support of campus goals.
Strategy 5	Identify items that can be procured using post-consumer recyclable content, and quantify the current and future diversion and minimization that can be accomplished by better purchasing.

Acknowledgments

Columbia University Executive Leadership

Columbia University Earth Institute

Senior Sustainability Advisory Committee

Focus Team Chairs and Members

Facilities and Operations Strategic Communications Team

Columbia University Strategic Communications and Public Affairs

Columbia Creative

University Life Office

Environmental Stewardship Office

Campus partners who supported their staff's participation in these efforts

Greener U

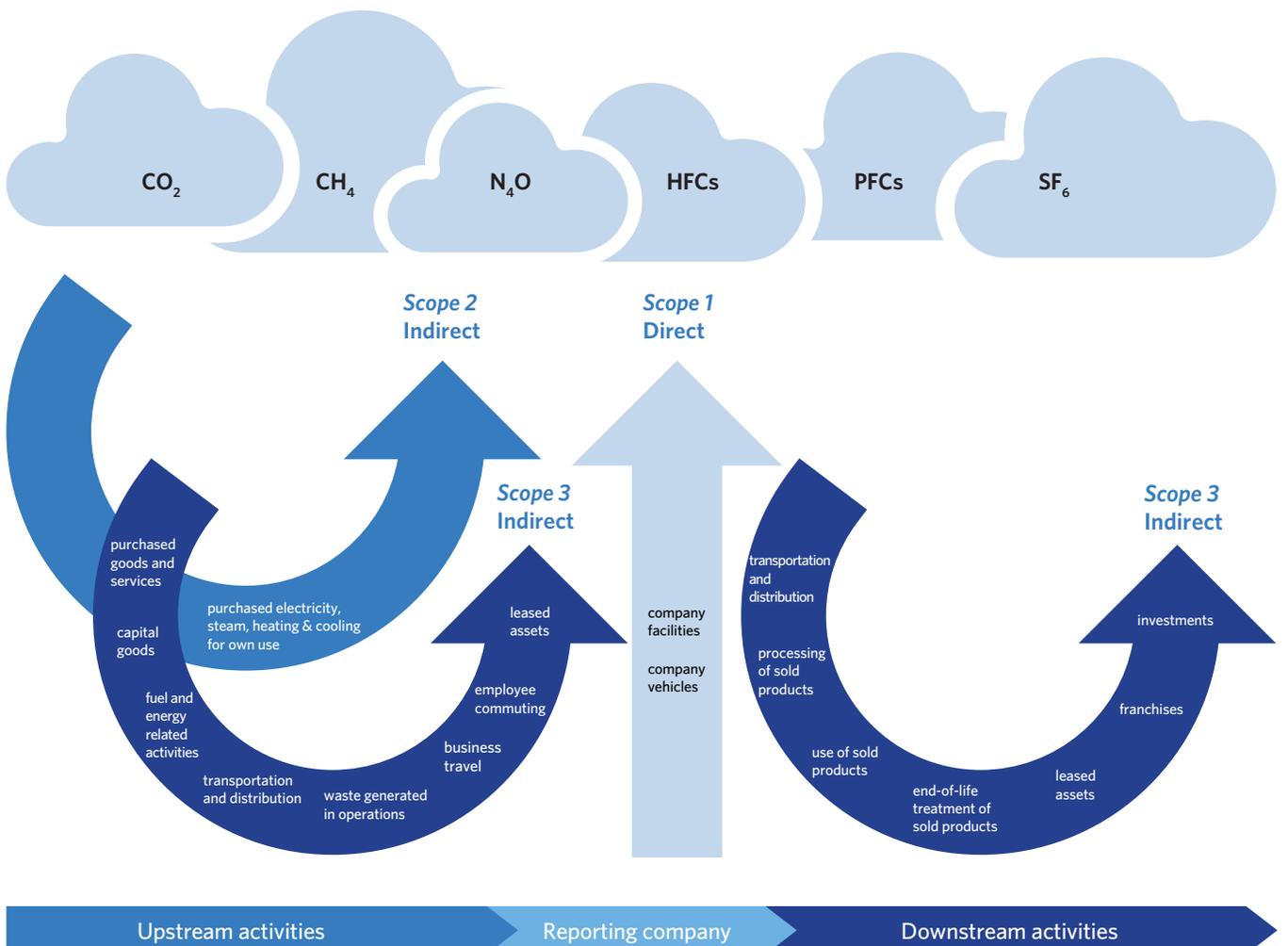
Energy Strategies

Christian Balmer Videography

Appendix

A. Greenhouse Gas Protocol Scopes

Overview of GHG protocol scopes and emissions across the value chain



Graphic from "Corporate Value Chain (Scope 3) Accounting and Reporting Standard," Greenhouse Gas Protocol

B. Sustainability Planning Team Membership

1. SSAC MEMBERS

The Senior Sustainability Advisory Committee (SSAC) is led by David Greenberg, Executive Vice President of Facilities and Operations, and Michael Gerrard, Chair of the Earth Institute Faculty and Director of the Sabin Center for Climate Change Law. The Committee members include Frank Martino, Vice President of Facilities Operations; Scott Wright, Vice President of Campus Services; Amador Centeno, Vice President of Facilities Management and Campus Services for Columbia University Medical Center; and Jason Smerdon, Lamont Associate Research Professor of the Lamont-Doherty Earth Observatory and Adjunct Associate Professor of Ecology, Evolution and Environmental Biology.

2. FOCUS TEAM MEMBERSHIP

The members of the focus teams are listed below.

a) GHG/Energy:

- » Maria Alba, Assistant Director, Columbia Housing
- » Alex Beecher, Student Representative, GSAS
- » Dave Carlson, Director, University Facilities
- » Dominic Chirico, Director, University Facilities
- » Tak Eng (Co-Chair), Senior Engineer, University Facilities
- » Justin Gundlach, Associate Research Scholar, Columbia Law School
- » Sophia De Bois Hill, Student Representative, Columbia College
- » Joyce Jackson, Executive Director, Columbia Housing
- » Jennifer Kearney, Director of Energy Programs, University Facilities
- » Mort O'Sullivan, Facilities Engineer, Lamont-Doherty Earth Observatory
- » George Pecovic (Chair), Assistant Vice President, Plant Engineering and Utilities
- » Jessica Prata (Facilitator), Assistant Vice President, Environmental Stewardship
- » Harris Schaer, Associate Director, Energy Management and Sustainability, Columbia University Medical Center
- » Allie Schwartz (Facilitator), Planning & Outreach Manager, Environmental Stewardship
- » Jason Smerdon, Lamont Associate Research Professor of the Lamont-Doherty Earth Observatory and Adjunct Associate Professor of Ecology, Evolution and Environmental Biology

b) Transportation:

- » Dan Allalemdjian (Co-Chair), Director, Transportation Demand Management, Environmental Stewardship
- » Steve Archuleta, Director of Campus Services, CUMC
- » Al Becker, Executive Director, Finance, Public Safety
- » David Dewhurst, Director, University Facilities
- » Erich Ely, Associate Athletic Director, Columbia Athletics
- » Toby Hyde, Student Representative, School of International and Public Affairs (SIPA)
- » Jimmy Lai, Manager of Planning & Administration, Public Safety
- » Deb Ndao, Director of Wellness, Office of Work Life
- » Patrick O'Reilly, Assistant Director of Facilities & Engineering, LDEO
- » Mike Pagan (Chair), Executive Director, Administrative Services
- » Jessica Prata (Facilitator), Assistant Vice President, Environmental Stewardship
- » Jose Rosa, Director, Facilities
- » Allie Schwartz (Facilitator), Planning & Outreach Manager, Environmental Stewardship
- » Elliot Sclar, Professor, Graduate School of Architecture, Planning and Preservation (GSAPP)
- » Jonathan Young, Student Representative, Columbia College

c) Waste:

- » Helen Bielak, Operations Manager, Environmental Stewardship
- » Keith Bottum (Co-Chair), Senior Hazardous Materials Specialist and Lab Sustainability Coordinator, Environmental Health & Safety
- » Jakob Brounstein, Student Representative, General Studies
- » Ruth DeFries, Professor, Ecology, Evolution and Biology Department
- » Vicki Dunn, Executive Director, Dining
- » Nelson Falcon, Director, Facilities
- » Keith George, Project Manager, Capital Projects Management
- » Ricky Gonowrie, Manager, Waste and Fleet Operations
- » Charles Harper, Student Representative, Columbia College
- » Mark Kerman, Assistant Vice President, Facilities

- » David Martin, General Manager, University Event Management
- » Howie Matza, Manager, Lamont-Doherty Earth Observatory
- » Ahmed Nassef, Assistant Director, Housing
- » Noel Pagan, Director of Campus Operations, Columbia University Medical Center
- » Chris Pettinato (Chair), Executive Director, Environmental Health & Safety
- » Jessica Prata (Facilitator), Assistant Vice President, Environmental Stewardship
- » Dita Sali, Director, University Facilities
- » Don Schlosser, Assistant Vice President, University Facilities
- » Allie Schwartz (Facilitator), Planning & Outreach Manager, Environmental Stewardship
- » Jesse Thorson, Student Representative, Columbia College

C. Lamont-Doherty Earth Observatory: Additional Information

1. CARBON INVENTORY STATISTICS

- 21 separate buildings on 180-acre campus, with private pumped water and sewer systems
- 3 utility Types (purchased electric, natural gas, and #2 diesel fuel)
- 389,856 square feet

2. GREENHOUSE GAS INVENTORY

An inventory was compiled in 2005 in recognition of the University's participation in the NYC Mayoral Carbon Challenge, although the Lamont campus is outside of New York City and excluded from participation. Spreadsheets have been maintained since then, and all buildings on campus are currently included and monitored using the EPA Energy Star Portfolio Manager. Lamont continues to use EPA accounting tools because they are free and provide a consistent year-over-year metric comparison, and Lamont is not bound to NYC regulatory reporting. Factors used by Energy Star for converting electric kilowatts to GHG equivalents are based on the makeup of power producers on the Upstate New York grid, which is appropriate.

3. HOW LDEO GENERATES ENERGY

The Lamont campus does not have a central heating and cooling plant, and each building is individually metered by the utility company (although some buildings are clustered to a single meter). Heating for all buildings is accomplished by natural gas. Most buildings have natural gas boilers that circulate hot water to baseboard radiators or heating coils in air handlers. One building has a low-pressure steam boiler, and a few buildings use forced hot air furnaces. Cooling is accomplished across much of the campus with window air conditioning units, through the wall heat pumps, and split direct action (DX) refrigerant systems. Central air systems rely on air cooled chillers and circulated chilled water to coils in air handlers and ductwork. One laboratory building has incorporated a hybrid water and air cooled DX cooling system, selected specifically to meet community noise standards. The two largest laboratory buildings, which require 100 percent outdoor air for ventilation purposes, are equipped with glycol energy recovery loops, which circulate from coils in the building exhaust system back to coils in the building air intakes to precool or preheat intake air, depending on the season. In addition to hosting several data centers of various sizes with independent year-round cooling systems, LDEO labs are supplied with processed cooling water year-round, and there are several large walk-in refrigerated rooms for storage of core samples and incubation.

The Lamont campus is especially vulnerable to power outages because of its location on the local distribution grid, and it includes a number of large diesel fueled emergency generators and smaller natural gas generators. It is desirable to replace all diesel fueled generators with natural gas fired generators as these machines reach the end of useful life for reduction of GHG emissions, and to reduce the regulatory burden of fuel oil spill prevention counter measures.





 COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

