

Cornell Leadership for Climate Neutrality

Strategies & 12-Month Milestones to Accelerate the Climate Action Plan

Prepared by the Climate Action Plan Acceleration
Working Group

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Cornell University

About this document

In February 2014, in response to a Faculty Senate resolution calling for accelerated action, Cornell University President David J. Skorton established a faculty/administrative working group to develop strategies to accelerate Cornell's progress toward climate neutrality. President Skorton asked the working group to report back to the campus by June 2014, with specific recommendations for how to accelerate Cornell's Climate Action Plan (CAP).

The Dean of Faculty, Joe Burns, and Vice President of Facilities Services, Kyu Whang, consulted with campus stakeholders to appoint 13 faculty and staff members to the Climate Action Acceleration Working Group (AWG). The AWG convened over a dozen times during April and May, and gathered input from more than 100 faculty and staff members in the process of crafting this report.

On May 8, about 30 faculty and staff members attended an open forum to discuss the draft AWG recommendations in small breakout groups. An additional 70 faculty provided input through an online survey. More than a third of those surveyed indicated their willingness to participate in an ongoing process to accelerate Cornell's CAP. The two primary areas of interest identified by faculty respondents were energy conservation and campus culture change. Additional analysis of survey results will be conducted over the summer to inform next steps.

In his response to the Faculty Senate, President Skorton acknowledged the importance and the difficulty of the AWG's assignment: *"I accept and endorse the Faculty Senate's recommendation that we seek a more aggressive reduction in the use of fossil fuels that could bring us to carbon neutrality by 2035. I say 'could' because it will require a set of decisions and changes in behavior and priorities throughout the campus to achieve this more aggressive goal."*

This report presents the key decisions and changes in behavior that should be initiated within the next 12 months in order for Cornell to raise the bar and strive for climate neutrality by 2035. This report is a companion document to the 2013 Climate Action Plan (CAP) Update & Roadmap, which lays out Cornell's comprehensive climate neutrality strategy. The CAP is available online at www.climateaction.cornell.edu.

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Contents

- Executive Summary..... 5**
- Introduction 8**
- Key Milestones..... 10**
- Building Capacity for Change..... 10**
 - RECOMMENDATION 1. Launch a Comprehensive Engagement and Education Campaign..... 10
 - RECOMMENDATION 2. Develop Climate Action Fundraising Initiatives 12
 - RECOMMENDATION 3. Incorporate Carbon Costs into Operations 13
 - A. Implement a Utility-based Carbon Charge 13
 - B. Develop a Travel-Offset Policy 13
 - RECOMMENDATION 4. Prioritize Sustainability in the Presidential Search 14
 - RECOMMENDATION 5. Continue the Acceleration Working Group..... 14
- Reducing Energy Demand 15**
 - RECOMMENDATION 6. Establish Higher Energy Standards for New Construction and Renovations. 15
 - RECOMMENDATION 7. Initiate Phase 2 of the Energy Conservation Initiative..... 16
 - RECOMMENDATION 8. Maximize Space Efficiencies..... 16
 - RECOMMENDATION 9. Increase Use of Sustainable Modes of Transportation..... 17
 - RECOMMENDATION 10. Improve Telecommunication Facilities to Reduce Travel 18
- Transitioning to a Renewable Energy Supply..... 18**
 - RECOMMENDATION 11. Advance the Hybrid Enhanced Geothermal – Bioenergy System (EGBS) Demonstration Project 19
 - RECOMMENDATION 12. Optimize Heat Distribution 20
 - RECOMMENDATION 13. Implement the Cornell University Renewable Bioenergy Initiative (CURBI) 21
 - RECOMMENDATION 14. Procure Renewable Energy 21
- Developing Mission-Linked Offsets 22**
 - RECOMMENDATION 15. Sequester Carbon with Existing and New Forest Resources 22
 - RECOMMENDATION 16. Develop Local Community Offsets 23
- Conclusion and Next Steps 25**
- Appendices 26**
 - APPENDIX 1. Summary Table of Report Recommendations..... 26
 - APPENDIX 2. Acceleration Working Group Abbreviated Biographies 30

Executive Summary

Cornell University is an international climate leader based on our accomplishments in research, education, public engagement, and campus carbon reductions. An intensified intellectual and organizational commitment is required to address the grand challenge of climate change. The science is solid: the planet is warming, and humans are the cause. Extreme weather is increasing, sea levels are rising, glaciers are retreating, and food insecurity is spreading. All citizens of the planet are affected, and social inequities exacerbated.

Earlier this year, President Skorton charged a faculty-led Acceleration Working Group (AWG) with the task of determining what steps Cornell should take to become climate neutral sooner than 2050, the current target date in our Climate Action Plan. After focused deliberations among our members and consideration of input from more than 100 faculty and staff members, our members have concluded that achieving climate neutrality by 2035 is both imperative and feasible – **but only if** we align our priorities throughout campus to achieve this more aggressive goal. We are at a critical juncture: Cornell’s students, staff and faculty must act boldly now to innovate and lead.

This report presents the key decisions and changes in behavior that should be initiated within the next 12 months in order for Cornell to raise the bar and strive for climate neutrality by 2035. The report outlines 16 specific recommendations, each with milestones for tracking progress. A summary table of report recommendations, milestones, preliminary cost estimates and staffing projections is located in Appendix 1. **Within the 16 recommendations, the following six key milestones are the priority. Completion or significant progress on these key milestones within the next 12 months is requisite, and will enable the achievement of the remaining recommendations, in order for Cornell to be confident in the 2035 target date:**

- 1) Launch a comprehensive education and engagement campaign to increase student learning, faculty research, and staff engagement in the Climate Action Plan. **See Recommendation 1 on page 10.**
- 2) Incorporate carbon costs into operations through: a) a carbon charge on utilities to fund campus sustainability projects, and b) a travel fee to fund a local community offset program. **See Recommendation 3 on page 13.**
- 3) Secure Board of Trustees approval to: a) establish higher energy standards for new construction and renovations, and b) extend the payback period for energy conservation projects in existing campus buildings. **See Recommendations 6 and 7 on pages 15 and 16.**
- 4) Secure \$3M funding for FY '16, internal site approvals for wells and infrastructure, and land resources needed for the Enhanced Geothermal-Bioenergy System (EGBS) Demonstration Project. **See Recommendation 11 on page 19.**
- 5) Obtain internal approval and complete Power Purchase Agreements for the wind, hydro, and solar projects currently being developed. **See Recommendation 14 on page 21.**
- 6) Initiate development of climate action fundraising initiatives, including: a) a capital campaign initiative in the range of \$500M over ten to twenty years, and b) appointment of a Director of Strategic Partnerships for Campus Climate Action. **See Recommendation 2 on page 12.**

We understand that our recommendations will require Cornell to shift its priorities and elevate the Climate Action Plan (CAP) to a top priority. The AWG sees this report as the beginning of an iterative planning process and ongoing conversation with university leaders to discuss implementation, financing, and evaluation of progress. To ensure continuity as we move forward, AWG members propose to continue their work through July 2015. During this time period, we will work closely with the senior administration, college deans, the President's Sustainable Campus Committee, the Atkinson Center for a Sustainable Future, the Campus Sustainability Office, and the Energy Institute to pursue full implementation of the recommendations in this report and integrate the key actions in our CAP into the university's capital planning, fundraising, and academic planning processes, as appropriate.

Milestones 1 and 6 are intended to **build capacity for commitment and change** at Cornell. Successful completion of these two milestones will position Cornell to implement the remaining recommendations and enhance Cornell's brand as the national leader in climate neutral research and implementation.

Milestone 2 includes a first step to **develop mission-linked carbon offsets**. Fully realized, mission-linked offsets could account for an annual carbon abatement equivalent to the university's current total commuting and business travel footprint – roughly 59,000 tons (CO₂ equivalent) and about 27% of Cornell's current annual carbon emissions.

Milestone 3 will significantly **reduce energy demand** at Cornell. Full implementation of the university's Energy Conservation Initiative would reduce university emissions by about 11,800 metric tons (CO₂ equivalent) annually – roughly 5% of the current carbon footprint, while adopting higher building energy standards can help the university avoid another 10,000 metric tons (CO₂ equivalent) of emissions annually.

Milestones 4 and 5 are key elements in Cornell's strategy to **transition to a renewable energy supply**. Milestone 4 advances the single largest emissions-reduction action in our CAP – Enhanced Geothermal-Bioenergy System (EGBS). Completely realized, EGBS could provide for over 82,000 metric tons (CO₂ equivalent) of average annual carbon abatement – more than 38% of Cornell's current carbon footprint. Deployment of EGBS in the northeast region would be a major breakthrough. If successful, this project will have broad application to municipalities and institutions in similar geographic locales. As the first project of its kind in the northeast region, EGBS at Cornell will require full engagement of the research community. Milestone 5 will ensure implementation of current proposals to reduce carbon emissions by 10% and could supply about 30% of the electric energy use of the campus from renewable sources without expenditure of capital or additional operational funds.

Many of the 16 recommendations will be challenging from a fiscal and organizational standpoint. We estimate that \$3.4M in known capital expenses plus three full-time (FTE) positions will need to be included in the FY '16 operating budget to initiate our recommendations. This funding commitment is a baseline and does not account for capital and operating expenses estimated to be in the range of \$500M over the next ten to twenty years. Cost estimates will be further refined through the planning and evaluation processes recommended in this report.

It is our view that fiscal and organizational challenges can be met through active engagement of the entire Cornell community, including everyone from first-year students to key business operations personnel. Moving forward, allocations for future years will need to be determined through the iterative planning process with university stakeholders described above. Presenting the AWG recommendations to the Board of Trustees, senior staff, and college leaders is an important first step in this ongoing conversation.

Acceleration of Cornell's climate commitment presents an opportunity to inspire our campus and alumni base to action. In addition to helping society respond to the unprecedented challenges we face, taking bold and strategic actions now will have multiple benefits beyond environmental leadership, including:

- 1) Opportunities to grow Cornell's academic mission through research, teaching, and outreach focused on the technological, sociological, and economic aspects of achieving climate neutrality;
- 2) Enhancement of the Cornell brand for the purposes of faculty, staff, and student recruiting;
- 3) New revenue streams from external fundraising, energy conservation savings, and the capital campaign;
- 4) Reduced financial exposure to increasingly unstable energy markets; and
- 5) A proactive response to existing and future compliance regulations.

Introduction

Cornell's early success in climate research, education and cutting greenhouse gas emissions has positioned us as a national leader in responding to climate change. Looking ahead, Cornell can continue its leadership role by aggressively moving forward with its Climate Action Plan (CAP), as recommended by the Faculty Senate. The Intergovernmental Panel on Climate Change, National Climate Assessment, and other recent reports remind us that now is the time to act. In concert with the university's CAP, this report outlines and articulates specific opportunities and recommendations for Cornell to enhance its leadership role in achieving climate neutrality.

We face an unprecedented challenge. The initial impacts of carbon pollution are already apparent and intensifying rapidly. Sea levels are rising, our food and water supply is less secure, and we are experiencing more extreme weather. All citizens of the planet are affected, with poorer communities and coastal regions disproportionately so. We either grasp the enormity of the risks posed by climate change and act boldly and quickly to change course, or we face the irreversible and catastrophic social, environmental, and economic consequences of a rapidly warming planet.

Cornell has the capacity to test and deploy innovative solutions and truly become the "land grant institution to the world." We have a deep reservoir of intellectual capacity across our many colleges and departments; we have dedicated staff focused on reducing our carbon footprint; and we have faculty, students, and staff passionately engaged in sustainability issues. Acceleration of Cornell's climate commitment presents an opportunity to develop and demonstrate breakthrough solutions, support climate resilience in diverse communities, and excite our campus and alumni base to action.

Bold and strategic actions now will have multiple additional benefits, including: 1) opportunities to grow Cornell's academic mission through research, teaching, and outreach focused on the technological, sociological, and economic aspects of achieving climate neutrality; 2) enhancement of the Cornell brand for the purposes of faculty, staff, and student recruiting; 3) new revenue streams from external fundraising, energy conservation savings, and the capital campaign; 4) reduced financial exposure to increasingly unstable energy markets; and 5) a proactive response to existing and future compliance regulations.

After careful analysis, the AWG has concluded that achieving climate neutrality by 2035 is imperative and feasible – **but only if** we align our priorities throughout the campus to achieve this more aggressive goal. We have developed 16 specific recommendations and six key milestones to accelerate Cornell's path to climate neutrality. Each recommendation has been carefully conceived so as to be fully within Cornell's ability to attain. The majority of these recommendations are based on established, proven approaches. We know what we must do, and we know how to do it. Now we must summon the courage to seize the opportunities before us. We must embrace our role as a model for broader society and demonstrate how individual, collective, and concerted actions can successfully address the grand challenge of climate change.

The milestones in this report thus serve as a concrete test of our willingness to achieve the 2035 goal. If we fail to make significant progress on these milestones, then achieving climate neutrality by 2035 is highly unlikely. If, however, significant progress is made in the course of the coming year, then the university can confidently proceed to adopt the 2035 target date in its 2015 Climate Action Plan (CAP) Update. At that point, the hard work will not be over, but just beginning. Full implementation of the recommendations in this report and integration of key actions in our CAP into the university's capital planning, fundraising, and academic planning processes will require an iterative planning process and ongoing conversation among campus stakeholders.

Many of the report recommendations are challenging from a fiscal and organizational standpoint. Yet, it is widely accepted that near-term difficulties such as these will pale in comparison with the long-term social, environmental, and economic consequences of inaction. Mobilizing the academic power of Cornell and securing the resources to bring about change in our research, teaching, campus culture, and infrastructure will require a concerted team effort. The AWG stands ready to contribute to this all-important effort to achieve our neutrality goal.

Key Milestones

This report presents the critical decisions and changes in behavior that should be initiated within the next 12 months in order for Cornell to raise the bar and strive for climate neutrality by 2035. The report outlines 16 specific recommendations, each with milestones for tracking progress. A summary table of report recommendations, milestones, preliminary cost estimates and staffing projections is located in Appendix 1.

Within the 16 recommendations, the following six key milestones are the priority. Completion or significant progress on these key milestones within the next 12 months is requisite, and will enable the achievement of the remaining recommendations, in order for Cornell to be confident in the 2035 target date:

- 1) Launch a comprehensive education and engagement campaign to increase student learning, faculty research, and staff engagement in the Climate Action Plan. **See Recommendation 1 on page 10.**
- 2) Incorporate carbon costs into operations through: a) a carbon charge on utilities to fund campus sustainability projects, and b) a travel fee to fund a local community offset program. **See Recommendation 3 on page 13.**
- 3) Secure Board of Trustees approval to: a) establish higher energy standards for new construction and renovations, and b) extend the payback period for energy conservation projects in existing campus buildings. **See Recommendations 6 and 7 on pages 15 and 16.**
- 4) Secure \$3M funding for FY '16, internal site approvals for wells and infrastructure, and land resources needed for the Enhanced Geothermal-Bioenergy System (EGBS) Demonstration Project. **See Recommendation 11 on page 19.**
- 5) Obtain internal approval and complete Power Purchase Agreements for the wind, hydro, and solar projects currently being developed. **See Recommendation 14 on page 21.**

- 6) Initiate development of climate action fundraising initiatives, including: a) a capital campaign initiative in the range of \$500M over ten to twenty years, and b) appointment of a Director of Strategic Partnerships for Campus Climate Action. *See Recommendation 2 on page 12.*

Milestones 1 and 6 are intended to **build capacity for commitment and change** at Cornell. Successful completion of these two milestones will position Cornell to implement the remaining recommendations and enhance Cornell's brand as the national leader in climate neutral research and implementation.

Milestone 2 includes a first step to **develop mission-linked carbon offsets**. Fully realized, mission-linked offsets could account for an annual carbon abatement equivalent to the university's current total commuting and business travel footprint – roughly 59,000 tons (CO₂ equivalent) and about 27% of Cornell's current annual carbon emissions.

Milestone 3 will significantly **reduce energy demand** at Cornell. Full implementation of the university's Energy Conservation Initiative would reduce university emissions by about 11,800 metric tons (CO₂ equivalent) annually – roughly 5% of the current carbon footprint, while adopting higher building energy standards can help the university avoid another 10,000 metric tons (CO₂ equivalent) of emissions annually.

Milestones 4 and 5 are key elements in Cornell's strategy to **transition to a renewable energy supply**. Milestone 4 advances the single largest emissions-reduction action in our CAP – Enhanced Geothermal-Bioenergy System (EGBS). Completely realized, EGBS could provide for over 82,000 metric tons (CO₂ equivalent) of average annual carbon abatement – more than 38% of Cornell's current carbon footprint. Deployment of EGBS in the northeast region would be a major breakthrough. If successful, this project will have broad application to municipalities and institutions in similar geographic locales. As the first project of its kind in the northeast region, EGBS at Cornell will require full engagement of the research community. Milestone 5 will ensure implementation of current proposals to reduce carbon emissions by 10% and could supply about 30% of the electric energy use of the campus from renewable sources without expenditure of capital or additional operational funds.

Building Capacity for Change

RECOMMENDATION 1.

Launch a Comprehensive Engagement and Education Campaign

For Cornell to meet its climate neutrality commitment, maintain its status as a pioneer in the field of sustainability, steward the resources entrusted to the institution, and build a prepared citizenry, the university must adopt a culture of sustainability in every respect. The transition to climate neutrality will require system-wide efforts and presents outstanding opportunities to advance the university's core missions of research, teaching, and public outreach. The AWG believes that every Cornell student, faculty, and staff member must understand both the challenges raised by climate change and ways to generate and participate in solutions.

Institutional Change

To ensure that Cornell can become climate neutral by 2035 will require the development of a formal governance and accountability process. Senior administration should work with each college and administrative unit to establish specific goals to create new learning outcomes, research incentives, and engagement programs in the effort to accelerate climate action. Requiring departments, colleges, and other operating units to formally set climate neutrality goals and report progress toward reaching those goals is essential to motivate behavior change and promote sustainable decision-making.

Students

Adopting a more challenging climate neutrality goal will create numerous opportunities for students to become meaningfully engaged with solutions from the time that they are freshmen – practices which they can carry on throughout their life. Fourteen thousand Cornell undergraduate students can be a great resource for generating ideas, implementing them under the supervision of faculty and staff, and testing their efficacy. Such engaged learning projects can serve as a powerful tool for recruiting talented students who are strongly motivated to study and work on the technological, sociological, environmental, and economic challenges resulting from climate change.

Faculty

Cornell is fortunate to have some of the world's foremost experts in areas relevant to climate neutrality that can inform our effort to create a new energy future. By operating as a "living-learning laboratory" which engages faculty, staff, students, and community members in ongoing efforts to develop, apply, and evaluate different actions to address climate neutrality, Cornell will not only enhance its reputation as a leading research institution, but also maintain its position as pioneer in the area of climate change research, teaching, and public engagement.

Staff

The operational challenge ahead is to build on the success of broad initiatives, such as "Toward New Destinations" and the "Life Sciences Initiative" and empower a culture of sustainability that is reflected in both the personal behaviors and academic endeavors of our campus community. Such changes in the work culture of campus can result in substantial financial savings. For example, the annual estimated savings from the College of Agriculture and Life Sciences "CALs Green" campaign in 2011 amounted to \$230,000. More recently, a similar effort, the "Think Big, Live Green" campaign, was piloted in the College of Engineering.

Recommendations

- 1) *Establish an institutional planning framework requiring each college and administrative unit to develop three or more goals in areas such as research, learning outcomes, curriculum, faculty hiring, staff training, energy conservation, space planning, and new construction and renovations. Basic elements of the framework should include tactical plans for achieving the goals with timelines and measures of success, a process for annually reporting progress, and incentives for meeting targets.*
- 2) *Research directly supporting the CAP should be given priority in internal funding programs and Cornell should join with other research institutions to create new or additional funding*

opportunities through state, federal, and private sources for those areas where new discoveries or translational research are required.

- 3) *Build on programs such as “CALS Green” and “Think Big, Live Green” to create a campus-wide engagement campaign.*

12-Month Milestones

- Establish an institutional planning and reporting framework requiring each college and administrative unit to develop three or more goals in carbon reduction, research, faculty hiring, staff engagement, and/or learning outcomes.
 - Each college forms a team to develop climate action curricular and engagement initiatives (\$100K in FY '16).
 - Fund a training specialist position within Human Resources to support staff engagement (1 FTE).
 - Develop a university wide brand for sustainability engagement (\$100K in FY '16).

RECOMMENDATION 2.

Develop Climate Action Fundraising Initiatives

Financing the major academic initiatives, staff engagement efforts, and infrastructure projects identified in the CAP will require a long-term commitment and a strategic fundraising approach. A major capital campaign is required to develop the necessary funds. A capital campaign can rally tremendous external support around campus sustainability. Some of our peer institutions (e.g., Stanford, Princeton, and Berkeley) have developed major energy related programs with funding commitments of hundreds of millions of dollars. Each of these programs has multiple corporate, foundation, and government partners that include major energy companies, automakers, and industrial and technology firms. Cornell's ability to serve as a model site for deployment of innovative solutions is attractive to corporate, foundation, state, and federal partners.

Recommendations

- 1) *Develop a capital campaign initiative in the range of \$500M over ten to twenty years for research, faculty hiring, education, demonstration projects, and infrastructure around the theme of climate neutrality. The message of the capital campaign should be one of system-wide transformation.*
- 2) *Create a Director of Strategic Partnerships for Climate Action to identify and connect external partners to the wide range of activities that comprise the CAP.*

12-Month Milestones

- Initiate development of a campaign initiative in the range of \$500M over ten to twenty years for CAP research, faculty hiring, teaching, demonstration projects and infrastructure improvements.
- Fund a Director of Strategic Partnerships for Climate Action (1 FTE) to identify and connect external partners to the wide range of activities that comprise the CAP.
- Develop a funding mechanism for campus climate action research within the Atkinson Center for a Sustainable Future.
- Work with AAD and Deans to assess current sustainability fundraising outcomes.

RECOMMENDATION 3.

Incorporate Carbon Costs into Operations

Part of the paradigm shift that Cornell can play a leadership role in is the effort to incorporate the price of carbon into our energy costs and business operations. Doing this will establish a clear link between production of greenhouse gases and the cost of these emissions for the colleges and units on campus, and, ultimately, for each individual. As the primary generator and distributor of campus-wide utilities, Cornell is uniquely positioned to become one of the first universities to implement an internal carbon charge.

The AWG recommends that Cornell develop an internal funding scheme that places a cost of emissions on utilities and business travel and generates funds for campus initiatives and local offset projects. Internal carbon fees can provide flexible sources of funding for pilot studies and new initiatives – sources that may be available more rapidly than external funds. While the total funding available from these fees will likely be modest, they can play an important role in the campus culture change that will be necessary to achieve climate neutrality.

A. Implement a Utility-based Carbon Charge

The use of fossil fuels has real external costs to the environment, public health, and infrastructure that are not factored into the cost of the fuels themselves. This failure to account for externalities has made coal, petroleum, and natural gas artificially cheap. Carbon charges provide a means of accounting for such costs and for improving the relative economics of alternative energy sources. They also create an economic disincentive for fossil fuel use and an income stream for implementing replacement energy.

B. Develop a Travel-Offset Policy

University-funded air travel and individual commuting contributed 27% to the roughly 218,000 tons of carbon emitted in 2012. Without a disincentive for travel, emissions will continue to increase with expansion to satellite campuses and initiatives to “internationalize Cornell.” Many of these trips are necessary to conduct university business and therefore not easily avoidable. Because there are currently no feasible carbon-free modes of air travel, Cornell’s commitment to climate neutrality cannot be achieved without some offsetting actions to mitigate travel-related emissions.

A travel-offset policy has the potential to accomplish several important objectives. Putting a price on travel-related GHG emissions is an important step to build awareness about emissions and will serve as a powerful incentive to reduce these emissions. A travel offset fee will also generate funds to enable other travel demand-reducing and carbon-mitigating initiatives on campus and in our local community.

Recommendations

- 1) Calculate and implement an appropriate carbon charge to be added to utility bills to reflect the carbon emissions associated with campus steam, chilled water, and electricity production. We recommend Year 1 costs in the \$20-\$30/ton range. As an example, a charge of about \$24/ton CO₂ would raise approximately \$3M per year, representing about 6% of the campus utility bill.*
- 2) Establish a university-wide policy that: 1) promotes reduced fossil fuel-based travel, and 2) establishes an offset fee for GHG emissions associated with unavoidable university-related commuting and business travel.*

12-Month Milestones

- Develop an internal funding scheme that places a cost of emissions on utilities and business travel and generates funds for campus initiatives and local offset projects.
- Secure approval from the interdepartmental fee committee to include a carbon charge in utility rates and operating budgets for FY '16.
- Determine appropriate jurisdiction (Board of Trustees or Executive Policy Review Group) and secure approval to develop a travel offset policy.
- Develop guidelines for use of the funds collected.

RECOMMENDATION 4.

Prioritize Sustainability in the Presidential Search

To ensure that Cornell remains a global leader with dedicated and visionary faculty and staff, it is critically important that the next president bring to Cornell a demonstrated commitment to and passion for sustainability. The next president must fully recognize the urgency of the challenges now faced by society and be capable of making the bold and difficult decisions required to transition to a new energy future.

Cornell's next president must, in every respect, embody the essence of sustainability. We require a leader who will inspire, motivate, and commit Cornell to being a model university for the 21st Century – that is, a responsible institution whose actions today do not compromise the ability of future generations to meet their needs.

We expect the next president to: 1) embrace Cornell's ambitious, but achievable, GHG reduction goals, and to 2) lead the effort to become climate neutral as soon as possible. We expect the next president to fully adopt the AWG recommendations and make a commitment to see that they are implemented.

Recommendation

Select a candidate for the next president of Cornell who has demonstrated leadership and passion for sustainability and who will commit to achieving campus climate neutrality as soon as possible.

12-Month Milestone

- Solicit a public statement from the new president committing to sustainability and endorsement of the University's climate action goals.

RECOMMENDATION 5.

Continue the Acceleration Working Group

Cornell faculty members are in a unique position to drive the changes needed to transform the Cornell campus to advance our climate neutrality goal. By demonstrating how these actions can enhance the academic and public service mission of Cornell and attract new investment, the faculty can accelerate progress toward our goal. Cornell faculty can mobilize action in many areas, for example, by: 1) expanding access to fundraising and development resources, 2) advocating for strategic faculty hiring, 3) catalyzing investment in energy conservation, 4) advocating for high-performance green buildings,

5) spearheading projects to increase the renewable energy supply, 6) finding ways to mitigate transportation impacts, and 7) evaluating and improving the effectiveness of carbon offsets.

Recommendation

The Acceleration Working Group should continue to serve in an advisory capacity, working with the PSCC to achieve campus climate neutrality. Recruit faculty to serve on new and existing PSCC task forces, as appropriate.

12-Month Milestone

- Continue the AWG to support implementation of recommendations in partnerships with the President's Sustainable Campus Committee, Atkinson Center for a Sustainable Future, the Energy Institute, and other initiatives, as appropriate.

Reducing Energy Demand

Reducing the campus demand for energy will yield long-term financial savings. Demand reduction is often the most cost-effective means to reduce the campus carbon footprint. Substantial capital will be required for Cornell to make the investments necessary to reuse existing spaces on campus, upgrade existing facilities, build high-performance buildings with lower operating costs, and provide incentives for lower-carbon transportation options. The challenge is how to balance current budget priorities with the long-term savings generated by energy conservation and efficiencies. There are a variety of tested financial approaches that can generate capital for such investments, including revolving funds. Harvard's \$20M revolving fund makes capital available to their colleges for energy and money-saving investments.

The following five recommendations for reducing energy demand provide a comprehensive framework for reducing energy costs in the long term through targeted investments in the short term.

RECOMMENDATION 6.

Establish Higher Energy Standards for New Construction and Renovations

Cornell should establish and enforce energy efficiency standards for all new construction and major renovations on campus. These new standards will reduce laboratory and office energy use by 50% over the energy-code-compliant baseline American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) 90.1. The new Energy Use Intensity (EUI) requirements for office space would be 50K BTU/SF/YEAR, and for lab space 150K BTU/SF/YEAR. These standards are achievable. For example, the first academic building at Cornell NYC Tech is projected to use less than 30K BTU/SF/YEAR, while the typical building on the Ithaca campus uses over 100 BTU/SF/YEAR.

12-Month Milestones

- Obtain Board of Trustees adoption of an energy standard policy for new buildings and renovations.
 - Implement a decision-making process for building efficiency measures which reflects the cost of climate-neutral energy options, then enforce this process for all projects.
 - Build new accountability structures into the Project Approval Request (PAR) and formal design process.
 - Hire a consultant to finalize energy modeling protocols and generate energy models for projects (this cost would be borne by the building or renovation project).
 - Implement a post-construction performance review.

RECOMMENDATION 7.

Initiate Phase 2 of the Energy Conservation Initiative

Phase 1 of the university's Energy Conservation Initiative (ECI) comprises roughly \$33M in projects that met the criteria for either a 7-year billed or 10-year marginal payback. Phase 1 was launched in 2010 and will be completed in 2015. ECI Phase 1 projects are expected to reduce Ithaca Campus utility costs by over \$3 million per year by 2016.

Phase 2 of the program would stretch the payback criteria to 20 years marginal or 15 years billed – to enable further energy reductions throughout campus facilities. Marginal cost is the commodity only cost; while billed cost is the “all in” cost of supplying the utility to the end user, including Central Energy Plant personnel, debt servicing, maintenance, and operations. The Phase 2 Energy Conservation Initiative aims to reduce Cornell's marginal utility costs by \$1.5 million per year. The work will focus on heat recovery in buildings with 100% outside air, full campus LED lighting conversion, further controls upgrades, and building envelope improvements.

12-Month Milestones

- Obtain Board of Trustees approval to extend the Energy Conservation Initiative (ECI) payback period to 15 years or more at billed utility rates.
- Develop a college and unit funding plan for the initial \$50M over the next five years to achieve a 20% reduction in metered heating and electricity usage by 2025.
- Assess life-cycle impact of a new deferred maintenance policy – upgrade from ‘replace in-kind’ to ‘aggressive reduction’ for energy efficiency on all projects.

RECOMMENDATION 8.

Maximize Space Efficiencies

Cornell can reduce energy (and greenhouse gas emissions) associated with new building construction by reducing the amount of new space required on campus. Future energy use can be reduced and avoided through efficient and effective use of existing campus space. The practicality and cost of repurposing and/or renovating existing space should be considered before new construction is proposed to meet space needs created by programmatic growth.

The following 12-Month Milestones align with the outcomes of the 2013 Space Study recommendations:

12-Month Milestones

- Commit to purchase/develop the technology tools included in the endorsed 2013 Space Study recommendations.
- Revise the capital planning process to include meaningful approvals of space management for all renovation and new construction projects.
- Revise the standard architect/engineer contract to define climate neutrality expectations for space programs.

RECOMMENDATION 9.

Increase Use of Sustainable Modes of Transportation

In order to realize transportation-related carbon reductions, a paradigm shift must occur – changing campus priorities from parking management to the provision of sustainable transportation options. Cornell has an existing Transportation Demand Management (TDM) program aimed at increasing transit use, ridesharing, bicycling, and pedestrian use; however, a significant increase in outreach, incentives, or disincentives such as carbon fees, needs to occur to motivate a further change in travel behavior. TDM programs need to be re-vamped and re-energized. Improved infrastructure for buses, bikes, and pedestrians needs to be provided. Additional time and resources need to be allocated to bicycle and pedestrian programs. New technologies to manage parking and access need to be considered.

To increase the penetration of clean-fuel vehicles in the Cornell fleet and make such vehicles into a viable option for commuters to campus, Cornell needs to develop and implement a “clean fuel plan.” This plan will provide recommendations on technology choices, deployment of infrastructure, provision of incentives for use, and allocation of resources.

Additionally, the AWG and existing groups on campus should continue to explore options for collaboration with faculty on research/teaching activities related to clean-fuel projects, as well as opportunities for partnering with local jurisdictions on clean-fuel infrastructure and grants.

12-Month Milestones

- Initiate a Transportation Strategic Plan and annual survey (\$100K in FY '16).
- Increase outreach and education about existing Transportation Demand Management programs.
- Reassign an FTE for Transportation Demand Management.
- Allocate financial resources and draft RFP for a Campus Bike/Pedestrian Master Plan.
- Allocate resources to study the extension of Campus-to-Campus service.
- Develop a deployment plan for EV-charging stations on campus.
- Implement incentives to increase use of clean-fuel vehicles.

RECOMMENDATION 10.

Improve Telecommunication Facilities to Reduce Travel

Cornell has the potential to reduce university-related travel through increased use of telecommunication. This will require behavioral change among Cornell faculty and staff, as well as finding low-carbon alternatives to conferences, meetings, events, and other activities which currently require travel. An increasing number of rooms on campus have the necessary technology to accommodate virtual conferencing with distant locations around the world. As telecommunications software and hardware continue to improve, the choice to forgo an expensive, carbon-intensive trip in favor of virtual conferencing will become more appealing. The following milestones are intended to build virtual conferencing capacity on campus and promote use of this option by the campus community.

12-Month Milestones

- Establish an inventory of existing video conferencing facilities campus wide.
- Identify the most appropriate video conferencing platform and integrate this platform with hardware.
- Develop protocols for widespread use of video conferencing facilities.

Transitioning to a Renewable Energy Supply

About two-thirds of Cornell's current GHG emissions come from combustion of fossil fuels for campus heat and electricity. Replacing high-carbon energy sources with low- or zero-carbon energy sources to efficiently heat and provide electricity to campus will require an integrated approach which links our campus distribution and supply systems.

If Cornell can successfully heat the campus buildings by harnessing renewable geothermal and biomass resources – namely, the thermal energy contained in the earth's crust in combination with the combustion of local bioenergy feed stocks, it will ultimately result in reduced operation of the natural-gas-fired combined heat and power plant. While a renewable energy heating system is taking a step in the right direction, if Cornell does not take other measures to generate renewable electricity, such a system will require increased purchases of electricity from the grid.

Therefore, Cornell must begin now to "green the grid" with infusions of solar, wind, hydroelectric, and bioenergy projects and to upgrade the campus distribution system to efficiently accommodate these new energy sources. The planning and execution of the major infrastructure modifications required to successfully complete the transition to renewables will require significant investment and take years to complete. This fact should move us to take immediate action.

RECOMMENDATION 11.
Advance the Hybrid Enhanced Geothermal – Bioenergy System (EGBS) Demonstration Project

An Enhanced Geothermal System hybridized with a set of bioenergy options (EGBS) is the CAP action with the largest GHG emissions reduction potential. Completely realized, EGBS could provide for over 82,000 metric tons (CO2 equivalent) of average annual carbon abatement – more than 38% of Cornell’s current carbon footprint (see **Figure 1**). It is the only action targeted at supplying the campus heating load with renewable energy.

Deployment of EGBS in the northeast region would be a major breakthrough. Though research and demonstration efforts to date are promising, there are aspects of the technology that are not proven at the scale of Cornell’s campus in the geologic conditions found in this region. As the first project of its kind in the northeast region, EGBS at Cornell will require full engagement of the research community. Therefore, it is of the utmost importance to immediately begin work on siting, permitting, and funding a test well, as well as associated community engagement and outreach efforts.

In the event that EGBS does not prove to be a viable option, an alternative plan to heat the campus must be developed. Alternatives ranging from carbon capture, to large scale biomass, to nuclear energy were part of a thorough analysis of potential technologies in the original 2009 CAP. EGBS was selected as the set of technologies with the greatest potential for successful implementation. If successful, this project will have broad application to municipalities and institutions in similar geographic locales.

Given current energy market conditions, the EGBS is not likely to be financially competitive with natural gas. However, current conditions include stable gas prices and no federal carbon tax - both of which are unlikely to continue for the next 20 years. The EGBS being proposed would provide energy without disruptions in supply or fluctuations in price that natural gas is likely to encounter in the longer term.

Innovative financing strategies, along with capitalizing on resources and support available from external partnerships, will be critical to funding a full-scale system for the long term. Successful full-scale implementation will also require investment in university infrastructure to optimize the heat

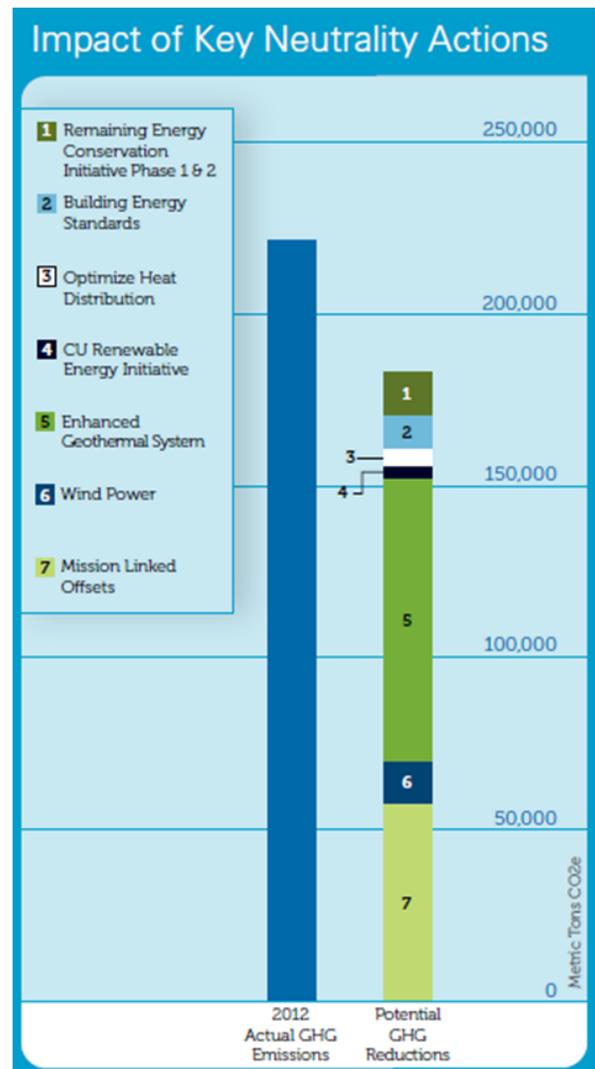


Figure 1

distribution system, as well as to develop the biomass technology (e.g. gasification) and feed stocks (e.g. regional supply, transportation logistics, etc.) needed to optimize the system to handle the campus heating load.

Significant outreach, collaboration, and benefits will be essential to secure community acceptance for EGBS technology. The logistical aspects of supplying large amounts of biomass to a centralized facility on campus will raise additional public acceptance issues that will need to be addressed. Full-scale implementation planning must take these issues into account. Cornell should actively seek opportunities to develop EGBS as a community partnership project.

12-Month Milestones

- Obtain approval in FY '16 budget for approximately \$1M outreach funding and \$2M technical funding; and submit 5-year capital plan proposals (\$30M - \$50M for Phase 1).
 - Complete internal campus engagement; create and kick off external outreach plan.
- Obtain internal site approval on Cornell land for the exploration well and eventual build-out of one well pair and surface infrastructure.
 - Complete scoping for an exploratory well permit application and Environmental Assessment Form.
- Obtain commitment from CALS (or other controlling entity) to allocate Cornell land resources needed to grow and harvest biomass, and establish sustainability criteria for external sourcing.
 - Estimate the land types and areas needed for biomass production at a scale needed for the hybrid geothermal-bioenergy integration.

RECOMMENDATION 12.

Optimize Heat Distribution

The campus heat distribution system must be optimized to facilitate the integration of Cornell's future renewable energy sources. Cornell currently has a robust steam system representing decades of planning and upkeep. To successfully accelerate the campus climate neutrality goal, it is imperative to create a plan to integrate renewable energy into the campus heat distribution system. This may require conversion of portions of the existing steam system to hot water, which can accept heat energy at a lower temperature. Properly engineered hot water systems operate at higher efficiency with lower losses than steam systems. In the long term, a hot water system is expected to be less expensive to construct, operate, and maintain, but the conversion process requires a significant financial investment in infrastructure and some short-term disruption and risk to customers.

The optimization plan must also address building systems. Campus buildings currently have steam-to-hot-water conversion equipment; however, the optimal design for a future retrofit to a hot water system needs to accommodate lower return temperatures in order to maximize efficiency and space for necessary mechanical equipment.

12-Month Milestones

- Complete a plan for optimization of the heat distribution system to enable integration of low-temperature renewable energy sources and to minimize energy loss.

- Make recommendations to modify the FY '17 Capital Plan to reflect this new approach.
- Institute a new Facilities Engineering Design and Construction Standard for building design to accommodate future heating distribution.

RECOMMENDATION 13.

Implement the Cornell University Renewable Bioenergy Initiative (CURBI)

Bioenergy is a critical component of Cornell's Climate Action Plan. A bioenergy facility will allow Cornell to capitalize on more than 50 campus waste streams and other university-owned biomass resources to generate renewable energy. The potential biomass available is estimated to be 36,000 tons/year. CURBI is planned as a research and demonstration platform for Cornell's world-renowned academics to test and demonstrate innovative bioenergy technologies such as slow pyrolysis, anaerobic digestion, and high-efficiency direct combustion and prepare them for full scale implementation. This initiative will also help to identify larger-scale agriculture-based opportunities to produce bioenergy. The goal is that these bioenergy resources could then scale up to significantly offset campus fossil fuel-based energy sources.

CURBI, whether alone or in combination with EGBS, needs to be thoughtfully implemented so as to support future campus-scale bioenergy needs. A comprehensive feasibility study encompassing the economic, social, and environmental impacts of CURBI has been completed. To construct and operate CURBI will require sustainable funding and the commitment of land resources for biomass production.

12-Month Milestones

- Secure \$100K in FY '16 funding for design and accurate cost estimate to permit realistic pursuit of funding.
- Confirm the 2010 Site Selection for the CURBI Facility or secure an alternate site.
- Expand the scope of feedstock and conversion options in CURBI.

RECOMMENDATION 14.

Procure Renewable Energy

Renewable energy procurement includes strategies to integrate more solar, wind, hydro, and bioenergy into Cornell's renewable energy portfolio by purchasing the electricity from projects that are owned and operated by third-party developers. This business model eliminates the need for Cornell capital expenditure and typically involves buying green electric power at a fixed price (at or below market prices) for 10 - 30 years. It also provides a hedge against exposure to rising natural gas prices at the Central Energy Plant (CEP). These projects advance our long-term climate neutrality goal since the third-party agreements typically provide for purchase of the asset by Cornell at the end of the contract term.

The AWG recommends: 1) aggressively pursuing all renewable energy projects currently under development, and 2) seeking new opportunities to add similar projects to the university's portfolio. This is an ideal time to pursue these projects – energy prices are low and subsidies are relatively high. Current projects alone would reduce GHG emissions by 10% and could supply about 30% of the electric

energy use of the campus on an annual basis without expenditure of capital or additional operational funds.

Cornell's project approval processes are designed around large capital building projects and do not align well with the short-term commitments and disruptive pace of government subsidy offerings and changing market conditions. A variance or process to fast-track these projects should be considered. When evaluating these projects, decision-making bodies within the university should utilize a triple bottom line decision-making framework to value carbon reduction. The hedge value of the project should be accounted for, because exposure to fuel price increases at the Central Energy Plant will be counter-balanced by the increase in value of the renewable energy procured.

12-Month Milestone

- Obtain internal approval and complete Power Purchase Agreements for the wind, hydro, and solar projects currently being developed.

Developing Mission-Linked Offsets

Developing a portfolio of local offset projects is perhaps the single most impactful action that links solutions to climate disruptions with economic disparities. Mission-linked offsets can provide Cornell with the opportunity to reach beyond our hill and invest in tangible actions with multiplicative benefits to our immediate and global community. A portfolio of local offset initiatives is recommended to mitigate currently unavoidable emissions, namely commuting and business travel. Each year of delay on offset initiatives results in 60,000 tons of CO₂ permanently present in the atmosphere. To postpone carbon offsetting actions until late in the timeline is irresponsible and disingenuous.

Carbon offsets (or credits) refer to investments in off-campus projects (local, regional, international) that remove carbon from the atmosphere, either directly or by reducing the flow of greenhouse gases to the atmosphere. International standards stipulate that any carbon offset activity must be real, permanent, additional, verified, and audited through third-party organizations. The AWG recommends a portfolio of mission-linked offsets that include carbon sequestration in soils and forest resources, home energy efficiency and fuel switch projects, and methane capture.

RECOMMENDATION 15.

Sequester Carbon with Existing and New Forest Resources

Afforestation and active forest management can enhance the carbon-storage capacity of Cornell lands, as well as enhance the educational and research mission of the university. The annual carbon sequestration rate on 9,500 acres of Cornell forest land (including both Plantations and non-Plantations forests) is approximately 11,260 tons of CO₂, or 1.2 tons CO₂ per acre per year. If the university does not actively plant new trees and manage its mature forest stands, the carbon abatement capacity of these lands will diminish over time.

An estimated 3,000 acres of Cornell lands that currently are abandoned fields or marginal farmland could be used to plant native tree species. Sequestration via advanced forest management is a

generally acceptable carbon offset practice; however, Cornell would need to develop a methodology that can be third-party verified and audited.

12-Month Milestones

- Refine estimates for the carbon-capture potential for Cornell lands.
- Reserve a portion of Cornell lands for sequestration and develop a plan for active forest management and afforestation.

RECOMMENDATION 16.

Develop Local Community Offsets

Cornell could meet its climate neutrality goal very quickly by purchasing carbon offsets through international markets. Although this might be the quickest and possibly the least expensive pathway, it could delay the long-term changes that could and should be made in Cornell operations and personal behavior. By applying internal offset fees to external local initiatives, Cornell can create a wealth of local mission-linked offsetting opportunities to mitigate its unavoidable emissions and accelerate progress towards climate neutrality. Working with established local partners, Cornell can directly engage in and help scale up real and verifiable offsets initiatives. Below are a few viable options for further development:

Energy Efficiency Renovations in Low-Income and Rental Properties

There are a over 38,500 households in Tompkins County, with about 46% of the population renting and about 20% living below the poverty line. Rental housing for lower-income workers is often substandard and wasteful of energy, further exacerbating these workers' financial vulnerability. Because of the split incentive in rental units, landlords are reluctant to invest in energy-efficiency measures because they can pass along increased utility costs to their tenants. Tenants have little reason to conserve energy unless they pay for utilities directly. There is an opportunity to address the community's need for energy-efficient housing with weatherization projects that comply with the international additionality standards for offsets.

Fuel Switch for Farms and Rural Homes

Home energy retrofits could also include fuel replacement programs like CCETC's Southern Tier Bulk Wood Pellet Infrastructure program. These projects could take advantage of relationships with Cornell faculty and or staff for bulk purchasing and installation of pellet boilers or furnaces.

Improve Soil Carbon Storage in Agricultural Soils

Agricultural practices have depleted soil carbon stocks however rebuilding these stocks is possible based on research by Cornell faculty. The agriculture sector in New York provides a significant offset opportunity. The AWG proposes wider implementation of the soil health practices promoted by the Soil Health Program at Cornell (<http://soilhealth.cals.cornell.edu>). This would require some additional investment in extension education, but Cornell and Cornell Cooperative Extension already have the research and extension infrastructure to engage the agricultural sector in this effort in a cost-effective manner.

Reduce Methane Sources in Agricultural Industries

The major sources of methane in Cornell operations come from leakage in natural gas use, animal agriculture, and composting/landfill. Capturing methane and using it as a fuel to produce heat and power reduces the climate forcing from methane. In addition to reducing methane emission from its own operations, Cornell has the potential to reduce significant methane sources throughout Upstate New York by encouraging the use of methane capture and conversion technologies, particularly within the agricultural industry.

12-Month Milestones

- Assign an FTE to develop a plan for a community offset program.
- Establish a multilateral partnership with a local offset project generator, a verifier, and a broker in an MOU.
- Partner with Cornell researchers and students to review international verification standards and recommend an existing option or develop our own.

Conclusion and Next Steps

After consultation with numerous university stakeholders and careful deliberation, the AWG has concluded that achieving climate neutrality by 2035 is imperative and feasible – if we align our priorities throughout campus to achieve this more aggressive goal. Three conditions will assure our success:

- 1) Academic integration of the Climate Action Plan (CAP) with the university’s mission,
- 2) An unwavering and university-wide commitment to our goal, and
- 3) Significant fundraising and partnership development to implement the recommendations in this report and the key long-term actions in the CAP.

The scientific consensus is clear that the costs of inaction far outweigh the costs of aggressive climate action. To meet the needs of the future, Cornell must transform its energy system and current business practices. There is tremendous institutional value to be gained by beginning now to make the large-scale investments that are necessary to achieve climate neutrality. Co-benefits of reaching for this goal include:

- 1) Opportunities to grow Cornell's academic mission through research, teaching, and outreach focused on the technological, sociological, and economic aspects of achieving climate neutrality;
- 2) Enhancement of the Cornell brand for the purposes of faculty, staff, and student recruiting;
- 3) New revenue streams from external fundraising, energy conservation savings, and the capital campaign;
- 4) Reduced financial exposure to increasingly unstable energy markets; and
- 5) A proactive response to existing and future compliance regulations.

Due to the scale of changes proposed, we should begin now to engage Cornell’s leadership and the Cornell community in a dialogue about the implications of an accelerated climate neutrality target on the university’s research, education, and physical investments. Presenting the AWG recommendations to the Board of Trustees, senior staff, and college leaders will be an important first step in this ongoing conversation.

To ensure continuity in the process as we move forward, the members of the AWG propose to continue their work through July 2015. During this time period we hope to work closely with the senior administration, college deans, the President’s Sustainable Campus Committee, the Atkinson Center for a Sustainable Future, the Campus Sustainability Office, and the Energy Institute to pursue full implementation of the recommendations in this report and to integrate the key actions in our CAP into the university’s capital planning, fundraising, and academic planning processes, as appropriate.

Appendices

APPENDIX 1. Summary Table of Report Recommendations

The AWG estimates that \$3.4M in known capital expenses plus three full-time (FTE) positions will need to be included in the FY '16 operating budget to initiate our recommendations. This funding commitment is a baseline and does not account for capital and operating expenses estimated to be in the range of \$500M over the next ten to twenty years. Moving forward, allocations for future years will need to be determined through an iterative planning process and ongoing conversation with university stakeholders. Cost estimates will be further refined through the planning and evaluation processes recommended in this report.

Recommendations	12-Month Milestones	FY '16 Costs	FY '16 FTE
Building Capacity: Launch a Comprehensive Engagement and Education Campaign	<ul style="list-style-type: none"> • Establish an institutional planning and reporting framework requiring each college and administrative unit to develop three or more goals in carbon reduction, research, faculty hiring, staff engagement, and/or learning outcomes. <ul style="list-style-type: none"> ➤ Each college forms a team to develop climate action curricular and engagement initiatives (\$100K in FY '16). ➤ Fund a training specialist position within Human Resources to support staff engagement (1 FTE). ➤ Develop a university wide brand for sustainability engagement (\$100K in FY '16). 	\$200K	1 FTE
Building Capacity: Develop Climate Action Fundraising Initiatives	<ul style="list-style-type: none"> • Initiate development of a capital campaign initiative in the range of \$500M over ten to twenty years for CAP research, faculty hiring, teaching, and infrastructure. • Fund a Director of Strategic Partnerships for Climate Action (1 FTE). • Develop a funding mechanism for campus climate action research within the Atkinson Center for a Sustainable Future. • Work with AAD and Deans to assess current sustainability fundraising outcomes. 	TBD	1 FTE
Building Capacity: Incorporate Carbon Costs Into Operations	<ul style="list-style-type: none"> • Develop an internal funding scheme that places a cost of emissions on utilities and business travel and generates funds for campus initiatives and local offset projects. • Secure approval from the interdepartmental fee committee to include a carbon charge in utility rates and operating budgets for FY '16. • Determine appropriate jurisdiction (Board of Trustees or Executive Policy Review Group) and secure approval to develop a travel offset policy. • Develop guidelines for use of the funds collected. 	TBD	None

<p>Building Capacity: Prioritize Sustainability in the Presidential Search</p>	<ul style="list-style-type: none"> • Solicit a public statement from the new president committing to sustainability and endorsement of the University’s climate action goals. 	<p>\$0</p>	<p>None</p>
<p>Building Capacity: Continue the Acceleration Working Group</p>	<ul style="list-style-type: none"> • Continue the AWG to support implementation of recommendations in partnerships with the President’s Sustainable Campus Committee, Atkinson Center for a Sustainable Future, the Energy Institute, and other initiatives, as appropriate. 	<p>\$0</p>	<p>None</p>
<p>Demand Reduction: Establish Higher Energy Standards for New Construction and Renovations</p>	<ul style="list-style-type: none"> • Obtain Board of Trustees adoption of an energy standard policy for new buildings and renovations. <ul style="list-style-type: none"> ➢ Implement a decision-making process for building efficiency measures which reflects the cost of climate-neutral energy options, then enforce this process for all projects. ➢ Build new accountability structures into the Project Approval Request (PAR) and formal design process. ➢ Hire a consultant to finalize energy modeling protocols and generate energy models for projects (this cost would be borne by the building or renovation project). ➢ Implement a post-construction performance review. 	<p>TBD</p>	<p>None</p>
<p>Demand Reduction: Initiate Phase 2 of the Energy Conservation Initiative (ECI)</p>	<ul style="list-style-type: none"> • Obtain Board of Trustees approval to extend the Energy Conservation Initiative (ECI) payback period to 15 years or more at billed utility rates. <ul style="list-style-type: none"> ➢ Develop a college and unit funding plan for the initial \$50M over the next five years to achieve a 20% reduction in metered heating and electricity usage by 2025. ➢ Assess life-cycle impact of a new deferred maintenance policy – upgrade from ‘replace in-kind’ to ‘aggressive reduction’ for energy efficiency on all projects. 	<p>TBD</p>	<p>None</p>
<p>Demand Reduction: Maximize Space Efficiencies</p>	<ul style="list-style-type: none"> • Commit to purchase/develop the technology tools included in the endorsed 2013 Space Study recommendations. <ul style="list-style-type: none"> ➢ Revise the capital planning process to include meaningful approvals of space management for all renovation and new construction projects. ➢ Revise the standard architect/engineer contract to define climate neutrality expectations for space programs. 	<p>TBD</p>	<p>TBD</p>

<p>Demand Reduction: Increase Use of Sustainable Modes of Transportation</p>	<ul style="list-style-type: none"> • Initiate a Transportation Strategic Plan and annual survey (\$100K in FY '16). • Increase outreach and education about existing Transportation Demand Management programs. • Reassign an FTE for Transportation Demand Management. • Allocate financial resources and draft RFP for a Campus Bike/Pedestrian Master Plan. • Allocate resources to study the extension of Campus-to-Campus service. • Develop a deployment plan for EV-charging stations on campus. • Implement incentives to increase use of clean-fuel vehicles. 	<p>\$100K</p>	<p>None</p>
<p>Demand Reduction: Improve Telecommunication Facilities to Reduce Travel</p>	<ul style="list-style-type: none"> • Establish an inventory of existing video conferencing facilities campus wide. • Identify the most appropriate video conferencing platform and integrate this platform with hardware. • Develop protocols for widespread use of video conferencing facilities. 	<p>\$0</p>	<p>None</p>
<p>Energy Supply: Advance the Hybrid Enhanced Geothermal - Bioenergy System (EGBS) Demonstration Project</p>	<ul style="list-style-type: none"> • Obtain approval in FY '16 budget for approximately \$1M outreach funding and \$2M technical funding; and submit 5-year capital plan proposals (\$30M - \$50M for Phase 1). <ul style="list-style-type: none"> ➢ Complete internal campus engagement; create and kick off external outreach plan. • Obtain internal site approval on Cornell land for the exploration well and eventual build-out of one well pair and surface infrastructure. <ul style="list-style-type: none"> ➢ Complete scoping for an exploratory well permit application and Environmental Assessment Form. • Obtain commitment from CALS (or other controlling entity) to allocate Cornell land resources needed to grow and harvest biomass, and establish sustainability criteria for external sourcing. <ul style="list-style-type: none"> ➢ Estimate the land types and areas needed for biomass production at a scale needed for the hybrid geothermal-bioenergy integration. 	<p>\$3M</p>	<p>TBD</p>
<p>Energy Supply: Optimize Heat Distribution System</p>	<ul style="list-style-type: none"> • Complete a plan for optimization of the heat distribution system to enable integration of low-temperature renewable energy sources and to minimize energy loss. <ul style="list-style-type: none"> ➢ Make recommendations to modify the FY '17 Capital Plan to reflect this new approach. • Institute a new Facilities Engineering Design and Construction Standard for building design to accommodate future heating distribution. 	<p>\$0</p>	<p>None</p>

<p>Energy Supply: Advance the Cornell University Renewable Bioenergy Initiative (CURBI)</p>	<ul style="list-style-type: none"> • Secure \$100K in FY '16 funding for design and accurate cost estimate to permit realistic pursuit of funding. • Confirm the 2010 Site Selection for the CURBI Facility or secure an alternate site. • Expand the scope of feedstock and conversion options in CURBI. 	\$100K	None
<p>Energy Supply: Procure Renewable Energy</p>	<ul style="list-style-type: none"> • Obtain approval for the wind, hydro, and solar projects currently being developed. 	\$0	None
<p>Carbon Offsets: Sequester Carbon with Existing and New Forest Resources</p>	<ul style="list-style-type: none"> • Refine estimates for the carbon-capture potential for Cornell lands. • Reserve a portion of Cornell lands for sequestration and develop a plan for active forest management and afforestation. 	TBD	None
<p>Carbon Offsets: Develop Local Community Offsets</p>	<ul style="list-style-type: none"> • Assign an FTE to develop a plan for a community offset program. • Establish a multilateral partnership with a local offset project generator, a verifier, and a broker in an MOU. • Partner with Cornell researchers and students to review international verification standards and recommend an existing option or develop our own. 	TBD	1 FTE

APPENDIX 2. Acceleration Working Group Abbreviated Biographies

Héctor Abruña	<p>Héctor D. Abruña is the Émile M. Chamot Professor, and former Chair from 2004-2008, in the Department of Chemistry and Chemical Biology and Director of the Energy Materials Center at Cornell (emc²). His research interests are currently focused on the design, synthesis, characterization, and device performance of materials for fuel cells and batteries. He is also involved in the study of graphene as an electrochemical platform, molecular electronics, and biosensors. More information can be found at: http://chemistry.cornell.edu/faculty/detail.cfm?netid=hda1 http://abruna.chem.cornell.edu</p>
Robert Bland	<p>Bert Bland is the Senior Director of the Energy & Sustainability Department within the Facilities Services Division. The department includes the Utilities Section which is responsible for the procuring, generating and distributing the energy and water for the Ithaca campus; the Energy Management Section which is responsible for managing and conserving energy in the buildings; and the Campus Sustainability Office which manages the transition to a sustainable campus. Bert directs the preparation of the Climate Action Plan and coordinates its implementation. http://energyandsustainability.fs.cornell.edu/</p>
Brian Chabot	<p>Brian Chabot, Professor Emeritus in Ecology & Evolutionary Biology, has been involved with Cornell's Climate Action Plan since its inception. Recent teaching has engaged students with environmental stewardship and sustainability projects at Cornell. He has been active in the community with Cornell Cooperative Extension, Sustainable Tompkins, and Finger Lakes Re-Use. Research with sugar maples relies on state and federal funding with no specific relation to actions recommended in the Acceleration Report.</p>
Todd Cowen	<p>Edwin A. Cowen (Todd) is a Professor in the School of Civil & Environmental Engineering in the College of Engineering, where he specializes in environmental fluid mechanics. His teaching focuses on fluid mechanics, experimental methods in fluid mechanics, and hydrokinetic and aeolian energy. His broad research interests include environmental turbulence, water wave induced flows, lake hydrodynamics (physical limnology), energy harvesting from fluid flows, and quantitative imaging techniques. He is the longtime Director of the DeFrees Hydraulics Laboratory and since July 2013 the Faculty Directory for Energy at the Atkinson Center for a Sustainably Future. More information on his work can be found here: www.cee.cornell.edu/eac20</p>
Louis Derry	<p>Louis Derry received a BA in Geology from Colorado College in 1981 and a Ph.D. in Geological Sciences from Harvard University in 1990. He came to Cornell as a Snee Research Fellow in 1994 and joined the faculty in 1996. He is a Senior Scientist with the Kohala Center, Hawaii, and a Fellow of the Canadian Institute for Advanced Research. Derry's research includes studying biogeochemical processes at multiple time scales, from modern environments to the evolution of couple biogeochemical cycles over Earth history. Derry's research interests include rates and process of carbon exchange in the land-ocean-atmosphere system, subsurface fluid flow and chemical reaction, and trace metals in natural and contaminated environments. http://www.eas.cornell.edu/people/profile.cfm?netid=lad9</p>

Chris Halladay	Chris Halladay is the Associate Vice President of Organizational Effectiveness in the Division of Human Resources and Safety Services, where he leads the university's internal efforts in Organizational Development, Compensation and Talent Planning. Most of his time is spent coaching leaders and assisting colleagues in realizing the potential of individuals, teams, and systems.
Mike Hoffmann	Mike Hoffmann is Director of the Cornell University Agricultural Experiment Station (Ithaca), and an Associate Dean of the College of Agriculture and Life Sciences. As Director, he is responsible for the allocation of \$5 million in federal funds as well as the College's multiple farms and extensive plant growth facilities. His major interests include sustainability, climate change, energy conservation, and the fostering of leadership among staff and faculty. Under his leadership the Experiment Station has adopted a culture of sustainability focused on reducing costs and its carbon footprint. He leads a NE US – Eastern Canada climate change initiative emphasizing opportunities for agriculture as the climate warms and he recently founded the Cornell Institute for Climate Change and Agriculture. More information can be found here: http://www.cuaes.cornell.edu/
Katherine McComas	Katherine McComas is a Professor in the Department of Communication in the College of Agriculture and Life Sciences, where she specializes in risk, science, and environmental communication. Her teaching and research focuses on examining how people perceive and respond to information about risk and environmental issues and who people trust for such information. She is also interested in understanding how communication influences attitudes and behaviors that support energy efficiency, sustainability, or conservation efforts. More information on her work can be found here: http://communication.cals.cornell.edu/people/katherine-mccomas
Abena Ojetayo	Abena Ojetayo (BS '07, M.Eng '09) is a project engineer in the Facilities Engineering department where she manages energy and sustainability projects ranging from renewable energy planning to green building certification. As staff lead for the PSCC Climate Team, she works with the Sustainability Office to draft the Climate Action Plan and works with stakeholders across the university to develop initiatives towards carbon neutrality.
Dan Roth	Daniel Roth is the Director for Campus Sustainability at Cornell University. In his current role, Daniel directs strategic planning, communications, and campus engagement efforts aimed in enhancing the environmental, social, and financial sustainability of the Ithaca campus. He received an MS in Adult and Extension Education from Cornell and a BA in Interdisciplinary Studies from New York University. As an educator Daniel has worked in the fields of environmental education, youth development, and outdoor education. As a project coordinator he has worked on social and economic justice campaigns, broad-based community partnerships, environmental and food security education, service learning programs, and civic engagement projects.

Jeff Tester	<p>Jeff Tester is the Croll Professor of Sustainable Energy Systems in the School of Chemical and Biomolecular Engineering at Cornell University and Director of the Cornell Energy Institute. He also served as Associate Director for Energy in the Atkinson Center for a Sustainable Future from 2009-2013. His general interests are in the energy and environmental area with an emphasis on cleaner energy extraction and utilization to lower environmental impacts and damages. The focus of his current work is on sustainable utilization of geothermal and biomass resources, where he applies his interests in chemical and physical transport processes in hydrothermal and supercritical media as they relate to energy extraction, storage and conversion, and environmental control technologies. Active projects include experimental and life-cycle assessment studies of hydrothermal liquefaction and gasification of algae biomass feedstocks, advanced drilling methods using hydrothermal jets, geothermal heat pump and co-generation simulation, and performance optimization of hydrothermal and enhanced geothermal systems (EGBS). More information on his research and teaching can be found at https://jeff-tester.cbe.cornell.edu/ and http://energyinstitute.engineering.cornell.edu/.</p>
KyuJung Whang	<p>KyuJung Whang is the Vice President of Facilities Services, which encompasses Capital Projects and Planning, Facilities Engineering; Facilities Management, Energy and Sustainability, Transportation Services, Contract Colleges Facilities, Cornell Real Estate, and Administration and Operations Support. Kyu currently serves as the Chair of the New York State Board of Architecture, as Chair of the Board of Directors of the Tompkins Consolidated Area Transit (TCAT), and a member of the Board of Directors of the Challenge Workforce Solutions. In January of this year he was elected to the Board of Directors of the Association for the Advancement of Sustainability in Higher Education (AASHE) to serve a 3-year term.</p>
Sarah Zemanick	<p>Sarah Zemanick is a Sustainability Management Specialist in the Energy & Sustainability Department in Facilities Services. She manages projects across a broad range of campus sustainability areas, including renewable energy procurement and climate action planning, and is part of the team that manages and supports the President’s Sustainable Campus Committee. Through a background in environmental compliance, she has a particular interest in water-related issues and is a member of the PSCC Water Focus Team.</p>