

# Detailed Description of Priority Actions

## TABLE OF CONTENTS

### 2 Campus Sustainability Office

2 Action 1 - STARS Platinum Status

### 4 Buildings

4 Action 1 - Maximum Space Efficiencies  
 6 Action 2 - Building Energy Standards  
 8 Action 3 - Energy Performance Review  
 9 Action 4 - "Energy Net Zero" Building  
 10 Action 5 - Green Building Education Program  
 11 Action 6 - Building Energy Standards Policy  
 12 Action 7 - LEED Standards for Existing Buildings

### 13 Climate

13 Action 1 - Mission-Linked Offsets  
 15 Action 2 - Climate Adaptation Planning  
 17 Action 3 - Campus Climate Literacy  
 19 Action 4 - Carbon Neutral Travel Policy  
 20 Action 5 - Collaborate in Climate Planning Beyond Campus  
 21 Action 6 - Climate Literacy Outreach

### 23 Energy

23 Action 1 - Energy Conservation Initiative  
 25 Action 2 - Optimize Heat Distribution System  
 26 Action 3 - CU Renewable Bioenergy Initiative  
 27 Action 4 - Enhanced Geothermal System  
 28 Action 5 - Wind Power  
 29 Action 6 - Solar Power  
 31 Action 7 - Optimize Steam Turbines  
 32 Action 8 - Hydroelectric Plant Upgrades  
 34 Action 9 - Hydroelectric Power  
 35 Action 10 - Campus Smart Grid  
 37 Action 11 - Innovative Financing Mechanisms  
 38 Action 12 - Green Electricity Pricing  
 39 Action 13 - Green Revolving Fund  
 40 Action 14 - Renewable Energy Research Park  
 41 Action 15 - Faculty Advocacy Group  
 42 Action 16 - Energy Procurement Plan

### 43 Food

43 Action 1 - Increase Regional Purchasing  
 45 Action 2 - Expand Food Recovery  
 46 Action 3 - Teach Food Skills

### 47 Land

47 Action 1 - Implement Cornell's Master Plan  
 49 Action 2 - Green Infrastructure  
 51 Action 3 - LEED for Existing Neighborhoods Policy

### 52 People

52 Action 1 - Energy Conservation Engagement Program  
 54 Action 2 - Virtual Conferencing  
 55 Action 3 - Integrate Sustainability into the Work Place  
 56 Action 4 - Flexible Work Arrangements  
 58 Action 5 - Triple Bottom Line Decision Making Training  
 59 Action 6 - Cornell Global Labor Institute

### 61 Purchasing

61 Action 1 - Equipment Efficiency Standards Policy  
 62 Action 2 - Sustainable Products Procurement  
 63 Action 3 - Incorporate Sustainability into Vendor Selection

### 64 Transportation

64 Action 1 - Increase Campus Use of Mass Transit  
 66 Action 2 - Campus to Campus Bus  
 67 Action 3 - Increase Efficiency of Cornell Fleet  
 68 Action 4 - Car Sharing, Carpooling, & Ridesharing  
 70 Action 5 - Campus Bike Master Plan  
 72 Action 6 - Big Red Bike Sharing Program  
 73 Action 7 - County-wide Support for Mass Transit  
 74 Action 8 - Campus-wide Vehicle Efficiency Standards Policy

### 75 Waste

75 Action 1 - Carbon Impact Study of Campus Waste Streams  
 76 Action 2 - Expand Campus Composting  
 77 Action 3 - Improve Campus Materials Management  
 78 Action 4 - Deconstruction Program  
 79 Action 5 - University Waste Reduction Policy  
 80 Action 6 - Re-use Programs

### 82 Water

82 Action 1 - Water/Energy Nexus Study  
 83 Action 2 - Increase Efficiency of Water Delivery System  
 84 Action 3 - Take Back the Tap

This Appendix presents a detailed description of the priority actions endorsed by each of the ten President's Sustainable Campus Committee's (PSCC) focus teams: **Buildings, Climate, Energy, Food, Land, People, Purchasing, Transportation, Waste, and Water**, as well as one action being spearheaded by the **Campus Sustainability Office**. Each action description includes three key components: **Goals, Next Steps**, and necessary **Resources**. For all projects described in the plan, specific funding and approvals are sought case by case, as resources become available and conditions are deemed favorable for implementation.

## CAMPUS SUSTAINABILITY OFFICE

### 1. Identify realistic actions and responsible parties to lead the effort to increase Cornell University's STARS® (Sustainability Tracking, Assessment, & Rating System™) rating with the goal of becoming one of the first Platinum-rated STARS campuses in the nation.

**Goal:** Identify cost-effective and high-impact actions needed to increase Cornell's STARS rating by at least 15 points, and engage the PSCC teams to commit to achieving these targets by 2015.

In 2010, Cornell began participation in a performance-based tracking systems called **Sustainability Tracking, Assessment & Rating System (STARS)** ([www.aashe.org/stars](http://www.aashe.org/stars)), administered by the Association for the Advancement of Sustainability in Higher Education (AASHE).

#### Next Steps

The Campus Sustainability Office will meet with PSCC teams to identify and prioritize realistic one- and two-year goals and integrate STARS Platinum planning into the April PSCC Summit. The following are potential actions that Cornell can target to attain the additional points needed:

- Expand peer-to-peer outreach programs for Cornell students.
- Incorporate sustainability learning outcomes into additional college curricula.
- Utilize faculty mentors and student interns to assess sustainability learning outcomes and review sustainability course designations.
- Develop and implement sustainability literacy assessments for all students enrolled in sustainability related courses and as part of the exit survey given to all graduating seniors.
- Pilot an incentive program for faculty to develop new sustainability courses or incorporate sustainability into existing courses.
- Increase local food expenditures.
- Expand renewable energy production on campus.
- Increase purchasing of EPEAT Silver or higher rated computers and monitors.
- Increase purchasing of Green Seal and/or EcoLogo certified cleaning products.
- Increase purchasing of recycled-content office paper.
- Increase purchasing of alternative fuel and alternative power vehicles at Cornell.
- Reduce Cornell's total waste generation, including all materials recycled, composted, and disposed of as trash.
- Begin tracking institutional efforts to reuse, donate, or re-sell items rather than landfill them.
- Reduce total water consumption on campus.
- Expand sustainability outreach efforts for Cornell employees.
- Expand Cornell's sustainable investment portfolio.

#### Resources

This action is dependent on engaging multiple stakeholders around the STARS Platinum goal, in order to mobilize the university to take on a national leadership role. Success will hinge on securing support from PSCC Co-Chairs, administrative leadership, and academic deans, as well as funding for strategic priorities.

AASHE's STARS program is the only one of its kind that involves publicly reporting comprehensive information related to a college or university's sustainability performance. Participants report achievements in four overall areas: **1)** academics, **2)** engagement, **3)** operations, and **4)** planning and administration. Currently, nearly 600 higher education institutions participate in STARS.

Cornell needs to earn 15 additional points (85 points total up from 70 currently) to become the first Platinum-rated university in the U.S. under the STARS program. This effort will involve multiple actions across many levels of the university in order to strengthen Cornell's sustainability outreach and education programs, increase local and sustainable purchasing, reduce waste, conserve water and energy, improve the fuel efficiency of our vehicles, and so on. This action impacts the work of all ten of the President's Sustainable Campus Committee focus teams and therefore will be overseen by the Campus Sustainability Office, within the University's Energy and Sustainability Department.

# BUILDINGS

**NEUTRALITY:** Reduce Cornell’s carbon emissions to net zero by the year 2050 or sooner.

## 1. Strengthen strategies to manage the use and allocation of campus space, and plan for maximum space efficiencies in renovation and construction projects.

**Goal:** 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 intended use, project needs, and source of funds to cover projected maintenance costs are all factored into decision making about whether to build new space on campus. Cornell’s Space Use Advisory Committee (SUAC), formed in March 2010, has successfully incorporated the principles of space planning and management into the university’s capital project decision-making process. SUAC members are vice provosts/vice presidents or their direct representatives. In the past few years, the SUAC has codified Cornell’s space planning and management protocols as follows:

- Published Guidelines for Space Needs Studies (2011), which requires units to present projects proposing the addition of space to the SUAC
- Published Space Management Principles (2012)
- Published Procedure for the Reallocation of Space; proposals for 8 different spaces have been solicited (2012)

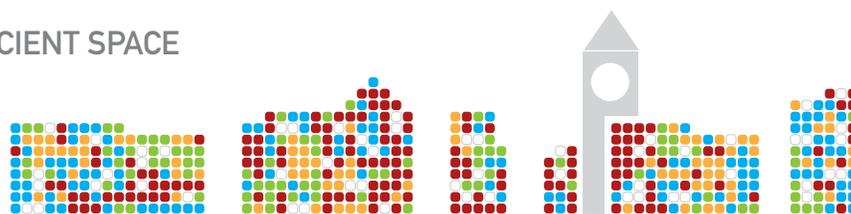
### Next Steps

- Implement Ithaca Campus Space Utilization Study recommendations, including publishing updated space guidelines; launching new scheduling software for classroom and event spaces; and integrating that software with HVAC (heating, ventilation, and air conditioning) control software. Currently, the university uses class schedules to determine HVAC cycles but applies the schedule at a fairly high level. So, for instance, the systems might come on at 6 AM and turn off at 11 PM. If the HVAC systems can be interfaced with the scheduling system, many spaces would likely turn on less, and thus the university would save energy.
- Revise the university’s architectural agreements to include clearer definitions and deliverable expectations for space programs.

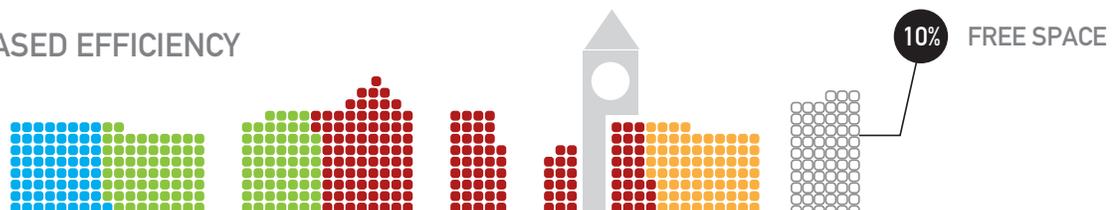
### Resources

This action is dependent on continued funding and senior leadership support for the role of space planning in capital project development.

### INEFFICIENT SPACE



### INCREASED EFFICIENCY

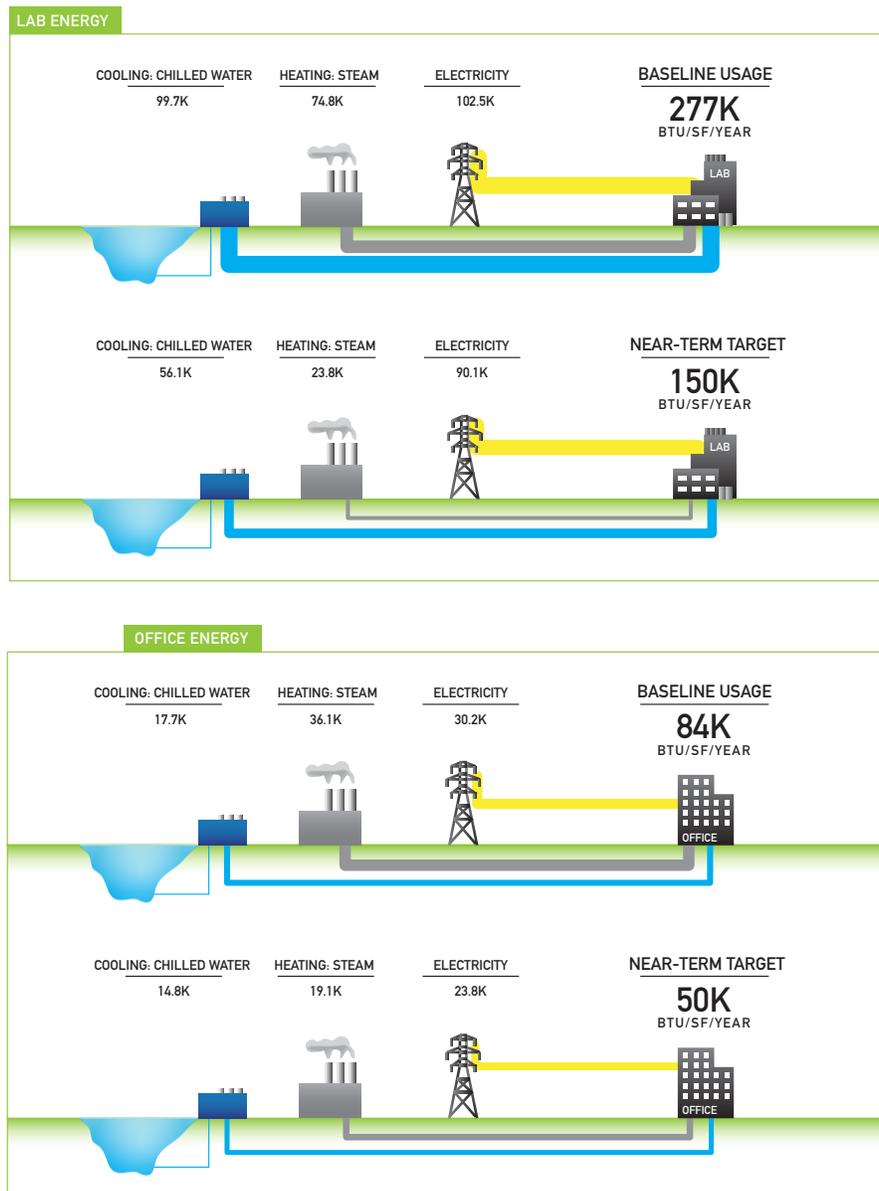


- Developed standard process for pulling and analyzing space data; created standard reports for space data (1996- 2013)
- Implemented SUAC review of needs for leased space (2013)

The Ithaca Campus Space Utilization Study, initiated in January 2012, will make recommendations to inform Cornell's space management program over the next several years and identify opportunities to improve utilization of existing space. The study should make it easier for units to consider strategies to more fully utilize existing space, through re-purposing to higher priority needs, sharing with other units, reallocating to other units, and/or making strategic capital investments to improve quality and functionality. For more information, visit **Cornell's Space Planning website** at: <http://dbp.cornell.edu/offices/space-planning>.

## 2. Integrate Building Energy Standards and energy modeling into the building design, review, and approval process in order to maximize energy efficiency

**Goal:** Cornell continues to refine its energy efficiency standards for campus buildings to reduce laboratory and office energy use by 30 - 50% over the energy-code-compliant baseline American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) 90.1. Our goal is to establish aggressive, but achievable goals for each major project and incorporate these goals as contractual obligations into architectural and engineering agreements. **Coupled with an aggressive space management program, Cornell's building energy standards can help the university avoid over 10,000 metric tons (CO2 equivalent) of emissions annually.**



The 2009 Climate Action Plan (CAP) mandated that the university adopt a well-defined energy modeling protocol and energy standards by building type to ensure that future construction on campus would be optimized to Cornell's Leadership in Energy and Environmental Design (LEED) program and also achieve a minimum of a 30% reduction in building energy use as compared with the industry standard (ASHRAE 90.1). The target in the 2009 CAP was established through a careful review of recent Cornell construction projects and comparison with benchmarks used elsewhere.

In 2013, Cornell's Facilities Engineering Department updated two campus-wide standards, "Energy Guidelines" and "Energy Modeling Guidelines" to standardize and more fully explain Cornell's energy requirements for buildings on campus. **Cornell's Design and Construction Standards** are found at the following URL: <http://cde.fs.cornell.edu/toc.cfm>. These guidelines set aggressive goals that require innovation, design discipline, and steady enforcement by our project management teams.

"Energy Use Intensity" (EUI) goals are now being incorporated into architectural and engineering agreements for all our major building projects. Standard EUI units are expressed in terms of BTUs per square foot per year. Each new building and major renovation on campus has a unique EUI, depending on how the building will be used. On average laboratories use 5-10 times more energy than dormitories on a per square foot basis. Cornell's goals are generally 150 kBtu/ft<sup>2</sup>/year for lab buildings and 50 kBtu/ft<sup>2</sup>/year for offices and classrooms. When compared to a business-as-usual approach, Cornell's building energy standards can help the university to avoid thousands of metric tons of emissions.

### Next Steps

- Continue to refine the modeling process, particularly early in design. Standard modeling techniques are not well suited for evaluating energy performance at the conceptual stage of design. We will work to develop better modeling tools or better ways to adapt the tools we have for evaluating building massing and envelopes. This will ensure that energy modeling done at the conceptual design stage is a meaningful indicator of future energy performance.
- Consistently implement our building energy standards.
- Refine our target goals to keep them aggressive and achievable. We will continue to benchmark our targets against the performance of the best buildings on our campus and elsewhere.
- Track modeled energy use and actual performance of recent buildings.

### Resource

Energy modeling software is improving, and we may be able to hire a third-party consultant to refine how the modeling is done, standardize the assumptions being made, and improve the accuracy of modeling predictions.

### 3. Monitor and evaluate building energy performance of recent projects by comparing design, modeling, and actual energy use, and utilize best practices that are identified through the performance review process to inform future projects.

**Goal:** Develop additional metrics and targets for post-occupancy evaluations of building performance.

Cornell's Facilities Engineering Department team has developed energy "budgets" for each building on campus, for a range of weather scenarios. We know how each building should be performing based on the daily weather, and we can track when a particular building uses more or less energy than the budget predicts. Comparing the budget to actual performance will help us to understand where there are discrepancies, so that we can assess what is causing these discrepancies and how best to address them. The Department has developed rigorous algorithms to track building performance and to identify factors which might help to improve performance. For example, lessons learned from Milstein Hall on how to maintain energy savings in buildings with extensive glass windows can help to inform decisions about how to optimize energy efficiency in new buildings, such as Gates Hall, which also has extensive glass windows.

#### Next Steps

- Develop and populate a spreadsheet with key data fields for each major project in order to compare: **1)** design phase energy goals with **2)** energy modeling predictions, and with **3)** actual building performance.
- Consult with project architects and engineers to determine how each building is actually performing compared to what was expected from the design and modeling process.
- Share the results of each building's performance review to inform the design process going forward, and incorporate the evaluation results into project management seminars and into university engineering design standards.
- Identify strategies that have been employed successfully to reduce energy use and incorporate these strategies as standard practices in future projects.

#### Resource

Work with multiple stakeholders to ensure that the data to be tracked for each project is obtainable and mutually agreed upon. Ensure that accurate data is collected from the initial design phase through building occupancy.

**INNOVATION:** Create a living laboratory for low-impact behaviors, climate education, and research.

#### 4. Evaluate the viability of constructing an “energy net zero” building on campus to serve as a new benchmark in sustainable building design.

**Goal:** Design and build an ultra-efficient academic building that will have “net zero” energy usage over time.

For the Ithaca Campus, Cornell continues to evaluate upcoming projects to identify a suitable candidate for an energy net-zero building. To achieve this goal will require integration of renewable technologies, including on-site solar power and a geothermal-based heat pump system, and a combination of efficiency measures, including minimizing heat losses using well-sealed, high performance windows and super insulating the building envelope.

Meanwhile, planning for Cornell’s permanent campus in NYC is moving forward at a rapid pace. Cornell is scheduled to break ground on the new campus in early 2014 and open the doors on Roosevelt Island in 2017. The Master Plan for the NYC Campus includes a combination of academic space, corporate facilities, an executive education center and hotel, housing for students and employees, and more than two acres of open space. The first academic building is being designed by Pritzker Prize-winning architect Thom Mayne of Morphosis and will aspire to achieve net-zero energy usage by producing as much energy as it uses. This will be achieved in part via an array of photovoltaic cells covering the roof of the building. Learn more about the NYC Campus at <http://www.news.cornell.edu/stories/2013/12/connectivity-be-hallmark-cornell-tech-campus-design> and at <http://tech.cornell.edu/future-campus/>.

##### Next Steps

Continue to evaluate new projects and renovations on the Ithaca Campus to identify a suitable candidate for an energy net zero building.

##### Resources

Consider building size and function, and project budget, to determine the best fit. The ideal candidate should be highly visible to the community, since an energy net zero building will represent a new level of achievement in sustainable building design.

## 5. Launch a Green Building education program to enhance student and public understanding of sustainable building practices in Cornell's built environment.

**Goal:** Provide outreach and education about Cornell's LEED (Leadership in Energy and Environmental Design) certified buildings, focusing on each building's: sustainable design features, aesthetics, functionality, history, and energy performance.

Since 2008 Cornell has required all new construction over \$5M to obtain LEED Silver certification or higher. There are currently 8 Gold buildings and 1 Platinum building at Cornell, as well as two Commercial Interiors Gold certifications for building renovations. An additional 9 certifications are currently in process for the Ithaca Campus, and the NYC Tech building is also in process and is targeting LEED Platinum certification.

Cornell typically includes an educational program for each building in the LEED application. The Central Energy Plant, the Plantations Visitor Center, and the Human Ecology Building are actively conducting tours and outreach through their students, staff, and faculty. Tours and presentations on Cornell's green buildings are currently offered by request.

The **Green Buildings page** (<http://www.sustainablecampus.cornell.edu/initiatives/green-buildings>) on Cornell's Sustainable Campus website lists all of the university's LEED buildings and their points. Data on the performance of each building, as well as background on green design features and ultra-efficient building systems, could be used to supplement the information currently on the website and to create a downloadable application for mobile devices. As a visitor walks around campus, he/she could scan codes and download relevant green building information. The new downloadable app could provide a more broadly accessible focus for green building education and tours on campus, and promote greater understanding of sustainable building practices for both the internal and the broader community.

### Next Steps

- Develop enhanced outreach about Cornell's LEED certified buildings, including supplements to the existing Green Buildings page, a downloadable application for mobile devices, signage, and pamphlets as appropriate.
- Integrate green building data with the new Building Dashboard, to track building performance.

### Resources

Identify a staff person to develop and oversee a university-wide Green Building education and interpretative program.

**LEADERSHIP:** Lead by example on campus and exercise climate leadership beyond campus.

**6. Adopt a university-wide policy that all new construction projects and renovations valued over 5M should achieve a minimum 50% energy savings compared to the baseline established by ASHRAE 90.1.**

**Goal:** The 2009 Climate Action Plan (CAP) prescribed Energy Use Intensity (EUI) standards by building type to ensure that future construction on campus would be optimized to limit energy consumption. Cornell's current EUI standards reduce laboratory and office energy use by 30% over the energy-code-compliant baseline (ASHRAE 90.1). The 2009 CAP recommended that, in order to achieve carbon neutrality by 2050, the university should ultimately require new buildings on campus to limit energy usage to 50% of the industry standard baseline. Achieving a goal of 50% lower energy use effectively reduces the rate of growth in GHG emissions by half.

In 2008 Cornell's Trustees approved a policy that Ithaca Campus new construction projects over \$5M total project cost must attain US Green Building Council's LEED (Leadership in Energy and Environmental Design) certification at a minimum of Silver level, and that these projects must achieve a minimum 30% energy savings compared to the baseline established by American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) 90.1, the national standard for energy efficient buildings. Current performance for buildings constructed since 2008 is averaging 35-40% below the ASHRAE standard. It is important to note that the ASHRAE standard becomes more stringent as it is updated, effectively raising the bar on building energy performance over time. Cornell's Facilities Engineering Department will continue to review the university's EUI standards to assure that our goals are both ambitious and achievable. To make ongoing reductions, we need to evaluate the type of project being proposed and work with our engineers to set realistic goals for that type of project.

**Next Steps**

- Incorporate EUI goals into the architectural and engineering agreements so that they become obligations within the project contract.
- Adopt realistic interim goals and reinforce that these are minimum standards.
- Encourage project teams to continually improve performance by making building envelopes tighter and building systems more sophisticated.

**Resources**

Achieving the long-term goal will require innovation and discipline, as well as steady enforcement of interim EUI goals.

## 7. Assess the feasibility of applying US Green Building Council's LEED (Leadership in Energy and Environmental Design) standards to existing buildings, in addition to new construction projects.

**Goal:** Evaluate the feasibility of performing existing building commissioning (LEED EB) on Cornell facilities in a five-year cycle (every building re-commissioned every five years) versus current re-commissioning practices. This analysis could yield recommendations to improve upon current re-commissioning practices in a cost-effective manner.

Currently Cornell re-commissions campus building controls on a regular basis in order to maintain the energy efficiency of our facilities. To perform a comprehensive LEED EB re-commissioning on every facility on a five-year cycle would be considerably more labor and cost intensive than what we do now.

The proposed feasibility analysis will quantify the additional effort and costs associated with this LEED EB certification, as well as possible benefits that would result, including the potential to earn additional **STARS** (<https://stars.aashe.org/>) points.

### Next Steps

- Evaluate the current re-commissioning program and make recommendations for: **1)** how to better coordinate building re-commissioning among the teams who are assigned to do this work, and **2)** how to incorporate re-commissioning practices into regular maintenance schedules for campus buildings.
- Identify incremental improvements in existing maintenance processes that could be implemented in order to save energy and reduce costs, while also improving Cornell's LEED EB and STARS ratings.

### Resources

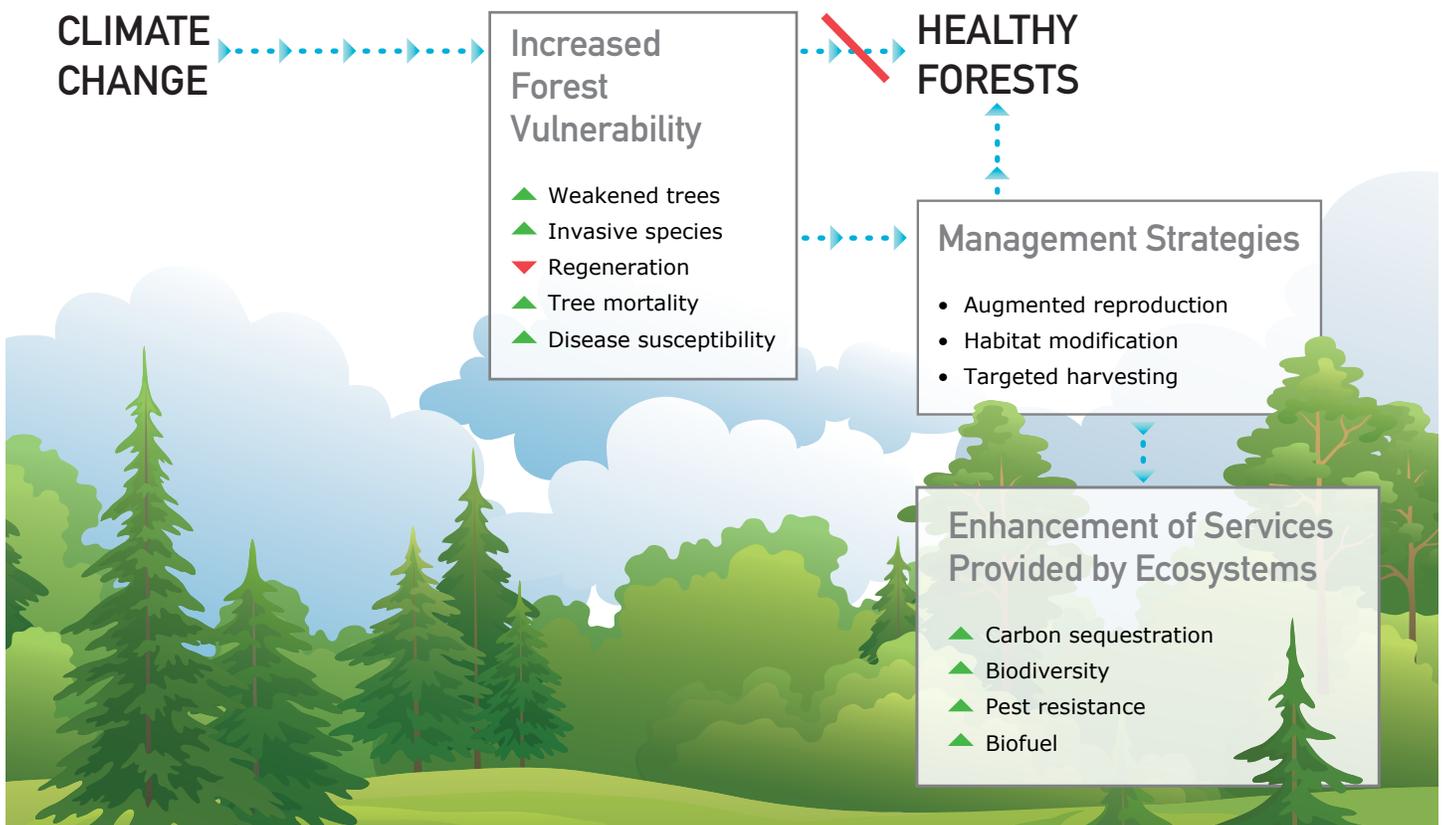
The Buildings Team will complete this analysis within the next two years, in consultation with the Energy and Sustainability Department Office.

# CLIMATE

**NEUTRALITY:** Reduce Cornell’s carbon emissions to net zero by the year 2050 or sooner.

## 1. Implement broad-based, mission-linked carbon management strategies such as forest management, carbon capture and sequestration, and community projects to offset unavoidable university emissions.

**Goal:** The roughly 14,000 acres of land owned by Cornell currently sequester approximately 11,000 metric tons of CO<sub>2</sub> annually; through active management practices it is possible to significantly increase the carbon sequestration rate of these lands. 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. The current sequestration rate is trending downward and will be near zero by 2050, because the existing forest is aging. **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 (CO<sub>2</sub> equivalent) and about 27% of the targeted reduction of 218,000 tons.**



Cornell faculty and the Cornell Lands Committee continue to investigate the potential to “afforest” or convert about 4,000 acres of Cornell’s land holdings from idle pasture or cropland to forest by planting trees. 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. For example, a demonstration nut grove on Cornell land currently serves as a research site for a practicum in agro-forestry.

Faculty and the CALS (College of Agriculture and Life Sciences) Forest Advisory Committee continue to refine estimates for the carbon-capture potential for Cornell lands and seek ways to make these efforts economically feasible. The recent dramatic reduction in the price of natural gas has made solid biofuel production less attractive as a back-up fuel source for the Ithaca Campus Central Energy Plant.

Future regulation of carbon emissions would provide a compelling incentive for Cornell to move forward with afforestation and active forest management. But changes in the regulation of carbon emissions at the state, national, and global scale are difficult to predict. In the absence of a price on carbon, we will continue to seek ways to preserve our forested lands and to optimize the carbon storage services they provide.

Land application of biochar (charcoal produced from the slow pyrolysis of organic biomass) has been proposed as an effective method for long-term capture and sequestration of carbon. Cornell researchers continue on-going efforts to understand and quantify the short- and long-term effects of biochar application for carbon sequestration.

### Next Steps

- Actively seek public and private funding for research and demonstration projects utilizing Cornell lands to sequester carbon and create viable, value-added products.
- Closely monitor the regulatory climate over the next decade to identify favorable conditions needed to make afforestation and active forest management projects economically viable for the university.

### Resources

This action is dependent on favorable economic and regulatory conditions to mobilize investment on the part of the university.

**INNOVATION:** Create a living laboratory for low-impact behaviors, climate education, and research.

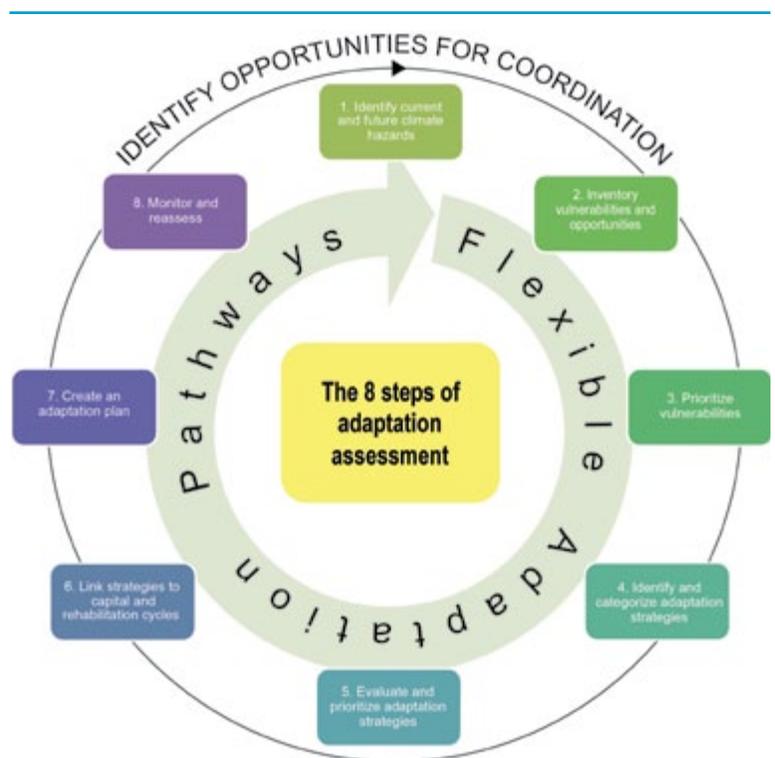
## 2. Conduct vulnerability assessments and climate adaptation planning in order to minimize disruptions to campus as a result of extreme weather events and increased flood risks.

**Goal:** Educate students and staff on campus about climate change impacts, engage faculty in climate adaptation research and demonstration projects, and help reduce future climate-related risks to the Cornell and Ithaca community through appropriate upgrades to campus infrastructure and protocols.

As part of the University's land-grant mission, Cornell faculty, graduate students, and extension staff support climate science and adaptation planning for New York State and the wider Northeast Region. According to the Higher Education Climate Adaptation Committee, Cornell also has a national leadership opportunity to engage the campus community and showcase the application of robust planning climate adaptation tools. Cornell is the first major U.S. university to include climate adaptation in its Climate Action Plan. By innovating and demonstrating new approaches to infrastructure development and emergency response, Cornell can serve as a state and national leader in climate adaptation planning.

As the host of the Northeast Regional Climate Center, Cornell works with federal agencies such as NOAA to provide accurate climate data and analysis tools for the 12 state region. The data and many interactive analysis tools are publicly available through the website <http://www.nrcc.cornell.edu/>. Cornell also provides climate adaptation support to farmers across the state through the Cornell Cooperative Extension and Agricultural Experiment Stations. The new Institute for Climate Change and Agriculture serves as a focal point to facilitate research, education, and outreach to reduce the agricultural sector's collective impact on the climate and to help farmers become more resilient to climate change.

In 2009, NYSERDA commissioned a comprehensive state-wide report, **Responding to Climate Change in New York State (ClimAid)** (<http://www.nyserderda.ny.gov/climaid>). Cornell faculty including Professors Art DeGaetano and David Wolfe helped coordinate the partnership with Columbia University and Hunter College to produce the report. The ClimAid report was undertaken to provide decision-makers with cutting-edge information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge.



(Above) Figure 11. Adaptation Assessment Steps, Climate Adaptation Guidebook for New York State, page 20, <http://www.nyserderda.ny.gov/Publications/Research-and-Development-Technical-Reports/Environmental-Reports/EMEP-Publications/-/media/Files/Publications/Research/Environmental/EMEP/climaid/ClimAID-Annex-II.ashx>.

The ClimAid report includes a useful tool for campus engagement, the **Climate Adaptation Guidebook for New York State**, which outlines a methodology for local and regional planning. The Guidebook and a similar model developed at Dalhousie University in Canada, provide a roadmap for Cornell to create a customized climate adaptation plan for campus.

Cornell's actions to mitigate climate change-related hazards will have widespread impacts across Tompkins County. Cornell University is the largest private land owner and employer in the county, and approximately 60,000 people live or work on Cornell property or adjacent to Cornell properties. Based on cost estimates from the **Tompkins County All Hazard Mitigation Plan** (<http://tompkinscountyny.gov/files/planning/HazMitRpt/Tompkins%20County%20HMP%20Final%20Draft%20-%20July%202013%20-%20ALL.pdf>), Cornell could experience significant capital losses and health related costs in the range of \$10,000 to \$10M per event from predicted increases in severe droughts, flash floods, heat waves, and disruptions to water filtration systems as a result of climate change. If climate adaptation planning can help the University to anticipate and mitigate just 10% of these losses, savings could range from \$1,000 to \$1M per event – or more.

The Tompkins County Hazard Mitigation Plan was updated in 2013 to reflect the increased understanding that climate change-related hazards needed to be specifically addressed. In the 2013 update the county's top three highest rated hazards identified using the Health Industry Representatives Association (HIRA) risk assessment process were: **1)** transportation accident, **2)** severe storm, and **3)** flash flood. Additionally the plan emphasized that the county should to prepare for the following impacts over the next 65 years:

- Heat waves will become more frequent and intense, increasing heat-related illness and death and posing new challenges to the energy system, air quality, and agriculture.
- Summer drought is projected to increase, affecting water supply, agriculture, ecosystems, and energy production.
- Heavy downpours are increasing and are projected to increase further. These can lead to flooding and related impacts on water quality, infrastructure, and agriculture.
- Major changes to ecosystems, including species range shifts, population crashes, and other sudden transformations, could have wide-ranging impacts, not only for natural systems but also for health, agriculture, and other sectors.

The County mitigation plan names Cornell as a partner in several key actions to mitigate the damage of climate change, including:

- Developing regulations to prohibit future building in flood-prone areas as well as creating incentives to encourage property owners to protect and improve streams and buffers. This should include improving gorge safety and carefully designed and maintained trails within these buffer areas.
- Developing and publicizing a heat response plan which includes the use of cooling centers.
- Working with the scientific community to update and refine regional climate projections/impacts and utilizing this information in planning and management.

### Next Steps

- Develop a Cornell climate adaptation working group.
- Evaluate the existing methodologies presented by ClimAid and Dalhousie University.
- Adopt a framework for climate adaptation planning.
- Administer a vulnerabilities survey of the campus community and develop prioritized actions based on identified vulnerabilities.

### Resources

The success of this effort will require support and involvement from Cornell EH&S, Tompkins County planning staff, and Cornell faculty to develop a robust assessment process. Funding will be required to conduct a vulnerability study.

In the next two years faculty, staff, and local partners can utilize existing adaptation planning tools and processes to better prepare for the impacts of a changing climate. Scenario-based vulnerability assessments involving the campus community can be used to evaluate the need for smarter, more resilient infrastructure to withstand extreme weather events and increased flood risks.

### 3. Work to ensure that climate literacy and sustainability are part of the curriculum and educational experience at Cornell.

**Goal:** Build climate literacy in the campus community through curricular and extra-curricular programs for students and professional development programs for faculty and staff.

Climate literacy is understanding how human society influences the climate and how the climate influences human society – and it is fundamental to meaningful climate action on campus and in the world beyond. This **Key Action** involves the development and implementation of educational programs for students, faculty, and staff to be integrated with freshman orientation, undergraduate club leadership development, residential life, and professional development trainings.

In 2007 CALS Communications Professor Katherine McCommas began surveying students and staff on their attitudes, behaviors, and knowledge relating to climate change. Her research determined that an overwhelming majority of undergraduate students, almost 85%, agree or strongly agree that global warming is a serious problem. A similar majority of students recognized the processes contributing to global warming and believe that human activities, especially the emission of greenhouse gases, contribute to global warming. The full report is available at <https://stars.aashe.org/media/secure/270/2/22/389/Carbon%20Neutral%20Survey%20Report.pdf>. A separate series of surveys were administered in 2010 and 2012 that focused more on knowledge and attitudes related to energy conservation actions. The full report is available at <http://cuaes.cornell.edu/cals/cuaes/sustainability/loader.cfm?csModule=security/getfile&PageID=1087236>. Follow-up surveys of Cornell students and employees will be necessary to determine the ongoing success of campus climate literacy initiatives.

Currently Cornell offers more than 40 courses that cover the science and implications of climate change from various departments on campus. The **Climate Change Minor** (<http://www.geo.cornell.edu/eas/PeoplePlaces/Faculty/mahowald/Climate%20Change%20Minor/>) administered by the Department of Earth and Atmospheric Sciences is available to undergraduate students from any college at Cornell. A **new website** (<http://climatechange.cornell.edu/students-courses/>) for students lists climate change courses, student initiatives, and programs.

The **EcoReps program** (<http://www.sustainablecampus.cornell.edu/initiatives/student-ecoreps>) was launched in 2012 to help engage students in campus sustainability efforts through educational programs and positive role modeling. Over 60 students serve as EcoReps – or sustainable living peer educators – during freshman orientation and in freshman residence halls on North Campus. The majority of EcoReps also participate in a 3-credit service learning capstone course that focuses on sustainable living concepts, peer education methods, social marketing strategies, and the psychology of behavior change.

#### Next Steps

- Promote the Climate Change Minor and advocate for expansion of sustainability related courses with the support of the Vice Provost for Undergraduate Education.
- Reach out to students at freshman orientation and throughout the year to inform them about climate issues and publicize opportunities to take action through the EcoReps program.
- Provide leadership development training for staff and graduate students in college buildings through the Green Ambassadors, Green Office Certification, and Green Lab Certification programs. In 2014 these programs will be expanded university wide.
- Develop and implement climate change and climate action staff development trainings related to the recent inclusion of sustainability as an overarching principle in Cornell's "Skills for Success" matrix.
- Develop tools and strategies to assess the climate literacy of incoming freshman, graduating seniors, and university staff.
- Evaluate the success of educational programs and make ongoing adjustments, as needed.

#### Resources

Secure support from senior administration and ongoing funding for current campus climate literacy programs, including "Think Big, Live Green," EcoReps, student leadership development, and Green Offices and Labs.

Looking beyond the classroom, Cornell students, faculty, and staff are applying the principles of sustainability to solve real-world problems. These efforts directly benefit the Cornell community, as well as people in communities around the globe. Recent examples of experiential learning both on and off-campus include:

- Energy Corps efforts to replace incandescent light bulbs across campus with more efficient LED and CFL bulbs are projected to yield \$245,539 in savings over the next seven years.
- CU Compost Club is currently conducting a fundraising campaign to install a compost bin to serve residents of Collegetown.
- Sustainability Internship Program students have tackled projects throughout Tompkins County to address energy planning, wood smoke assessment, waste reduction, greening operations, and wetlands development, among others.
- Cornell University Sustainable Design's (CUSD) Schoolhouse South Africa project is an award-winning design-build project focusing on resilient design and collaboration.
- Cornell faculty and students are creating sustainable micro-energy systems for cooperative agriculture projects on Hawai'i Island.
- Educational videos by Cornell staff, faculty, and students are helping to share climate change information and inspiring action. View recent video projects at the following links:
  - **Professional Climate Action Plan Educational Video:**  
<http://www.cornell.edu/video/sustainable-cornell-making-climate-neutrality-a-reality>
  - **Student-made Climate Action Plan Video:**  
<http://www.youtube.com/watch?v=kBFXDxTjwig>
  - **Over 30 climate change educational videos by faculty:**  
<http://www.cornell.edu/video/topic/climate%20change>

For a more comprehensive list of Cornell's sustainability outreach programs, visit: [http://www.cornell.edu/outreach/programs/search\\_results.cfm?SearchTerms=sustainability&FormAction=Search&SearchTermsChanged=Y](http://www.cornell.edu/outreach/programs/search_results.cfm?SearchTerms=sustainability&FormAction=Search&SearchTermsChanged=Y).

**LEADERSHIP:** Lead by example on campus and exercise climate leadership beyond campus.

#### 4. Establish a university-wide Carbon Neutral Travel Policy that fosters zero-footprint travel through purchase of carbon offsets.

**Goal:** University-funded air travel and individual commuting emitted roughly 59,000 tons of carbon into the atmosphere in 2012, a nearly 10% increase since the Climate Action Plan was initiated and the only emission category that did not improve. Cornell's commitment to climate neutrality cannot be achieved without some offsetting actions to mitigate these travel related emissions. Putting a price on GHG emissions via carbon offsets is an effective strategy to raise awareness about travel-related emissions and presents an excellent opportunity to invest in high impact local sustainability initiatives.

The Climate Team recommends instituting a Carbon Neutral Travel Policy encouraging purchase of local offsets. A draft policy is currently being reviewed by senior administration for further refinement and endorsement. The Climate Team is also partnering with the Study Abroad, Campus to Campus Bus, Business Procurement, and other departments that generate significant university related travel, to develop and integrate carbon offsets within their operations.

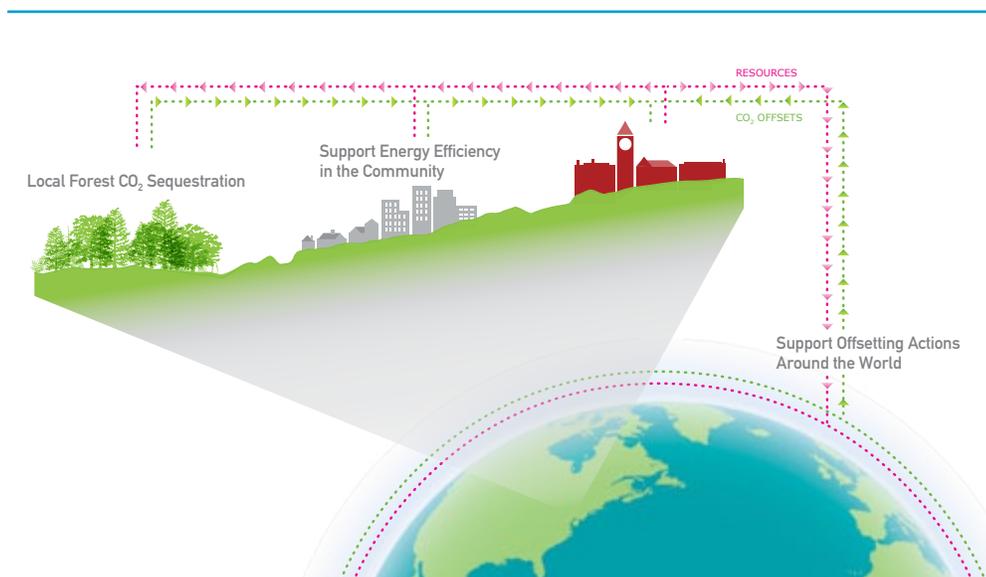
The **Finger Lakes Climate Fund** ([www.fingerlakesclimatefund.org](http://www.fingerlakesclimatefund.org)) (FLCF) is a local carbon offset program intended to promote greenhouse gas emission reductions in the Finger Lakes region. Though the current capacity of the FLCF cannot accommodate all of the university's unavoidable travel-related emissions, a partnership with FLCF presents an excellent opportunity to invest in a local sustainability initiative that is aligned with the university's mission. High impact carbon offsets can be purchased locally through FLCF for as little as \$3 per trip. Donations are used to fund energy efficiency projects for low to moderate income households in our region. FLCF grants help these households pay for insulation, air sealing, energy efficient heating equipment, and other upgrades to reduce energy use and greenhouse gas emissions. A typical FLCF energy efficiency project yields a saving of ~100 tons CO<sub>2</sub> per year – an amount equivalent to the carbon sequestration provided by 82 acres of forest or to the annual emissions of 20 passenger vehicles. A partnership with FLCF could result in community based carbon offsets of 300-500 tons per year.

#### Next Steps

- Promote a voluntary program for employees to offset their carbon generated from daily commuting via FLCF. Add offsetting links to existing travel procurement and employee commuting websites.
- Integrate offsetting options within the Campus to Campus Bus online reservation process.
- Design and implement a Study Abroad student travel offset program.
- Establish a university wide Carbon Neutral Travel Policy encouraging reduced business travel when possible and purchase of offsets when travel is unavoidable.

#### Resources

In order to properly account for carbon offsets purchased through FLCF, collect and transmit accurate travel data to FLCF and obtain third-party verified "certificates" or other proof of offsets purchased.



## 5. Collaborate in local, regional, state, national, and international planning efforts to address challenges posed by climate change and to increase resiliency.

**Goal:** Actively partner in local, regional, state, and larger-scale climate planning.

By **executive order** (<http://www.dec.ny.gov/energy/80930.html>) of the Governor, New York State has set a goal to reduce greenhouse gas emissions by 80% below the levels emitted in 1990 by the year 2050. As New York's land grant university, Cornell is committed to engaging the public in climate and energy solutions. Cornell Cooperative Extension offices in counties across New York State support renewable energy and energy efficiency planning and implementation among local governments, businesses, and directly with homeowners. For an overview of Cooperative Extension's climate and energy initiatives, visit <http://www.cce.cornell.edu/EnergyClimateChange/Pages/default.aspx>.

Cornell University is a significant stakeholder in the City of Ithaca, the Town of Ithaca, Tompkins County, and the six-county Southern Tier region, and Cornell has been an active participant in both climate and energy related planning processes and collaborative organizations within each of these jurisdictions. Cornell staff are currently engaged with the [City of Ithaca's Energy Action Plan](#), the [Climate Smart -Climate Ready](#) conference, the [Town of Ithaca Energy Action Plan](#), the [Tompkins County Planning Department](#), the [Tompkins County Hazard Mitigation Plan](#), the [Tompkins County Climate Protection Initiative](#), and the [Cleaner Greener Southern Tier initiative](#).

Cornell graduate students have provided research and expertise to assist with several recent county-wide climate and energy initiatives. Recent reports prepared by Cornell graduate students include the following:

- [Assessment of Locally Sourced Biomass Energy for Residential Thermal Demand](#)
- [Geothermal Energy Potential in Tompkins County](#)
- [Energy Supply and Demand in Tompkins County](#)
  - [Energy Supply and Demand in Tompkins County \(PPT\)](#)
- [Wind: A Technical Analysis of Wind Power Potential in Tompkins County](#)
  - [Wind Power Potential in Tompkins County \(PPT\)](#)
- [Solar: Solar Energy Generation Potential of Tompkins County](#)
  - [Solar Power Potential in Tompkins County \(PPT\)](#)
- [Biomass: Tompkins County Energy Road Map](#)
  - [Biomass Power Potential in Tompkins County \(PPT\)](#)

To ensure ongoing coordination between Cornell's Climate Action Plan and these numerous planning efforts will require that knowledgeable University staff actively participate. During 2014 and 2015, emphasis will be placed on participation in the **Tompkins County Comprehensive Plan Update** (<http://www.tompkinscountyny.gov/compplan/news>) and on collaboration with the county-wide education campaign, **Get Your Green Back** (<http://getyour-greenbacktompkins.org/>). The Campus Sustainability Office and the Cornell Center for Engaged Learning and Research will also explore opportunities to increase student and faculty participation in these regional initiatives.

### Next Steps

- Actively participate in the Tompkins County Comprehensive Plan Update in 2014 with a focus on community sustainability and climate change adaptation.
- Identify and support collaborative funding proposals to NYSERDA, other state agencies, and private foundations to support campus-community climate and energy programs.
- Encourage faculty and students to develop academic connections (research and course) to regional planning initiatives.

### Resources

Secure administrative support for staff time to be dedicated to community and regional planning efforts.

## 6. Participate actively in climate literacy outreach to ensure that the broader community receives Cornell's assistance in making critical decisions for a sustainable future.

**Goal:** As the 2013 **IPCC (Intergovernmental Panel on Climate Change) report** (<http://www.ipcc.ch/report/ar5/wg1/#.UknR9mXD-Uk>) makes clear, the option of “business-as-usual” is no longer acceptable. Continued growth in greenhouse gases poses a clear and present danger to the Cornell community, our nation, and the world. The climate change challenge is understood by some but not all, and a sense of urgency needs to be conveyed in order to motivate long-term behavior change.

As New York's land grant university, Cornell and the Cornell Cooperative Extension (CCE) system provide research-based education, resources, and tools to help individuals, families, and communities make better decisions to mitigate and adapt to climate change. Current education and outreach efforts to New Yorkers are guided by several interdisciplinary efforts:

- 1) The Atkinson Center for a Sustainable Future's Climate Change Program Focus Group (CCFG) consists of 17 interdisciplinary faculty members from departments across campus, which provide a focal point for campus climate change activities and information, including teaching and outreach efforts.
- 2) Cornell's Climate Change Program Work Team (PWT) is comprised of over sixty Cornell faculty, staff, CCE educators and stakeholders from around New York State who are working to share information on climate change research and funding opportunities, develop new educational materials and outreach programs for the public, and incorporate climate change into existing outreach programs, including train the trainer efforts. Faculty and CCE educators regularly provide climate change presentations to community groups and key stakeholders, such as the Farm Bureau, Soil and Water Conservation Districts, local county legislatures and municipal boards, and climate change materials at events such as Empire Farm Days and the NYS Fair. Two concrete examples are:
  - a) Climate change training provided to New York State Master Gardener Volunteer (MGV) Programs through Cornell Cooperative extension. The NYS Master Gardener Volunteer Coordinator organized an October 2013 conference for CCE educators and Master Gardener Volunteers on “Gardening in a Changing Climate.” Additional materials will be developed to help support MGVs as they work to educate New York's gardeners about climate change (<http://www.gardening.cornell.edu/>).
  - b) USDA-funded Animal Agriculture and Climate Change Program. This is a national extension project, with the Northeast region led by Cornell University. An online train-the-trainer course on climate change was developed for extension educators, who can then provide information to livestock producers on issues such as heat stress in dairy and extreme weather events.
- 3) The Institute for Climate Change and Agriculture (ICCA) at Cornell University was established in 2013 to facilitate research, education, and outreach to reduce the agricultural sector's collective impact on the

### Next Steps

- Continue to provide research-based climate change tools and resources through the [climatechange.cornell.edu](http://climatechange.cornell.edu) website.
- Provide training and resources for CCE Educators to educate New Yorkers, in order to extend the scope of the outreach effort.
- Work with the Institute of Climate Change and Agriculture to review the concept of creating and strengthening a network for climate change to allow researchers to broadcast new information quickly and to enable farmers and natural resource managers to share their adaptation strategies. The development of this network may involve university and public/private partnerships.

### Resources

Build partnerships with state and federal agencies, associations, and NGOs, through the Institute for Climate Change and Agriculture and the Atkinson Center.

climate and help farmers to become more resilient to climate change. The ICCA will serve as an interactive clearinghouse of information about climate change impacts on agriculture for farmers, researchers, decision-makers, officials, and the public. The Institute will also foster collaborations and seek to increase funding to address needs related to climate change and agriculture; assess farm-level impacts, knowledge gaps, and needs around warming trends and more extreme weather; promote the development of policies and decision-tools for farmers; and provide clear, research-based educational tools and outreach about climate change and agriculture to help encourage adoption of climate change adaptation or mitigation measures.

- 4) The [www.climatechange.cornell.edu](http://www.climatechange.cornell.edu) website provides a comprehensive, interdisciplinary gateway to climate change initiatives, research, student courses and organizations, events, and public engagement at Cornell. The site provides specific tools and resources that have been developed for farmers, natural resource managers, communities, youth educators, and the general public to understand the fundamentals of climate change science. The website also provides an interactive forum for the public to ask relevant questions about climate change science or its effects in the Northeast, and a “what’s with the weather” explanation of recent extreme weather events.

The premise of all of these outreach efforts is that greater awareness will lead to long-term behavior change both within the Cornell community and among key stakeholders across New York State. A short- to medium-term goal is that climate change concepts will be incorporated into two new statewide outreach programs and will reach thousands of New Yorkers through multiple community events within the next two years. Additional outreach efforts will be coordinated with the PSCC Climate Team, members of the CCFG, Climate Change PWT, and Institute for Climate Change and Agriculture.

# ENERGY

**NEUTRALITY:** Reduce Cornell's carbon emissions to net zero by the year 2050 or sooner.

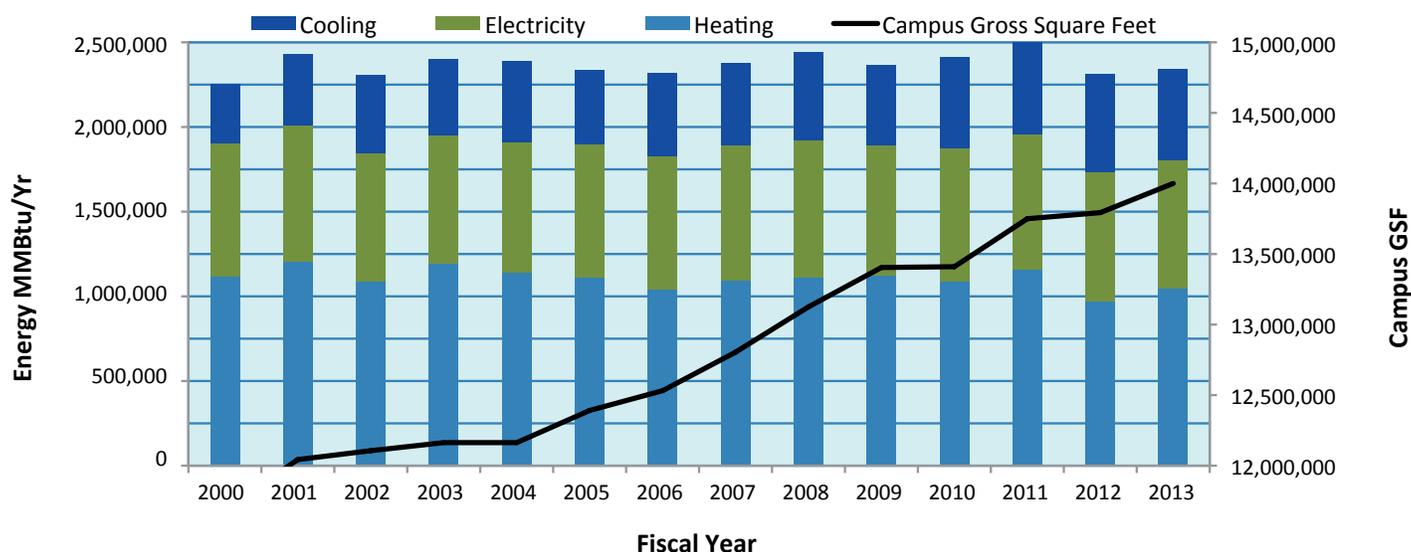
## 1. Complete Phase 1 of the Energy Conservation Initiative (ECI) and initiate Phase 2 to conserve energy in campus buildings.

**Goal:** Cornell's Energy Conservation Initiative includes retrofits, replacements, and weatherization projects in buildings across campus. ECI projects are designed to optimize the energy efficiency of building automation and control systems, heat recovery systems, and lighting systems. Additional goals include increased occupant comfort and reduced maintenance expenses. ECI Phase 1 projects are expected to reduce Ithaca Campus utility costs by over \$3 million per year by 2016. **The completion of Phase 1 and full implementation of Phase 2 of the Energy Conservation Initiative would reduce university emissions by about 11,800 metric tons (CO2 equivalent) annually – roughly 5% of the current carbon footprint.**

Building automation systems are microprocessor-based computers that monitor and control a range of building functions, including heating, ventilating, air-conditioning, refrigeration, lighting, fire and smoke alarms, utilities, elevators, access control, and intrusion detection. These systems are used in virtually every building on the Cornell campus. Dramatic and lasting conservation results can be achieved by optimizing Cornell's building automation and control systems, heat recovery systems, and lighting systems. Conservation focused preventive maintenance on these systems reduces usage and maintains performance. Wherever feasible, the latest features are cost effectively retrofitted into existing systems.

Phase 1 of the university's Energy Conservation Initiative from 2010 through 2015 allocated roughly \$33M toward projects which met the criteria for either a 7-year billed or 10-year marginal payback. 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 so forth.

## Campus Energy Use Compared to Campus Growth



To date, Phase 1 ECI projects have saved over one million dollars in energy use and enabled the university to maintain a flat energy use profile, while increasing the Ithaca campus footprint by over one million square feet of new construction.

A full-time staff of two Certified Energy Managers and a Senior Engineer/Director of Energy Management oversee the university energy management program for the central plant (supply side) and campus buildings (demand side). Completion of Phase 1 ECI projects is expected in 2015. To review completed **ECI Project Summaries** (<http://energyandsustainability.fs.cornell.edu/em/projsum/default.cfm>), please see **Appendix 4** of this report.)

The second phase of the program would stretch the payback criteria to 20 years marginal or 15 years billed – to enable further energy reductions throughout campus facilities. The Phase 2 Energy Conservation Initiative aims to reduce Cornell's marginal utility costs by \$1.5 million per year. Cornell is presently tracking seven applications submitted to the New York State Energy Research & Development Authority (NYSERDA) New Construction Program to extend the ECI program and help fund the \$12M cost of Phase 2 projects.

### Next Steps

- Complete Phase 1 ECI projects, including weather corrected regression analysis of energy savings from all projects by FY16.
- Develop a timeline for conducting building energy studies to guide Phase 2 energy conservation projects.
- Initiate and complete energy studies on approximately 10% of campus buildings each year.
- Based on the results of the studies, develop a list of program priorities.

### Resources

Meet with colleges and units to develop funding plans and continue to seek external funding, including NYSERDA rebates, for Phase 2 ECI projects.

## 2. Optimize the campus Heat Distribution System to increase efficiency and cost-effectiveness and to facilitate the integration of Cornell's future energy sources.

**Goal:** Cornell currently owns and operates over 60,000 feet of underground steam, condensate, and hot water lines to provide heat to the Ithaca campus. Approximately 15% of the metered heat energy produced at the Central Energy Plant is currently lost in the distribution system. Optimizing the campus heat distribution system could potentially cut those losses by more than half, increase reliability and flexibility to accommodate alternate heat sources, and **reduce the university's GHG emissions by about 6,500 metric tons (CO2 equivalent) or about 3% of the current carbon footprint.**

The campus Heat Distribution System has not been optimized for efficiency or operations, and the deferred maintenance backlog is increasing. The existing system is also not optimized for the integration of future renewable resources, such as geothermal or solar thermal energy. A planning study will evaluate the current system and provide specific and quantified recommendations for prioritizing of future improvements to optimize efficiency and alternative energy integration. The study will focus on prioritizing future capital work to reduce overall operating and maintenance costs, including energy, maintenance, and repair expenses. Optimizing the campus Heat Distribution System should reduce future energy costs, resulting in lower utility rates for customers.

### Next Steps

- Perform an in-house study to prioritize and determine near-term requirements for steam line renewal and maintenance to increase reliability and efficiency.
- As part of Energy Action 4 Enhanced Geothermal System (EGS), study the optimum heat distribution system for a single well pair demonstration project to serve one zone of campus.

### Resources

The core knowledge for this task resides within Energy & Sustainability and Facilities Engineering Departments at Cornell. Outside support will be needed to assist with the EGS study.

### UPGRADED PIPE Negligible Losses

R-16 Insulation  
Saves 13,600 mmBTU/yr

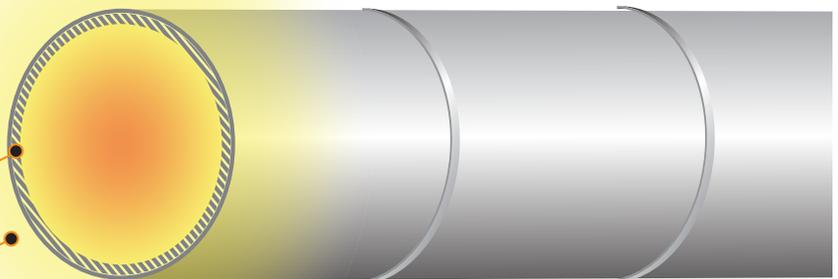
High Thermal Distribution Efficiency



### OLDER PIPE 8-12% Losses

R-2 Insulation

Heat Loss  
340 BTU/hr/Linear Foot



### 3. Capitalize on more than 50 campus waste streams and other university-owned biomass resources to generate renewable energy through CURBI (CU Renewable Bioenergy Initiative).

**Goal:** Cornell University’s Renewable Bioenergy Initiative (CURBI) is a research and demonstration platform for bio-fuel research. While the carbon reduction potential of CURBI research and demonstration is relatively small, CURBI can help identify larger-scale agriculture-based opportunities to produce bioenergy that could significantly offset traditional energy sources. Biomass could be turned into biogas to fuel Cornell’s combined heat and power systems, and heat generated through CURBI could be used to heat campus greenhouses and other energy-intensive facilities. **Although the exact combination and utilization of energy conversion technologies is yet to be determined, CURBI at demonstration scale has a carbon reduction potential of about 3,000 metric tons (CO2 equivalent) per year or about 1% of the current carbon footprint.**

CURBI is a scalable research and demonstration platform which can support a number of different technologies. These technologies may be simultaneously employed and will likely alter as the focus of research changes over time. A feasibility study for the CURBI concept was completed in January 2010 with support from the New York State Energy Research and Development Authority (NYSERDA). The feasibility study evaluated several options, including direct combustion, anaerobic digestion, and pyrolysis/gasification as potentially “stackable” technologies, meaning that waste products from one system could be used as feed stocks (or inputs) for another system.

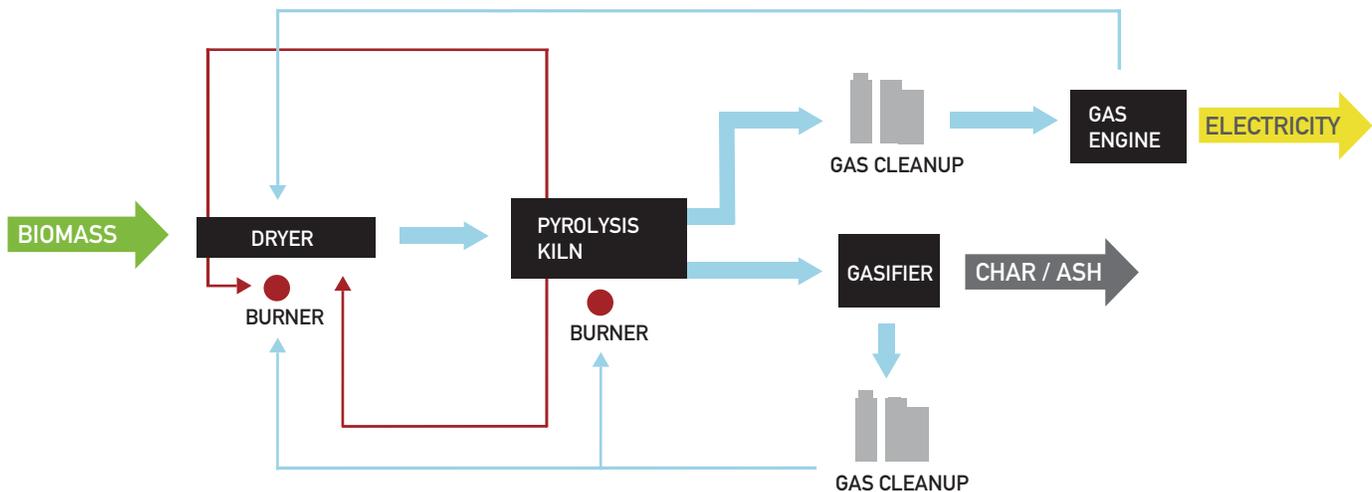
The Cornell University Agricultural Experiment Station (CU AES) currently manages most of the bio-energy resources for the Ithaca campus. CU AES administration and farm support staff stand ready to support CURBI, and the necessary biomass is readily available and includes manure, food wastes, woody and agronomic (bio-energy) crops. CURBI could have substantial positive impacts on the local agricultural economy and communities, if the research and demonstration projects conducted through the project result in the successful commercialization of specific technologies.

#### Next Steps

- Revise the 2010 project plan for the design and construction of a flexible work platform to support CURBI initiatives, similar to the facility recommended in the feasibility study. Without such a facility to house and facilitate research, there are limited opportunities to obtain grants for specific research. Conversely, a functional research platform would provide numerous diverse research and development opportunities for campus.
- Study and develop financial metrics for a small-scale digester at Harford or the on-campus dairy.

#### Resources

Cost estimates for the CURBI initiative as presented in the feasibility study are about \$12M, but the basic research platform would likely be more in the \$6M range. Grant funding is available to help pay a significant share of the technology costs once the supporting structure and systems are in place.



#### 4. Eliminate fossil fuel combustion for heating campus by developing an Enhanced Geothermal System (EGS) hybridized with biogas. Prepare a preliminary design and phased implementation plan and build a demonstration project.

**Goal:** Build a demonstration project and assess the feasibility of installing a full-scale project that would allow Cornell to substantially heat and cool the campus using only natural, renewable resources and stored heat energy from the earth. **Completely realized, this hybrid innovation could provide for over 82,000 metric tons (CO2 equivalent) of average annual carbon abatement – more than 38% of the university’s current carbon footprint.**

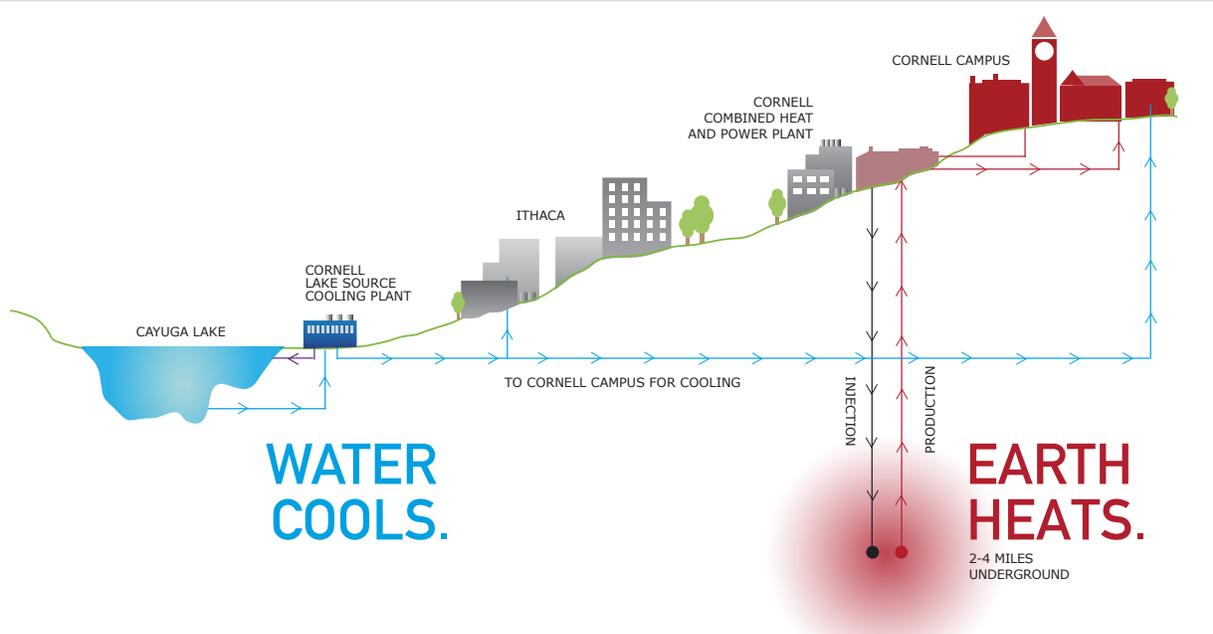
EGS is an emerging technology that utilizes heat energy available deep beneath the earth’s surface to generate heating and electricity via distribution equipment located at the surface. Cornell’s Hybrid Enhanced Geothermal System (HEGS) is a combination of two innovative, demonstration-scale research projects: Engineered Geothermal Systems (EGS) and Bio-Mass Gasification. The hybrid system would link the EGS to a biomass-to-biogas system scaled up from CURBI (See Energy Action 3). During very cold weather when EGS alone is not enough, the biogas would be used to supply the additional electricity and heating needs of campus.

#### Next Steps

- Work with development professionals at the university to actively seek public and private funding for this project, using recent analyses conducted by the Cornell Energy Institute.
- Study, conceptually design, and develop financial metrics for a small-scale demonstration project to include a single well pair, heat exchange facilities, and interconnection for target areas on North Campus and East Campus.
- Complete a Full Environmental Assessment Form (FEAF) to document the project’s potential environmental, social, and economic impacts.
- Draft a white paper that documents the steps needed over the next decade to bring the full-scale project to fruition.

#### Resources

Recent cost estimates are \$19 million for a demonstration system consisting of a single well pair, and \$40M for a full-scale project which includes one well pair and heat extraction/delivery systems, tie into the campus distribution system, and two years of operations. This system could supply 25% of energy for campus.



## 5. Support the expansion of regional wind generation capacity and integrate wind power into Cornell's renewable energy portfolio.

**Goal:** Support the expansion of regional wind power generation capacity through procuring energy for university facilities from external projects and through construction of dedicated facilities. This action will increase renewable generation capacity in our region and the overall renewable energy portfolio of New York State, as well as enabling Cornell to expand research and teaching opportunities around wind power. **Full-scale implementation of this action, including power purchased from external projects and power produced by Cornell wind facilities, could provide 11,900 metric tons (CO<sub>2</sub> equivalent) of average annual carbon abatement – or roughly 5% of the current carbon footprint.**

Wind power is among the most cost effective, large-scale renewable energy sources currently available. Cornell is actively investigating opportunities to harness wind power for education, research, demonstration scale projects, and full-scale utilization to provide power for the university.

Since wind energy generation is variable (produced only when the wind blows), Cornell will implement strategies to reconcile seasonality and variability in wind with campus needs. During the winter months, all of the energy needs of the Ithaca Campus are currently met through on-campus production at the Central Energy Plant. Cornell purchases the majority of its grid power in the summer. Yet adequate storage, transmission, and “back up” electricity is needed to ensure sufficient and reliable electricity is provided for campus at all times. Large-scale wind energy will produce more power during the winter months, so some mechanism for balancing Cornell's energy demands with wind energy production is needed.

The **Black Oak Wind Farm** (BOWF) (<http://www.blackoakwindny.com/>) serves as a recent example of Cornell's commitment to work with the local community to encourage the development of renewable energy. Upon completion in 2015, BOWF is projected to produce about 42 million kWh per year. Cornell is working with the BOWF leadership team in an effort to negotiate a reasonable power purchase contract. Large-scale renewable energy typically requires a long term power purchase contract to secure the private equity financing that is critical to project success.

Cornell researchers and economists continue to work with small towns, land owners, and rural communities throughout our region to explore and evaluate wind power opportunities. Recent technological advances have decreased the generating cost per kilowatt hour from many times grid prices to nearly equal to grid prices after subsidies, making wind energy one of the few economically viable alternatives ready for large-scale adoption. There can be significant economic advantages for communities that have favorable wind sites near electric grids; landowners receive lease payments and royalties from wind generators, while the energy generated creates profits for companies and revenues for local governments.

### Next Steps

- Complete a market analysis of external renewable projects, including wind, solar, geothermal, and biogas. Based on the results of the market analysis, determine if a demonstration-scale wind project on Hungerford Hill and/or other renewable energy projects should be pursued.
- Determine the extent of Cornell's involvement with Black Oak Wind Farm.

### Resources

Funding has been identified to pay a consultant to assess Cornell's load profile, develop Cornell-specific decision making criteria, and complete a market analysis.

In one New York town, wind-energy revenues account for 30 percent of the local school budget. Cornell Cooperative Extension has described the positive impact in the Maple Ridge project in Lewis County, which now has close to 300 commercial-style wind generators, includes a widely distributed and discussed publication: **Wind Energy Development in New York State: Issues for Landowners** ([http://ageconsearch.umn.edu/bitstream/122033/2/Cornell\\_AEM\\_eb0504.pdf](http://ageconsearch.umn.edu/bitstream/122033/2/Cornell_AEM_eb0504.pdf), Brian Henehan, Applied Economics and Management; Deborah Grantham, Natural Resources)

## 6. Integrate solar power into Cornell's renewable energy portfolio by building or buying into solar photovoltaic energy systems.

**Goal:** New York State has identified solar photovoltaic energy as a critical renewable resource, and Cornell will seek to increase the solar photovoltaic electricity supply for campus. Opportunities for deploying this technology using State tax incentives and subsidy programs are expected to continue – making solar projects an economically viable option for the University. Cornell's first solar PV project, the Snyder Road Solar Farm, consisting of a 2MW array on eleven acres of Cornell property in the Town of Lansing, is slated for completion in 2014 and is expected to reduce the university's annual GHG emissions by 625 metric tons per year. Additional GHG reductions can be achieved as new projects are identified and completed.

The Snyder Road Solar Farm is expected to produce 2.5 million kilowatt-hours annually – about 1 percent of Cornell's total electricity use, the equivalent electricity to power about 320 homes for a year. The project includes ten solar panels and an inverter which will be dedicated to academic research. These panels will be installed on a "tilt" racking system which allows for adjustment to facilitate research studies, and they will be available for Cornell sponsored research and teaching projects as well as for collaborative projects with local community K-12 schools, colleges and their students. Tours of the solar facility will also be offered. Cornell is partnering with a private developer, Distributed Sun LLC, to implement this project. Learn more at:

<http://www.sustainablecampus.cornell.edu/initiatives/solar-power>.

In the process of securing approvals to construct its first solar project, Cornell filed a petition with the NYS Public Service Commission (PSC) seeking clarification on how "remote net metering" rules had to be applied by electric distribution companies. Remote net metering allows an entity to build a renewable energy project (e.g. solar, wind, etc.) where it has space that is well-suited for this purpose, and to credit the energy value generated by the project towards consumption of energy at another location. The PSC ruled that utilities must credit electricity at the same rate they charge for electricity at a particular location, that the customer does not have to have an account at that particular location prior to the installation of the renewable energy project, and that there is no minimum electrical load required. The PSC ruling was extended to apply to all utilities and types of renewable generation projects throughout New York State. This ruling resulting from Cornell's efforts means that there are now many more options for siting renewable projects at locations with electricity rates that make such projects economically feasible. See the **Cornell University, Declaratory Ruling on Minimum Load Requirements for Remote Net Metering** (<http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={4FE3D755-C41F-4607-AA8F-058A631C5B0D}>) for more details.

Under current regulatory limits, Cornell has the capacity to utilize the electricity from 3 to 5 additional remote-net-metered renewable energy projects, which could include solar, wind, hydro, etc. If all these projects come to fruition, they would produce a minimum of 10-15 million kWh, or 6% of Cornell's total electricity use. At this time, large (~2MW) off-campus installations that take advantage of the PSC ruling on remote net metering offer Cornell the best opportunity for increasing its renewable energy portfolio.

### Next Steps

- Implement a solar PV project at Snyder Road.
- Cornell Energy and Sustainability and Facilities Engineering will partner with Cornell University Sustainable Design, a student led analysis and design team, to conduct a Solar Potential Inventory and Analysis to evaluate roofs on campus. The analysis will be used to develop a ranked list of sites so that solar installations can be considered when roofs are replaced, and/or when funding/innovative ownership opportunities become available. This analysis will help quantify how much solar energy is possible on campus, which will in turn inform Cornell's long-term renewable energy strategy.
- Identify the next project and funding opportunities.

### Resources

- Obtain support and approval from the unit that has stewardship responsibility for potential project locations, since encumbering a rooftop or land parcel for solar energy production is a long-term commitment that must be weighed against other potential uses and maintenance needs.
- Meet economic criteria for internal approval of renewable energy projects. Currently solar energy projects require subsidies (NYSERDA grants, tax benefits, donations, etc.) to bring their costs on par with grid electricity.

Other small solar installations are in process or proposed for buildings across campus. These include a research array on the roof of Snee Hall, a 30 kW installation on the roof of Klarman Hall, and a third-party owned array of up to 100 kW on the roof of the new Gannett Health Services renovation and expansion project.

The recently released **Southern Tier Regional Sustainability Plan** developed in coordination with the Regional Economic Development Councils calls out solar as a priority initiative. The Cleaner Greener Plan suggests that solar can produce 2% of total electricity in our region, with a doubling of capacity every four years. (See [http://assets.metroquest.com/img/cgst/CGST\\_Regional\\_Sustainability\\_Plan\\_FINAL\\_5\\_22\\_13.pdf](http://assets.metroquest.com/img/cgst/CGST_Regional_Sustainability_Plan_FINAL_5_22_13.pdf) p. 21)

## 7. Optimize the operation of the existing steam turbine generators to improve the efficiency of the campus Central Energy Plant.

**Goal:** Investigate methods of reducing energy losses when Turbine Generator 1 (TG-1) is not operating (during most of the year), and consult with the manufacturer on possible upgrades to increase the operating efficiency of TG-1 during times of peak steam demand in the winter.

The Cornell co-generation facility consists of two back pressure steam turbine generators, TG-1 and TG-2. The turbines' main function is to reduce the steam pressure going out to campus from approximately 400 psi to 30-60 psi. Since 2012, TG-2, which is a larger and more efficient unit than TG-1, has been run continuously all year, and TG-1 has only been run during times of peak steam demand in the winter. TG-2 was overhauled in the summer of 2010 to improve efficiency through redesigning the turbine blades and changing the steam path through the turbine. It may be possible to make similar upgrades to increase the operating efficiency of TG-1, as well as to reduce energy losses from TG-1 during the vast majority of the year when it is not being utilized.

### Next Steps

- Investigate methods of reducing energy losses when TG 1 is not operating, for example a dry layup.
- Consult with the turbine manufacturer (Dresser Rand) regarding possible upgrades and their impacts on steam consumption and electrical generation.
- If any upgrades to TG 1 or TG-2 are found to be economically beneficial, place the turbine upgrade project in the 5-year capital plan.

### Resources

The proposed changes must be economically beneficial and receive funding in the capital plan.

## 8. Complete upgrades to the existing hydroelectric plant to optimize electric generation.

**Goal:** Upgrade Cornell's existing hydroelectric plant to optimize electric generation. When completed, plant upgrades are expected to increase electric production by 1 million kWh per year and reduce greenhouse gas emissions by 450-600 metric tons per year.

Fall Creek has played an important role in Cornell's history since Ezra Cornell first arrived in Ithaca in spring 1828. According to The Ezra Cornell Bicentennial Exhibition, "Ithaca in the 1820s was a growing community. Water from the creeks powered lumber, flour, plaster, paper, cotton, and woolen mills... Cornell first found work as a carpenter, before being hired as a mechanic by Otis Eddy to work at his cotton mill on Cascadilla Creek. On Eddy's recommendation, Jeremiah S. Beebe then hired Cornell to repair and overhaul his plaster and flour mills on Fall Creek. During Cornell's long association with Beebe, he designed and built a tunnel for a new mill race on Fall Creek; a stone dam on Fall Creek, which formed Beebe Lake; and a new flour mill. By 1832, he was in charge of all Beebe's concerns at Fall Creek." See <http://rmc.library.cornell.edu/ezra/exhibition/ithaca/> for more details.

The first electrical generation facility in Fall Creek gorge was built in the early 1880s. That plant was powered by water from a dam just above the present plant and a cable to a generator located near the Cornell Foundry. In 1904, the plant was built in its present site under the Suspension Bridge.

### Next Steps

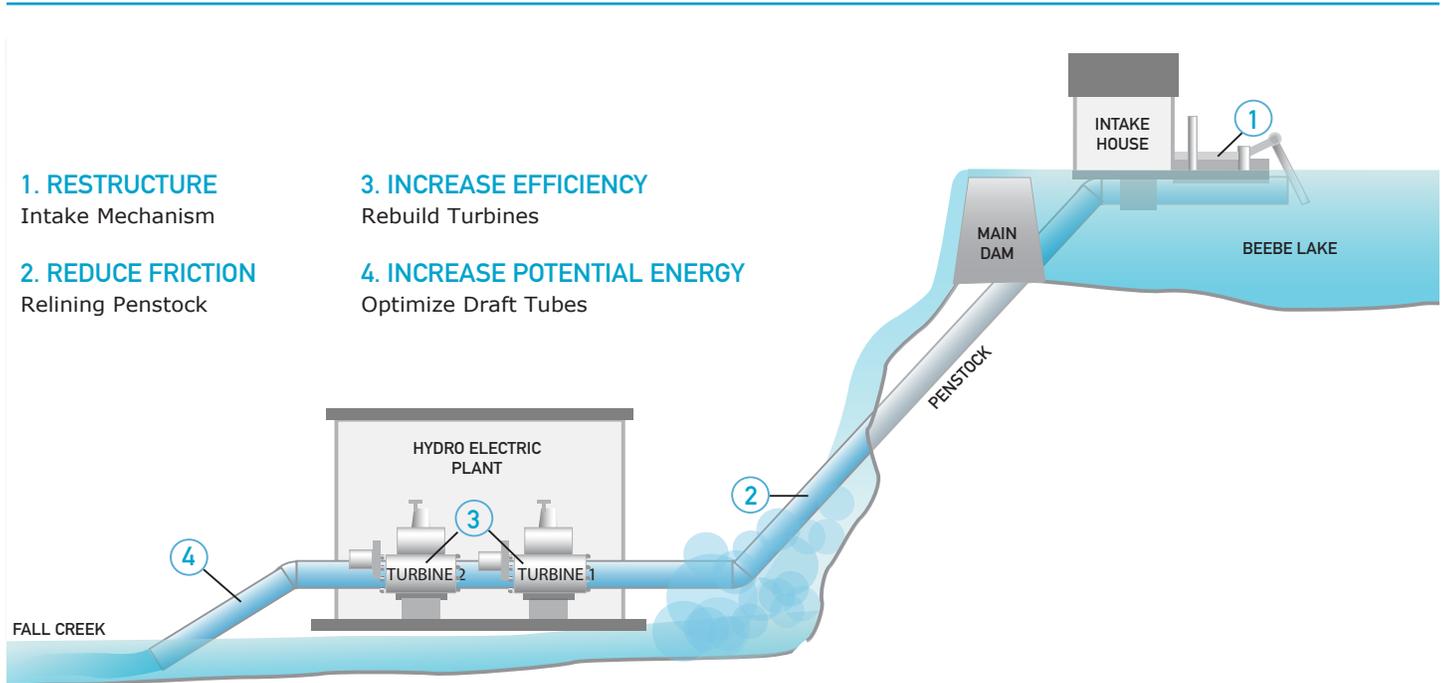
- Complete upgrades to the first turbine in Fall/Winter 2013.
- Complete upgrades to the second turbine in Fall/Winter 2014.
- Design and rebuild the intake to reduce head losses and increase plant efficiency by 10%.
- Investigate installing a smaller, more efficient turbine for low summer flows.
- Investigate modifying the plant's Federal Energy Regulatory Commission operating license to permit partial water storage at Beebe Lake – which would enable electric generation at peak daytime hours during the summer months.
- Reline or rebuild and resize the penstock to reduce head losses at peak production times.

### Resources

Most other renewable power sources are subsidized to offset high installation costs. If hydropower customers at the University paid a premium for their hydro-electricity, the rate of payback on the investment in plant upgrades would be considerably shorter than it is currently.

Water is supplied to the plant from Beebe Lake by a five-foot diameter underground penstock, which is 1700 feet long. The water is then directed to one of two turbines, causing them to spin and drive an induction motor – thus generating electricity. Cornell’s hydroelectric plant is “run of river,” which means that no water is stored. At all times, 10 cubic feet per second of water must continue to pass over the dam. The average production for the plant is 4.5M KWh to 5.5M KWh per year depending on rainfall.

One of the 30-year-old turbines is in the process of being rebuilt and the second one is scheduled to be refurbished in Summer 2014. Other plant upgrades include the restructuring of the intake, relining of the penstock, and possible optimization of the draft tubes. When the turbine upgrade project is completed, it will allow complete remote starting of the units – which will enable Cornell to take advantage of increased flows and operate two turbines (for example, during rainfall events) to generate more power without the need for manual adjustments.



## 9. Increase the amount of hydroelectric power in Cornell's renewable energy portfolio by building or buying into hydroelectric generation facilities.

**Goal:** Support regional hydroelectric power generation through procuring energy for university facilities from external projects, and through construction of dedicated facilities. Along with Energy Action 5, wind power, and Action 6, solar power, this action will increase renewable generation capacity in our region and the overall renewable energy portfolio of New York State.

Partnering with private developers may provide opportunities for Cornell to procure long-term, cost-effective hydroelectric power – while also helping to conserve and restore historical sites and expand employment, educational, and recreational opportunities in the region. The 2013 Public Service Commission (PSC) ruling **Cornell University, Declaratory Ruling on Minimum Load Requirements for Remote Net Metering** (see Energy Action 6) created options for siting renewable projects at locations with electricity rates that make such projects economically feasible. See the **Cornell University Declaratory Ruling on Minimum Load Requirements for Remote Net Metering** (<http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={4FE3D755-C41F-4607-AA8F-058A631C5B0D}>) for more details. A petition for additional clarification from the PSC on the applicability of remote net metering to hydroelectric projects has been filed by Clarkson University (<http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B357E59DE-5513-498D-A090-17779D19DAF6%7D>). The outcome of this ruling may impact the feasibility of future external projects.

Building dedicated hydroelectric facilities is not financially feasible at present. The current cost of grid electricity is too low for the University to justify the investment required for construction.

Students with Cornell University Sustainable Design (CUSD) have identified three sites along Fall Creek for potential future hydropower generation projects. Each of the three sites could support a different kind of hydroelectric generation system. A conventional turbine-generator system could be implemented at a site in the Forest Home Neighborhood, a hydrokinetic system could be implemented upstream of the Sackett Footbridge, and a capacity extension project could be implemented at the existing Cornell hydro plant. The Cornell Hydro Plant Extension Project is currently the most promising of the three projects. Follow-up investigations are planned to identify systems that could optimize energy generation and cost effectiveness at these sites.

### Next Steps

Monitor Public Service Commission rulings and the status of regulations for opportunities to pursue external projects with private developers.

### Resources

Support CUSD team follow-up investigations and continue to explore future options.

**INNOVATION:** Create a living laboratory for low-impact behaviors, climate education, and research.

## 10. Implement a Smart Grid which combines supply and demand management technologies to optimize the campus electrical system.

**Goal:** Utilize supply and demand management technologies to optimize the campus electrical system. By closely monitoring energy use and continuing to refine the campus Smart Grid, Cornell can take advantage of opportunities to sell excess generation back to the utility, or decrease the energy supply in response to decreased demand.

Microgrids that provide localized self-generation of electricity have been around for decades. By matching generation to local demand and by utilizing energy storage, microgrids provide improved security and reliability in the event of an interruption in the external grid (the macrogrid) due to natural or manmade disruptions.

A “Smart Grid” is a microgrid that continuously manipulates its load in order to fiscally optimize generation. A Smart Grid that can supply extra power when demand spikes, as well as usefully take in extra power when supply is high, can increase energy efficiency, and thus support carbon and greenhouse gas reduction goals. Coordinating a constantly-changing supply with power consumers’ constantly-changing demand requires serious planning and intelligent software to manage the second-by-second ebbs and flows throughout the system.

### Next Steps

- Document existing Smart Grid components at Kite Hill, Gates Hall, etc.
- Seek NYSERDA funding to perform an engineering study to articulate how the existing system can incorporate demand-side management through:
  - integration of building systems with distribution systems,
  - integration of the installed Smart Metering with controls to activate demand response,
  - integration of Smart Controls at substations and large buildings,
  - possible regulation of the Hydropower plant intake for “time of use” during peak hours, and
  - exploration of alternate storage mediums such as chilled water or batteries for peak shaving
- Obtain funding for a demonstration project.
- Demonstration of effective storage, power generation, and demand curtailment processes that result in lower capacity and demand charges from the utility will be an indication of success. Lowering the total energy imported annually from the utility will be a second indicator. Decreasing total energy exported from generation may be a third indicator if coupled with efficiency data.

### Resources

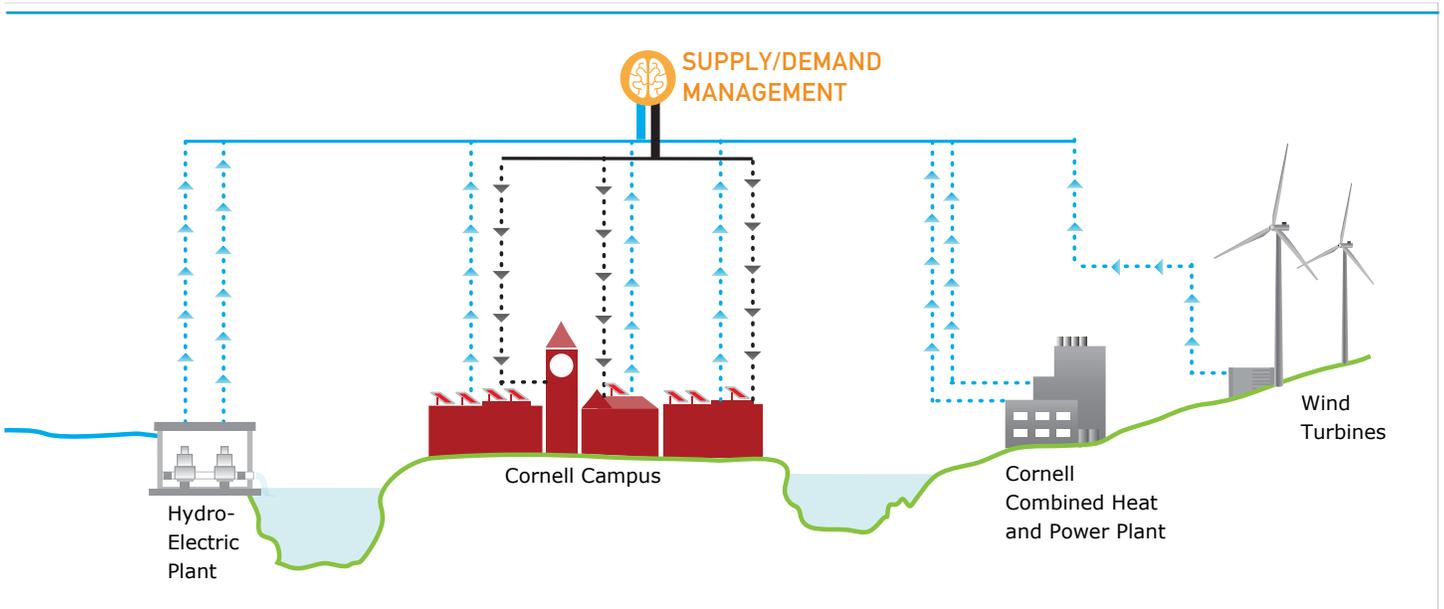
A NYSERDA incentive application has been submitted to fund the \$50,000 cost of the engineering study. Full implementation costs and benefits will be evaluated during the study phase. After the study phase, a small pilot project will need to be implemented on a portion of the campus.



Cornell's Energy Management and Control System (EMCS) currently collects steam, electricity, and chilled water data from nearly 200 locations around the campus and, for many of these locations, has archival data for the past several years. This information is fed into our Utility Data System in order to bill the responsible campus departments and to perform various energy analyses. Monitoring is done both passively, by routinely observing system operation, and actively, by responding to any of the more than 9,500 computer-generated alarms that are currently defined. In addition, operators can interactively make adjustments to more than 8500 motorized fans, pumps, dampers, and valves at buildings throughout the campus.

Cornell already has well-integrated building management systems to adjust temperature, lighting, and other indoor environment settings, according to time of day, occupancy, season, and room use. We are now investing in state-of-the-art electrical transformers and switchgear across campus, allowing our energy managers to track energy usage in real time. Smart Grid implementation would add a new level of sensors and controls into the electrical distribution systems at the building or equipment level. Benefits of these new features include the following:

- 1) Better visibility of daily system trends that allow plant operators to adjust fuel usage.
- 2) Optimized distribution of electricity to campus through voltage regulation and power flow.
- 3) More efficient operation of the Central Energy Plant.
- 4) Integration of renewables (hydro/solar) into the campus micro-grid.



## 11. Explore innovative financing mechanisms, including third-party financing, federal and state grants, and other means to fund demonstration and scale-up projects.

**Goal:** This is an “enabling” action that will facilitate other priority actions by identifying alternative sources of funding for both capital and operating expenditures. The Energy Team will explore innovative financing mechanisms such as:

- A systematic way to identify grant opportunities
- Third-party ownership of solar, wind, and other renewable energy facilities
- Strategies to support the work of the Green Revolving Loan Fund action team

The University is constrained in obtaining capital funds, and there is no new debt policy. CAP projects that require a capital expenditure cannot obtain funding through conventional debt instruments that have been used to finance projects such as Lake Source Cooling and Combined Heat and Power in the past. This action explores innovative financing strategies to allow projects which require capital funding to move forward.

For priority actions in the CAP, the Energy Team will work to identify funding needs and promising funding streams. Specific strategies to be employed include:

- 1) Develop a system to monitor NYSERDA, DOE, and other public and private grants, identify promising opportunities, and coordinate a response.
- 2) Engage the University’s Energy Risk Oversight Committee on actions involving third party ownership and long-term Power Purchase Agreements. The Committee can recommend “hedging” strategies to ensure greater price certainty for renewable fuels.
- 3) Coordinate with development professionals within the university to identify mutual areas of opportunity.
- 4) Collaborate with the Johnson School Center for Sustainable Global Enterprise and other academic units to leverage Cornell’s educational and research capacity. For example, in fall 2012, Professor Mark Milstein and students at the Center for Sustainable Global Enterprise created a very accurate financial model of the Cornell Tech Campus energy systems, in order to analyze the economic feasibility of integrating renewable energy. The Energy Team will continue and expand such collaborations.

### Next Steps

- Demonstrate the viability of third-party ownership of renewable energy facilities serving the university by commissioning the Snyder Road 2MW solar facility, which will provide electricity to Cornell through a long-term Power Purchase Agreement.
- Navigate and resolve issues of ownership of “renewable energy attributes” and other issues that impact the economic viability of renewable energy projects, such as “hedging” strategies and escalation of power prices.
- Develop a methodology for consideration by the University administration to sell carbon credits through a verified third-party certification process to raise funds for other CAP actions.
- Implement a system to track and follow through on relevant grant opportunities through NYSERDA, DOE, or other entities.

### Resources

The intended outcome of these tasks is to either procure green energy at costs similar to conventional energy, or if the costs are higher, to ensure that green energy is appropriately valued through a process which has been agreed to by the University administration.

## 12. Establish a framework for Green Electricity pricing to enable buildings/departments/colleges on campus to purchase renewable energy at a slightly higher cost from both internal and external sources.

**Goal:** Building/departments/colleges purchase renewable energy from internal sources (solar, hydro, etc.) at a slightly higher cost, and revenue generated through the surcharge is used to implement small energy conservation projects.

Current renewable energy production on campus from the hydroelectric plant and solar installations on Day Hall and The Campus Store amounts to roughly 5,711,500 kWh per year. The Snyder Road solar farm will add 2.5M kWh to this total. This green energy can be sold to various units on campus for a slightly higher surcharge, on the order of \$.02 per kWh. All buildings, departments, and colleges would be invited to participate in the Green Electricity Pricing scheme, and they could choose to buy anything from a small fraction of their total usage to 100% of their electricity from internal renewable sources.

Once adequate funds accumulate from the surcharge, they could be used to finance energy saving projects, such as efficient lighting upgrades or replacement of space heaters with foot warmers. Funds could also be combined with unit or college allocations to buy down the payback on larger projects, for example, to upgrade lab controls to reduce airflow. Qualifying projects would have a minimum of five-year simple payback on the initial investment.

### Next Steps

- Establish a process for pooling and distributing the surcharge funds.
- Determine how energy savings from small projects will replenish the fund over time.
- Work to ensure that 100% of available renewable energy is sold to various buildings/departments/colleges on campus.
- Accumulate renewable energy surcharge proceeds for two years, and utilize these proceeds to implement energy conservation projects.

### Resources

Educate and raise awareness among buildings/departments/colleges about the value of renewable energy and the proposed energy conservation projects, so that they purchase this energy at a slightly higher cost.

## 13. Create a Green Revolving Fund to invest in energy conservation projects and capture energy cost savings for reinvestment.

**Goal:** Projects funded by Phase 1 of the Energy Conservation Initiative (ECI) must meet the criteria for either a 7-year billed or 10-year marginal pay-back. The proposed Green Revolving Fund (GRF) would reinforce existing ECI efforts and provide funding for: **1)** small projects with longer returns on investment, **2)** student led projects, and **3)** research projects which are not currently eligible for funding under the ECI. The GRF can complement larger-scale energy conservation projects by providing quick access to funding for smaller college, unit, and student initiated ideas. It can also provide a source of smaller grant funds (which don't require repayment) for projects that foster campus collaboration and sustainability.

The proposed GRF would provide capital, in the form of loans or grants, to individual colleges and units to fund small-scale sustainability projects, such as:

- Building insulation and weatherization
- Electricity plug load reduction
- High-efficiency office and research equipment purchasing
- HVAC upgrades
- Lighting and water efficiency retrofits
- Renewable energy projects
- Sustainable purchasing
- College/unit specific energy efficient improvements

Cornell could also consider joining the nationwide Green Billion Dollar Challenge, which would provide access to the Green Revolving Investment Tracking System (GRITS), a tool to assist with project selection and tracking of project-specific finances, energy data, and carbon data. The Challenge requires that participating colleges and universities pledge at least \$1 million dollars in a fund structure that ensures a continuously available, self-financing source of capital for sustainable improvements. Energy Corps at Cornell and the Student Assembly have proposed the GRF concept to the university administration, with a goal to initiate a \$1 million dollar fund. To support the establishment of the new fund, The Cornell Store implemented a 5 cent surcharge on plastic bags on Earth Day 2013. As of November 2013, The Store had collected nearly \$2K in funds to seed the GRF.

### Next Steps

- Facilities Services staff, in partnership with the Budget and Finance Office, will work to establish a business plan for the GRF that meets university requirements.
- Invite campus stakeholders, including college/unit, faculty, staff, and student representation, to determine how the GRF can be effectively managed, utilized, and maintained.
- Determine how energy savings from funded projects will replenish the fund over time.
- Determine which available resources are best suited to fund a GRF for a three- to five-year trial period, and secure funding for the pilot program.
- Establish guidelines for projects to be funded by the proposed GRF and appropriate payback criteria, as applicable.
- Utilize funds from the GRF to implement energy conservation projects which meet the specified criteria.

### Resources

Secure initial funding and build ongoing funding mechanisms into the overall business model for the GRF. Based on the success of the fund, the size of the GRF could be increased (or decreased) to respond to future opportunities and needs.

## 14. Work with Cornell Energy Institute to assess the feasibility of establishing a renewable energy research park to increase the visibility of new technologies and serve as a teaching tool for the university.

**Goal:** Assess the feasibility of establishing a renewable energy research park to **1)** increase the visibility of new technologies, **2)** demonstrate their viability at scale, and **3)** serve as a teaching tool for the university in a living laboratory setting.

Faculty at the **Cornell Energy Institute** (<http://energyinstitute.engineering.cornell.edu/energyinstitute>) will take the lead to prepare a white paper and conceptual illustration of the proposed research park, highlighting how the facility will function as a living laboratory for renewable energy research and demonstration. Possible renewable and efficient technologies to be demonstrated or deployed at the park include: solar photovoltaic, solar thermal, geothermal heat pumps, biomass thermal gasification and liquefaction concepts for a range of feedstock types (CURBI), and small-scale wind energy.

The proposed energy research park would provide a living laboratory for faculty conducting research in renewable energy, as well as for engineering and CALS students. At the appropriate time, the community, including K-12 schools, would be welcome to tour and take advantage of the educational opportunities provided by the various projects deployed at the energy research park.

### Next Steps

- Cornell Energy Institute will prepare a conceptual drawing and a white paper to describe the value of the project to the university.
- Convene a planning team to help determine the appropriate site on campus for the park and potential funding sources.
- Actively seek public and private funding for this project.

### Resources

The project cost is expected to range between \$10-15M.

**LEADERSHIP:** Lead by example on campus and exercise climate leadership beyond campus.

## 15. Recruit key faculty to serve as advocates with university leaders to advance renewable energy projects and progress toward carbon neutrality.

**Goal: Cornell Energy Institute** (<http://energyinstitute.engineering.cornell.edu/energyinstitute>) will recruit key faculty to advance Climate Action Plan (CAP) renewable energy actions with university leadership. Faculty advocacy will demonstrate the value of these actions to the educational mission of Cornell, both in terms of enhancing teaching and research, and in terms of attracting new investment on campus.

During the next two years, the Energy Institute Director (Professor Jeff Tester), working closely with the Atkinson Center for a Sustainable Future and the CALS Agricultural Experimental Station, will organize a Faculty Advocacy Group to help promote the deployment of sustainable energy systems on campus. A key objective of this group will be the development of a plan for a renewable energy research park (see Energy Action 13) that could serve as a living laboratory for students and faculty to evaluate renewable energy supply and end use technologies at scale and provide usable low carbon energy to advance the university's CAP goals. In addition, the Faculty Advocacy Group will work with Cornell's Facilities and Cooperative Extension teams to identify state, federal, and private groups interested supporting clean energy technology demonstration and deployment on campus. The goal of the Faculty Advocacy group will be to facilitate energy education, research, and outreach projects which are consistent with Cornell's land-grant commitment to advance the common good, in this case by developing and sharing sustainable energy options.

### Next Steps

- Identify and recruit key faculty to participate in the group.
- Convene members to develop an advocacy plan and identify potential funding sources.
- Actively support renewable energy demonstration projects on campus and seek public and private funding for these projects.

### Resources

Need to demonstrate the value of renewable energy projects to enhance Cornell's mission and generate new investment on campus.

## 16. Draft an Energy Procurement Plan to identify long-term (30-year) strategies for energy procurement at Cornell.

**Goal:** Prioritize investment and develop a realistic timeline for Cornell's transition to renewable energy through a long-term Energy Procurement Plan.

Natural gas is not a long-term greenhouse gas alternative, and it does not provide a direct path for Cornell to make the transition to renewable energy. A long-term Energy Procurement Plan will establish a clear pathway for the University to achieve its desired energy portfolio. Preparation and periodic updating of an Energy Procurement Plan will require Cornell to engage in a proactive strategic planning process to maximize renewable energy resource development and deployment and reduce dependence on fossil fuels. In short, the plan will provide the Cornell community with a clear vision of the energy portfolio it wants to achieve, as well as strategies for getting there.

By identifying clear action steps in a long-term Energy Procurement Plan, Cornell can target future investment and policy decisions. The plan will increase understanding and awareness about the financial and operational aspects of specific renewable energy and energy efficiency technologies. It could also spur action by presenting short- and long-term steps to achieve the desired scenario.

The plan will evaluate the energy generation potential of renewable energy (including solar, wind, biomass, geothermal, and hydropower), the energy saving potential of these renewable technologies, energy resource availability, financial resource availability, market conditions, community buy-in, and pathways for technology deployment through existing or future networks. Energy consultants will partner with staff to quantify the University's existing load profile, the energy generation potential of renewable energy (including solar, wind, biomass, geothermal, and hydropower) based on resource availability, and the cost of each option.

While no immediate reductions in GHG emissions will be achieved by creating this plan, the plan will provide decision makers with a more detailed understanding of the University's energy demand and renewable supply potential. The plan could also help to define and accelerate key demonstration projects and determine the most effective and efficient means of meeting our long-term energy goals.

### Next Steps

- Hire a consultant to complete a load profile and perform a market analysis of available external projects (wind, solar, geothermal, biogas, and hydropower) that could be incorporated into Cornell's long-term energy portfolio.
- Investigate remote net metering opportunities.
- Develop an initial energy procurement plan with an annual review process.
- Amend the energy procurement plan as needed to achieve the desired scenario.

### Resources

Need to prioritize investment in renewable energy projects to enhance Cornell's mission and achieve our long-term energy goals

# FOOD

**NEUTRALITY:** Reduce Cornell's carbon emissions to net zero by the year 2050 or sooner.

## 1. Reduce the environmental footprint of the food supply chain through increased regional purchasing.

**Goal:** About 23% of the produce served by Cornell Dining is sourced regionally/locally. To increase the volume of local purchasing, the Food Team is recommending that the university conduct an analysis of all campus food purchases to **1)** identify local and regional food vendors, and **2)** identify opportunities to increase both the supply and delivery of local and regional products.

Cornell's commitment to local food dates back to the formation of the Cornell Dining Local Foods Advisory Council, (CDLFAC) a student/staff effort initiated in 2005. The council supports efforts to increase university procurement of locally grown food, provide education and outreach related to sustainable food and agriculture, and promote relationships with local farmers – in order to improve the quality of life for the Cornell campus and the surrounding community. Council members include students, chefs, staff, faculty, Cooperative Extension Agents, and Cornell University Agricultural Experiment Station (CU AES).

An ongoing challenge to increasing the local market share of Cornell food purchases has been that local producers cannot always guarantee crops or provide delivery to multiple locations. Cornell Dining contracts with a local distributor who can manage relationships with local growers and deliver a consistent supply to multiple dining facilities. Another challenge is that local products are often more costly than food imported from other regions. To maintain a balanced budget, Cornell Dining incorporates higher priced items as unique features rather than as consistent menu items.

Cornell Dining actively partners with the regional farming community to purchase seasonal produce and locally grown foods, including the following:

- Local beef burgers
- Local and regional produce
- Local grains and legumes
- Local dairy products
- Local/regional shelf-stable products
- Locally produced bakery products such as bagels and breads
- Locally roasted coffees

In addition to Cornell Dining, there are many other food service and catering providers serving the campus community, including Maines, Cooper Booth, Sysco (which supplies most of non-Cornell Greeks & Coop housing), Premier Catering, F&T Distributing Company, the Statler Hotel/School, Aramark, the Temple of Zeus, Mandibles Café, and the Law School. These "vendors" need to be included in data collection efforts and local food purchasing outreach campaigns.

In November 2013, Albert R. Mann Library, Cornell Cooperative Extension of Tompkins County, Cornell Small Farms Program, and the Farmers' Market at Cornell co-hosted the fifth annual Local Fair in Mann Library on the Ag Quad. The fair featured an open market of food, fiber, and energy products from the Finger Lakes region, as well as displays highlighting campus and community initiatives which support fair and equitable local economies and **"value chains"** (<http://localfair.mannlib.cornell.edu/subpages/valuechains.html>). The goals of the Local Fair are to:

- Celebrate the productivity and ingenuity of the Finger Lakes region;
- Educate community members about local food, fiber, and energy systems, and localized economies;
- Highlight campus-community partnerships that are vital to fulfillment of Cornell's Land Grant mission; and
- Encourage greater collaboration and innovation in support of these goals.

Learn more at <http://localfair.mannlib.cornell.edu>.

### Next Steps

- Approach all food providers on campus, as well as university purchasing and contracts divisions, to supply their buying information for analysis.
- Determine the current volume of local/regional purchases.
- Work with the Cornell Purchasing Department to explore sourcing areas and develop best practices to increase the local market share.
- Attempt to increase local/regional food purchases by 5 to 10% over the next five years.

### Resources

Designate a staff person to collect the requisite data and compile reports. Allocate funding to pay for these activities.

## **INNOVATION:** Create a living laboratory for low-impact behaviors, climate education, and research.

### **2. Enhance and expand Cornell's food recovery program.**

**Goal:** Implement practices and motivate patrons to reduce food waste at dining facilities and programs on campus.

Cornell Dining has implemented several business practices specifically designed to reduce food waste in their facilities on campus. These include:

- 1) Decreasing portion sizes so that students and staff discard less food.
- 2) Implementing tray-less dining to discourage students/staff from taking more dishes (and food) than they will actually eat.
- 3) Preventing food waste through improved tracking of prepared food to more accurately predict how much food to serve on a daily basis.
- 4) Incorporating excess food that has not been placed in service (food that has not been taken from cold or hot holding) into menu options that will be served the following day.
- 5) Donating perishable foods to the Food Bank of the Southern Tier (FBST) during academic breaks when many dining units are closed. This typically occurs two or three times per year, and the value of donated food ranges between \$2,500 and \$5,000. Donations are consolidated at one unit for pick up by FBST, and the food is redistributed to the food bank's six-county region. Cornell Dining has partnered with FBST since 2010 in this "food rescue" program.

After transitioning to tray-less service at all units between 2009-2012, Cornell Dining has reduced the use of water and chemicals in its facilities – but there is no way to assess exact usage and cost reductions specific to dining operations. Dining halls are rolled into the overall building meters, and there are currently no separate meters for measurement of water, energy, and heat loss for individual dining halls.

Another important focal point for Cornell Dining is to help motivate students to reduce their own personal food waste. In fall 2013, student sustainability coordinators launched a "Taste, Don't Waste" campaign in North Campus dining halls. The goals of the campaign were to encourage students to take smaller portions and consider the impact of their own food waste on the economy and environment. Student coordinators weighed food waste prior to the campaign and then again after the campaign, and they surveyed diners to assess the effectiveness of the campaign in reducing personal plate waste in selected dining units. The next phase of the campaign will involve more formal outreach programs targeted at first- and second-year students to educate them about how their actions in the dining hall can substantially reduce the volume of wasted food.

Many opportunities exist to expand food recovery beyond Cornell Dining facilities to other food outlets, caterers, and programs (e.g. Athletics) on campus. These opportunities need to be assessed and included in future efforts to enhance Cornell's food recovery program.

#### **Next Steps**

- Design the next phase of the "Taste, Don't Waste" awareness campaign to launch in fall 2014.
- Continue plate waste studies and awareness raising to reduce personal food waste.
- Evaluate and refine existing strategies to reduce food waste in selected dining units.
- Work to engage other food providers on campus, as well as Cornell Dining, to implement practices to reduce food waste in their operations.

#### **Resources**

Develop tools to assess the overall impacts of practices such as tray-less dining on reducing water, energy, and heat loss for individual dining halls.

## LEADERSHIP: Lead by example on campus and exercise climate leadership beyond campus.

### 3. Teach food skills and increase students' knowledge of and interest in the local food system.

**Goal:** Ithaca is surrounded by farms and local foods enthusiasts, but Cornell students are largely disconnected from the region's food system. Most lack knowledge about where their food comes from and are unable to participate in the food system as responsible and engaged consumers. No fresh food stores exist in Collegetown, leaving car-less students without adequate access to healthy food. The Food Team will implement two programs to address these challenges: **1)** a Farmer's Market on campus to increase access to fresh, locally grown food, and **2)** a pilot program, "Beyond Ramen," to build food skills and literacy among second semester freshmen who will soon be moving off campus to their own apartments.

The Cornell Farmer's Market is an important step in increasing student access to fresh local produce. The market is a student-led effort which serves approximately 300-400 students per market day. The market was held on the Agriculture Quad every Wednesday during the fall 2013 harvest season and featured a range of products grown by local farmers. More than 15 local producers participated in the 2013 market, including produce and dairy farmers, bakers, prepared food vendors, and crafters. Key challenges to sustaining the Cornell Farmers Market are limited student budgets and the need to educate students to understand the importance of eating locally. As more students purchase local produce, more farmers will be interested in selling on campus.

In spring 2014 the Food Team will implement the "Beyond Ramen" pilot program. The pilot will include four weekly sessions for 10-12 students, focused on improving their shopping and food preparation skills and food system knowledge. Food skills lab sessions will be held in the Martha Van Rensselaer teaching kitchens, and will be supplemented with farm tours, a supermarket tour, and a local food processing facility tour. A pre-intervention survey to assess food skills self-efficacy and food system knowledge was administered in fall 2013, via an online questionnaire sent out to the entire freshman class residing in North Campus housing. After the four-session pilot series, participants will be interviewed to assess changes in knowledge and skills as well as intended and reported changes in food-related behavior. Project coordinators will then assess resources and institutional capacity for scaling up the program to involve a greater number of students.

#### Next Steps

- Establish Farmers Market on campus in fall 2013.
- Implement a pilot program for off-campus students in spring 2014 to present food system knowledge and hands-on cooking activities.
- Seek funding to scale up the pilot project from the Office of Campus Life; the Office of Student and Academic Services; the Office of Fraternities, Sororities, and Independent Living; and/or other sources.
- Expand the "Beyond Ramen" pilot and evaluate the efficacy of the program in building students' food skills and food system literacy.

#### Resources

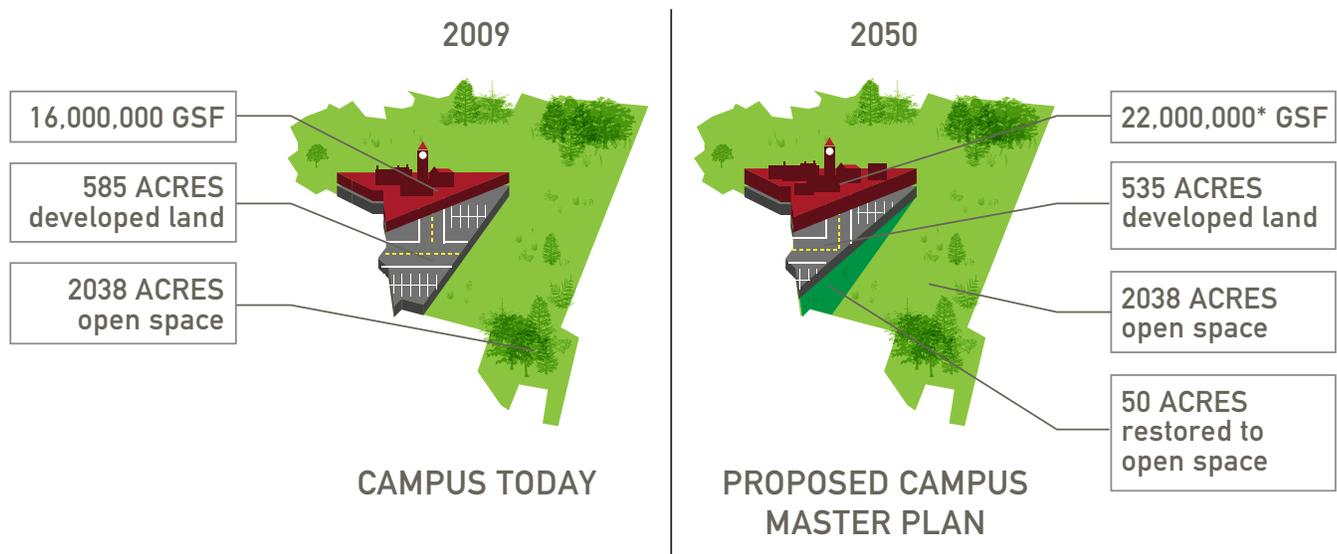
The cost of the pilot "Beyond Ramen" program is roughly \$4,000, which includes a student assistant, food, supplies, and equipment.

# LAND

**NEUTRALITY:** Reduce Cornell's carbon emissions to net zero by the year 2050 or sooner.

## 1. Implement the land use recommendations and sustainability principles articulated in Cornell's Master Plan.

**Goal:** The land use recommendations of the Cornell Master Plan (CMP) seek to create a balanced mix of land uses, which lessen infrastructure demands, and to conserve, increase, and enhance green spaces on campus, which provide carbon sequestration and other ecosystem services.



The sustainability goals articulated in the CMP were intended to ensure that the Ithaca Campus would be a learning landscape in every sense of the term. Cornell's Ithaca campus provides multiple opportunities within walking distance for students to learn about sustainable development in urban contexts and land and natural resource conservation in urban and rural contexts. Land adjacent to and on the developed urban core campus is used for agriculture as well as natural resource protection. The main campus showcases several best practices for land use as well as transportation.

The Land Team will continue to advocate for and seek to implement Cornell Master Plan recommendations for compact development, open lands management, and conservation on campus. Since the 2009 CAP was released, several building projects have been completed which exemplify the kind of compact development supported by the CMP. These include the Human Ecology Building (with under-building parking); the Johnson Art Museum Expansion (largely sub-surface and extending the existing facility); the

Combined Heat and Power Plant (built on a brownfield area where coal was formerly stored); the new Food Sciences building under construction on the site of the former building; the Animal Health and Diagnostic Center on the site of several smaller and obsolete buildings; and several major renovations which have avoided new construction and related land, space, infrastructure, and energy use. Many of these projects have also effected improvements to the site landscape and transportation infrastructure, in keeping with CMP objectives and recommendations.

The CMP states that there will be no net loss of ecosystem services, such as carbon sequestration, storm water retention, filtration (bioremediation), groundwater recharge, water quality, erosion control, shade and climate control, biodiversity of plants and animals, soil health, etc. These services are provided by the natural system at a fraction of the cost it would take to design, install, and maintain mechanized systems to provide the same services for the campus. The CMP's commitment to no net loss of ecosystem services also means that stands of trees or mature trees cannot be cut without addressing the resulting loss of ecosystem services. As Cornell moves forward with future land use improvements, the Land Team will work to ensure that these improvements enhance landscape ecosystem services and link to pedestrian and bike networks.

Visit the **Cornell Master Plan website** for more information:  
(<http://www.masterplan.cornell.edu/>)

### Next Steps

- Continue the holistic implementation of the Campus Master Plan development and open space recommendations.
- Create a heat map of campus to identify "hot spots" and understand relationships of buildings to site and landscape. Analyze tree profiles on campus to see where/if trees are contributing to climate control of adjacent buildings. MIT has developed and utilized a model to map Cambridge, and this model could be applied here at Cornell. Approach faculty in the Colleges of Engineering and Architecture to see if they could utilize the MIT model to create a heat map of the Ithaca Campus.
- Create an ecosystem services map of campus. Utilize the map to quantify ecosystem services on sites across the campus, and identify areas which can be enhanced to optimize storm water retention, climate control (shade, wind breaks, etc.), subsurface water flows, etc. This map could serve as a tool for sustainable site development and for allowing Cornell's natural systems to complement the campus built environment, by identifying how natural systems can work to reduce energy needs for campus buildings (for example, by building below grade to reduce heating and cooling needs). The map can also identify areas which can provide enhanced erosion control, by working with hydrology, soil types, and the existing ecosystem to catch and slow water at the source before it flows into the gorges.
- Work with the Transportation Team to ensure that systems for transportation and circulation are coordinated with future land development.

### Resources

Secure resources (staffing and funding) to create an ecosystem services map of campus. This could be complemented by the heat map of campus.

## INNOVATION: Create a living laboratory for low-impact behaviors, climate education, and research.

### 2. Enhance green infrastructure and associated research and interpretation on campus.

#### Goals:

- 1) The Land Team will seek to document how green space (plants and soils) on Cornell's campus serves as a natural storm buffer and provides ecosystem services, such as: habitat, carbon sequestration, storm water mitigation, water filtration, soil remediation, energy conservation, and enhanced biodiversity. Existing green infrastructure projects across campus can be expanded to serve as a research and teaching tool, as a showcase for sustainable landscape practices, and as an effective means of adapting to the weather-related impacts of climate change.
- 2) The Land Team will identify areas on campus that are suitable for different types of green infrastructure interventions.

Each landscape on campus brings a set of values that contribute to the overall ecological services provided by Cornell's open spaces. Individual green infrastructure projects demonstrate and highlight different values and functions within our campus landscapes. For example, climate models are predicting high-intensity rainfall and other extreme weather events that will impact water management at Cornell. The Land Team will advocate for the inclusion of green infrastructure components in campus projects and attempt to study, document, and interpret the specific effects of different green infrastructure projects to capture runoff on campus. The **Sustainable Sites Initiative™** (<http://www.sustainablesites.org/>) should be considered as a standard for site development and maximizing green infrastructure at project sites on campus.

In 2014 the Land Team will be collaborating in the creation of a bioswale and sidewalk along entire south side of Tower Road. On-street parking spaces will be converted to an 8'-wide sidewalk with structural soil underneath connecting to the bioswale, and a 5'-wide planted bioswale will be constructed with curb cuts to allow water into the bioswale. The Urban Eden class will landscape the bioswale in the fall. Groups of woody plants, mostly low growing shrubs, will be used on site. There will be three replicates of five different groups of stormwater tolerant shrubs along the road. These were chosen based on the research recently completed by Master's student Ethan Dropkin (see <http://www.hort.cornell.edu/uhi/outreach/index.htm#selection>). The goal of this project is to evaluate the growth and efficacy of these shrubs over time, and to collect data on water quantity and quality after construction of the bioswale and sidewalk is complete.

Other green infrastructure projects focus on long term soil remediation after construction to improve the chemical, biological, and physical properties of soils and allow for improved plant growth. Measurements before and after remediation can document the beneficial effects of these projects on soil health and biomass production.

#### Next Steps

- Formalize and convene the Green Infrastructure team regularly to coordinate existing efforts and collaborate on upcoming projects, such as providing stakeholder input on the Concept Plan for the Arts and Ag Quads and streetscape design for Tower Road. Input from the team could significantly influence the plan and could integrate existing projects in the vicinity of both Quads into a larger vision for how to incorporate green infrastructure into research, teaching, and outreach at Cornell.
- Work collaboratively with the Green Infrastructure Team to develop consistent interpretive signage for campus sites. Coordinated interpretation will help raise awareness and build public understanding of the value of these efforts.
- Identify and collaborate to obtain grant funding for priority projects to mitigate storm water runoff, improve water quality, etc. Look specifically at the Green Innovation Fund of NYS, water quality grants, Atkinson Center grants, etc.
- Work with the Atkinson Center to host topical lunches featuring green infrastructure topics to draw in others who might be interested in collaborating on grant seeking for particular projects on campus.
- Develop and pilot a green infrastructure tour of campus, utilizing green system signage, with multiple loops to interpret various focal points. Highlight the ecosystem values of Cornell's open spaces and natural areas and utilize Cornell's green infrastructure as a tool for research and education. (cont...)

Where soil compaction is necessary under pavement and along sidewalks, structural soils have been used to provide a medium for tree growth, as well as a base for turf that improves storm water and snowmelt infiltration, while resisting snowplow and de-icing salt damage in the winter and early spring. These practices may reduce the need to repair miles of sidewalk each year. Examples of these practices on the Cornell campus can be measured and interpreted.

There are also numerous green roofs, rain gardens, and bio-swales on campus. Some of these will be developed into water detention and filtration systems in addition to providing habitat for birds and pollinators. The ability of green roofs to mitigate storm water while creating habitat and improving roof membrane performance will be measured.

Existing green infrastructure projects at Cornell that could be inventoried and interpreted for the greater campus community include:

- Thirteen years of soil remediation and landscape development conducted by the "Creating the Urban Eden" class. Research is underway to evaluate the effects of soil remediation and plant growth over time.
- Three depths of structural soil including a control have been replicated along a stretch of Tower Road and tall fescue sod planted. The objectives are to evaluate the effects of snow plowing and deicing salt on the turf grown.
- Tree growth in structural soil on campus.
- Low-mow turf areas on campus.
- Proposed water filtering, habitat-enhancing bio-swale behind Rice Hall and existing bio-swale by Plantations Nevin Welcome Center.
- Acoustic monitoring of birds in different planting schemes.
- Green roofs, bio-swales and rain gardens to conduct research with controls.

These projects can be used for research as a source of data and potential innovative solutions. They can also serve as interpretive sites, to enhance student and community understanding of green infrastructure and its value to the campus.

Potential partnerships with the City of Ithaca and the Town of Ithaca are also possible. The City maintains a street tree inventory and uses Forest Service metrics that quantify ecosystem benefits provided by the trees and associated green space. Several research projects are on-going in the City, such as the use of Cornell University Structural Soil, identification of stress tolerant trees, and use of porous pavements and structural soil to reduce storm water runoff and improve tree growth. Cornell and the city could work in partnership to enhance the development and use of these green infrastructure practices.

(cont...)

- Develop outreach tours of the sustainability "trail" for municipalities, extension educators, classes, and appropriate professional and community groups.
- Develop interpretive information for each site and create a downloadable application for mobile devices. As a visitor walked around campus, he/she could scan codes and download relevant green infrastructure education.

### Resources

An engaged group of faculty and staff are actively pursuing these practices for research and teaching/interpretation purposes. Many green infrastructure practices are not cost prohibitive, although monitoring and data collection will require some modest but on-going funding. By fostering greater integration of these practices with the curriculum, students could be engaged to incorporate various green infrastructure sites on campus into a sustainability "trail."

**LEADERSHIP:** Lead by example on campus and exercise climate leadership beyond campus.

### 3. Assess the feasibility of piloting a LEED Existing Neighborhood (EN) certification for the Ithaca Campus similar to the LEED- Existing Buildings (EB) for building renovations. Collaborate with other universities to advocate in favor of applying this standard to existing campuses, as well as to existing development anywhere – campus or municipality or neighborhood.

**Goal:** Develop a new standard for LEED that can be applied to existing development. LEED-EN would provide an incentive to redevelop existing neighborhoods to green standards, rather than building new, which is the focus of the current LEED-ND (Neighborhood Development) certification. By focusing on the existing built and developed footprint, this action can potentially avoid or significantly reduce the carbon impact of building on open space.

Land is a resource which is increasingly in short supply. In a time of constrained budgets and resources, LEED-EN can provide low-cost options for achieving sustainability and avoid the use of more open land for new development. Using existing infrastructure and land significantly lowers the cost of development and encourages the introduction of retrofits and redevelopment that can reduce energy use, enable greater walkability and sustainable transportation alternatives, and encourage greater density, the conservation of open space, better integration of the built environment into the natural environment, and enhancement of open spaces to provide critical ecosystem services.

The Land Team will evaluate the feasibility of developing a pilot LEED-EN standard that could be proposed to the USGBC (U.S. Green Building Council) to include in their suite of LEED options. This new standard could be applied to existing development, retrofits, or redevelopment initiatives that achieve the outcomes desired by LEED-ND. The new LEED-EN standard, like the LEED-EB (for building renovation), could serve as an incentive to optimize existing built, infrastructure, and open space resources at a relatively lower cost than new construction. LEED-EN would be applicable to campuses as well as to existing urban and suburban environments.

LEED-EN could potentially be applied on a national and international basis and be a low-cost way to improve upon existing resources for sustainable development. Cornell has an opportunity to pioneer the new standard and to lead the effort to change existing USGBC policy. This would involve partnering with other interested campuses to advocate collectively with LEED administrators to allow existing developments to be certified LEED-EN.

#### Next Steps

- Work collaboratively with Cornell University Sustainable Design to develop metrics for LEED-EN to achieve outcomes comparable to the existing LEED ND standard.
- Create a table summarizing the new LEED-EN requirements showing how Cornell's Ithaca Campus meets these requirements.
- Present the new standard to the Ivy Plus Coalition to seek partners who would like to certify their campuses as well.
- Lobby USGBC for a policy change to allow existing developments to be certified LEED-EN.
- Collaborate with other campuses across the country to demonstrate the value of ecosystem services and pedestrian/bicycle/transit oriented development as part of an integrated approach to campus master planning.

#### Resources

Engage faculty and students in the research and development of the new standard. Seek assistance from the PSCC Advisory Board to strategize on how best to lead the effort to change existing USGBC policy.

# PEOPLE

**NEUTRALITY:** Reduce Cornell's carbon emissions to net zero by the year 2050 or sooner.

## 1. Expand Cornell's Energy Conservation Engagement Program to achieve a 1% reduction in annual electrical energy usage and to educate the campus community, including thousands of future graduates, on the value of sustainable energy use.

**Goal:** Educate individual users to reduce their energy consumption, resulting in more sustainable energy use, long-term behavior change, and savings for the University. **A 1% reduction in university-wide annual electrical energy usage will reduce emissions by about 800 metric tons (CO<sub>2</sub> equivalent) per year. Estimated annual savings based on a 1% university-wide reduction on electrical energy costs are roughly \$181,400.**

Changes in the day-to-day behaviors of the campus community in terms of how individuals use lighting, heating, and office and laboratory equipment can potentially result in substantial energy savings – with a relatively low up-front investment. To foster such behavior changes, conservation outreach is needed.

Conservation Outreach was one of the 19 initial actions included in the 2009 Climate Action Plan. Previous outreach efforts were largely ad hoc: this **Key Action** seeks to formalize and improve on existing efforts, quantify the energy savings, and expand the effort across campus.

Cornell's new budget model provides a compelling incentive for colleges and units to reduce their energy consumption and increase cost-saving measures. In July 2013, the University transitioned from centralized utilities to a budget model in which each college/unit is responsible for its own utilities.

Cornell's Energy Conservation Engagement Program, the **"Think Big, Live Green"** campaign ([thinkbiglivegreen.cornell.edu](http://thinkbiglivegreen.cornell.edu)), employs multiple complementary initiatives to educate users and build a culture of conservation at Cornell. Users are provided with monthly real-time energy use and cost data, as well as best practices for conserving energy which are customized to that user's particular work place, whether it be a classroom, office, lab, residence hall, kitchen, etc. Peer educators, or "Green Ambassadors," provide education, leadership development, social marketing, resources, and oversight of these initiatives.

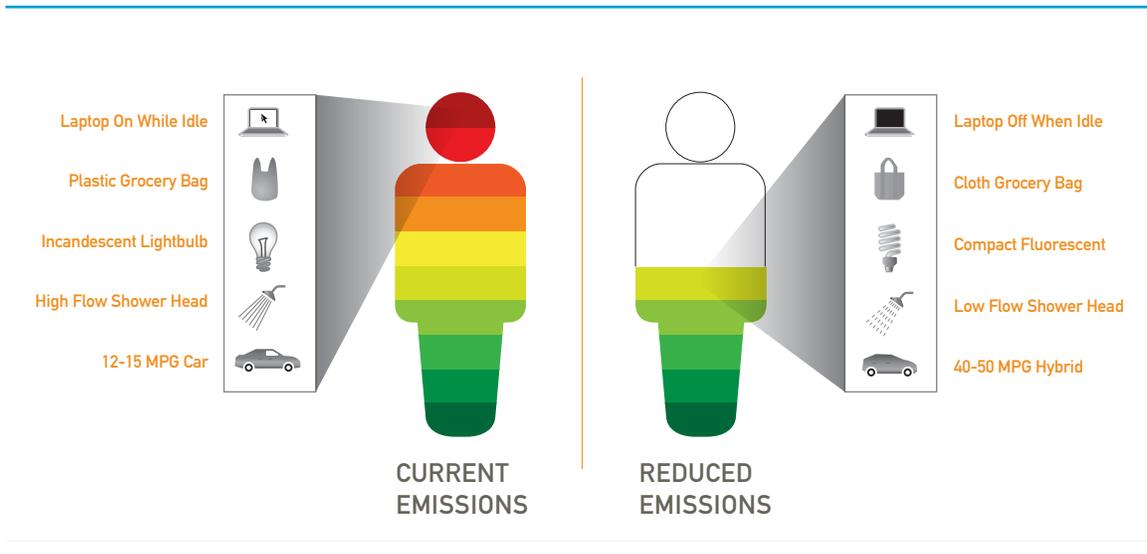
When fully implemented, the Think Big, Live Green campaign aims to reduce campus electric use by 1% from 2012. Early results from the pilot program in the College of Engineering are encouraging: from November 11 – December 10, 2013, the ten buildings participating in the "Fall 2013 Energy Smackdown" saved over 191,000 kWh and \$15,000. Based on the projected electric budget for the College of Engineering (COE), the 1% reduction target (300,000 kWh or \$24,000) is achievable by the end of the academic year – with continued engagement on the part of the COE community.

### Next Steps

- Complete the successful pilot of the Think Big, Live Green engagement program within the College of Engineering and assess progress on the 1% electrical energy reduction goal within the first year.
- Conduct research and focus groups on community behaviors and mind sets in each college/unit prior to launching the Think Big, Live Green campaign in that college/unit.
- During the 2013-2014 academic year, expand the Think Big, Live Green Campaign to the College of Human Ecology and to Student Academic Services (to serve approximately 10,000 students).
- Evaluate and refine the pilot program, and launch the Green Labs and Green Offices Certification Program university wide in 2014.
- Add the remaining 54 buildings on campus to the Building Dashboard as funds become available.
- Roll the Think Big, Live Green Campaign out within three colleges by 2015 and university wide over the subsequent 2-3 years.

### Resources

Secure funding for the Energy Outreach Coordinator and two outreach specialists to manage and coordinate the Think Big, Live Green Campaign roll out across campus (\$200,000 annually).



The four components of the Think Big, Live Green campaign include:

**1) College Engagement Program:**

This program educates students, faculty, and staff within a college or unit about sustainable practices they can adopt. The program was piloted in the College of Engineering in fall 2013, with the following monthly themes:

- **September:** The BIG Paper Cut focused on reduced paper use and reduction
- **October:** GREEN Your Workplace focused on certifying Green Labs and Green Offices
- **November:** Fall Energy Smackdown focused on recognizing buildings that achieved the highest energy reductions
- **December:** Setback = Payback focused on unplugging equipment and setting back thermostats during the break

**2) Green Ambassadors:** Faculty, staff, and graduate student volunteers support resource conservation within their respective workgroup, and serve as a point of contact between Cornell's Energy & Sustainability Department and the college community.

**3) Cornell Building Dashboard (<http://buildingdashboard.cornell.edu>):** This Internet-based display tool tracks building energy performance through "real-time" metering (in 15-minute intervals) of electric, steam, and chilled water usage. The dashboard enables end users to see firsthand the energy and cost savings that result from specific conservation actions within their work places. A total of 96 buildings will be integrated by spring 2014 and the remaining 54 buildings on campus will be added as funds become available.

**4) Green Labs and Offices Certification Program (<http://www.sustainablecampus.cornell.edu/initiatives/green-your-lab> or <http://www.sustainablecampus.cornell.edu/initiatives/green-your-office>):** Participating labs and offices commit to sustainable practices that are feasible for their particular situation, and, by successfully implementing these practices, they earn points towards a green certification.

## 2. Expand the university's virtual conferencing capacity to provide an alternative to business travel.

**Goal:** Expand the Cornell community's access to and use of virtual conferencing options, as a means of reducing energy and emissions associated with University-related travel.

Cornell University procured a WebEx site license for "One Cornell" in April 2012. A pilot program to test the software was launched in June, and WebEx service for campus employees began in August 2012. Since then, WebEx has been broadly adopted as the Cornell's web conferencing platform, replacing existing spending on multiple program licenses. Over 14,000 WebEx sessions were hosted in the first year of service offering, and Cornell is currently hosting between 1,600 - 1,800 WebEx meetings a month. A pilot project to expand the program to Cornell students is currently underway at the Samuel Curtis Johnson Graduate School of Management.

User feedback on WebEx is generally very positive. The service support team has heard from staff members that WebEx has been transformative, allowing them to telecommute and work effectively with virtual teams. Approximately 100 staff and faculty have attended formal WebEx trainings, which are offered quarterly by Cornell Information Technology (CIT) staff. Trainers report that participants in these formal WebEx trainings also have positive feedback about the new service. Campus usage of WebEx and other video and web conferencing tools, including Lync and standards based video conferencing, will continue to be monitored by CIT staff.

### Next Steps

- Continue integration of WebEx into physical spaces (conference rooms and classrooms) on campus.
- Continue providing formal WebEx trainings to campus employees.
- Review progress on expanding WebEx access and usage with the University's Travel Policy group, in order to incorporate this initiative into the ongoing work of this group.
- Evaluate and refine the WebEx student pilot program, and assess the costs and benefits of expanding the student service.
- Think through how to evaluate the cost effectiveness of WebEx and track the impacts of this initiative in reducing business travel.

### Resources

Secure approvals to continue integration of WebEx into physical spaces on campus. Identify a responsible party to monitor the effectiveness of this initiative in reducing energy and emissions associated with University-related travel.

**INNOVATION:** Create a living laboratory for low-impact behaviors, climate education, and research.

### 3. Integrate sustainability as an overarching principle into the performance management process.

**Goal:** Integrate sustainability and climate action into the annual objectives and job expectations of every employee in order to foster a culture of sustainability at Cornell.

In 2013, the Division of Human Resources revised the university-wide guidance document for employee expectations, “Skills for Success,” to include sustainability as an overarching principle. The new Skills for Success ask all employees to: **1)** develop and implement best practices, **2)** encourage others to adopt a culture of sustainability and efficiency, and **3)** consider environmental, economic, compliance and social impacts in decision-making. In order to fully embrace these changes, we need to reach out to employees to help them understand the long-term and far reaching impacts of acting sustainably, and how they can most effectively contribute to a culture of sustainability through their day-to-day decisions and actions.

The performance management process, including the annual performance review process, has also been revised to align with the new Skills. The updated performance review process is set to launch in 2014, with full implementation university-wide by 2015. Demonstration of the new skills – including sustainability – will soon become a performance expectation for every Cornell employee.

Next steps include training managers and supervisors on how sustainability and climate action can be integrated into their work places to support these new expectations. The new Sustainability Module in the Cornell Management Academy was designed to provide hands-on training for our supervisory staff, by:

- 1) Demonstrating how sustainability fits into Cornell’s culture
- 2) Communicating Cornell’s vision and a manager’s role in fostering sustainability
- 3) Giving managers tools to encourage sustainable practices in their units
- 4) Identifying interests, passions, and skills related to sustainability, and
- 5) Developing plans for integrating sustainability into their units

#### Next Steps

- Create outreach programs to help employees fully appreciate the importance of sustainability in the work place and its implications on their daily actions.
- Provide training for all supervisors to provide them with tools to integrate sustainability into their work places and the performance management process.
- Develop strategies to evaluate the success of the outreach and training programs described above.

#### Resources

Develop metrics to measure success and find the most effective ways to provide training to campus supervisors.

## 4. Continue to promote and expand Cornell's flexible work arrangements, which enable employees to vary their starting/departure times and work place, thereby reducing commuting and associated GHG.

**Goal:** In partnership with faculty from the School of Industrial and Labor Relations (ILR), implement a Remote Work Pilot Program involving staff from two large campus units in order to evaluate and maximize desired outcomes and better inform and support future flexible work initiatives at Cornell.

Flexible work schedules enable Cornell employees to vary their starting and departure times and work place. With large-scale implementation, remote work programs could reduce commuting to and from campus, resulting in reductions in the university's carbon emissions, and reduce the amount of office space required on campus. The University's new budget model charges departments/units/colleges for occupied space. Savings on rent and utilities costs could provide an incentive for supervisors to utilize flex work arrangements to reduce the space their unit uses and their lighting and heating bills.

Remote work also has been shown to positively impact employees' level of engagement by helping them to better balance their work and personal lives. A robust flex work program could help attract new recruits to the university, as flex options increasingly become an expectation for our workforce. Remote work options could also support the university's goal of recruiting and retaining diverse talent, by allowing employees to live in neighboring communities such as Syracuse, Rochester, Binghamton, but not requiring them to commute to the Ithaca Campus on a daily basis.

Cornell has supported flexible work arrangements since 1998, and flex arrangements are becoming increasingly prevalent on campus. Flex options include flexing standard hours, remote work arrangements, job sharing, partial-year assignments, and more. The Division of Human Resources has a flexible work policy and online resources for employees. Live webinars on "Understanding Flexible Work Arrangements" are available to both employees and supervisors to explain university policies and recommended best practices for requesting and managing flexible work arrangements. In these webinars, employees learn how to draft a proposal for consideration by their supervisor, and supervisors learn how to review these proposals. All participants also learn how to leverage flexible work to help departments and individuals achieve their established goals.

As remote work programs have expanded to work places across the country, academic interest in the topic has also grown. Over the past decade, numerous studies have been conducted to understand how remote work impacts employees, teams, and organizations, as well as to identify the best practices that organizations can utilize to maximize the success of their remote work programs. Bradford S. Bell, Associate Professor in the ILR School, has been engaged in several projects designed to better understand the consequences of remote work.

### Next Steps

- Implement the Remote Work Pilot Program & Research Study with roughly 60 employees participating in remote work arrangements. Complete the supporting website, initial training, and initial surveys.
- Continue collecting data on all planned metrics, including engagement, commitment/satisfaction, impacts on sustainability, supervisory feedback on managing remote workers, and work performance.
- Document outcomes in terms of multiple parameters, including: space reduction (office sharing), reduced vehicle miles traveled, reduced greenhouse gas emissions, reduced energy costs for office space, reduced traffic on local roads, reduced stress on families, enhanced wellness, dollar savings to employees and/or departments, increased organizational commitment, appeal to diverse population, etc.

### Resources

Apply lessons learned from the pilot program to develop recommendations and best practices that support future remote work initiatives and maximize benefits for employees and Cornell.

The Remote Work Pilot Program & Research Study, launched in October 2013, will carefully assess potential benefits to both employees and the university resulting from remote work arrangements. The pilot study is being conducted by Dr. Brad Bell, in partnership with Michelle Artibee, Cornell's Program Manager for Career/Life, and Dr. Linda Croll Howell, Cornell's Director of Inclusion and Diversity Metrics. The pilot involves roughly 60 employees from two units on campus, and includes employee and manager training, formal tracking of remote work arrangements, a variety of online resources, and multiple participant surveys conducted throughout the two-year program.

The pilot program will closely examine how employees transition to working outside the office, and results will be used to identify strategies for further enhancing the remote work program at Cornell. Lessons learned from the pilot project will be used to create tools and other support systems which ensure that future remote work initiatives at Cornell maximize potential benefits.

## LEADERSHIP: Lead by example on campus and exercise climate leadership beyond campus.

### 5. Provide training on triple bottom line decision making for Cornell's leadership.

**Goal:** Incorporate climate and sustainability impacts into organizational decision making and management practices at Cornell.

Pioneered in the late 1980s by **The Natural Step** (<http://www.naturalstep.org/>), sustainability-based decision making and organizational leadership has evolved over the years into a sophisticated set of tools and processes that can support managers and leaders at all levels of an organization.

Cornell was one of the first universities in the country to integrate sustainability management tools into a university management academy. Sustainability training for Cornell managers is offered twice a year, and 36 managers have completed the program since it was launched in 2012. The 3-hour sustainability module provides an introduction to the core decision-making concept of 'triple bottom line' thinking through case studies and scenario-based activities. Through these activities managers practice how to incorporate environmental, social, organizational, and economic factors into day-to-day decision making. The goal is for participants to:

- 1) Understand Cornell's vision and a manager's role in sustainability
- 2) Demonstrate how sustainability fits into Cornell's culture
- 3) Practice tools to encourage sustainability practices in their unit
- 4) Identify interests, passions, and skills in relation to sustainability
- 5) Develop plans for integrating sustainability into their units

A new leadership training initiative designed for the realities of departmental directors, associate deans, deans, associate provosts, and vice presidents will be needed to build on the sustainability trainings for Cornell managers that have occurred during the past two years. The goal of this new initiative will be to further integrate sustainability into institutional decision-making at Cornell.

Consultation services have been identified that could support development of a sustainability leadership program for higher level directors and administrators at Cornell. The Harvard Center for Health and the Global Environment offers executive education services based on the groundbreaking work of Leith Sharpe. A possible collaboration between the Harvard Center and Cornell is currently being explored. For more information on the Harvard program, visit <https://ccpe.sph.harvard.edu/programs.cfm?CSID=EELS0614>.

#### Next Steps

- Draft a Senior Leadership Sustainability Education initiative concept paper.
- Form a planning team with representatives from the Campus Sustainability Office, Human Resources, and the Presidents Sustainable Campus Committee to meet with representatives of the Harvard Center.
- Develop and administer a survey to departmental directors, associate deans, deans, associate provosts, and vice presidents to assess their needs and interests for customized sustainability trainings.
- Pilot a one-day training program with ten Cornell administrators in collaboration with the Harvard Center for Health and the Global Environment.

#### Resources

The success of this action hinges on securing senior administration support for additional trainings and establishing a partnership with external professionals who are experienced in delivering senior administration sustainability trainings.

## 6. Develop and advance labor policies to support climate protection goals and a global transition to decarbonized energy through the Cornell Global Labor Institute.

**Goal:** Work with trade unions at a global level to develop and advance policies to support climate protection goals and a transition to decarbonized energy.

The Cornell Global Labor Institute (GLI), a program of the Worker Institute of Cornell University's School of Labor and Industrial Relations, was established in 2005 to work with trade unions in the U.S. and internationally to solve major social, economic, and environmental challenges, such as climate change. Since then, GLI has organized over 100 conferences, forums, and seminars. Thousands of trade unionists have attended these events and trade union leaders from more than 25 countries have shared their ideas and experiences with union leaders and activists in the U.S.

GLI also provides trainings on the following topics:

- Labor and Climate Change
- U.S. Legislation on Climate Change
- Labor, Energy Transition, and Democracy
- International Climate Change Negotiations
- Labor and Sustainable Transportation
- Climate Jobs: Direct Hire Approaches to Climate Policy and Job Creation
- Green Jobs in the U.S. Context
- Green Jobs in a Low Carbon World

Current GLI projects include:

- **Labor Leaders Climate Forum** to assist unions in developing and advancing policies that support ambitious, science-based and equitable climate protection goals, sustainable transport, and a transition to decarbonized energy.
- **Sustainable Transportation Policy Working Group** to engage labor unions in the public policy discussion about developing sustainable transportation systems that provide equitable, accessible, low-carbon, and safe transportation options for U.S. residents and communities.
- **Trade Unions for Energy Democracy** to engage the international labor movement in the transition away from extreme energy extraction and towards a renewables-based energy system.
- **Climate Jobs Research** to explore how direct-hire climate jobs programs can both reduce greenhouse gas emissions and reduce current levels of unemployment.

### Next Steps

Achieve significant changes in Union Policy in core areas through the following initiatives:

- **Trade Unions for Energy Democracy** ([www.energydemocracyinitiative.org](http://www.energydemocracyinitiative.org)) - A global, multi-sector initiative to advance democratic direction and control of energy in a way that promotes solutions to the climate crisis, energy poverty, the degradation of both land and people, and the repression of workers' rights and protections. GLI is organizing this initiative with the goal of building a global community of unions and close allies that are committed to public and democratic direction of energy resources and options.
- **Global Advisory Group Meetings** - Representatives of 30 unions, national and global union federations, and allied organizations from many different countries are now participating in this GLI initiative.
- **UN Conference of the Parties (COP) 20 Planning Retreat** in Lima, Peru (<http://climate-liisd.org/events/unfccc-cop-20/>) - The 20th session of the Conference of Parties to the UNFCCC; Sean Sweeney and Lara Skinner of GLI will attend to gain knowledge about UN and intergovernmental activities to address global climate change.

### Resources

Project funding needs to be increased, and shifts in the public discourse around climate and energy policy need to occur. GLI's climate change agenda has garnered support from liberal foundations and trade unions. Current funds for Calendar Year 2014 total approximately \$221,000. However, the scope of the project is such that funding should grow considerably in order for GLI to exert a major impact on union policy.

Specifically, GLI is working to:

- 1)** Secure union commitments to join the effort to impede “carbon lock-in” and the expansion of “extreme energy” like shale gas and tar sands oil,
- 2)** Advance union engagement in municipal and community based renewable energy systems,
- 3)** Highlight the health and economic impact of fossil fuel pollution, and
- 4)** Support the civil society effort to secure a global climate agreement by 2015 under the auspices of the United Nations.

The notion of energy democracy is still undeveloped in terms of promoting practical policy approaches and best practices. GLI is thus exploring relatively uncharted territory. Progress is being made one union at a time through targeted outreach focusing on leadership. Each union sometimes requires months of engagement before a decision to participate is made. Funding is needed for outreach and research support. A full-time person with research and writing skills is required to expand the horizons of the project. Union participation could rise by 100-200% with the right attention to outreach and profile building.

# PURCHASING

**NEUTRALITY:** Reduce Cornell's carbon emissions to net zero by the year 2040 or sooner.

## 1. Implement an efficiency standards policy for equipment purchases at Cornell.

**Goal:** Establish energy-efficient standards based upon Energy Star certification for new purchases and bids.

Establishing energy efficiency requirements for new purchases and bids can help to reduce the life-cycle cost of the product or equipment purchased. Energy-efficient products (such as ENERGY STAR-rated products) reduce energy consumption by 10-75% and result in operational cost savings of 5-75% percent on a continual basis, depending on the product replaced.

The ACUPCC Climate Commitment that President Skorton signed explicitly identifies, "Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist," as a tangible action that participating universities should include in their Climate Action Plans. As of August 2013, 82% of the universities that have signed the commitment have adopted an appliance efficiency policy. The Purchasing Team will work to move this recommendation forward at Cornell, by promoting and encouraging the purchase of energy-efficient equipment and appliances.

To effectively encourage this practice and communicate potential savings, the Purchasing Team will work to educate the campus how to evaluate the life-cycle costs of their purchases. The Procurement Services Buying Manual will be updated to include information to assist users in arriving at the correct decisions based on the life-cycle costs of various products or appliances. Procurement Services will also publish a list of appliance standards and equipment that end users are encouraged to purchase, and update Cornell's sustainable purchasing brochure.

The Procurement Services' website currently highlights ENERGY STAR, EPEAT, and Green Seal certified products, and markets the benefits of purchasing locally. Learn more about **Cornell's Energy Star Purchasing initiative** at <http://www.dfa.cornell.edu/procurement/sustainability/energy-star.cfm>.

### Next Steps

- Publish and distribute information on recommended equipment and supplies to campus. Include an update to the Procurement Services Buying Manual, with specific attention paid to Energy Star certification.
- Improve and enhance selections, monitor percentages, and focus on key areas to encourage improvement.

### Resources

Effective, campus-wide communication of the life-cycle costs will be needed to promote the cost savings and incentivize employees to make energy-efficient purchases.

**INNOVATION:** Create a living laboratory for low-impact behaviors, climate education, and research.

## 2. Utilize “Fast Tracks” in Cornell’s online Procurement Gateway to facilitate purchasing of sustainable office equipment and supplies, recycled paper, remanufactured toner, EPEAT certified computers, etc., and to limit the availability of less sustainable products.

**Goal:** Encourage sustainable purchasing decisions and reduce the availability of non-sustainable goods.

Creation of “Fast Tracks” in Cornell’s purchasing website will enable Procurement Services to more easily direct buying choices for office equipment and supplies, paper, toner, and so on. Fast Tracks will be a group of “favorites” that will be set up in the e-SHOP system that Cornell users will have access to when they log into the e-SHOP system. Fast Track options will be limited in number, and the intention will be to give users the easiest and quickest path to sustainable choices. For example, only 100% and 30% post-consumer waste recycled paper and EPEAT certified computers will be included in the Fast Tracks menu, and remanufactured toners will be featured.

Implementation of Fast Tracks is expected to result in increased purchasing of the featured items, as well as decreased purchasing of non-sustainable options, such as virgin paper.

Fast Tracks options are still being refined through interactive discussions with campus constituents, as the options are intended to help the university meet multiple goals, including sustainability. While there will be no requirement to buy the items recommended through Fast Tracks, Procurement Services will market these items via their newsletters and attempt to influence campus decision making by streamlining and simplifying the process to purchase featured items. Office paper, computers, toner, and cleaning products will likely be included in the Fast Tracks system.

Cornell needs to earn 15 additional points (85 points total up from 70 currently) to become the first Platinum-rated university in the U.S. under the STARS program. By increasing sustainable purchasing through Fast Tracks, Cornell can work to increase its 2012 STARS rating of 3.8 out of a possible 7.5 points in the Purchasing category.

### Next Steps

- Build product lists, complete website programming, and launch Fast Tracks.
- Expand and improve Fast Tracks selections on an ongoing basis.
- Improve Cornell’s STARS rating for paper, computers, toner, and cleaning supplies purchases.
- Document the positive impact of the new ink refilling station at The Cornell Store on decreasing purchases of toner cartridges by the campus community.

### Resources

Programming costs to implement Fast Tracks are estimated at about \$6,000. Procurement Services hopes to implement Fast Tracks sometime in the 2013-14 fiscal year, pending availability of funds.

## **LEADERSHIP:** Lead by example on campus and exercise climate leadership beyond campus.

### **3. Consider sustainability criteria, including locality and GHG emissions, in the vendor selection process to reduce the environmental footprint of Cornell's supply chain.**

**Goal:** Ensure that Cornell's purchasing decisions are in alignment with the university's overarching commitment to sustainability.

Local investment and business incubation are part of Cornell's land grant mission, i.e., Cornell returns New York State's investment by directing its education, applied research, and outreach to benefit the citizens of New York. As a major enterprise, Cornell makes a significant contribution to the State's economic prosperity. Roughly 20% of Cornell's business is done locally, and 50% is done in New York State. The Purchasing Team has worked diligently to incorporate, promote, and give increased weight to sustainability criteria, including locality and GHG emissions, as part of the university's product and vendor selection process.

Sustainability is one metric used to grade a key group of the university's most strategic partners, called "preferred suppliers." Cornell's Procurement Services asks these 20+ suppliers to describe their key sustainability efforts and accomplishments. These efforts can be specific to Cornell or can include practices the company is implementing on a global basis.

For example, last year VWR Scientific implemented a Cornell-specific program to recycle pipet tips boxes which recovered 4,500 pipet tip boxes that would otherwise have ended up in a landfill. A more global example is provided by Staples, which has introduced a competitively priced sugarcane-based copy paper to its product lines, converted a portion of its delivery fleet to electric vehicles, and installed solar power at more than 30 of its stores. Staples is also providing Procurement Services with data on the amount of packaging Cornell is saving as a result of a new requirement that all orders placed on campus meet a \$50 minimum.

Through the competitive bidding process, Procurement Services can give increased weight to vendors that meet sustainability criteria, including locality and potential for reduced GHG emissions. A local business, The Computing Center, was recently awarded the contract for all university purchases of print toners. This contract represents approximately \$750K of consolidated business which was previously done by a variety of Cornell suppliers, most of whom were not local.

Procurement Services will incorporate sustainability criteria into preferred vendor recognition and give greater weight to sustainable practices when evaluating preferred vendor performance. These practices will be shared with the campus community through annual business reviews and through marketing and communications. Selected vendors will be encouraged to showcase their sustainable practices for student interns and thus build pathways for Cornell students to work in these businesses after graduation.

#### **Next Steps**

- Encourage and market the benefits of purchasing locally, and highlight EPEAT, ENERGY STAR, and Green Seal certified products in all areas for which such ratings exist.
- Include sustainability initiatives on the Procurement Services website, and distribute a brochure which highlights these initiatives across campus.
- Include a section devoted to sustainable accomplishments in the Procurement Services quarterly newsletter and highlight sustainable vendors in each issue.
- Expand the number of participating suppliers by 20-25%.
- Review inbound logistics, and implement a program that assists small and local businesses with freight consolidation.

#### **Resources**

Procurement Services purchases goods and services locally when possible, but it has not formally evaluated how much of Cornell's overall business could be done locally and how this shift would impact the University's carbon footprint. Such analysis could inform future purchasing decisions.

# TRANSPORTATION

**NEUTRALITY:** Reduce Cornell's carbon emissions to net zero by the year 2040 or sooner.

## 1. Increase the use of mass transit by the Cornell community through the OmniRide Program and enhanced outreach for Cornell employees during the onboarding process.

**Goal:** Expand the use of public transit and reduce parking demand at Cornell by providing discounted and no-fee transit access to Cornell employees and students.



Drawing by Trowbridge & Wolf Landscape Architects, LLP

Tompkins Consolidated Area Transit, Inc., usually referred to as TCAT, is a private, non-profit public transportation operator, managed jointly by Cornell University, Tompkins County, and the City of Ithaca.

Cornell offers its employees and students partially- or fully-subsidized transit through the OmniRide transit program. Students who are new-to-Cornell (roughly 6,500 active annually) and employees who enroll in OmniRide have anytime, anywhere access to TCAT buses with their Cornell ID card; Cornell pays the fare.

Students who are not new-to-Cornell and student spouses can purchase deeply discounted OmniRide privileges (\$200; the comparable TCAT pass is \$600). Access to the buses is gained by using the Cornell ID card at the fare box. Eligible Cornell employees, retirees, and affiliates also receive fully-subsidized ride privileges on TCAT buses within TCAT zone one, Monday- Friday. The number of eligible riders was approximately 15,000 in December 2013 – 10,000 of whom are faculty and staff.

### Next Steps

- Evaluate possibilities and determine how to fund the OmniRide program sustainably. Study the financial implications of Campus to Campus expansion and the feasibility of using this revenue stream to offset TCAT deficits.
- Include temporary staff, as well as permanent staff, in the transportation outreach program for new hires.

### Resources

- Continuation of the OmniRide program depends on adequate fares and partner contributions to meet TCAT's operating and capital expenses.
- May need additional support to enable Transportation staff to provide onboarding outreach to temporary employees.

Cornell's OmniRide program is part of the University's Transportation Demand Management strategy and has been highly successful at reducing parking demand at Cornell since its inception in 1990. By avoiding the need to build hundreds of extra faculty and staff parking spaces, Cornell has experienced a notable cost savings benefit through the OmniRide program.

Since March 2011 a representative from Transportation Services has participated in Cornell's employee onboarding program to ensure that all new hires to the university are made aware of their transportation options, including the OmniRide program, car sharing, carpooling, and ride sharing. Transportation staff are able to provide new staff members with an objective view of the various travel options and information about incentives to encourage the use of alternative commuting methods – before employees make a commuting decision. From March 2011 through June 2013, a total of 1,299 onboarding appointments were held, and current projections indicate that there will be more than 1,000 onboarding appointments between July 2013 and June 2014. The total number of OmniRide passes issued to employees has increased by 26% in the past three years - from 1,586 passes in 2010 to 1,974 passes in 2013.

Student OmniRide participation has expanded by 35% in the past 6 years, from roughly 4,000 riders in 2005, to 6,500 riders in 2013. In 2012, 741,000 TCAT rides were purchased by Cornell students (3,705 passes @ \$200 each), and 1,070,000 free rides were given to Cornell students using OmniRide passes. Because of the substantial increase in ridership, the university is currently realizing a \$1M deficit for the free pass program annually - and this deficit is growing. For the past few years, Cornell has been using proceeds from the Campus to Campus (C2C) bus program to offset the OmniRide deficit. The Transportation Team is proposing to study the financial implications of C2C expansion and the possibility of using this revenue stream to offset TCAT deficits.

The Transportation Services eBusiness site offers TCAT OmniRide passes for sale, so that Cornell community members can purchase or appeal their passes online. The list of valid Cornell riders is updated daily and sent to TCAT.

## 2. Encourage mass transit between Ithaca and NYC through continued support for Campus to Campus Bus.

**Goal:** Provide express bus service between Cornell's Ithaca and New York City campuses to reduce carbon emissions resulting from individual vehicle trips to and from the city.

The Campus to Campus (C2C) bus has been in operation since 2004, providing the Ithaca Campus and surrounding communities with express service to New York City. The C2C bus service operates seven days a week, year round except on Thanksgiving and during the University's Winter Break. The coaches offer single and double seating for up to 32 passengers, with ample work room, internet service, and a well-stocked galley. The C2C service is currently achieving 146 passenger-miles per gallon, and highway speed is monitored to increase fuel efficiency.

When U.S. Air discontinued its LaGuardia service three years ago, the C2C bus load factor (how full the bus is) increased from 72% to 74% - resulting in a 2.8% increase in overall ridership since 2010. Annual ridership in 2012 was 23,838 passengers. The C2C program is profitable and is currently supporting deficit's in Cornell's OmniRide program.

C2C's five buses are owned by Cornell and maintained, serviced, and driven by Cornell employees, as part of the university's Transportation Services. In October 2013, Cornell made the decision to hire its own drivers and insource C2C operations completely. Seven new bus operators and a program manager were recently added to the C2C team.

A new, more fuel-efficient bus was added to the fleet in November 2013. The new bus will have lower particulate emissions and should increase overall fuel efficiency from 5.8 mpg to 6.4 mpg. In addition the new bus will be equipped with a reverse osmosis water system, eliminating the need to provide bottled water.

Another C2C bus has recently been re-engineered with an altered rear differential gear ratio to improve its mileage. Once adequate data has been collected from this vehicle, Transportation Services will determine whether or not sufficient fuel efficiency has been achieved to justify similar modification of the entire fleet. Transportation Services is also considering the integration of water coolers into each bus to decrease the use of plastic water bottles and encourage the use of refillable containers. All buses are equipped with recycling bins, and biodegradable bags are available at all seats.

University administrators are currently considering a possible partnership with the **Finger Lakes Climate Fund** (<http://fingerlakesclimatefund.org/>) to offer Cornell business travelers the option to offset their travel emissions by making donations to the Fund. Passengers could use the Fund's carbon calculator to determine the amount of greenhouse gas emissions resulting from their trip, and choose to make a donation to offset these emissions via investing in residential energy efficiency projects for qualified local residents.

### Next Steps

- Study the financial implications of C2C expansion to serve Washington D.C. or Boston, and the possibility of using this new revenue stream to support the OmniRide program or other transportation initiatives.
- Evaluate carbon offset options, secure approval from University administrators, and once consensus is reached, implement changes to C2C reservations programming to allow for passenger donations to be accepted and processed.

### Resources

- Evaluate the return on investment for additional C2C runs.
- Secure approval for the travel offset program and create internal processes to manage passenger donations.

### 3. Reduce fossil-fuel consumption of the Cornell fleet through MPG standards in vehicle purchases, alternative-fueled vehicle purchasing, and a fleet management system.

**Goal:** Reduce fuel consumption of the campus fleet and increase use of alternative fuel.

One of the 2009 CAP's original 19 actions, "Greening the Fleet" seeks to reduce fuel energy needed to operate university vehicles. The two main components of this action are: **1)** to require higher efficiency standards for the campus fleet, and **2)** to consider alternative fuels for university-operated vehicles.

Five years ago, the original CAP established goals to reduce the size of the Cornell fleet by 30%, reduce overall costs by 30%, and increase average mileage by 30%. The university has achieved a 32% reduction in the size of the fleet – from 220 vehicles in 2009 to 149 vehicles in 2013, and it has increased fuel efficiency by 15%, from 18.9 mpg in 2009 to 21.7 mpg in 2013. In 2013 alone, the Agile Fleet Commander fleet management system enabled Cornell to better manage use of its existing vehicles and reduce the fleet vehicle count from 166 to 149 vehicles.

High-efficiency vehicles have been incrementally added to the fleet since 2009, including:

- 2 all-electric vehicles (EVs)
- 6 compact hybrids
- 9 sub-compact hybrids
- 2 sub-compact plug in hybrids

Plans are to continue expanding the campus fleet with hybrid vehicles.

Fleet Services is currently working on the installation of a charging station at the Maple Avenue Transportation facility to further promote the use of electric and plug-in hybrid vehicle technology. The charging station will charge the all-electric fleet vehicles and will also be available for Cornell employees to recharge personal electric vehicles used for commuting to and from work.

At the start of 2014, Transportation Services replaced 12 midsize sedans and 3 subcompacts with Partial Zero Emission Vehicles, which will reduce greenhouse gas emissions for these vehicles by 25%. Transportation Services purchased 15 new Toyota Camrys, with a 34 mpg rating, to replace 12 Chevy Impala and 3 Malibu vehicles with a 29 mpg rating. After careful analysis, staff chose the Toyota Camry for its total cost of ownership over the lifetime of the vehicle, which includes mileage, resale value, maintenance costs, etc.

#### Next Steps

- Continue tracking changes in technology and fuel options to further enhance fuel efficiency of the campus fleet.
- Study the feasibility of installing more EV charging stations at optimal locations (Cornell currently has 3 EV charging sites on campus).

#### Resources

Continue outreach to campus stakeholders on how utilizing the lifetime cost of ownership impacts vehicle selection.

## 4. Encourage the use of existing private platforms for car sharing, carpooling, and ridesharing by the Cornell community.

**Goal:** Expand Cornell community membership and participation in alternative transportation options in order to reduce transportation emissions.

**Carsharing** helps to reduce traffic congestion, improve local air quality, reduce wear on roads, and free up parking spaces. Transportation Services currently operates a carshare at the Humphreys Service Building (HSB) for employees requiring transportation for Cornell business. The HSB fleet consists of two all-electric vehicles and two hybrid vehicles. The average travel distance for these vehicles is six miles, so all four vehicles are typically operated as completely electric vehicles. Fleet Services is currently working on the installation of a second carshare program at Cornell's East Hill Office Building. Two vehicles will be located at East Hill in order to accommodate up to five employees for business travel needs.

**Ithaca Carshare** (<http://www.ithacacarshare.org/>) is a community-based commuting service. Ithaca Carshare is a membership service offering 24/7 self-serve access to 23 fuel-efficient cars, a minivan, and a pickup truck located in Ithaca. The program allows members to reserve a car or truck online or by phone, drive wherever they like during their reserved time, and then return the car or truck to the same location once they are finished.

The University offers special incentives to Cornell community members to become Carshare members. All Cornell employees enrolled in the OmniRide program are provided with free Just in Case membership or discounted *It's My Car* membership to Ithaca Carshare. Non-OmniRide employees are provided with smaller discounts on their memberships. All enrolled Cornell students may get free or discounted membership as well. In the 2012-2013 academic year, 584 students and 237 employees took advantage of these incentives. Cornell participation has grown from 508 total participants in 2008 to 821 participants in 2012-2013, or about 63 % of Ithaca Carshare's total membership. Cornell has been subsidizing Cornell community members' Ithaca Carshare memberships since 2008, through an annual contribution of roughly \$30,000 per year.

There are now four Ithaca Carshare locations on the Cornell campus, at Carpenter Hall, in the Maple Avenue parking lot, on North Campus, and on Tower Road across from Kennedy Hall. There are four additional Carshare locations on city streets in Collegetown and surrounding neighborhoods, for a total of eight locations that directly support Cornell students and employees. Since 2011, Ithaca Carshare has added nine Toyota Prius Cs, averaging 43 mpg, to their fleet – representing 36% of the total fleet. Within the next five years Ithaca Carshare hopes to incorporate some electric vehicles as well.

Cornell community member can also choose to **carpool** to work to save on commuting and campus parking permit costs. One person purchases and is responsible for the commuter parking permit. Carpoolers can link up to six license plates to the permit so it can be switched among registered vehicles. Carpool members make their own arrangements for sharing commuting costs.

### Next Steps

- If current growth trends continue, add one or two carshare locations on or near the Cornell campus per year to meet demand from the university community.
- Seek opportunities to incorporate more low-emission/electric vehicles into the campus and community carshare fleets.

### Resources

Continue outreach to campus stakeholders on the value of alternative transportation options, including carsharing, carpooling, and ridesharing.

Cornell's award-winning Faculty & Staff **RideShare** is a more formal version of a carpool, with added incentives and benefits for participants. The RideShare program helps over 1,500 eligible employees save on parking permit costs, and many qualify for free parking. Members turn in their individual parking permits and receive one permit on which all of their vehicles are listed. The RideShare parking permit can include up to six vehicles and may be used in any group member's car. Fees can be shared equally, but all members of the RideShare must be regular Cornell employees receiving university benefits and work in locations where permits are required.

Besides sharing parking permit costs, there are numerous other benefits to joining RideShare, including:

- Savings on fuel and vehicle maintenance fees.
- Possible discounts on auto insurance premiums.
- Eligible groups can receive free books of ten one-day parking permits valid in all Perimeter and Outer Tier Parking areas.
- A thirty-day risk-free trial period.
- Cornell provides numerous support services, such as emergency ride and FamilyCare.
- On-campus transit from parking areas.
- Ride free on TCAT buses when traveling among Cornell's Ithaca facilities via the OmniRide Program.
- Need help finding a ride partner? Check out **Zimride!** <http://www.zimride.com/>, an online ridesharing community.

**INNOVATION:** Create a living laboratory for low-impact behaviors, climate education, and research.

## 5. Implement a comprehensive bike master plan to improve the safety and accessibility of campus and public roadways.

**Goal:** Develop a Bicycle Master Plan for Cornell's Ithaca Campus, with recommendations for increasing bicycle usage, improving bicycle infrastructure, implementing bicycle friendly policies, and increasing overall safety of cyclists.

Cornell supports cycling as a sustainable means of commuting to and from campus, as well as an excellent means of transportation within the campus. In April 2006, as part of the transportation-focused Generic Environmental Impact Statement, Cornell conducted a travel survey of the entire campus community that provides the most recent bicycle commuting data. The survey indicated that 3% of employees, 4% of graduate students, and 1.4% of undergraduate students commute by bicycle. The bike master plan will target the employee and student populations in an effort to increase these percentages.

The Campus Planning Office, in cooperation with Transportation Services, is currently seeking a consultant to assist with the development of a Bicycle Master Plan for campus, to be completed by December 2015 or sooner. It is intended that this Plan will be part of an update to the Cornell Master Plan. The bike plan will include recommendations for improving the accessibility and safety of the campus for cyclists, as well as recommendations regarding cycling policies, procedures, and staffing for the University. The plan will examine and prioritize various infrastructure improvements, such as additional marked bike lanes, pedestrian-shared paths, dismount zones, covered bike parking, bike stairs, etc.

The proposed bike master plan will also include recommendations regarding improvements to better facilitate inter-modal use with the transit system. The Tompkins Consolidated Area Transit (TCAT) buses which serve Cornell's Ithaca Campus are currently equipped with bike racks.

Cornell's Bicycle and Pedestrian Committee meets regularly to address bicycle issues and needed improvements. This group, as well as existing biking organizations at Cornell, will be among the broader Cornell community stakeholders who will be engaged in a comprehensive process to create the bike plan.

### Next Steps

- Secure funding to hire a consultant, hire a consultant, and prepare a plan.
- Encourage stakeholder participation in the planning process, and document/prioritize stakeholder input into a plan which has broad community consensus, to the extent possible.

### Resources

The success of this action item hinges on support from the University administration, financial resources to prepare the plan, and stakeholder participation and advocacy.

**Goals of the Bike Master Plan include:**

- 1) Increase ridership among students and employees to reduce single occupancy vehicle commuting.
- 2) Identify amenities and resources needed to promote increased ridership and address key obstacles to behavior change, for example, "It's too hot, too cold, too far, too hilly, too bumpy, too unsafe, etc."
- 3) Identify bike routes on campus and incorporate these routes into complete street planning for future construction/renovations on campus to ensure set-backs, etc. for cyclists).
- 4) Encourage stakeholder participation in the planning process, and document/prioritize stakeholder input into a plan which has broad community consensus, to the extent possible.
- 5) Set realistic and measurable goals to increase cycling and reduce commuter travel impacts at Cornell, including quantifiable GHG emissions resulting from implementation of the plan.

The implementation of the Bicycle Master Plan recommendations will have a direct impact on the larger community by improving connectivity between neighborhoods and improving neighborhood livability for residents. By reducing single occupancy vehicle use, the Plan should also reduce carbon emissions and traffic congestion, and improve the overall health of the community.



Drawing by Trowbridge & Wolf Landscape Architects, LLP

## 6. Continue support for the Big Red Bike sharing program.

**Goal:** Assess opportunities to expand and improve the bike share program and promote bicycling as a commuting alternative.

**Big Red Bikes** <http://bigredbikes.cornell.edu> is Cornell University's student-run bike share program. It is open to all current students and employees who register for the program, with no membership fee or fees for use. The bike share fleet includes 30 bicycles that are available for use from Spring Break in mid-March until Thanksgiving Break in late November. Registered users can check out a bike at Mann Library, Uris Library, or at Appel Commons, a student residence community center. The bikes must be returned to one of these three locations by closing time on the same day.

During the 2012-2013 fiscal year, Big Red Bikes were checked out over 1,600 times by 742 active users. User surveys indicate that usage is primarily recreational. Thus far, the bike share has little or no positive effect in changing employee or student commuting behavior, or in increasing bicycling as a commuting alternative.

Transportation Services serves as sponsor and provides a staff advisor for the program. Transportation Services currently contributes \$10,000 per year for a vendor hosted bike share management database and web interface, provides offseason and out-of-service storage for the bikes, and allocates \$5,000 annually to hire student employee(s) to oversee maintenance and safety checks for the bikes. Cornell Outdoor Education contributes administrative and logistical support to manage and assist the student employee(s) with bike share operations. University Libraries and the Appel Commons Service Center contribute administrative support – checking the bikes, keys, and helmets in and out, as well as alerting student organization officers about user registration issues, and maintenance or safety issues reported by users.

Partial funding for the program comes from a Student Assembly fee of \$1 per undergraduate. Facilities Services finance personnel provide administrative support for the Big Red Bikes operating account, under Transportation Services oversight, through which the Student Assembly funding is received and disbursed. In addition to Student Assembly funding, the program has also received private gifts from alumni and other individuals.

Students working in Big Red Bikes have a unique opportunity to impact Cornell's campus as part of an innovative business practicing social entrepreneurship. Several active members of the organization have designed and completed class projects and independent study plans related to their involvement in development, management, and improvement of the bike share program. Former student officers report that their leadership and collaborative experience with the program proved invaluable as they sought employment and transitioned to the workplace.

### Next Steps

- Investigate the New York City bike share program, and other examples of bike share programs to discover options for improving security and accountability that may be financially sustainable at a scale appropriate to the campus.
- Support student leaders in exploring options for a more sustainable program of bicycle safety inspections and maintenance.
- In the context of development of the Bicycle Master Plan, examine and assess relative costs and benefits of the program and recommend changes or improvements.

### Resources

Future success hinges on student involvement and commitment, institutional commitment and funding, evaluation of program benefits, integration of program goals into the larger bike master plan.

Challenges to sustaining and expanding the program include:

- The current volunteer model for performing daily safety checks and basic maintenance is inadequate. Funding for a more appropriate model for safety checks and maintenance has not been identified.
- The current check-out and check-in system does not adequately protect against theft and loss of bikes and other equipment.

**LEADERSHIP:** Lead by example on campus and exercise climate leadership beyond campus.

## 7. Develop and implement comprehensive strategies to support mass transit in Tompkins County and increase ridership.

**Goal:** Support Tompkins Consolidated Area Transit, Inc. (TCAT) to reduce impacts of Cornell commuter travel.

Reducing transportation energy demand and shifting to non-fossil energy sources will require long-term, concerted effort. In the short-term, Cornell will continue to focus its attention on mass transit system improvements. As TCAT's largest customer, accounting for roughly 71% of annual ridership, Cornell wields significant influence as a major proponent of mass transit in Tompkins County. Supporting the local mass transit system is Cornell's single largest transportation initiative.

TCAT is a not-for-profit corporation that provides public transportation for Tompkins County. TCAT's annual ridership is more than 4 million and its routes cover a distance of about 1.6 million miles. TCAT's fleet of approximately 55 buses currently includes 8 hybrid electric-diesel buses. TCAT also offers complementary ADA Paratransit services called Gadabout. In 2011, TCAT was recognized as the nation's "Outstanding Public Transportation System" in the 1-4M ride category by the American Public Transportation Association. For more information about **TCAT**, visit [www.tcatbus.com](http://www.tcatbus.com).

The three TCAT partners—Tompkins County, the City of Ithaca, and Cornell University—allocate operational funding for TCAT, each currently contributing about \$900,000 annually. Cornell makes an estimated annual contribution of \$3.5M to TCAT: roughly \$900,000 in operating funds plus \$2.6M in bulk fares to fund the OmniRide program. The three partners split budget deficits and capital acquisitions three ways.

In 2014 TCAT will add New York State's first **hydrogen fuel-cell bus** (<http://www.emc2.cornell.edu/news/story/tcat-to-receive-ithaca-s-first-cutting-edge-fuel-cell-bus.html>) to its fleet, and a hydrogen station will open in Ithaca to fuel the bus and other fuel-cell vehicles. The station will generate hydrogen right on site, and it will be the first public hydrogen station in upstate New York and one of only a dozen in the country. Fuel cells produce electricity from a chemical fuel, so fuel cell powered vehicles have long ranges, fast refuel times, and emit no carbon pollution. Paul Mutolo (EMC2), a fuel cell chemist and director of external partnerships for the Energy Materials Center at Cornell, helped develop the federal grant proposal to purchase the new bus. Seed funding to research sustainable hydrogen production, awarded by the Atkinson Center in 2012, was instrumental in facilitating this groundbreaking effort to create an infrastructure for emissions-free transportation.

### Next Steps

Continue operations and management role with TCAT.

### Resources

Continuation of the OmniRide program depends on adequate fares and partner contributions to meet TCAT's operating and capital needs.

## 8. Establish a campus-wide policy for reduced fossil-fuel consumption among Cornell-owned vehicles.

**Goal:** Set carbon reduction goals for Cornell's non-fleet vehicles.

Cornell owns a total of 1,354 vehicles (as of July 2013), but only 12% of these are university fleet vehicles. While major improvements in tracking mileage and fuel usage for the 1,205 non-fleet vehicles have been made in the past few years, Transportation Services has not yet established carbon reduction goals for its non-fleet vehicles.

One major class of low-mileage vehicles on campus is the pickup truck. Transportation Services will partner with other university departments that utilize pickup trucks (Grounds, Shops, Vet College, Plant Breeding, the Plantations, etc.) to explore the feasibility of replacing these low-mileage, high-GHG vehicles with alternative fuel vehicles, namely liquid propane gas (LPG) burning vehicles, to greatly reduce campus vehicle emissions. Each LPG vehicle that replaces an unleaded gasoline vehicle represents a potential 31% reduction in GHG emissions. Many of Cornell's service vans are also driven primarily within a 10-mile range for various campus work assignments, and these vans are another viable candidate for replacement with LPG fueled vehicles.

A recent event at the East Campus Service Center featured a demonstration of propane-powered trucks for use by various university departments, including Grounds, R5, Shops, and the Plantations. A follow-up meeting is planned for spring 2014 to assess the feasibility and cost of utilizing LPG-powered utility vehicles at Cornell.

The **Cornell Climate Action Plan (CAP) Update 2013 & Roadmap 2014-2015** proposes several policy recommendations which were identified by the PSSC focus teams as potential actions the university can take to move our CAP agenda forward and institutionalize change. Key policy recommendations include establishing campus-wide fuel efficiency standards for Cornell-owned vehicles. The PSSC Advisory Board will further explore this policy recommendation during the next two years. Next steps include preparing financial, environmental, and social impact assessments; obtaining approval from the appropriate parties; and convening stakeholders to develop implementation plans.

### Next Steps

- Explore the feasibility of replacing low-mileage, high-GHG vehicles, such as pickup trucks and vans, with LPG fueled vehicles.
- Work with the PSSC Advisory Board to explore the feasibility of implementing a campus-wide fuel efficiency policy.

### Resources

Develop a strategy for working with campus stakeholders to encourage the transition to LPG-fueled trucks and vans.

# WASTE

**NEUTRALITY:** Reduce Cornell's carbon emissions to net zero by the year 2050 or sooner.

## 1. Complete a carbon impact study for Cornell's waste stream to establish a baseline of GHG emissions associated with the current waste stream.

**Goal:** Quantify carbon impacts associated with the campus waste stream in order to identify opportunities to better manage Cornell's waste and reduce emissions.

Cornell's 2009 and 2011 Climate Action Plans did not account for the impacts of the campus waste stream on the university's carbon emissions. To better inform decision making on campus, the Waste Team is currently conducting a systemic analysis of campus waste, including the impact of waste operations on Cornell's GHG emissions. This waste impact study can serve as the foundation for improved management of university materials. The study can help Cornell to identify and quantify waste streams which are not currently being optimally utilized. Some of these waste streams can serve as additional feed stocks for CURBI (Cornell University Renewable Bio-energy Initiative) (see Energy Action 3), or for local non-profit and for-profit ventures. For example, wastewater from the digester at the Cornell University College of Veterinary Medicine is now being delivered to the Ithaca Area Wastewater Treatment Facility, where it serves as an energy source, and surplus furniture from campus was recently donated to the Finger Lakes Fresh Food Hub to outfit their new facility.

Cornell's R5 Operations (Respect, Rethink, Reduce, Reuse, Recycle) is working with Cornell's Facilities Engineering Department, with vendors, and with campus partners to prepare an Ithaca Campus GHG Waste Inventory. The Cornell Solid Waste Institute is working to identify the carbon impacts related to the campus compost stream. The inventory will identify and collect metrics for all wastes on campus.

Once completed, this inventory can be used to analyze current business decisions the university makes regarding its waste handling procedures and contracts. For example, the primary landfill the university contracts with in Ontario County captures methane, which reduces carbon impacts. Both the data itself and the methodology for collecting and interpreting the data may be useful to the Tompkins County Solid Waste and Recycling Department, to both local and benchmark colleges and universities, and to University vendors.

### Next Steps

- Identify the parameters of the study, identify all wastes, and collect metrics for all wastes.
- Complete the Ithaca Campus GHG Waste Inventory and use the results to analyze current waste management practices, contracts, underutilized waste streams, and opportunities to reduce waste and associated carbon impacts.

### Resources

Think through how best to complete the study, including the feasibility of utilizing student assistance to compile the necessary data from campus sources and vendors.

## **INNOVATION:** Create a living laboratory for low-impact behaviors, climate education, and research.

### **2. Work to integrate composting into events, offices, and residence halls on campus.**

**Goal:** Expand compost collection on campus to include campus events and small generator locations, such as office spaces and residence halls.

Compost collection on Cornell University's Ithaca Campus is expansive and highly successful. All major dining facilities on campus collect food waste compost, capturing the majority of the food waste stream. Roughly 37% of the total campus waste stream is compost, virtually all of which is captured and processed here on campus. Cornell Dining chefs separate composting material during food preparation, and students, faculty, and staff compost their waste after their meals. About 515 tons of food scraps and organic waste were composted from Cornell Dining facilities in 2012-2013. All campus dining units use compostable take-out containers, flatware, table ware, and napkins.

Next steps involve expanding existing composting programs to include office spaces, residence halls, and coffee shops on campus, and to uniformly implement compost collection at campus events. Campus demand for growth of compost collection is high. Ad hoc volunteer programs currently exist in many locations throughout campus. For true waste diversion impacts, these ad hoc programs need to be centrally coordinated and institutionalized. Cornell's R5 Operations (Respect, Rethink, Reduce, Reuse, Recycle) manages the non-hazardous waste and recycling program for Cornell's Ithaca campus. Cornell's Farm Services Department manages compost collection and works in partnership with Cornell Dining and the Statler Hotel for material collection.

Compost collection at events and in office and residence spaces presents an excellent opportunity to educate the campus community through compost monitoring interactions, and to motivate staff and students to participate in these efforts. In 2014-2015, Cornell's Solid Waste Institute will be working to quantify the carbon reduction impacts of compost collection on University emissions.

A significant challenge to the success of the effort to expand composting to small generator locations is that, at present, the compost being collected through these streams is highly contaminated. Therefore, the majority of material collected through the green offices pilot program or at special events is landfilled. Additionally, labor and implementation costs for this action are high. At current rates, small-scale collection at multiple locations could increase waste collection costs for campus facilities.

#### **Next Steps**

- Cornell's R5 Operations intern will inventory and assess strategies to institutionalize the existing volunteer compost collection efforts in North Campus residence halls. (Current volunteer efforts range in scope and success. Ongoing challenges range from rodent and bug infestations to volunteer coordination and management.)
- Farm Services and R5 Operations are jointly piloting a volunteer compost collection in one office building on campus, with paid pickups by Farm Services at central building collection points. The pilot project will be designed to eliminate contamination.
- Review success of pilot programs in both office spaces and residence halls related to contamination of collected material, longevity of volunteer efforts, solutions related to on-site collection/storage pending pickup by Farm Services, and strategies to control rodent and bug infestation.
- Streamline and institutionalize compost collection system for special events, which range in size from small office parties to multi-day annual Reunion events.
- Identify and pilot paper towel compost collection in targeted facilities.

#### **Resources**

- Current pilot projects are funded through R5 Operations as feasibility studies. Maintenance or expansion of pilot projects beyond FY14 will require identification of future funding.
- Ongoing success of an expanded composting program will need to demonstrate resulting environmental benefits and landfill diversion.

### 3. Develop strategies for improved management of university materials and identify opportunities to utilize recovered materials as inputs for local not-for-profit or for-profit ventures.

**Goal:** Perform ongoing analyses of the inputs and outputs to Cornell's Ithaca campus in order to identify opportunities to divert materials from the landfill and, when possible, redirect these materials to new and existing businesses.

Cornell's R5 Operations (Respect, Rethink, Reduce, Reuse, Recycle) manages the non-hazardous waste and recycling system for Cornell's Ithaca campus. With many campus partners, R5 Operations hosts programs for recycling of papers, plastics, cans, glass, electronics, used oil, scrap metals, wood, tires, light bulbs, batteries, and more. Visit the **R5 Operations website:** (<http://r5.fs.cornell.edu/about/faq.cfm>) for a detailed inventory of Cornell's recycling metrics. R5's overarching goals are to increase the campus waste diversion rate, to reduce overall waste, and to ensure regulatory compliance.

One goal of this action is to develop programs to capture wastes which have not yet been identified. Cornell's new recycling program for pesticide containers serves as a good example. While the larger generators of this material (for example, the golf course) have been identified, identifying and capturing material from smaller generators of the material (i.e., labs) will improve landfill diversion.

Another goal of this action is to identify opportunities to utilize materials recovered from campus as feed stocks for new and existing businesses. For example, R5 Operations is currently reviewing strategies for improved management and potential diversion of polystyrene, clean wood waste, and construction plastics. This action targets non-hazardous and Universal Wastes, and excludes compostable waste. Additional diversion streams for Universal and non-hazardous waste, depending on the material stream, will have both positive and negative costs. R5's goal is to keep costs neutral.

A good example of an existing mutually beneficial partnership to utilize "waste" inputs to produce valuable outputs is Cornell's mulching operation. The Grounds Department and Cornell Plantations create mulch from leaves, brush, and tree waste which are collected on campus and from neighboring municipalities. In the fall the City of Ithaca and the Village of Cayuga Heights send most of their leaf waste to Cornell Plantations for mulch generation. Cornell's Farm Services processes the material for the Plantations at their campus compost facility.

#### Next Steps

- Continue to build relationships with local partners, including: Tompkins County, local colleges, and existing and potential vendors.
- Look for opportunities to coordinate this action with Cornell Cooperative Extension programs.
- Build relationships with regional partners and strengthen ties through participation in the New York State Association for Reduction, Reuse and Recycling (NYSAR3).

#### Resources

As new material streams are identified, cost-benefit analyses will be conducted.



Graphic provided by The Compost Crew, LLC.

## 4. Develop a deconstruction program to divert waste from building clean outs, renovations, and decommissions from the landfill.

**Goal:** Develop a deconstruction program on campus to divert construction waste from the landfill.

This action expands construction waste diversion practices for capital building projects, with a specific focus on deconstruction. Deconstruction is the process of systematically removing a building or structure by taking it apart in the reverse order of construction, with a goal of maximizing re-use and recycling of building materials and increasing the diversion of campus waste from the landfill.

The Waste Team is proposing to partner with the PSCC Buildings Team and Facilities Contracts Office to provide the necessary tools and resources to increase waste diversion in the demolition or construction phases of capital building projects. These tools include access to local and regional vendors for demolition and deconstruction, sample vendor contracts, project manager toolboxes, and other resources to be determined in conjunction with the Buildings Team.

Implementing a robust deconstruction program on campus should result in improved waste diversion percentages per project, and could result in additional points for LEED certification of the particular building being renovated or constructed.

This action will involve working with the local and regional construction industry, re-use vendors, and recycle vendors – and could build mutually beneficial relationships with these area businesses.

### Next Steps

Work with Buildings Team to:

- Study current and past Cornell capital projects to identify opportunities for improvement in waste diversion for waste streams that are not currently captured (for example, wood, drywall, windows, doors, etc.).
- Benchmark capital project construction practices of peer institutions that are working to achieve LEED certifications.
- Identify regional deconstruction vendors and conduct a formal Request for Information (RFI) process.
- Work with the Facilities Contracts Office to incorporate increased diversion goals into campus capital projects.

### Resources

From a single bottom line perspective it is anticipated this action will have a (financial) point of diminishing returns whereby increased labor costs will outweigh the landfill savings. Where this threshold lies will be dependent on project type, construction site, and vendor selection goals. The RFI process will be a valuable tool to help determine accurate financial cost estimates.

**LEADERSHIP:** Lead by example on campus and exercise climate leadership beyond campus.

## 5. Develop a university-wide waste reduction policy, including a comprehensive, campus-wide materials management strategy.

**Goal:** Implement a Universal Waste Management and Non-Hazardous Waste Handling Policy at Cornell to establish strategies for achieving waste reduction, clarify responsibilities, and ensure university-wide compliance with applicable laws and regulations.

As a member of the Tompkins County community, Cornell University is committed to supporting the County's solid waste and recycling diversion goals. Cornell strives to maintain its record of responsible environmental stewardship with regard to waste reduction and landfill diversion, and the University follows proper disposal practices for both non-hazardous waste and Universal wastes. However, given the complexity of Cornell waste streams, the variety of facilities, the decentralized structure of the university, and the breadth of staff, students, and vendors who generate and handle waste, the Waste Team is advocating for an overarching waste reduction policy for the university.

This policy would provide standardized reporting and handling practices, and resources for waste reduction. It would clarify responsibilities and strategies for achieving waste reduction and maintaining university-wide compliance with government laws and regulations. It would also streamline the collection of metrics to meet local, state, and peer reporting requirements. By improving existing practices and establishing a comprehensive materials management strategy, the policy would reduce the potential for inconsistencies and oversights – thereby reducing institutional liability.

The implementation of a campus-wide waste reduction policy will not incur additional costs for the university. In fact, the proposed policy could provide potential cost savings through streamlined waste management processes, increased efficiencies, increased awareness resulting in increased waste reduction and diversion, and reduced risks of non-compliance with applicable regulations.

### Next Steps

- Present an impact statement for the Universal Waste Management and Non-Hazardous Waste Handling policy to Cornell's Executive Policy Review Group for approval.
- Following approval, collaborate with stakeholders to draft the campus-wide policy.
- Obtain approval for the policy from Cornell's Executive Policy Review Group.
- Implement the policy and educate the campus community to build stakeholder buy-in and ensure compliance.

### Resources

Collaborate with stakeholders to draft the policy and build consensus for approval among the members of Cornell's Executive Policy Review Group.

## 6. Expand re-use programs both for internal reallocation of university owned materials and for repurposing of surplus materials no longer needed on the campus, either by offering these items for sale or by donating them to non-profit organizations.

**Goal:** Strengthen existing practices and develop new programs to reduce the campus waste stream through re-use.

Cornell University has a longstanding tradition of re-use of materials. Campus re-use programs support the local community through a variety of channels, including, but not limited to:

- Direct donations to non-profit organizations and local schools
- Funds raised for local non-profit organizations through the annual Dump and Run event
- Computers given to communities that would not otherwise have access to them
- Support of Tompkins County Solid Waste reduction goals, and
- Promotion of culture change through reduced use of disposable materials and reduced waste

Formal existing programs in support of re-use on Cornell's Ithaca campus include the following:

- **The Cornell Assets Transfer System (CATS)** – run by the Division of Financial Affairs – Cost and Capital Assets Department. This system is intended for capital assets, and is designed to connect those with available campus assets to those who can put these assets to further use.
- **System for Trade & Auction of Cornell Surplus (STACS)** - managed by Cornell's R5 Operations Department. STACS has TWO components: 1) an online public auction system for surplus materials no longer needed on the campus, and 2) an online system for internal reallocation of university owned materials. The STACS Re-use program saved more than \$40,000 in its first seven months of operation, mainly by repurposing office furniture which is offered for free to worksites on campus. After one month, unclaimed items are auctioned off to the community for personal use, for \$1, the value of the scrap metal, or for a nominal fee. STACS is designed specifically for distribution of non-capital materials and does not change or replace any function of the Capital Assets Transfer System (CATS). Visit <http://r5.fs.cornell.edu/about/reuse.cfm> for more information about STACS & other Re-Use programs at Cornell.
- **Chemical Re-use Program** – managed by the Environmental Health and Safety Department. Cornell University maintains a surplus chemical recycling program available for Cornell researchers. By using (and helping to promote) the surplus chemical recycling program, researchers can save money on chemical purchases and help to minimize chemical waste. The chemicals available through the surplus chemical recycling program are free of charge and are stored in containers that are either unopened or in very good condition.

### Next Steps

- Identify all re-use programs on the Cornell Ithaca Campus.
- Raise awareness on campus about existing re-use opportunities.
- Identify additional opportunities for re-use on campus (for example, capture of additional scrap wood for the making of mulch).
- Raise comfort levels within the Cornell community associated with utilizing re-used materials (examples range from utilizing Chemical Re-use Program for research materials to comfort with tap water in reusable water bottles).
- Grow markets and outlets for re-used materials off the Cornell campus (examples include creating formal relationships with local re-use merchants, to creating outlets in local schools, to exploring the potential to create outlets in larger metropolitan areas).
- Implement a campus-wide policy to standardize donation and sale of re-use materials.
- Track the volume of re-use on campus.

### Resources

Re-use programs are anticipated to have a financial cost saving through both reduced landfill costs and averted purchasing costs. Both a cost-benefit analysis and GHG impact study should be conducted to identify where cost and GHG savings are being realized, and where opportunities for improvement are available.

- **Cornell Computer Re-use Association (CCRA)** – managed by Cornell students. The CCRA works to donate computers and other technology to humanitarian organizations in the local community and to community centers, orphanages, schools, and other organizations around the world. The computers are used to create educational opportunities that the recipients would not otherwise have without access to the technology. Whenever possible, the CCRA provides technical assistance to the communities that are receiving donations so that the computers' use and longevity can be maximized. The Association has donated to many international locations, including South Africa, Nigeria, Afghanistan, Iraq, Nicaragua, and Jamaica. CCRA promotes the University's sustainability mission by reducing the amount of technology-related waste that Cornell creates.
- **Dump & Run** – managed by Student and Academic Services. Dump & Run is Cornell's annual campus-wide waste-reduction and recycling program. Students and staff volunteers collect items students might otherwise throw away when they leave campus in May, sort and organize the collected items over the summer, and resell them at a large community sale when students return in August. Admission is free, and the sale is open to the public. Proceeds from each Dump & Run sale are donated to local nonprofit organizations. The 2013 Dump & Run sale featured approximately 30 tons of recycled furniture, clothing, jewelry, lamps, kitchenware, and electronics, and the event raised almost \$55,000 to benefit local charities. Since the program began in 2003, Cornell has contributed nearly \$250,000 to Ithaca-area charities and donated many tons of reusable goods to local human service agencies. For more information visit: <http://living.sas.cornell.edu/explore/news/1305-dump-run-collection.cfm>.
- **Sedgwick Business Interiors Asset Inventory Management (AIM) Program** – available for use by Cornell departments through a contract with Procurement Services. The AIM Program inventories all furniture for a University department or unit's project and provides a customized Internet-based asset inventory (AIM) list of all items stored. AIM allows users to view all products online for future moves and reconfigures. AIM provides reliable and consistent information to promote better utilization of assets and reduced customer storage costs.
- **Donations** – Cornell's Community and Government Relations Department collaborates with departments and units campus-wide to oversee donations of materials to non-profit organizations and government entities.

# WATER

**NEUTRALITY:** Reduce Cornell's carbon emissions to net zero by the year 2050 or sooner.

## 1. Complete a water/energy nexus study for the Cornell campus and implement comprehensive strategies to monitor usage, conserve water, and reduce energy associated with treating potable and waste water.

**Goal:** Quantify energy use associated with the campus water delivery system, and implement measures to optimize the system and conserve both energy and water.

The source of Cornell's water is the 125-square mile Fall Creek drainage area.

**Cornell's Water Filtration Plant** (<http://energyandsustainability.fs.cornell.edu/util/water/drinking/default.cfm>) provides a population of about 34,000, including the campus community and residents of the adjacent Forest Home and Cornell Heights neighborhoods, with safe and reliable drinking water. In 2012, the plant produced 507,000,000 gallons of potable water: approximately 9% of this water was used to generate energy for campus, while 91% of the total supplied campus potable water and agricultural needs.

Water and energy are inherently linked, intersecting on both the supply side and the end use side. This intersection is commonly called the "water/energy nexus." Efficiency programs that save water will also save energy and vice-versa. To more precisely quantify the energy associated with Cornell's water system, the Water Team is proposing a water/energy nexus study for the Ithaca campus. This study will quantify energy use associated with the current water delivery system as a basis for prioritizing and implementing infrastructure upgrades, such as pump replacements. The study will also provide a basis for implementing water conservation measures on campus, by linking these measures to reductions in energy use.

A preliminary analysis conducted in 2012 showed that approximately 4% of campus energy is used to treat and pump campus potable water, and 9% of campus water is used to generate energy. The next phase of the study will assess how much energy is used to treat campus wastewater at the Ithaca Area Wastewater Treatment Plant, and may also attempt to quantify the volume of water used to extract the natural gas used to generate campus electricity.

Approximately 15-20% of the water Cornell produces is currently unaccounted for. Metering all of the water produced would stabilize water rates and share costs equally among all customers. Utilities staff will continue to search for unmetered locations and install water meters as needed. In the longer term, water usage will also be added to the **Cornell University Building Dashboard** (<http://buildingdashboard.cornell.edu>), so that colleges and units can track their usage and save money by adjusting their consumption.

### Next Steps

- Complete the water/energy nexus study, including a cost-benefit analysis, evaluate the study recommendations, and present findings to campus Utilities staff.
- Find un-metered water on campus. Install sub meters at strategic locations to account for all water used on campus and stabilize water rates for all customers, including Town of Ithaca and City of Ithaca customers.
- Add water usage to the Cornell University Building Dashboard.
- Include water conservation in the college engagement campaign, **Think Big, Live Green** (<http://thinkbiglivegreen.cornell.edu>).

### Resources

Collaborate on joint water and energy utility programs to maximize savings and share tracking, metering, and data evaluation responsibilities.

## 2. Increase the energy efficiency of the campus water delivery system through upgrading aging pumps and infrastructure.

**Goal:** Optimize the energy efficiency of the campus water treatment and delivery system.

Several infrastructure upgrades are planned in the next two years to increase the efficiency of the Cornell Water Filtration Plant. The electrical service entrance to the Water Filtration Plant will be upgraded to improve efficiency in the plant's pumping operation, and five pumps will be replaced. The current pumps are either ON or OFF, pumping to their maximum capacity or off entirely. The current pumps will be replaced by pumps with variable frequency drives, so that plant personnel can adjust them to appropriate flow rates. Since the new pumps will provide only the necessary energy to deliver water, they will improve the overall efficiency of the water delivery system. Electrical savings will pay back the upfront costs of the pump replacement project.

In the next three to five years, additional improvements to the distribution system are planned, including replacement of aging pipes on North Campus. Such improvements will decrease the frictional losses in the system and remove potential vulnerabilities due to breakage or failure.

### Next Steps

- Complete upgrades to the Water Filtration Plant and optimize pumping controls.
- Track current electrical usage before and after upgrades to evaluate results.

### Resource :

Assess costs and benefits of current projects as a basis for seeking approval/funding for future efficiency upgrades to the campus water delivery system.

**LEADERSHIP:** Lead by example on campus and exercise climate leadership beyond campus.

### 3. Continue the **Take Back the Tap** outreach campaign to promote the use of reusable water bottles and containers, particularly at events and conferences, thereby reducing supply chain emissions and waste associated with bottled water.

**Goal:** Reduce bottled water consumption and associated costs, energy use, and GHG emissions through education and behavior change.

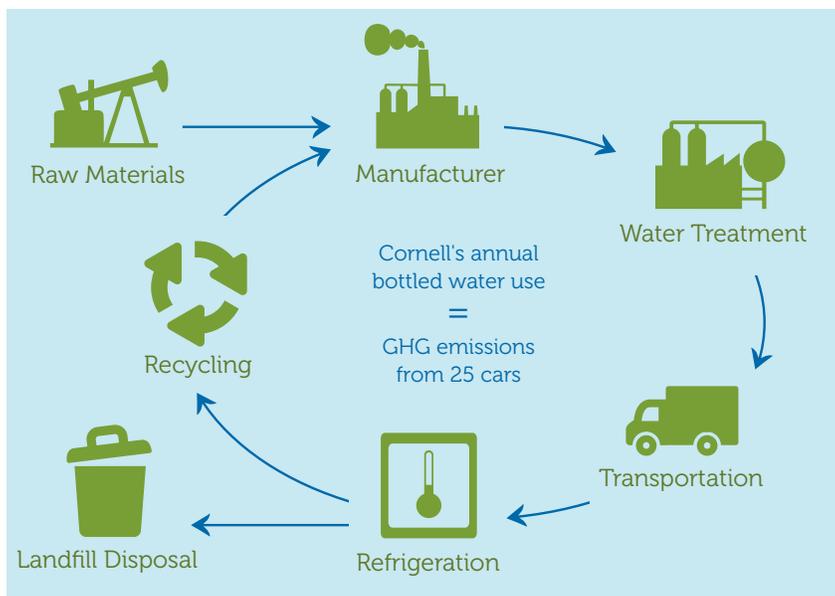
Between 350,000-400,000 single-serving bottles of water are sold on the Cornell campus annually, and more than 30,000 five-gallon carboy bottles of water are purchased for use in campus water coolers. Bottled water costs the campus community an estimated \$640,000 per year, but the same volume of tap water would cost just \$1,000. Cornell's annual consumption of bottled water causes nearly 115,000 kg of CO<sub>2</sub> emissions, or the equivalent of 265 barrels of oil. **"Take Back the Tap"** (<http://www.sustainablecampus.cornell.edu/initiatives/take-back-the-tap>) (TBTT) is an education/awareness campaign at Cornell to reduce bottled water consumption – and associated costs, energy use, and GHG emissions. The goal is that this behavior change will be sustained even as students graduate and leave Cornell. The TBTT student club currently has ten members who regularly attend meetings. The club's main focus is changing the Cornell population's attitudes and habits relating to bottled water and making tap water more appealing and convenient to the campus community. The club owns four 10-gallon water jugs that they loan out for informal events, such as races, and three 3-gallon water dispensers that are available for more formal events, such as graduation receptions.

#### Next Steps

- Continue education and outreach to reduce bottled water sales on campus.
- Prioritize locations, secure funding to retrofit water fountains with in-line water coolers, and retrofit water fountains as funding permits.
- The green events team will identify existing communications channels and processes through which university events are typically planned and advocate for making events bottle-free.

#### Resources

Develop strategies to increase student engagement and work with University Communications to move TBTT messages out to the Cornell community.



The TBTT campaign is making a difference: bottled water sales at campus convenience stores and community centers have decreased by roughly 25%. Other recent achievements include:

- TBTT education is a part of orientation.
- All incoming students receive reusable bottles.
- Cornell's design standards for new buildings and renovations now include bottle fillers.
- Many existing drinking fountains have been upgraded with bottle fillers.
- An **inventory of bottle filling stations** has been posted online at <http://energyandsustainability.fs.cornell.edu/file/DAT-2013-04-22-BottleFillerInventory.pdf>.
- Inline water coolers, which are fed by Cornell water, are a sustainable, cost effective option to replace carboy style water coolers. Mister Koffee, a local business, has been selected as Cornell's vendor of choice, and the new coolers are now available through eShop. More than 25 inline coolers have been installed to date.

Tips on how to host bottle-free events are included in the **Sustainable Events Planning Guide** at <http://www.sustainablecampus.cornell.edu/resources/13/download>. The Guide is also available through the **Cornell Event Planning website** at <http://www.cornell.edu/event-planning/>. Bottled water sales at campus events have, however, not declined – emphasizing the need for increased outreach and education around green event planning. A newly formed ad hoc “green events team” is working to identify existing communications channels and processes through which university events are typically planned and to advocate for making events bottle-free.

TBTT concepts are included in the “**Green Your Workplace**” (<http://www.sustainablecampus.cornell.edu/initiatives/october-green-your-workplace>) initiative that is being launched as part of the Think Big, Live Green college engagement campaign. This initiative was piloted in the College of Engineering in Fall 2013, and will be expanded campus-wide in 2014.