Climate Action Plan

September 15, 2009

ITHACA

Approved
by the Ithaca College
Board of Trustees
October 9, 2009

This Climate Action Plan was developed by the **Presidents Climate Commitment Committee** *(PCCC)* comprised of the following members of the Ithaca College community:

Carl Sgrecci, Vice President for Finance and Administration and committee chair

Marlene Barken, associate professor of Business Marketing / Law and chair, School of Business Sustainability Committee

Marian Brown, Special Assistant to the Provost and Vice President for Academic Affairs

Alexandra Chesney '09 *, Humanities and Sciences *(graduated Spring 2009)*

Beth Ellen Clark Joseph, associate professor of Physics**,** and past convener of Tompkins Renewable Energy Education Alliance

Rick Couture, Associate Vice President of Finance and Administration for Facilities

Paige Davis '10 *, Humanities and Sciences

John Fracchia, Associate Director, Career Services, and Staff Trustee

Jeff Goodwin '10, Communications and Student Body president, and summer '09 intern on alternative transportation planning

Jason Hamilton, associate professor of Biology

Doreen Hettich-Atkins, Coordinator of Special Services and Programs, Student Affairs and Campus Life

George Lampila, HVAC Technician, Facilities Maintenance

Brooks Lape '09, student, School of Business *(graduated Spring 2009)*

Michelle Rios Dominguez, Human Resources Specialist, Recruitment and Student Employment

Irene Scott, Coordinator, Desktop Technology Acquisitions, Information Technology Services

Cindy Smith, Mail Processing Assistant, Mail Services, and Staff Council Sustainability subcommittee representative

Stephanie Piech '11 *, Humanities and Sciences

Susan Swensen, associate professor of Biology and Environmental Studies; chair of Center for Natural Sciences Sustainability Group; convener, Ithaca College Sustainability group

***Denotes students who worked with Dr. Susan Swensen to update the college's greenhouse gas emissions inventory as an independent study project. Each participating student has been invited to serve on the PCCC committee until graduation as an advisor on the inventory process and findings.*

We are grateful to the following team of consultants who guided our Climate Action Plan development effort:

Stan Wrzeski, Senior Planner and Project Manager
Affiliated Engineers, Inc.
5802 Research Park Boulevard, Madison WI 53719
Phone: 608-441-6625 *swrzeski@aeieng.com*

Rob McKenna, Senior Consultant for Energy Facilities
Energy Strategies LLC
215 South State Street, Suite 200, Salt Lake City, Utah 84111
Phone: 801-355-4365 *RMcKenna@Energystrat.com*

Nathaniel Grier, PE, Senior Associate
Martin Alexiou Bryson
309 Spruce Avenue, Edgewater MD 21037
Phone: 410-514-6150 *nathanielgrier@mabtrans.com*

Match funding support for the development of this Climate Action Plan was provided by the **New York State Energy Research and Development Authority** (*NYSERDA*).

Table of Contents

Table of Figures

Executive Summary

Our Commitment

Ithaca College, as an early signatory of the American College and University Presidents Climate Commitment (ACUPCC), committed to undertake three actions:

1. Within two months of signing, create institutional structures to guide the development and implementation of this Climate Action Plan. *The Presidents Climate Commitment Committee (PCCC) was established in 2007.*
2. Within one year, complete a comprehensive inventory of all greenhouse gas (GHG) emissions and regularly update the inventory thereafter. *Our first greenhouse gas emissions Inventory was completed in 2006 for fiscal years 2000-05, with the inventory updated in succeeding years to include FYs 2006, 2007 and 2008. We are using 2007 as our baseline year for this plan.*
3. Within two years, develop a Climate Action Plan for becoming climate neutral, which includes the five elements noted in the left column of Table 1. *Our responses are noted in the right column.*

Climate Action Plan Requirements	Our Response
i. a target date for achieving climate neutrality as soon as possible.	Our goal is to achieve climate neutrality by 2050.
ii. interim targets for goals and actions that will lead to climate neutrality.	Our interim targets: **25%** reduction in GHG emissions **by 2015**, another **25%** reduction **by 2025**.
iii. actions to make climate neutrality and sustainability a part of the curriculum and other educational experiences.	We outline past educational and outreach activities, and identify opportunities for future student engagement.
iv. actions to expand research or other efforts necessary to achieve climate neutrality	We focus on actions that reduce costs *and* allow us to make more informed choices among more expensive options later.
v. mechanisms for tracking progress on goals and actions	A reconfigured organizational structure focused on implementation will allow us to track reduced emissions *and* reduced costs.

Table 1: ACUPCC Requirements and Our Response

This Climate Action Plan represents the first step in a 40-year journey to climate neutrality. It is an evolving plan that will need to be reviewed and updated periodically to reflect ever-changing technologies, economics and institutional circumstances.

This Climate Action Plan builds on preceding and ongoing efforts that have begun to make Ithaca College more energy-efficient:

- Sightlines report identifying and prioritizing major infrastructure improvements
- Clough Harbor Associates recommendations to guide energy efficiency improvements
- our early investments in building metering, automation systems and controls

It's time to finish the job. Even if we were not an ACUPCC signatory and did nothing, the effects of future carbon regulation on energy commodity markets will subject Ithaca College to significant financial liabilities. This report demonstrates that **it will actually *cost us less* to implement this plan than if we took no action at all.** Wise investments now will help us avoid these future costs.

A Call to Action

The Ithaca College Presidents Climate Commitment Committee requests that the Board of Trustees approve this Climate Action Plan, which includes the following recommendations:

Action #1: Assign responsibility for an Energy Manager and complete the installation of necessary metering and controls to monitor energy consumption in our facilities and energy-using systems.

Action #2: Begin an ongoing program to inventory all energy-using equipment and ensure that all energy-using systems are performing optimally and as designed.

Action #3: Determine the most cost-effective actions to reduce both energy costs and emissions, *especially* with respect to major HVAC plants reaching their end of service life.

Action #4: Undertake a two-year review of policies and programs, identifying changes needed to encourage the use of best practices to reduce emissions.

These early actions will yield cost savings to be reinvested in upgrades to further reduce energy costs and emissions.

But these steps will not be enough. More costly investments will need to be made in the future. So our early actions will build a foundation from which we may make more informed choices later.

To carry out these early actions, we have identified the Working Groups (p. 32) to guide and monitor the implementation of our Climate Action Plan. These groups will report on the performance of their assigned initiatives, and ensure that recommendations for future investments are well-conceived and likely to achieve their intended results.

A more in-depth *Overview* (pp. 6-11) follows. The detailed Climate Action Plan begins on page 12.

Overview

Rationale

Ithaca College signed the American College and University Presidents Climate Commitment (ACUPCC) in May 2007. As an early signatory, we agreed to meet a number of obligations, chief among them to develop and submit this Climate Action Plan (CAP) by September 15, 2009.

This past July, the PCCC recommended that Ithaca College plot a course to achieve climate neutrality by 2050, a goal that is consistent with the findings of accepted science. For an explanation of the broader rationale for this Climate Action Plan, see *Introduction* (p. 12).

Even in the absence of the Presidents Climate Commitment, Ithaca College would be subject to the financial risk of increased energy costs in the future, whether these are driven by market forces or regulatory requirements. Based upon *"Business As Usual"* trends derived from our own development plans and projected population growth, as a result of federal GHGE regulation, we estimate that **Ithaca College may be subject to future costs with an expected value of $25,000,000**. Depending on regulatory stringency and rate of technology development, the present value of these costs could be as low as $5,000,000 or as great as $62,000,000. This broad range of potential costs highlights both the *uncertainty* of the cost impact as well as the *opportunity* associated with identifying and successfully implementing greenhouse gas emissions (GHGE) abatement actions that mitigate this economic risk (p. 15).

Framing The Choices

Ithaca College Environmental Studies students, under the direction of Dr. Susan Swensen, have conducted *Greenhouse Gas Emissions Inventory* (p. 14) for the periods 2000-2007. These GHGE inventories have shown that facility energy use accounts for over three-quarters of our CO_2e emissions (of which 2/3 is purchased electricity and 1/3 is natural gas). Transportation accounts for most of the remaining quarter (of which 50% is commuting, 40% air travel, and 10% fleet operations).

We then laid out a *Portfolio Sketch* (p. 16) showing a credible path to carbon neutrality by 2050. This diagram defines an achievable set of CO_2e reduction targets to reach our goal.

More detailed information was developed on the cost and impact of each individual action in the *Description of Actions and Assumptions* (p. 18), and then packaged into a model that shows the present value of their individual impacts in the *Action Abatement Curve* (p.26). We also show their cumulative impact when staged over time in the *Base Portfolio* (p. 27) and the *Finishing Portfolio* (pp.28-29). Finally, we compared and contrasted the *Economic Performance* (pp.30-31) of these alternative portfolios of actions.

The Plan

A Climate Action Plan is about *acting*. But we must act wisely, and within the limits of our financial and human resources. We therefore propose a mix of short-term actions and long-term goals. Our present portfolio of actions is divided into two parts:

- A short-term **Base Portfolio** (p. 27) of actions to reduce the demand for energy and improve the efficiency of energy-using systems. It makes sense to complete these actions first because:
  (1) energy cost savings may be re-invested; and
  (2) the reduced demand will make supply-side actions more cost-effective. Examples of supply-side actions include major replacement of HVAC plant and integration of renewable energy systems.

- A long-term **Finishing Portfolio** (pp. 28-29) of mostly energy supply-side actions from which we will choose to meet our long-term goals. Choosing among these actions – and others we cannot now conceive – will depend on the success of our short-term actions, the evolution of new technologies, future costs of energy and carbon mitigation, and the availability of capital.

The need to replace aging boilers/chillers presents a major choice that bridges these two portfolios. We need to think strategically about whether to phase out individual building-level HVAC systems and replace them with regional district heating/cooling plants that could eventually be linked into a single large district plant. This centralized approach, although requiring significant investments, may offer us greater system efficiencies, lower maintenance costs, and the potential to use fuels that are more benign in their climate impact than fossil fuels.

The First Five Years (2010-15)

There are three objectives for the first five years:
(1) gain a better understanding of our energy use, energy-using systems, and behaviors,
(2) focus on actions of modest cost that yield immediate savings, and
(3) undertake demonstration projects that evaluate the efficacy of renewable technologies that may be deployed in the future.

Key actions recommended for this first 5-year period include the following:

- **Complete metering** of all campus buildings and major energy-using systems
- **Upgrade controls** for lighting and HVAC systems
- **Expand the data inventory** of our energy-using systems
- **Assign responsibility for energy management** to track performance of building systems
- **Retro-commission all facilities** to assure their systems are operating at peak efficiency as designed
- **Develop performance-driven facility design guidelines**:
    - during 2010, study the feasibility of local vs. regional/central plant options, then develop design specifications to guide a campus-wide solution commencing in 2012.
    - develop energy- and space-use intensity guidelines for new construction and major renovations
    - develop building envelope renovation guidelines to maximize efficiency of existing structures
    - standardize energy-using systems and equipment as appropriate
- Develop, test, and **evaluate program and policy changes** that support emissions-reducing behaviors
- Package a **demonstration of solar domestic water heating** and develop specifications for a campus-wide installation
- Develop the documentation necessary for permitting a wind turbine.
- Evaluate the potential for third-party financing of renewable energy technologies, including photovoltaic and wind power
- **Assign responsibility for transportation coordination** to establish commuter reduction goals, along with policies and programs to support reduced business travel
- Establish **vehicle purchase and operation standards** to reduce fleet fuel consumption

At the end of this period, we will have developed a comprehensive set of baseline information upon which to build a solid, actionable plan to achieve our long-term goals. These early actions will provide a foundation that prepares us to make informed choices among more expensive and expansive actions necessary beginning in 2016.

More detail on and the rationale for specific actions that comprise each of the first five years may be found under *Implementation* (pp. 32-33)

The Next Ten Years (2016-2025)

During this period, we envision significant investments to improve the efficiency of our energy-using systems. A major focus of this period is:

- Replacement of aging HVAC plant in buildings with either upgraded local equipment or central/regional systems
- Installation of solar domestic water-heating systems for residential and dining facilities
- Installation of up to two commercial-scale wind turbines on campus (based on feasibility study results) and/or investigation of investment in purchase power agreement with local wind farm project
- Assurance that best practices in energy efficiency are followed, so both re-commissioned and new systems are operated in a manner that achieves *continued* emission reductions.
- Procurement of alternative-fuel vehicles and development of any necessary supporting policies and infrastructure

By the end of this period, actions of the Base Portfolio should be completed or well underway. We should also have a much better grasp of the opportunities and circumstances that will define our work in the next 25 years.

The Final Twenty-Five Years (2026-2050)

By 2026, we will near the half-way point of our 40-year endeavor. At this point, our previous years' efforts to reduce energy demand and improve system efficiency will allow us to optimally exploit renewable sources of energy.

By then, perhaps there will be a "Silver Bullet" technology that creates inexpensive, carbon-free energy. Minimally, we hope that there will be major advances in the efficiency and cost-effectiveness of proven renewable energy technologies like solar photovoltaics. With the substantial investments we will have made in efficient buildings, energy systems, and changing the consumption habits of our campus community, we can be satisfied that we will use only the energy we need. The cost savings from consuming less energy can be redirected to meet other campus needs such as capital equipment upgrades, financial aid, and academic program development.

Facilities Actions

Our actions to reduce facilities emissions need to address both the building systems and the behaviors of people who use them. Our ordered strategy is to:

1. reduce demand by changing institutional operations and individual behaviors
2. improve efficiency of building systems
3. switch to more benign fuels where feasible

Early investments in renewable technologies (solar domestic hot water, solar photovoltaics, wind turbines, etc.) may be justified by the availability of third-party financing. However, we need to concentrate on making our existing buildings and systems as energy-efficient as possible, keeping in mind the important decisions to be made among major HVAC plant upgrade options, given the age and condition of building plant and distribution piping.

For the first year of our Climate Action Plan (2010), we recommend the following actions aimed at helping us make more-informed choices about future investments in our facilities:

1. **Complete metering and control upgrades** for all our buildings, along with their major energy subsystems. Then **assign responsibility for energy management** to monitor and track energy use. Such coordinated oversight will help us understand our existing building energy use, identify problems to be corrected, and support our ability to document the impact of both energy upgrades and programs to change user behaviors.

2. **Retro-commission all of our buildings**, making needed repairs and adjustments to assure they are operating as designed. At the same time, **complete a comprehensive inventory of all energy-using systems**. This site work, along with energy audits as necessary, will help us identify opportunities for energy-saving replacements and upgrades.

3. **Conduct a detailed feasibility study of alternatives to replace our aging HVAC plant** and infrastructure. The more expansive knowledge gained from #1 and #2 will help inform this choice.

4. **Evaluate institutional policy and process changes** needed to effect *A New Paradigm* of shared responsibility (see page 10).

5. **Package a solar domestic hot water demonstration project** to evaluate the efficacy of this renewable technology for residential units and dining facilities throughout campus.

		reduction target		
Action	**begins in**	**Gas**	**Elec**	**GHGE**
Behavior Change Programs	2010	3%	4%	3%
promote energy-conserving behaviors by faculty, staff and students, complementing transportation actions (p. 20)				
Metering and Energy Management	2010	2%	12%	7%
finish installing meters; energy manager to monitor meters and building automation system and dispatch staff to assure proper system operation (p. 19)				
Space Management	2011	1%	1%	2%
more effectively using existing spaces, and shut down or turn back spaces that are not needed (p. 20)				
Controls Upgrades	2010	20%	20%	14%
enable improved monitoring of system performance and balancing of systems to space management needs (p. 20)				
Environmental System Upgrades	2016	3%	0%	2%
reduce heat gains/losses and infiltration, and improve thermal comfort for occupants (p. 20)				
Major Plant Upgrades	2013+	40%	10%	14%
make decision to either replace distributed existing boilers and chillers, or use regional/central plants and improved distribution piping (pp. 21-22)				
Solar Domestic Hot Water	2016	5%	-	3%
focus on residential and dining hall applications, where hot water consumption is greatest (p. 22); pilot project by 2013				
Appliance Efficiency Standards	2011	-	3%	2%
improve the efficiency of plug loads, and eventually require standards for personal appliances as well (p. 19)				
Lighting Upgrades	2011	-	15%	8%
improve the efficiency and controls, and have more uniform equipment specifications (p. 19)				
Wind Power	2026	-	*TBD*	*TBD*
feasibility study has been completed (p. 23)				
Design Standards	2011	*TBD*	*TBD*	*TBD*
more aggressive performance-based requirements to guide new construction and major renovation work				

Table 2: Summary of Facilities Actions

Transportation Actions

Transportation is a part of our daily lives and essential to the educational mission of the College. While nearly all of these emissions are released off-campus, they occur because of the college, and thus are considered part of Scope 3 emissions. While many of our transportation actions may go unnoticed in the community, some can be highly visible. Moreover, the efforts we make to curb our transportation-related emissions can establish behavior patterns that last well beyond when we and our students leave the campus.

We recommend the following transportation-related actions:

1. **Create a coordinated travel-demand management program** (**TDM**), enhancing incentives and, where appropriate, introducing disincentives to operate single-occupant vehicles. As part of this effort, we recommend **assigning responsibility for TDM coordination**. This will help us track progress toward our goals. This program also complements the Campus Master Plan goal of a "walkable" campus.

2. **Reduce the carbon-intensity of our vehicles**. This will include the development of a 'green fleet' policy, establishing continually-increasing efficiency standards and the use of alternative fuel vehicles such as those that run on electricity or bio-fuels. We will also examine our day-to-day business practices to determine where usage can become more efficient through shared material and equipment delivery, idling policies, and personnel transportation services.

3. **Provide distance-learning and web conferencing tools, training and support** to enable students, faculty and staff to participate in these and other electronic communications where such activities can appropriately replace air travel. This would include **assigning a part-time coordinator** to oversee the program and related outreach efforts.

4. **Enhance our reporting and tracking tools** to provide improved data on the carbon impacts of campus commuting and business travel, particularly air travel.

		reduction target		
Action	**begins in**	**Gas**	**Elec**	**GHGE**
Commuter Travel	2010	-	-	2%
programs and policies to encourage the use of non-single occupant vehicles for faculty, staff and student commutes. These would include enhanced incentives such as a guaranteed ride home and vanpool support. Changes to the parking system would begin concurrently and be phased in over several years. Complements efforts to change user behaviors toward campus facilities (p. 24)				
Business Travel	2010	-	-	<1%
include staff to provide support for use of electronic communications in lieu of travel. Also include education and awareness as part of campus-wide change programs (p. 23)				
Campus Fleet - Fuel Efficiency	2010	33%	-	1%
include a program to establish continually improving fuel standards for owned and leased vehicles. Ongoing monitoring would adjust purchase and usage standards to ensure continued success (p. 24)				
Campus Fleet - Alternative Fuel Vehicles	2020	50%	-	1%
program to actively migrate to non- and lower-petroleum fuel sources for vehicles and fuel-consuming equipment. Includes both electric and liquid fuels (p. 23)				

Table 3: Summary of Transportation Actions

Financial Actions

The ACUPCC defines Climate Neutrality as *"having no net GHG emissions, to be achieved by minimizing GHG emissions as much as possible and using carbon offsets or other measures to mitigate the remaining emissions."* To understand the potential cost of achieving climate neutrality, we calculated the "Reference Cost" of using financial instruments only (no direct actions to reduce emissions) to achieve our 2050 neutrality goal. This approach to neutrality can be accomplished through the purchase of either offsets or Renewable Energy Credits (RECs).

As shown in Figure 1, **the present value of the cost to *"buy our way out"* with RECs or offsets is estimated to be $15,600,000. This is in addition to the $25,000,000 in direct and indirect regulatory costs.** See *"Potential GHGE Financial Exposure"* (p. 15).

Offsets are created through financial support of projects that reduce the emission of greenhouse gases at locations external to our campus. There are numerous types of offset projects that may be grouped into four broad categories:

1. Fossil fuel reduction
2. Sequestration
3. Methane capture and combustion
4. Industrial gas destruction and other types of projects.

For simplicity, we assume that:

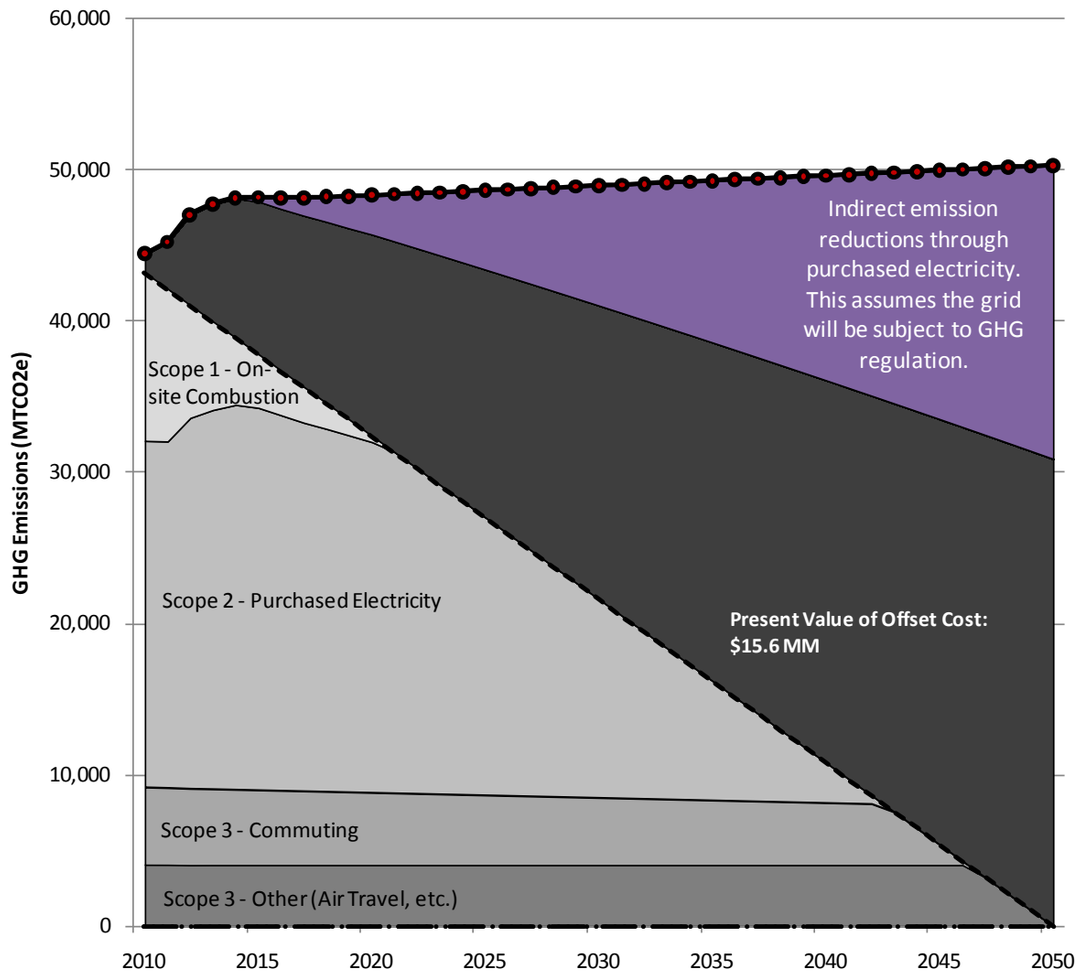
(1) offsets will be purchased rather than making direct investments in projects, and
(2) the price per unit of these offsets will be the same as regulatory compliance allowances.

Although ***Renewable Energy Credits*** (RECs) have been traded in voluntary carbon markets and counted by some institutions as a credit against their GHG emissions, *a REC is not an offset or an allowance and does not necessarily represent a reduction in existing GHG emissions*. Therefore, a REC cannot be used as a credit against Scope 1 (on-site combustion) and Scope 3 (travel) emissions.

However, RECs *may* have a limited role to play as one element of a portfolio of actions we can take to achieve climate neutrality. RECs can be used by an institution or individual to demonstrate a valid claim that they are purchasing zero-emissions electricity. Where RECs are certified and tracked by a registry, sold only once and then retired, they offer a mechanism to obtain electricity with zero-CO_2e emissions. The purchase of "Green Power" as verified by a REC can be counted as a reduction in our Scope 2 (purchased electricity) emissions. In this way, we reduce our carbon footprint for purposes of the ACUPCC.

The costs in *Figure 1: Reference Cost Wedge Diagram* represent only a "reference cost" against which we may compare the cost of direct actions to reduce emissions. Once we better understand the cost and impact of those direct actions (pp. 18, 26 and 30), we can compare them to the cost and impact of these financial actions.

Figure 1: Reference Cost Wedge Diagram



Policy and Program Actions

It is a common perception that buildings and vehicles produce emissions, so the solution lies in improving their efficiency. But the scale of emissions reductions required at Ithaca College – as well as the scale of reductions needed worldwide – requires that we recognize that our ***use*** of those buildings and vehicles creates emissions.

Solutions to global climate change require an understanding of both technology *and* behavior. This intersection creates an opportunity for action that is uniquely suited to the mission and perspective of a comprehensive college that blends liberal arts and professional education. We therefore propose that Ithaca College articulate, as an essential component of this Climate Action Plan, that ***climate neutrality is a shared endeavor***.

A New Paradigm

Our facilities professionals – and their budgets – should not bear sole responsibility for reducing energy use. There must be **a new paradigm of shared responsibility between Ithaca College and the Individuals that comprise it:**

- Ithaca College is responsible for providing living, learning and working environments that meet *both* minimum environmental standards (thermal comfort, indoor air quality, visual environment, adequate space, and access to natural environments) and minimum energy-performance and resource-consumption requirements (energy-use intensity, carbon footprint, space-use intensity).

- Members of our campus community are responsible for operating College facilities and equipment in an energy- and resource-efficient manner and acquiring and disposing of materials in a manner that reduces environmental impacts (in keeping with our Comprehensive Environmental Policy (see *Appendix A).*

Policy Actions

Shared responsibility for achieving climate neutrality must be incorporated into the College's mission. The built environment, the behaviors of *all* members of the our campus community, the curriculum taught in our classrooms, the research conducted by our faculty, and the projects engaged in with our communities must all inform – and be informed by – our efforts to reduce greenhouse gas emissions.

Program Actions

Our efforts with respect to building design, maintenance, and efficiency improvements will need to be substantially expanded to achieve carbon neutrality. These improvements must be complemented by behavior changes that are individually incremental, but collectively substantial. Building occupants need to understand at a very basic level how their buildings function, how much energy the buildings consume, and actions that can be taken to reduce consumption. Creative incentives and recognition programs will be needed to stimulate desired behaviors.

This *Overview* highlighted the major initiatives needed to carry out our Climate Action Plan. The remainder of this report details the process by which we decided what needs to be done, along with the rationale for those actions.

Ithaca College Climate Action Plan – The Details

Our Climate Action Plan is a guide to help us understand and reduce emissions at Ithaca College. It is also intended to assist other similar institutions to learn from our experiences as they formulate their own path. We strived to make both the process and the rationale for our actions transparent and transferable.

Introduction

There are still many unknowns, so this plan needs to be a living document. Our Climate Action Plan will need ongoing work to frame the implications of upcoming decisions, many of which could have large financial and operational impacts for Ithaca College. The necessary replacement of major building HVAC systems (boilers, chillers, and shared distribution piping) is the most prominent example of a potential "fork in the road" that bears more scrutiny.

Technology solutions will only take us so far toward climate neutrality. We will also need to change the way we behave, which will be challenging since many of our habits are deeply engrained and culturally reinforced. We recommend that operating units be empowered with decision-making authority and the funding necessary to make ongoing progress.

Many of our initial actions to reduce carbon will yield short-term financial returns. But we also need to consider longer-term actions that will pay back in energy savings more slowly.

An initial focus on energy conservation

We assume that the Ithaca College CAP will be a multi-year effort. Our first efforts will focus on actions to conserve energy (by either reducing demand or improving system efficiencies) that yield energy cost savings to be re-invested to achieve even more reductions in energy costs *and* GHG emissions.

By reducing the demand-side energy load during the early years of our CAP, we hope to improve the viability of future supply-side technologies that are more efficient and/or use renewable energy sources. So we will first engage in the discipline of establishing mechanisms to **manage our emissions, rather than simply inventory them**. We need an energy management capability to address the campus as a whole.

Not just carbon

This Climate Action Plan does not stand alone. Efforts to reduce GHG emissions are a subset of a broader sustainability initiative at Ithaca College. We must identify potential program synergies and cultivate opportunities to weave together common agendas.

As noted under *A Rich History of Environmental and Outreach Initiatives at Ithaca College* (pp 38-39), sustainability has been an emerging part of the culture at Ithaca College for some time.

A sustainable decision system

Since our CAP will guide decisions over many decades, it will need to be re-visited and revised over its life. It is imperative that our process and assumptions be transparent. Our first Climate Action Plan tries to capture the rationale for both accepted *and* rejected actions, allowing future decision makers to understand our choices and our methodology, and to revisit past *"sidelined"* options as circumstances and assumptions change in future years.

The costs and benefits associated with our carbon reduction efforts will involve millions of dollars. We urge consideration of the "triple bottom-line" (economic, environmental, and social factors) when making choices. Given the unique mission of Ithaca College, we have added one additional factor (institutional), yielding a *"triple bottom line-plus"* decision system. These factors, evaluated under *Description of Actions and Assumptions* (p. 18), need to be considered in present and future decisions about this Climate Action Plan.

Engaging the Ithaca College community

The CAP process of ACUPCC signatories is intended to help future generations understand the trade-offs associated with climate change. The transparency of our decision process is central to this purpose.

To assure that this is an *educational* effort, we do not simply solicit ideas, but pose trade-offs for discussion and debate. This can occur by comparing and contrasting alternative packages of actions shown in the *Action Abatement Curve* (p. 26) and the *Finishing Portfolio* (pp. 27-28) to help people understand the organic and synergistic nature of the Climate Action Plan.

Since a major goal of our Climate Action Plan is to *engage* the campus community, we have identified specific opportunities for our CAP to inform -- and be informed by -- educational and research activities on campus. See the section on *Education* (pp. 38-40) for examples of past, present and future educational and research activities.

Our Share of the Problem

"To provide a foundation for a lifetime of learning, Ithaca College is dedicated to fostering intellectual growth, aesthetic appreciation, and character development in our students. The Ithaca College community thrives on the principles that knowledge is ***acquired through discipline****, competence is established when knowledge is* ***tempered by experience****, and character is developed when competence is exercised* ***for the benefit of others****."*

~ *excerpted from* Ithaca College Mission Statement

Acquired through Discipline

While there is a role for symbolic actions in raising awareness of global warming, achieving climate neutrality is a massive enterprise (both financially *and* organizationally) for an institution with a large vision and modest means. *Achieving* climate neutrality will require a disciplined, long-term perspective.

Just as the technological solutions we require will evolve over time, so, too, will our Climate Action Plan evolve over time. Our CAP has an ambitious end in mind. But it is just a beginning, defining only near-term actions. The plan is intended to be malleable, to accommodate changing conditions. However, we must begin *now* to act within our capabilities.

Tempered by Experience

Our share of the problem was defined through an inventory of greenhouse gas emissions (p.14). After examining our historical experience of energy use, we found that our facilities account for over three quarters of our total GHG emissions (54% due to purchased electricity, 23% from natural gas used for heating). Transportation accounts for the majority of the remaining quarter (10% commuting, 8% air travel, 2% fleet vehicles and 2% solid waste).

Our approach to changing this historical experience will be tempered by the practical experience of the people who understand the physical, organizational and cultural elements that comprise Ithaca College.

For the Benefit of Others

Our Ithaca College community is motivated to achieve climate neutrality as matter of *institutional* character development. Just as we expect our students to utilize their acquired competence for the benefit of others, our Climate Action Plan is an exercise for the benefit of other educational institutions (which we hope will learn from our efforts) and the world (which we hope will be in small part restored by our efforts). Rather than wait for environmental mandates, we act now out of a sense of shared responsibility.

As one of the 650 signatories to the American College and University Presidents Climate Commitment, Ithaca College has committed to developing this Climate Action Plan to achieve climate neutrality. Our goal is not simply to achieve *operational* climate neutrality (which we understand will *not* be simple). Rather, we envision this Climate Action Plan process as a means by which our students, faculty and staff may understand the significant trade-offs facing them and future generations.

Framing the Choices

To achieve climate neutrality in a world of finite resources, we must make choices. The following sections are ordered in a sequence that mirrors the process by which we have framed the choices so that we might choose the *optimum* actions to reduce emissions. Each analytical tool in the sequence draws on the preceding analysis.

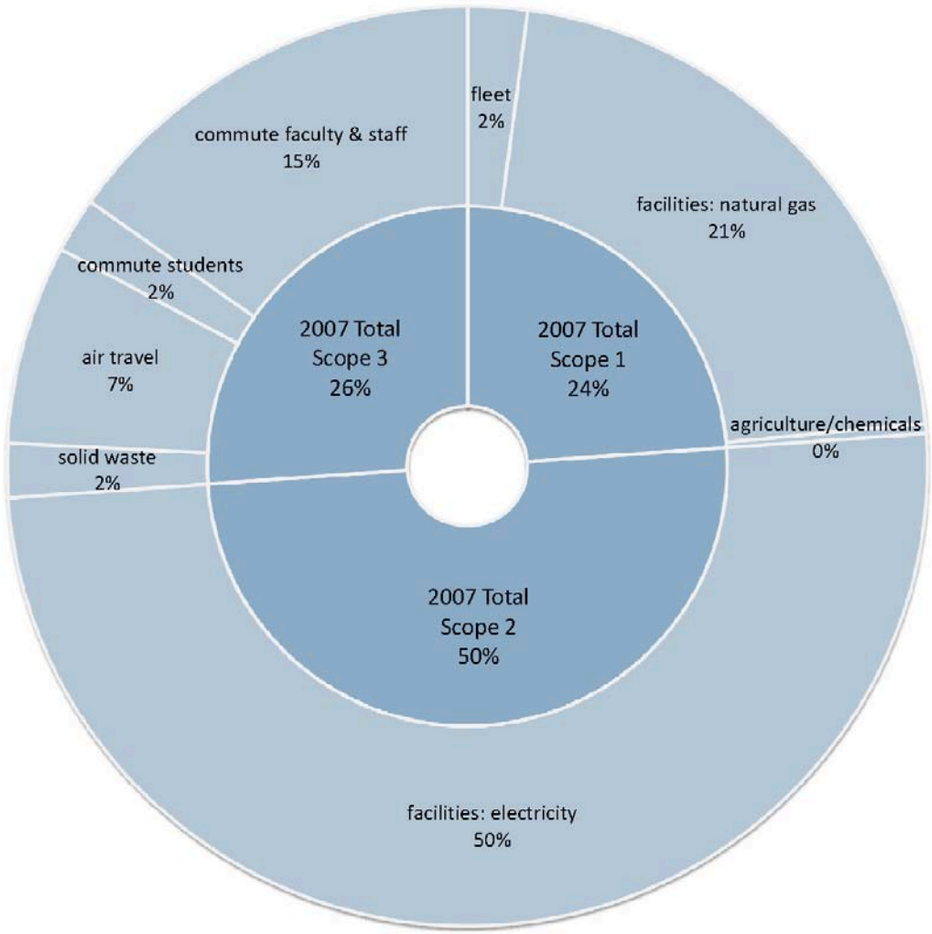


Figure 2: GHG Emissions by Scope and Source

Greenhouse Gas Emissions Inventory

Using the Clean-Air Cool Planet inventory tool, Ithaca College has completed inventories of its greenhouse gas emissions (GHGE) for fiscal years 2000 through 2008. We are using FY 2007 as our baseline year. Figure 2 illustrates the relative importance of the scope (inner ring) and source (outer ring) of these emissions for 2007.

The ACUPCC Implementation Guide (September 2007 v 1.0, Definition of Terms, p. 30) defines the three categories of GHG emissions for accounting and inventory-reporting purposes:

- **Scope 1** accounts for direct GHG emissions from sources the institution owns or controls. At Ithaca College, this comprises natural gas (largely used for space and domestic-water heating), fuel for fleet vehicles, and a small amount of chemicals (mainly fertilizers and refrigerants).
- **Scope 2** accounts for indirect GHG emissions from the generation of purchased electricity consumed by equipment or operations owned or controlled by the institution. Electrical consumption in our facilities produces half of our total emissions. Throughout forty years of this Climate Action Plan, the electricity from our grid will increasingly come from less carbon-intensive sources. This change *may* cause us to focus more on the Scope 1 and 3 emissions over which we have more control, and for which we may experience a greater regulatory or market cost burden.
- **Scope 3** accounts for indirect GHG emissions from all other sources that occur as a consequence of the institution's activities that are not owned or operated by the institution. These are largely related to transportation (commuting by faculty and staff, air travel for school business) along with a small amount of emissions from solid waste. It should be noted that in our inventory, the one "offset" we are currently able to take advantage of to reduce our overall emissions is from our increasing collection of compostable materials.

The GHGE Inventory and this image is only a snapshot in time. Future decisions (for example, the construction of additional campus buildings) will increase GHG emissions – as can be seen in the black dotted *"Total GHG Emissions"* trend line in *Figure 4: Analysis of GHG Financial Exposure* on the following page. This trend reflects the completion of the Athletics and Events Center and the construction in the near future of an additional faculty office building, as called for in the College Master Plan.

Potential GHGE Financial Exposure

It is anticipated that federal climate change legislation will be enacted, implementing a cap-and-trade system for greenhouse gases (GHGE) not later than 2015. A World Resources Institute analysis of the impact of current legislative initiatives is depicted in Figure 3.

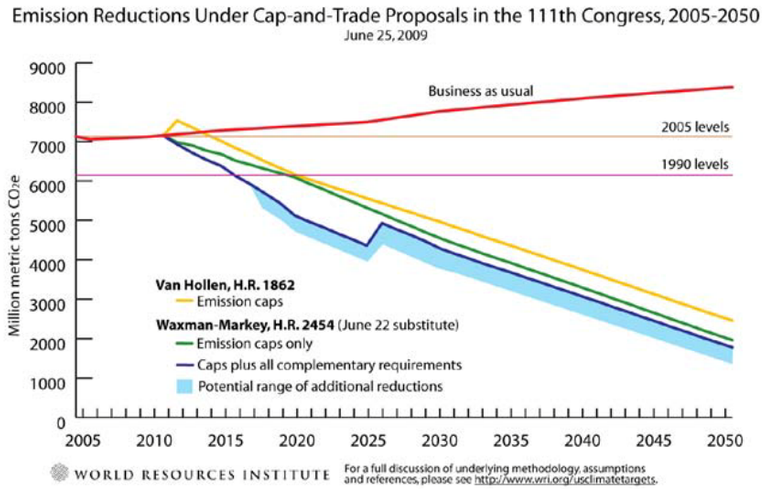


Figure 3: Emission Reductions under Cap-and-Trade Proposals

Virtually all of our directly-financed activities resulting in GHG emissions will likely be covered either directly or indirectly under the legislation. Accordingly, Ithaca College will bear the cost of compliance either directly or in the form of higher costs from its energy and transportation supply chains.

For example, assume the current price of electricity purchased by the College is $100 per megawatt-hour (MWh). Assume also, for simplicity, that each MWh purchased is associated with 0.5 metric ton of CO_2e (MTCDE). For this example, we will assume that we are in a world where GHG emissions have a price (e.g. a federal cap-and-trade system) and that price is $50 per MTCDE of GHG emissions. In this example, Ithaca College would be subject to the risk of the price of purchased electricity rising from $100 per MWh to $125 per MWh ($100 per MWh plus $50 per MTCDE multiplied by 0.5 MTCDE/MWh) as a result of the utility passing on that compliance cost to the College. A similar risk is also present with respect to the purchase of natural gas, transportation fuels, directly-financed air travel and other directly-financed activities associated with GHG emissions.

Energy Strategies developed three federal climate change policy scenarios: "soft", "moderate", and "stringent". All three scenarios assume that a cap-and-trade system will be implemented as of January 1, 2015, with the annual cap defined as a percent of 2000 economy-wide emissions. As suggested by their titles, the scenarios reflect varying degrees of mandated reductions. Under the "moderate" scenario – as depicted by the dashed line in Figure 4 below – it is estimated that over 60% of Ithaca College's Base Case cumulative emissions will be subject to a mandated compliance costs through 2050. This "moderate" scenario is consistent with federal bills currently being debated in Washington.

Compliance costs could arise as a result of an economy-wide cap on emissions or from the need to purchase allowances to emit amounts below the cap. Virtually all emissions arising from incremental decisions would be subject to a compliance cost. The chart shows an estimate of the portion of our GHG emissions that are projected to be subject to compliance cost under the "moderate" policy scenario as well as the potential annual financial exposure. Note that the expected GHG emissions from the College are decreasing. This assumes that the electricity purchased from the power grid will become less GHGE-intensive as a result of a federal cap-and-trade system.

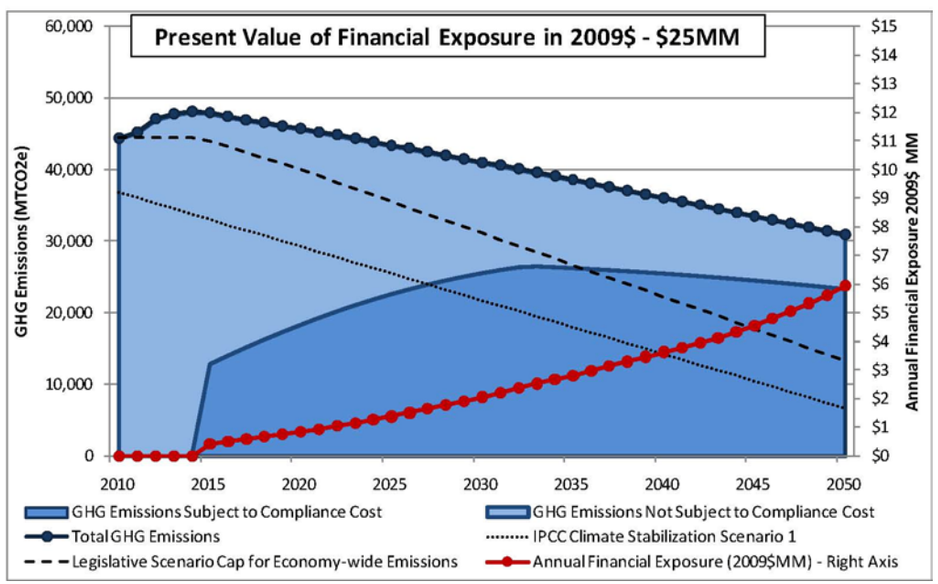


Figure 4: Analysis of GHGE Financial Exposure

Portfolio Sketch

The Portfolio Sketch in Figure 5 depicts one set of available options to take action. Building on the *GHG Emissions by Scope and Source* (p. 14), the outer ring of the pie chart captures one viable path toward carbon neutrality for discussion and exploration. This portfolio sketch offers an opportunity to think about the relationships between various actions.

Each action is described in greater detail under *Description of Actions and Assumptions* (p. 18). As noted in the legend, the actions in the outer ring are color-coded to indicate the time period during which they will likely be implemented.

There are two percentage reduction targets for each action: The first number after the equal sign represents the percentage reduction in *emissions from that source*; the number following the comma for each action is the percentage of *total emissions reduced*. (For example, GeoExchange – in gold in the outer ring of the upper right quadrant – would reduce 40% of natural gas emissions, but only 9% of total emissions.)

The percentage reductions shown are simply estimates. They are only targets, to be confirmed or modified as we better understand how we use energy (see *Metering and Energy Management* at p. 19). Changing technologies, campus needs, and financial conditions -- perhaps even the changing climate -- will require that these targets be adjusted throughout the life of our Climate Action Plan.

Note that there are still gaps in our outer ring (light gray areas). Approximately **28% of our emissions are not addressed by the direct actions shown.** If these actions cannot be expanded – or other direct actions identified – we will need to explore the potential purchase of offsets to compensate for the remaining emissions.

This is just a first step.

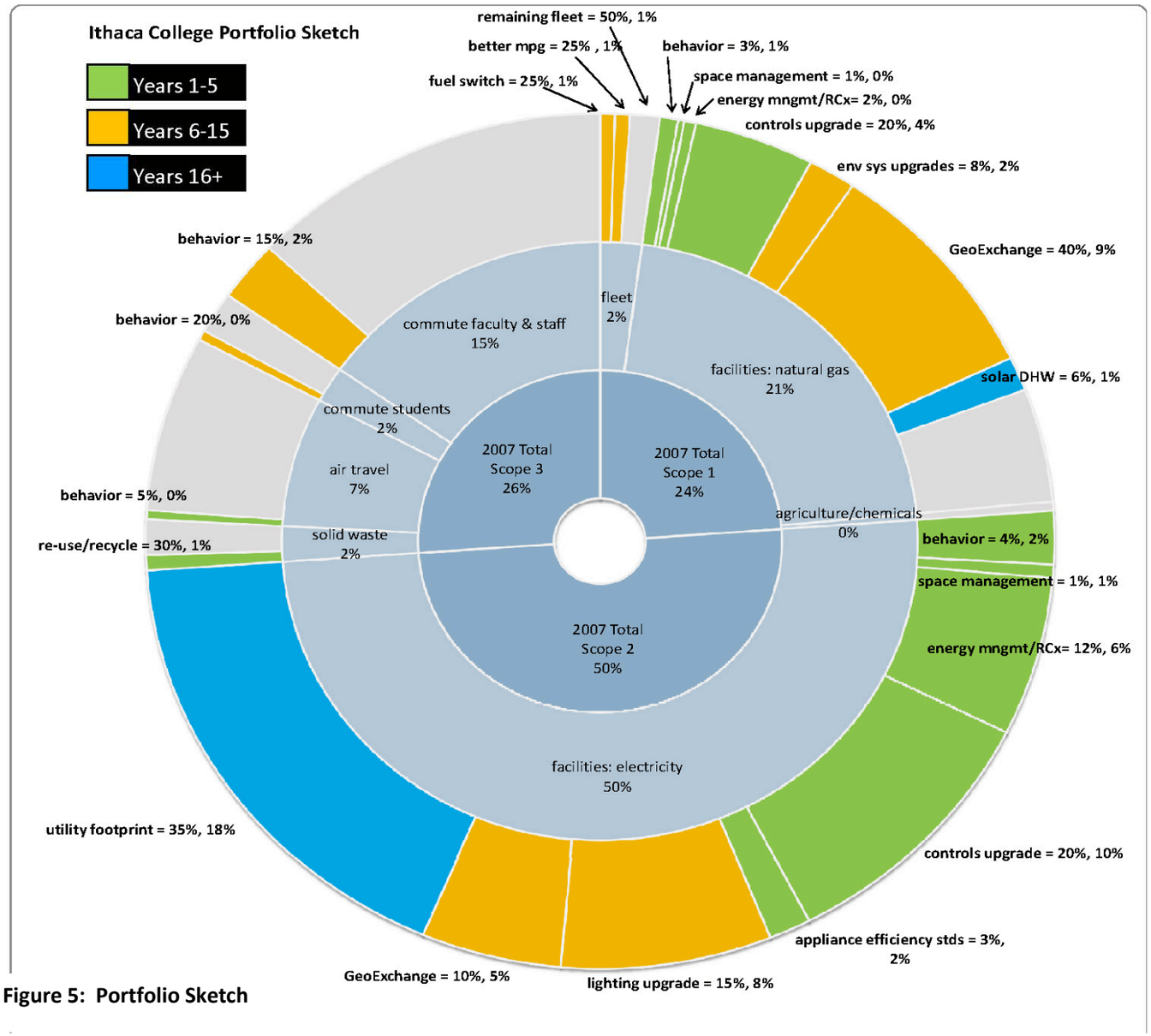


Figure 5: Portfolio Sketch

Facilities

Our use of facilities is the source of most Scope 1 (purchased natural gas) and Scope 2 (purchased electricity) emissions. One early strategic decision is whether one source of emissions is more important than the other. Government policy initiatives typically encourage the reduction of those sources most within the control of emitters. Since our electric utilities are mandated to reduce their carbon footprint, we show the potential impact of changing from gas-fired boilers to a heat pump-based GeoExchange system (p. 21), transferring a significant portion of our heating load from natural gas to electricity.

However, GeoExchange is just one option for replacing our aging HVAC plant. A serious evaluation of these options (pp. 21-22) will likely take a year or two. Therefore, our earliest actions will focus on reducing demand and improving the efficiency of systems that are "downstream" of our major heating/cooling plant. These actions should benefit Ithaca College no matter which heating/cooling plant solution we ultimately decide to pursue. Of particular note are the following:

- Numerous facilities-related actions will yield emissions reductions for both electricity *and* natural gas.
- Most of the actions during Years 1-5 will produce cost savings.
- The largest reductions are actions to improve the control or efficiency of major building systems. Actions to reduce the demand for energy via changed behaviors are conservatively estimated to yield modest reductions. However, policy, process, and program changes should not be dismissed, as they hold the potential to generate the greatest reductions for the least cost (p. 33).
- There is a gap. Twenty-one percent of natural gas emissions still need to be addressed. This may be done through offsets (p. 25), more aggressive demand reductions and efficiency improvements, or by burning a more benign fuel in a central plant (pp. 21-22).
- The "improved utility footprint" (blue lower left quadrant of Portfolio Sketch (p. 16) will result from regulatory mandates. While this may appear to conveniently reduce a major portion of our present electricity-based emissions, we will likely pay for the reduced footprint via increased utility rates. To avoid these costs, more aggressive efforts to reduce demand for and improve the efficiency of electricity-consuming systems will be justified.
- For purposes of the Portfolio Sketch, energy management and retro-commissioning have been combined. One informs the other and both are intended to optimize the operation of building mechanical systems.

There will be substantial opportunities to reduce energy use and emissions in the design and construction of new facilities. Their impact is not included in the sketch because new design guidelines to be developed in Years 1-2 will not affect proposed new facilities already in design.

Transportation

This portion of the portfolio sketch focuses on the three main areas of Scope 3 transportation-related emissions in the upper left quadrant: commuter travel, air travel and fleet vehicles. The largest of these is commuter travel, four fifths of which is generated by employee commuting. The portfolio sketch estimated that up to 15 percent of employee commuter emissions and 20 percent of student emissions might be reduced through Transportation Demand Management (TDM) programs and the switch to more carbon-efficient modes of transport. Without shifts in the marketplace to carbon-free propulsion or in the spatial distribution of the campus residence locations (with a greater percentage of employees and students living within walking and biking distance), further reductions are unlikely in the CAP timeframe.

While college-related air travel accounted for nearly 8 percent of total GHG emissions in 2007, nearly all of this relates to the educational mission of the college. Any reduction would come at the expense of the student experience, or limit the ability of faculty and staff to stay abreast of the latest research and trends. In some instances, faculty and staff travel may be effectively substituted with electronic communications such as web conferences and video links. It is estimated that up to five percent of the air travel emissions could be substituted by 2050.

With respect to fleet vehicle emissions, we estimate that roughly one quarter of the emissions could be eliminated by changing the vehicle types, increasing their efficiency, and developing supportive operating policies. By switching to low or zero-carbon fuels a similar amount could be eliminated. The limiting factors to fleet reductions are availability of fuel and appropriate vehicles, as well as the ability of non-vehicles (such as generators and grounds equipment) to run on alternative fuels.

Having identified a set of programs and technologies to move us down the path toward climate neutrality, we must now consider the costs and benefits associated with these actions.

Description of Actions and Assumptions

The following pages describe each action shown in Table 4 (and also in the Portfolio Sketch (pg.16), along with the assumptions about their costs and benefits. There is a brief "Triple Bottom-Line Plus" summary for each action. The color-coded "at a glance" box for each of the four factors use the following color code to indicate whether there may be no issues, small issues or large issues associated with that action. These signals are not intended to keep us from moving forward; red does not automatically mean "STOP". Rather, these color codes highlight the need for additional investigation in order to avoid future problems.

- no significant issues
- some issue(s) to be addressed
- significant issue(s) to be addressed

Table 4 at right summarizes the net present value (NPV) of both the capital costs and the net financial benefit of each action comprising the Portfolio Sketch. Triple bottom line-plus benefits (addressing environmental, social and institutional factors) are not accounted for in this table. The final column highlights the CO_2e reductions for each action. Note that in the net benefit column, all but three **actions result in net positive financial benefits.** Options for plant upgrades require further study; some of these are options are mutually exclusive.

The annual numerical assumptions used for each action are noted in the following tables:

- Table 6: GHGE Abatement by Action (p. 44)
- Table 7: Fuel Savings by Action (p. 45)
- Table 8: Incremental Capital Expenditures by Action (p. 46)
- Table 9: Incremental Operating Expense by Action (p. 47)
- Table 10: GHGE Compliance Savings by Action (p. 48)

Table 4: Net Present Value of Capital Costs and Benefits

Action	Life Cycle NPV ($MM; 5% discount rate) Through 2050		
	Capital Costs	Net Benefit (Savings - Cost)	Contribution Toward Neutrality in 2050 (MTCDE)
Facilities			
Base Portfolio			
Appliance Efficiency Standards	$0.0	$1.58	62
Lighting Upgrades	($2.5)	$5.83	367
Metering and Energy Management	($0.1)	$8.17	547
Space Management	$0.0	$0.96	137
Behavior Change	($0.02)	$3.23	460
Environmental Systems Upgrade	($3.3)	$7.48	2,041
Actions for Future Consideration			
Plant Upgrade Options			
Boiler Upgrades	($3.7)	$6.72	1,735
Geoexchange	($5.7)	$10.89	4,214
Central Utility Plant	($15.1)	($4.55)	1,735
Central Utility Plant plus EGS	($21.2)	$2.88	7,685
Wind Power	($6.0)	$1.32	457
Solar Domestic Hot Water	($1.5)	$0.76	600
Transportation			
Base Portfolio			
Business Travel	($0.0)	$1.52	273
Campus Fleet - Fuel Efficiency	($0.2)	$0.67	211
Campus Fleet - Alternative Fuel Vehicles	($0.1)	$0.83	310
Commuter Travel (Moderate)	($0.1)	($1.28)	360

Facilities

Appliance Efficiency Standards

… calls for improved efficiency requirements for electrical appliances. IC already requires the procurement of Energy Star appliances for institutional purchases. This existing program would be expanded to cover a larger range of devices (e.g., lamps, fixtures, larger stationary equipment) where such standards exist. It would also expand the efficiency requirements to include personal devices brought into the workplace by users.

Costs: No additional costs are assumed because the additional incremental cost of more efficient equipment is typically modest, and will be borne by existing institutional or individual budgets.

Benefits: a 3% reduction in electrical consumption, phased-in as a 1% increment in 2015, and another 2% increment in 2020.

	Environment	(+) avoids unnecessary waste
	Economy	(+) low-cost action; (-) resistance to cost increase
	Social	(+) encourages culture change; (-) change resisted
	Institution	(+) demonstrates good stewardship to community

Lighting Upgrades

… includes lamp, luminaire and control improvements to existing artificial lighting systems. Based on field findings during retro-commissioning work, specific retrofits will be packaged to yield a blended payback of 7 years. There will likely be additional modest CO_2e reductions due to reduced cooling loads.

Costs: initial investments to reduce lighting energy use intensity (EUI) from 2.0 watt/square foot to 1.0 watt/sf will yield a 5-year payback. Secondary investments to reduce lighting energy use intensity to 0.5 watt/sf will yield a 10-year payback. Average payback is 7 years.

Benefits:

(1) lighting accounts for 20% of electrical consumption campus-wide (we chose the low end of an estimated 20-30% range);
(2) "actual" energy-use intensity (EUI) for lighting is 2.0 watt/square foot; and
(3) after 40 years, target EUI for lighting is 0.5 watts per square foot of building space. Installation commences in 2012.

	Environment	(+) avoids unnecessary waste
	Economy	(+) low-cost and rapid payback
	Social	(-) need to proactively address safety and security issues
	Institution	(+) visible evidence of institutional stewardship

Metering and Energy Management

… comprises two parts:

(1) completing the installation of metering for each building, along with metering of hydronic hot and chilled water to buildings that share boilers and chillers; and
(2) assigning responsibility for energy management to monitor and track energy use.

In order to realize the benefits of better metering and management, building systems need to be properly maintained and adjusted. Conservation-focused maintenance (resulting from more effective monitoring of building energy performance) will be handled by the deployment of existing maintenance staff. There are no additional staff costs above the base case.

A *Building Characterization Worksheet* (p. 47) was developed to capture existing information resources and identify information gaps. As it is updated and completed, it will be a useful tool to benchmark our performance.

Costs: 60 meters are assumed to be required (20 building electric, 20 building gas, and 20 shared system meters) at a cost of $1,000 apiece, for a capital cost of $60,000. An energy manager is assumed to represent an additional annual cost of $70,000.

Benefits: Energy management functions typically yield 2-5% reductions in energy use. Given that energy management is more likely to yield reductions in academic buildings (on the electrical side) vs. residential buildings (these are not mechanically cooled and are largely consumers of natural gas), assume commodity reduction targets of 2% for natural gas and 12% for electricity. Retro-commissioning will be a major focus of Years 1-5, so savings for both commodities will be phased-in over 4 years, commencing in 2010.

	Environment	(+) energy mgr can improve efficiency/reduce emissions
	Economy	(+) simple, proven means to measure performance
	Social	(+) provides feedback to end users and researchers
	Institution	(+) necessary to take control of energy use

Space Management

… covers two types of impacts:

(1) Space Use Intensity (SUI): efforts to more effectively utilize existing facilities on campus by increasing space-use intensity standards. It may also increase the potential benefits from more-intensive use in newly-constructed facilities; and

(2) Shut-down: efforts to close down energy-using systems during periods when the building is not needed (e.g., during weekends and vacation periods).

Costs:

(a) there will be cost reductions in newly-constructed facilities, as higher SUI's should yield the construction of less GSF. These benefits are not accounted-for here;

(b) the cost of shutting-down and re-starting systems will be absorbed by re-deployment of existing maintenance staff;

(c) better coordination between Facilities and Planning staff will be absorbed within existing staff lines.

Benefits: reduction targets are 1% for both electrical and natural gas consumption. Since policies will be evaluated and revised during years 1-3, assume reductions will not commence until Year 5 (2015).

Since the benefit goals are modest, any incremental costs above the base case (additional staff time, etc.) will likely be offset by savings realized by the SUI and shut-down actions. There will likely be increased benefits above 1% in future years. Those are not accounted for here, but should be included in future estimates once the results of our early years' work have been evaluated.

	Environment	(+) may avoid unnecessary new construction
	Economy	(+) cost effective means to economize a limited resource
	Social	(+) pushback on managing equitable space allocation
	Institution	(+) necessary to manage energy and space resources

Behavior Change

… includes all program efforts to encourage people to operate equipment most efficiently and act in an energy-conserving manner. This programming should be targeted to specific user groups, and reflect "best practices" for each piece of energy-using equipment in each space type or occupancy.

Costs: $50,000 annual cost for student staffing; $20,000 capital cost to develop web tools; development of web content and print materials are included in existing program budgets.

Benefits: studies evidence potential for 7-10% reduction from behavior and outreach programs. However, these do not address a college environment. We will assume the following may be achieved through behavior change programming:

(a) a 3% annual reduction in natural gas, phased in at 1% increments/year starting in 2013;

(b) a 4% annual reduction in electrical consumption, phased in at 1% increments per year starting in 2010.

Program design will commence in 2010, with pilot programs scheduled for 2011 + 2012. Reductions will begin in 2013. Pilot programs will result in no incremental costs.

	Environment	(-) uncertainty that long-term reductions will be realized
	Economy	(+) low-cost first step; (-) may need financial incentives
	Social	(+) encourages necessary culture change; (-) sacrificial
	Institution	(+)may complement improved maintenance/monitoring

Environmental System Upgrades

… includes a multitude of retrofits intended to improve the efficiency of building environmental systems. These include improvements to both mechanical and envelope systems that provide thermal comfort in academic and residential buildings. (Electrical reductions resulting from "Lighting Upgrades" are evaluated separately.)

Since an energy audit of individual buildings is beyond the scope of this effort, we are unable to estimate projected costs and savings based on specific retrofits. We will work backwards, deriving a set of costs and resulting commodity reductions from an assumption that our Facilities staff will use a combination of building-specific energy audits and the results of their energy monitoring efforts to ascertain those measures that best achieve the target payback period (which may be adjusted in future years, based on the changing economic and regulatory environment.)

Costs and Benefits: during Years 6-15, a 15% energy commodity reduction for both electricity and natural gas may be realized with a payback period of less than 7 years

	Environment	(+) most likely to yield assured carbon reductions
	Economy	(+) modest cost; assured payback
	Social	(+/-) does not require behavior change
	Institution	(+)builds - and builds on - existing staff capacity

Plant Upgrade Options

… focus on the replacement of existing HVAC plants – most in individual buildings, but some shared by groups of buildings – that are reaching the end of their service life. The replacement of aging underground piping among shared systems must also be considered. This analysis is well beyond the scope of a Climate Action Plan, so we recommend that a detailed feasibility study be conducted to assess the best path forward. However, the following options have been further analyzed under the section titled *"Finishing Portfolio"* (pp. 28-29) to assess potential CO_2e impacts:

1. Upgrade Efficiency of Boilers and Chillers

… involves replacing existing boilers and chillers with comparable equipment of improved efficiency. Since most of these pieces of equipment are at the end of their 30-40 year service life, the cost of these replacements is already factored into the base case. So only the cost of achieving an additional 15% reduction above the performance of the existing plant is included in this analysis. We assume that this retrofit will be done over a 5-year period commencing in Year 6 (2015).

Costs:
(a) additional cost for 15% reduction in energy use is based on 5-10 year payback period; so assume a 7-year payback period; and
(b) replacement costs for existing building plant assumes that boilers will cost $300/boiler HP (< 500 boiler HP), and chillers will cost $500/ton (< 1,000 tons)

Benefits: Assume a 15% energy reduction due to improved efficiency.

	Environment	(+) may net significant CO_2e and energy cost reductions
	Economy	(+) cost-effective increment; (-) capital intensive
	Social	(+) largely transparent to users
	Institution	(+)necessary to properly steward institutional assets

2. GeoExchange

… is an alternative to replacing existing boilers and chillers. A heat pump-based GeoExchange system would be installed in academic buildings. A hybrid GeoExchange-boiler system should be considered as part of the feasibility study.

GeoExchange would not be used for residential buildings, since most lack central air conditioning. It would be worthwhile considering GeoExchange for future residential construction if the units are to be air conditioned. (However, this would add to the base load and likely increase CO_2e emissions.)

Costs: Most existing boilers and chillers are at or approaching the end of their service life. Since the cost of GeoExchange plant is comparable to a new boiler/chiller plant, we will assume that these costs are already in the base case. So the only net additional cost is the ground loop, which is estimated to cost $7-9 per GSF of tempered space (assume $8/GSF).

Benefits:
(a) assume a 40% reduction in natural gas consumption. Since those gas-fired heating loads are being transferred to electrical power, assume that electric-side cooling-load reductions will be only 10%;
(b) elimination of cooling towers should reduce operating costs; however, those are not accounted for here; and
(c) the potential to use waste heat to temper domestic hot water should be considered as part of the feasibility study, but is not included this analysis.

Assume that both costs and benefits will accrue over Years 6-15, as the GeoExchange systems are installed over that 10-year period.

	Environment	(+) shifts heating load to less carbon-intensive source
	Economy	(-) distribution system modifications may be required
	Social	(+) less noice; low-cost cooling for residential units
	Institution	(+/-) must be compared against central system

3. Central Utility Plant (CUP)

… creates the opportunity to burn less carbon-intensive fuels to produce heat – and possibly electric power – at a central location. The distribution piping may evolve over multiple years, building on one or more existing regional plants to a connected system serviced by a single central plant.

Costs: Assume 15% reduction based on 7-year payback:
1a. CUP cost estimate of $2,500/ton (metal building) to $3,000/ton (brick building) includes electrical distribution, back-up power, pumps, etc. for chiller ... *assume 3,034 total tons of chiller to be replaced in mostly-academic buildings*
1b. CUP also needs boiler replacements at $800-1000/boiler HP ... *assume 3,430 HP of boiler to be replaced, mostly in academic buildings*
2. Cost of distribution system (either buried or enclosed) … *assume 3600 linear foot to service cluster academic buildings only; based on $2500/lf for both cold water and hot*

water = $9MM for central distribution
3a. Cost of branch distribution to -- and heat exchangers in -- buildings will be 75% of the cost of replacing boilers and chillers, so these are not included as costs.
3b. Replacement costs for existing building plant: boilers = $300/boiler HP (< 500 boiler HP, chillers = $500/ton (< 1,000 ton)

Benefits:
(a) 15% minimum energy commodity reduction, solely due to better diversity scheduling; and
(b) not included are cost savings due to substantially-reduced maintenance.

	Environment	(+) great potential for improved efficiency
	Economy	(+) reduced operating costs; (-) large capital investment
	Social	(+) less noise at campus buildings without cooling towers
	Institution	(+) evidences long-term investment in reduced costs

4. Central Utility Plant with Enhanced Geothermal System (EGS)

… is a technology that taps heat sources some 3 miles below the surface (and why it is sometimes called "deep hot rocks"). It is presently not commercially viable, but Cornell University will be exploring this technology as part of its research initiative. EGS would require a central plant, underground distribution piping, and heat exchangers in each serviced building. This raises a number of issues:

1. If EGS is a future option, should we migrate toward central plant/distribution technologies (rather than building-based HVAC plant)?
2. If a central plant is required to harvest this heat resource, should a central chiller plant -- along with associated chilled-water distribution piping -- be included in a capital effort of this size?
3. Should the heating loop be extended to residential buildings as well as academic buildings since most residential buildings are only heated, and not air conditioned?

The CAP Model assumes both heated- and chilled-water application to the academic building cluster.

Costs: All costs below are *in addition to* the cost of a Central Utility Plant:

- $ 20,000,000 drilling costs
- $ 5,000,000 heat exchange plant
- $ 7,000,000 for distribution loop for heated water only
- *plus* additional drilling costs every 10-15 years to access an adjacent underground heat source.

Benefits:
(a) complete displacement of natural gas for space/DHW heating for academic buildings;
(b) assume that academic buildings constitute 2/3 of natural gas consumption;
(c) reduced maintenance costs (not included in this analysis).

	Environment	(+) potentially large impact on heating fuel consumption
	Economy	(-) expensive, unproven technology at this time
	Social	(-) side effects (fracturing, radiation, tremors, water supply)
	Institution	(+/-) requires demonstration of Cornell research

Solar Domestic Hot Water (Solar DHW)

… was evaluated for an expansive application that served all 2200 residential units on our campus. Computer modeling using RETScreen calculated a need for 1533 flat-plate glazed collectors (each 3 meters square).

There are practical considerations regarding the placement of this many collectors (with respect to shading, aesthetics, etc.). But this was simply a scoping analysis to ascertain the potential for providing solar DHW for campus residential applications.

The efficacy of solar DHW needs to be compared with alternatives sources of heat energy for DHW (e.g., waste heat from GeoExchange, or heat from a central heated-water loop (from either EGS or other fuel sources). Solar DHW should also be considered for dining halls and other water-intensive occupancies.

Costs: $2,273,000 for glazed flat-plate collectors (we did not evaluate evacuated-tube collectors due to their $6,700,000 cost)

Benefits: 264,201 therms of natural gas are used to temper domestic how water now; 150,958 therms will be needed to supplement solar energy, so 113,243 therms are saved. Installation assumed to be a 5-year effort, commencing in Year 6 (2015), with both costs and benefits spread over that period.

	Environment	(+) displaces natural gas emissions
	Economy	(-) uncertain economics; (+) regional green jobs
	Social	(+) may be positioned to create shaded outdoor spaces
	Institution	(+) large, iconic visual impact

Wind Power

… involves the installation of two wind generators over a two-year period commencing in Year 16. Location 1 will be installed in 2025. Location 2 will be installed in 2026. This action is staged later because:

(1) there may be an extended permitting process; and

(2) earlier investments to reduce demand and improve efficiency.

Assumptions were taken from the Sustainable Energy Development, Inc. feasibility study of June 2009.

Costs:

(a) installation costs only are $ 4.6 MM for each unit;

(b) a maintenance reserve of $20,000 per year per turbine during warranty period, and $25,000/year after warranty;

(c) annual insurance cost of $10,000 per MW.

Benefits: annual energy production of 3,783 MWh at Location 1, and 3,627 MWh at Location 2.

	Environment	(+) displaces purchased electricity
	Economy	(+) may need 3rd party financing to be competitive
	Social	(+) regional green job creation
	Institution	(+/-) large, iconic visual impact

Transportation

Business Travel Programs

… include staff to provide support for the use of electronic communications in lieu of travel. This would include education and awareness of IC resources as part of campus-wide change programs. This would also include establishing policies and standards for the availability of distance learning and web and video conferencing tools in new and renovated space.

Costs: It is assumed that the initial support would be 0.25 FTE to oversee the programs and awareness campaign, increasing over time to a full-time position. It is anticipated that there would be a one-time capital cost of $50,000 in 2015 representing one or two new video-conference facilities. Any additional costs are assumed to be incremental and absorbed into ongoing budgets

Benefits: a long-term (2050) reduction in staff and faculty travel of 18% in both miles traveled and total travel expenditures. This represents a 4% reduction in air-travel college-wide. Student programs are assumed to hold constant.

	Environment	(+) reduces emissions
	Economy	(+) reduced travel saves money; (-) hurt Ithaca airport
	Social	(+) increased interaction; (-) less face-to-face interaction
	Institution	(-) reduced travel may impact research/networking

Campus Fleet - Alternative Fuel Vehicles

… is a program to actively migrate to non and lower-carbon content fuels sources for vehicles and fuel-consuming equipment. The program would include both electric and liquid-fuel vehicles. Because of the current limitations in vehicle technology and, for certain fuels, fuel supply, it is anticipated that such a program would begin in earnest in 2020.

Costs: It is assumed that while such vehicles may be commonplace by year of implementation, there may still be a premium for these vehicles. Liquid-fuel vehicles were assumed to have a $1,200 premium and electric vehicles a $4,000 premium.

Benefits: by 2050, the program would result in roughly a five-fold decrease in petroleum usage on campus. The limiting factors of the decrease will largely be the availability of non-vehicle equipment capable of consuming biofuels and availability of fuel/charging stations off-campus.

	Environment	(+) reduces emissions
	Economy	(-) fuel savings may not offset vehicle premium
	Social	(+) exposes campus community to alt. fuel vehicles
	Institution	(+) vehicles seen as further commitment to sustainability

Campus Fleet - Fuel Efficiency

… is a program to establish continually improving fuel standards for owned and leased vehicles. A critical part of the effort includes ongoing monitoring to adjust purchase to ensure continued success. As part of the program, vehicle usage patterns would be evaluated for potential efficiencies. The standards would also promote 'right-sized' vehicles and the use of bikes, carts and non-motorized elements where feasible.

Costs: It is assumed that more fuel efficient vehicles would carry a premium of $1,800 initially, decreasing to $1,000 over 15 years.

Benefits: It is estimated that the program would reduce fuel consumption by one-third beyond reductions resulting government-mandated improvements to fuel economy.

	Environment	(+) reduces emissions
	Economy	(+) reduces fuel consumption
	Social	(+) exposure to alt. fuel vehicles; improved fitness
	Institution	(+) vehicles seen as further commitment to sustainability

Commuter Travel (Moderate)

… are programs and policies to encourage the use of non-single-occupant vehicles for faculty, staff and student commutes. These would include enhanced incentives such as a guaranteed ride home and vanpool support. Changes to the parking system would begin concurrently and be phased in over several years. These efforts would be overseen by an assigned TDM coordinator and would complement other behavior-change efforts on campus.

Costs: Initial costs would include a half-time TDM coordinator and moderate initial program costs. The college would bear most of the costs of improved shuttle service up-front though this may decrease over time. Program costs, particularly bus rides, will increase over time to several hundred thousand dollars per year.

Benefits: a reduction in parking demand and related maintenance costs. There would be reduced traffic on campus as well as on adjacent roadways. A revised parking permit system would raise several hundred thousand dollars in revenue per year.

	Environment	(+) reduces emissions and traffic on campus
	Economy	(-) cost rises may not be offset by increased parking fees
	Social	(+) greater commuter flexibility; (-) initial pushback
	Institution	(+) complements educational mission; better land use

Actions for Future Consideration

This section documents actions that have been set aside – for now. These actions can be revisited in the future, as circumstances, market conditions and technologies evolve.

Solar Photovoltaics

We have set aside solar PV because the economics are not now favorable, given the current combination of technology costs and energy prices. However, we do intend to explore the potential for demonstration installations on selected buildings to monitor in-the-field performance of existing technologies. This should allow us to make more-informed about actual performance as these systems become more affordable.

	Environment	(+) large visual impactg for renewable resource
	Economy	(-) may require 3rd party financing; (-) not economical
	Social	(+) regional green job creation
	Institution	(+) large, iconic visual impact

Commuter Travel (Reach)

The action is similar to the “moderate” commuter travel action, but contains more expansive and aggressive programs. While the carbon reductions are potentially double that of the moderate set of actions, the net annual cost could triple. The difference in cost is largely the result of increased bus ride and permit costs coupled with decreases in permit revenue resulting from the successes of the program. If higher permit costs were viewed as acceptable, this action might replace the moderate action.

Role of Offsets and Renewable Energy Credits

As discussed previously, there will be a role for offsets and Renewable Energy Credits (RECs) to mitigate the remaining emissions for which the College is responsible. Since the College will likely have no direct regulatory compliance obligation, all offset and REC purchases will be voluntary. This means that the College can choose the level of rigor it may choose to apply in meeting the remaining reductions.

For Scope 1 emissions—from combustion of fuels on campus – the College may choose to purchase compliance-quality offsets (e.g. offsets that could be used to meet regulatory compliance obligations) in order to meet the spirit of the regulations.

For Scope 2 emissions, "green power" or REC purchases will be the likely choice.

For Scope 3 emissions associated with directly-financed air travel, there may be a program available through the airlines that will meet the spirit of the climate commitment. Finally, for Scope 3 emissions related to commuting, the College may choose to provide an opportunity for students, faculty and staff to participate in an offset purchase program where indirect GHG emission reductions can voluntarily be purchased to mitigate the impact of commuting.

An alternative path to achieve indirect emission reductions by the College may be to develop or participate in some sort of community offset program. This could be a program in which the College collaborates with regional institutions of higher education and government entities to fund and/or facilitate GHGE reduction activities. This could take the form of helping local primary and secondary schools achieve GHGE reductions while educating younger students on the importance of climate stewardship. It may take the form of helping local business or other organization reduce their footprints. A community offset program has the potential to become a valuable tool in achieving indirect GHGE reductions while achieving some of the broader goals of the Presidents Climate Commitment including education and outreach.

The Finger Lakes Climate Fund, such a community offset program, is currently in development by Sustainable Tompkins with some underwriting support of an anonymous foundation.

Action Abatement Curve

To prioritize alternative carbon abatement actions, it is useful to rank them based on the cost per ton of carbon reduction and assigning a higher priority to projects that offer the greatest value to Ithaca College.

A common approach for comparing projects with varying lives and implementation timeframes is to use *"levelized cost"* which, in the context of climate action planning, represents the present value of any additional capital or operating costs required by an action over its economic life, divided into equal payments for each ton of carbon that the action saves. An abatement curve – shown in Figure 6 at right – helps visualize and compare both the levelized cost per ton (on the vertical axis) and carbon abated (on the horizontal axis) for each option.

Each action is represented by a rectangle where the height shows the levelized cost (expressed as dollars per ton of carbon savings) and the width shows the average annual carbon savings over a project's life. Rectangles that extend below the zero-dollar line (on the horizontal axis) represent an opportunity for both carbon mitigation *and* cost savings.

The calculation of levelized cost *does not* take into account the effect of carbon regulations on the College's operating costs. As discussed previously, it is anticipated that there *will* be a cost associated with GHGE regulation. The "Adjusted Levelized Cost (Savings) per MTCDE Avoided" (a dotted line in the graphic) represents the value of each of the actions in a world where GHG emissions *do* have a cost associated with them.

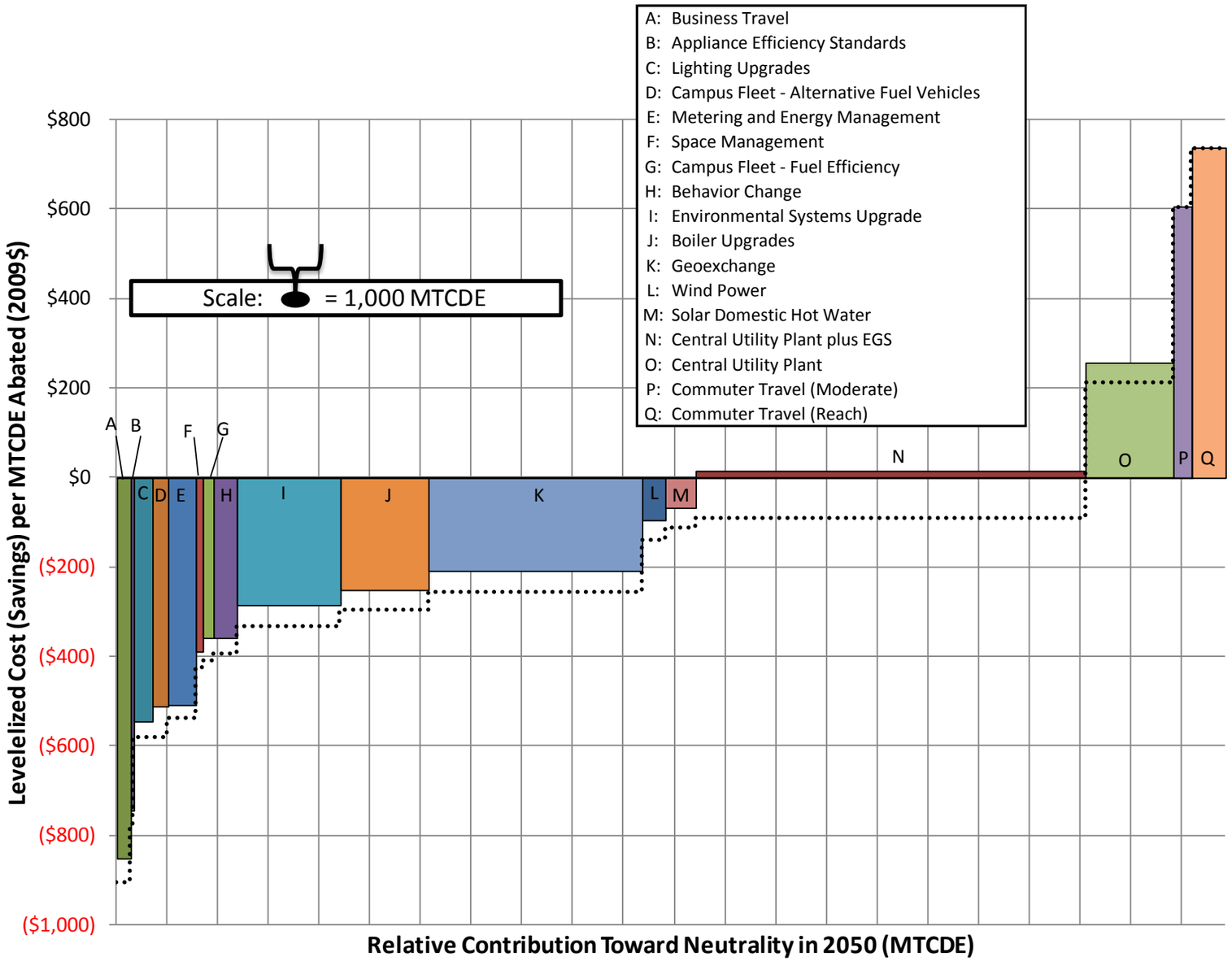


Figure 6: Action Abatement Curve

Base Portfolio

Simply stated, there are some things we *know* we are going to do. It's only a question of when and how much. Those actions comprise our "Base Portfolio."

Most of the Base Portfolio actions will yield energy cost savings that may be re-invested to further reduce energy costs and carbon emissions. But some actions (such as efforts to reduce commuter-related emissions) address the broader educational and student-involvement goals of the ACUPCC.

The *Base Portfolio Wedge Diagram* in Figure 7 shows the impact of our Base Portfolio actions over the 40 years of this CAP. Please note that:

- newly constructed facilities will cause our Business-As-Usual emissions to increase during the first five years
- the "Grid Footprint Change" (uppermost purple wedge) will play a substantial role in reducing our Scope 1 emissions through 2050
- the Base Portfolio actions reduce offset costs to $11,700,000 (from $15,600,000 shown in *Figure 1: Reference Cost Wedge Diagram* (p. 10)
- our proposed Base Portfolio actions have a modest impact on total emissions

The Base Portfolio alone will not get us to climate neutrality. We'll need to consider other actions to achieve our goal and avoid the future regulatory costs of carbon emissions. Those future actions will be depicted in the *Finishing Portfolio* that follows.

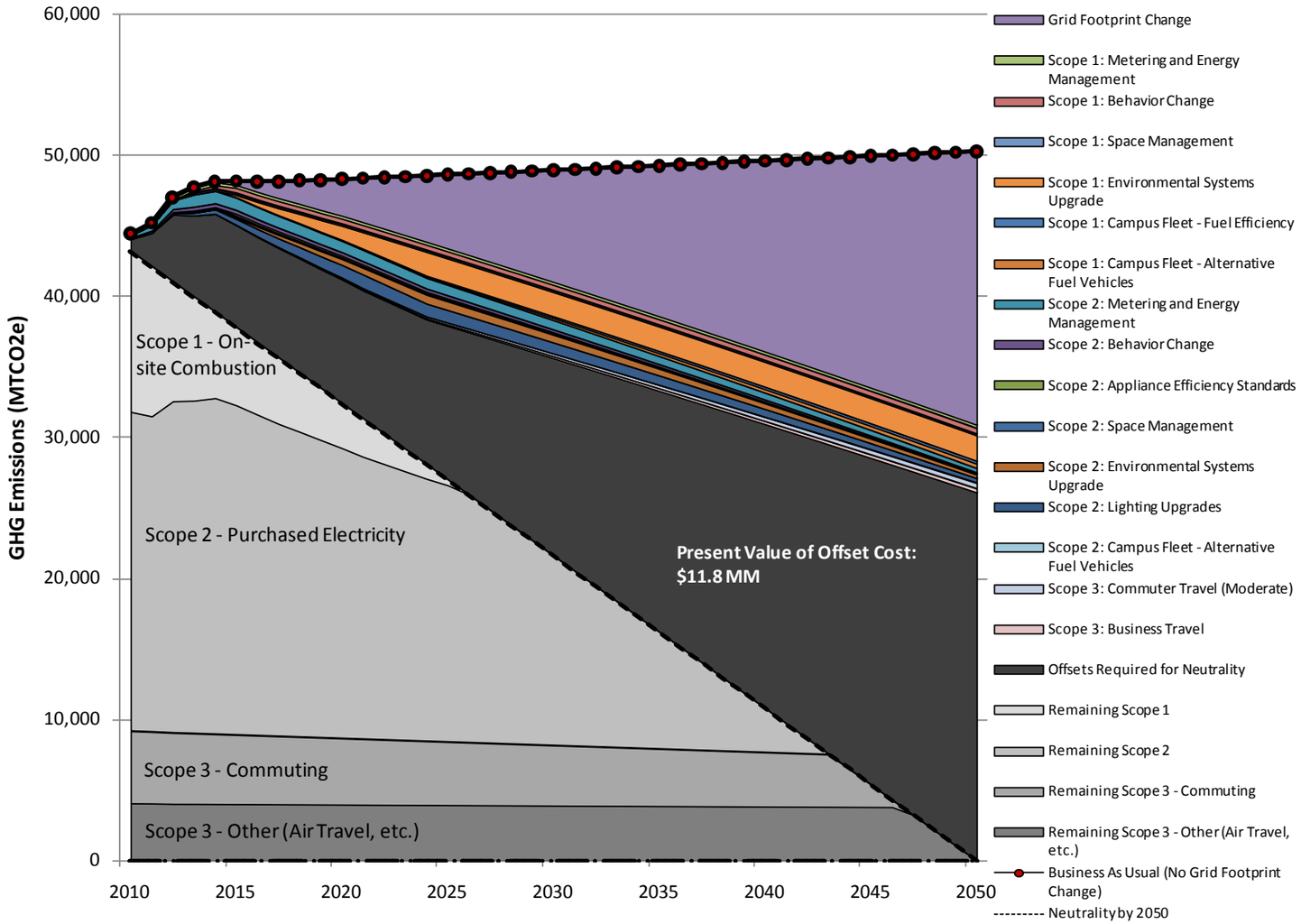


Figure 7: Base Portfolio Wedge Diagram

Finishing Portfolio

The Base Portfolio will get us only part of the way to climate neutrality. We'll need to take other actions to *finish* the job. Those actions will comprise our *"Finishing Portfolio."*

Each of the Wedge Diagrams on the facing page capture the impact of both the Grid Footprint Change (purple) and the Base Portfolio (turquoise). Below these, we layered in the impacts of the two supply-side renewable technologies: Solar Domestic Hot Water and Wind (pp. 22-23).

We now consider the carbon impacts of the major HVAC plant replacement choices. As noted on page 21, **a detailed feasibility study will be needed to assess the particular choice – or a hybrid among these choices – that best serves the future needs of Ithaca College**. These alternatives are presented only to compare and contrast the scale and timing of *potential* carbon reductions.

In each diagram, the green wedge depicts the impact of each major plant upgrade alternative. The assumptions behind each action are detailed beginning at page 21.

Boiler/Chiller Upgrades

Figure 8 shows the impact of boiler/chiller upgrades. Since this equipment is reaching the end of its service life, we would simply reproduce the existing building-based local configuration with more efficient equipment.

GeoExchange

The impact of GeoExchange is shown in Figure 9. This is an electricity-powered combined heating/cooling system that taps near-surface ground temperatures. It holds the potential to harvest substantial reductions in Scope 1 natural gas emissions. The use of a ground loop eliminates the cost and noise associated with rooftop condensers. Since the heat pump produces lower-temperature water, building distribution systems may need to be modified, or a supplemental boiler included in the package.

As with the boiler/chiller upgrade, this assumes a building-based local plant configuration. However, GeoExchange may also be incorporated in regional- or central-plant configurations described hereafter.

Figure 8: Finishing Portfolio Wedge Diagram with Boiler/Chiller Upgrades

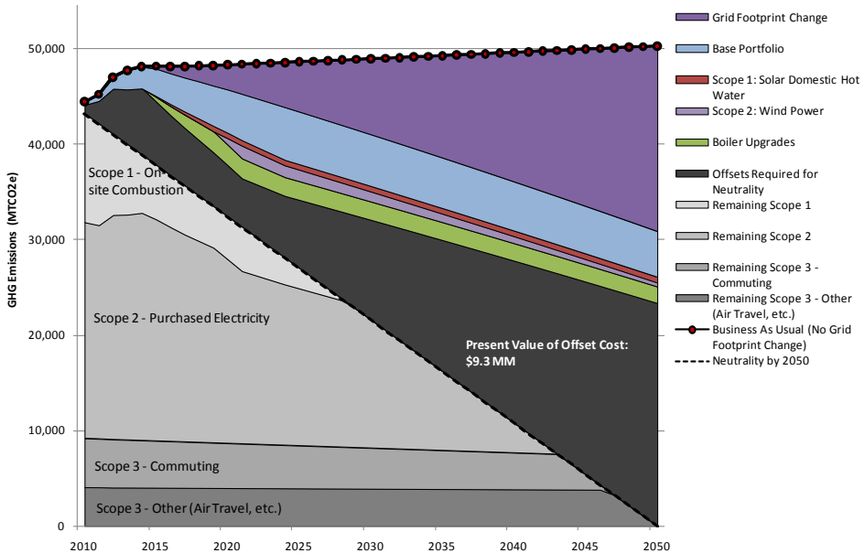
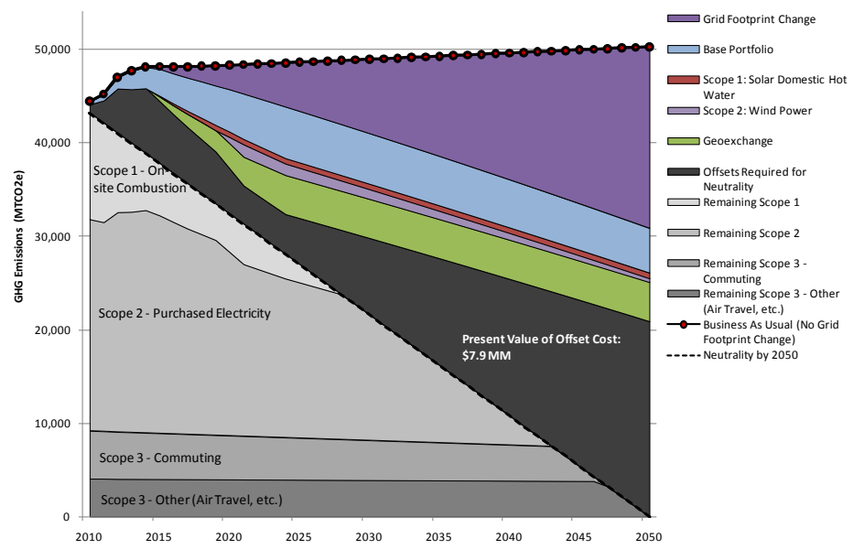


Figure 9: Finishing Portfolio Wedge Diagram with GeoExchange



Central Utility Plant (CUP)

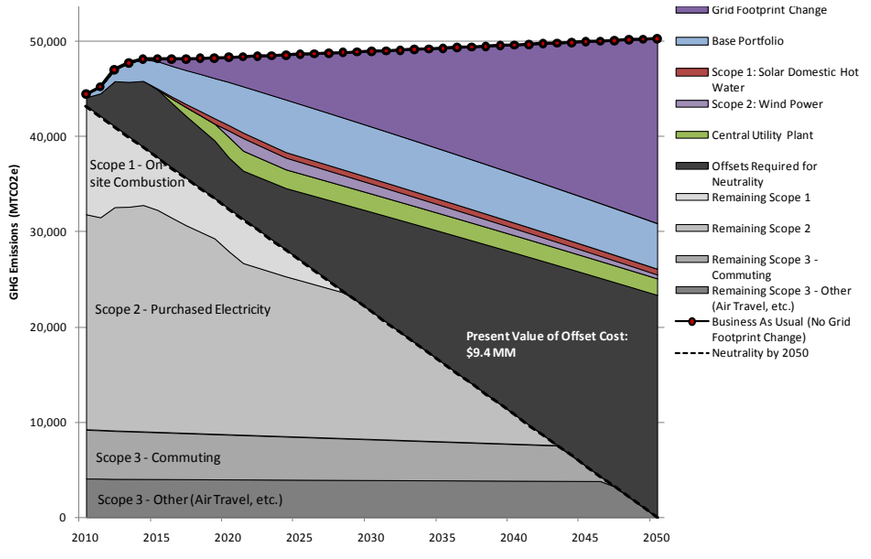
Though labeled as a "Central Utility Plant," this option includes the likely potential for smaller Regional Utility Plants (such as we have now at Job Hall) that provide near-term benefits while holding the potential to later be connected to a single central plant.

Central or regional plants would allow us to eliminate – over time – much of our building-based local plant. Simpler heat-exchange equipment in individual buildings would be easier to maintain. There are also potentially significant efficiency improvements (and resulting energy cost savings) in serving the diversity of campus occupancies via a single heating/cooling plant.

A central plant may incorporate elements of GeoExchange technology that is typically applied as a local system in individual buildings. A move toward a central plant creates the opportunity to later burn other fuels with lower carbon intensity (such as bio-fuels) or use more benign heat sources (such as deep geothermal). Enhanced Geothermal Systems (below, and at p. 22) are not yet commercially viable, and bio-fuels are not yet available as scalable commodities. But their potential to substantially reduce our carbon footprint may create a more compelling case to move down the path toward a central plant.

The wedge diagram in Figure 10 assumes a 5-year build-out of a central plant and distribution system beginning in 2015.

Figure 10: Finishing Portfolio Wedge Diagram with Central Utility Plant (CUP)

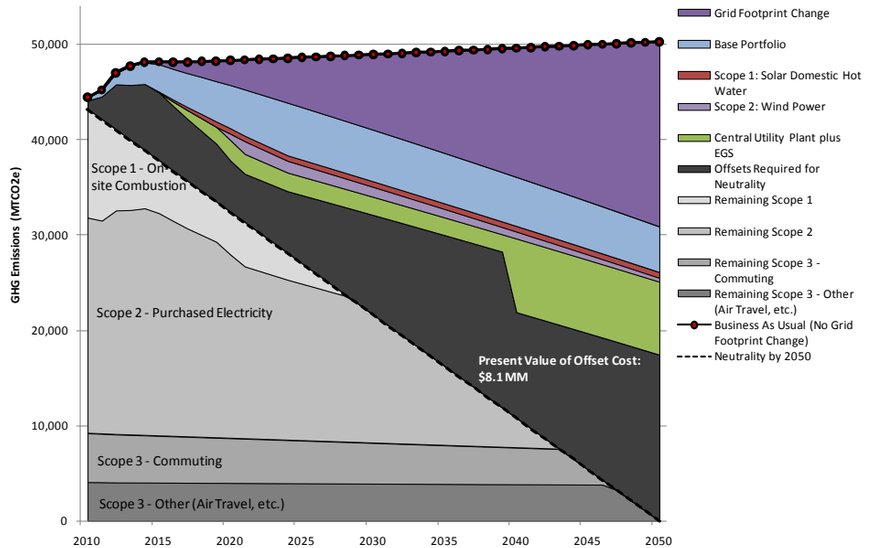


Central Utility Plant with Enhanced Geothermal System

An Enhanced Geothermal System (EGS) taps the heat of the deep earth, 2-3 miles below the surface. While principally a heating source, it may be possible – though perhaps not economical – to harvest electricity from the system.

While not yet a commercially-viable technology, it will be the focus of a research initiative at neighboring Cornell University. As can be seen, it would substantially reduce our Scope 1 emissions. However, as noted in the previous section, we will need a central plant to tap this resource. The CUP and distribution system are shown as having been built out commencing in 2015 (as noted in the previous section) to harvest the economic benefits of a central system.

Figure 11: Finishing Portfolio Wedge Diagram with CUP plus Enhanced Geothermal System



Economic Performance

The valuation for each individual action is represented in the *Action Abatement Curve* (p. 26). We now discuss the value of the base portfolio and potential alternative portfolio paths *relative to the reference portfolio*. We will consider two evaluation metrics: net present value and annual cash flow types. These economic valuations are only screening-level economics for planning purposes. More detailed analyses will be needed to develop "investment ready" information before actual investment decisions are made.

Reference Portfolio

We created a Reference Portfolio to understand the cost of achieving climate neutrality using financial actions only (e.g., offsets and RECs, see *Financial Actions* at page 10). As noted in Figure 12, the resulting present value of this reference portfolio has a cost of $6,200,000 (assuming all voluntary offsets) to $15,600,000 (assuming all compliance quality offsets). No capital is required to implement this approach.

We assumed that the cost of each offset and REC would be the same as a GHGE compliance-quality allowance. This is a worst-case assessment. The College could set a policy to try to meet the requirements of compliance-quality allowances in all the financial instruments purchased and incur these "worst case" costs.

If *voluntary* offsets are used to address Scope 1 and Scope 3 emissions and "green power" purchases are made to address Scope 2 emissions, the cost of the Reference Portfolio goes down.

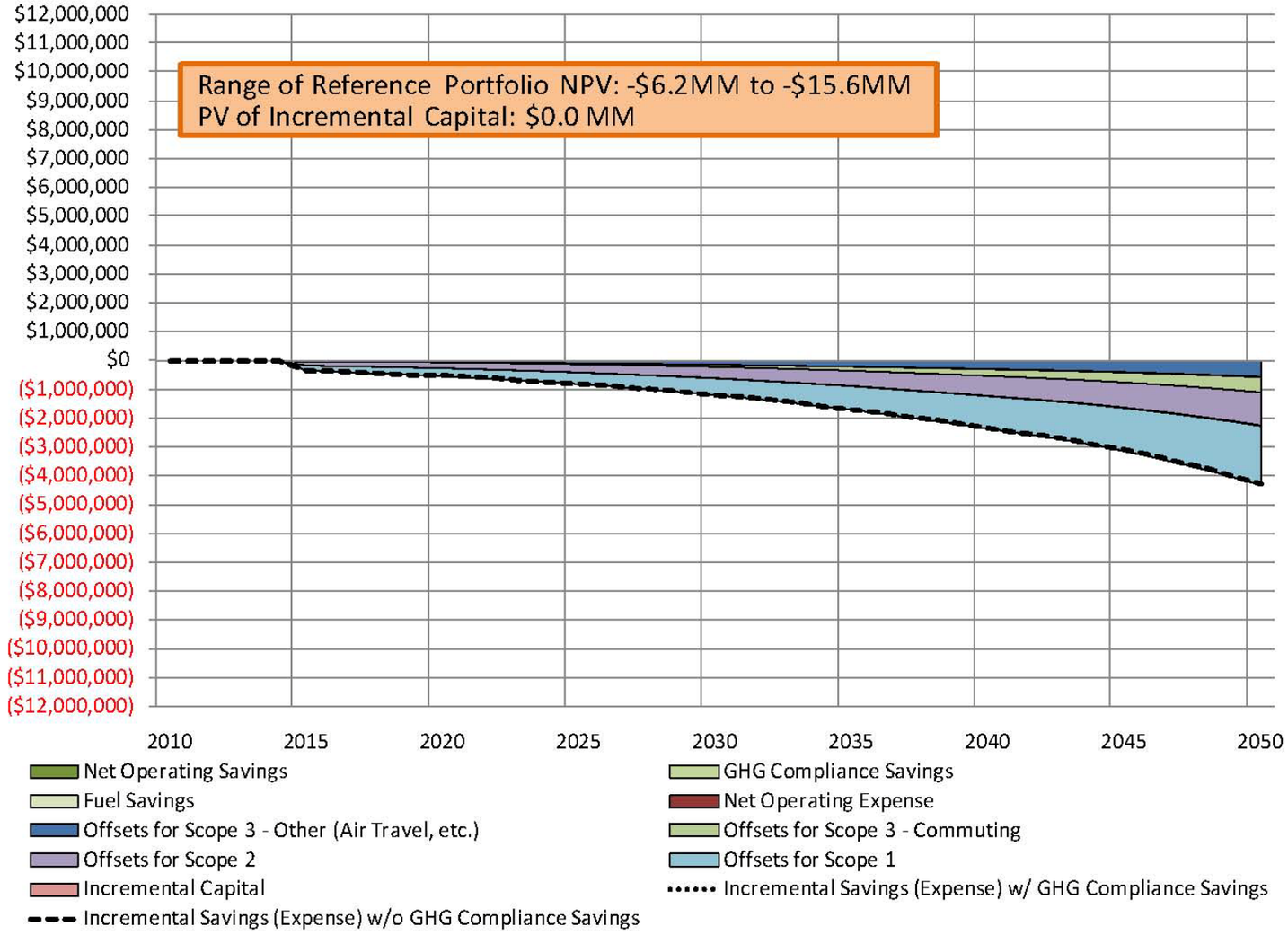


Figure 12: Reference Portfolio Costs

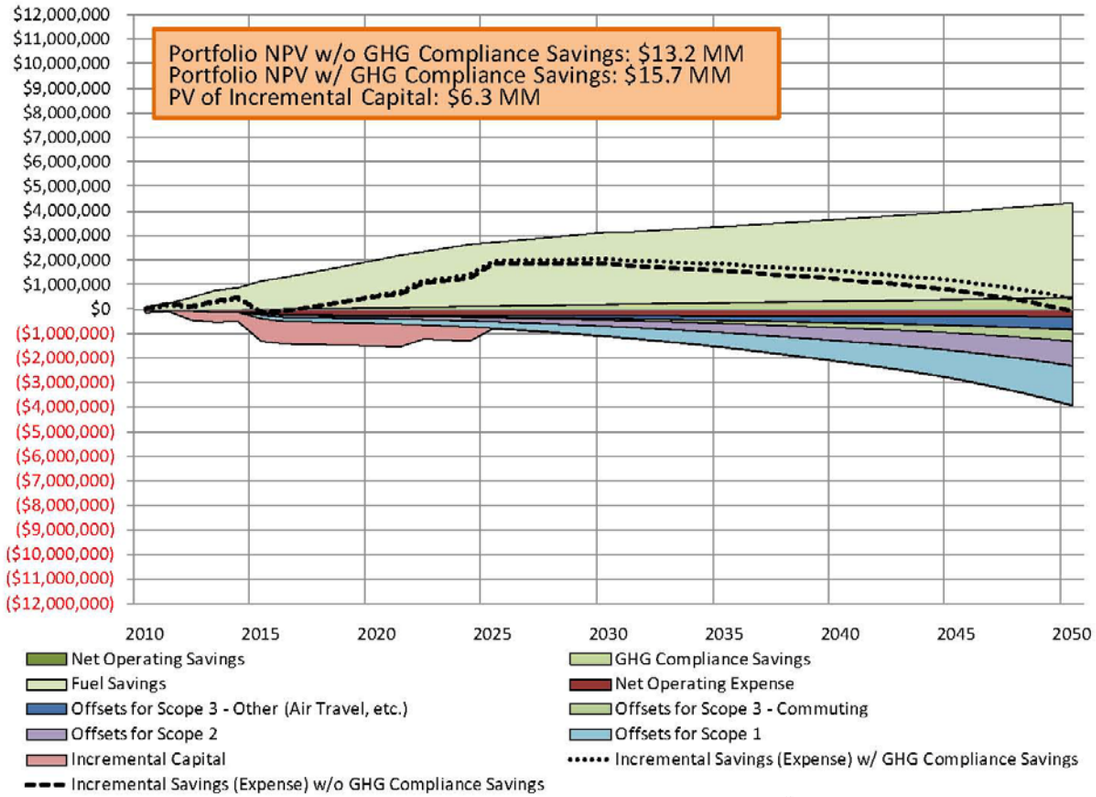


Figure 13: Base Portfolio Costs

Base Portfolio

The Base Portfolio comprises a set of actions, *not* including any of the Finishing Portfolio actions discussed in the previous section, that potentially save the College money or, in the case of commuter related emissions, should be undertaken to achieve some of the broader education and student-involvement goals of the ACUPCC commitment.

As shown in Figure 13, **this portfolio is estimated to have a net *benefit* of $13.2MM**, including the GHGE compliance savings, and require $10.7MM in incremental capital to implement. This value includes the cost of the $11.9MM in offsets and RECs purchased to cover the emissions not directly reduced.

Finishing Portfolio

The potential costs and benefits of each of the alternative portfolio paths are represented in Table 5 below. Note that all of the portfolio paths save money relative to Reference Portfolio. In the case of the Central Utility Plant paths, the Base Portfolio is subsidizing the cost to implement the central plant, thus the value for those two paths is less benefit than the Base Portfolio alone.

Table 5: Costs and Benefits of Alternative Portfolio Paths Base Portfolio Costs

Portfolio Path	Net Present Value without GHGE Compliance Savings ($MM)	Net Present Value with GHGE Compliance Savings ($MM)	Present Value of Incremental Capital ($MM)	Cost of Offsets and RECs ($MM)
Reference Portfolio	($15.6)	($15.6)	$0.0	($15.6)
Base Portfolio	$13.2	$15.7	($6.3)	($11.8)
Base with Boiler Upgrades	$22.8	$26.9	($17.5)	($9.3)
Base with GeoExchange	$27.3	$32.5	($19.5)	($7.9)
Base with Central Plant	$11.5	$15.6	($28.9)	($9.4)
Base with Central Plant plus EGS	$11.7	$16.9	($35.0)	($8.1)

Implementation

This section details how we plan to **act** on the recommendations of this Climate Action Plan.

Figure 14 shows how we will re-deploy and augment the members of the Presidents Climate Commitment Committee toward an organizational structure focused on implementation.

Key bulleted actions have been assigned to one of four working groups along the bottom. Working Group members have line responsibilities in these areas, and are best positioned to generate and monitor the changes we need.

The CAP Implementation Committee will review recommendations for policy/process changes or budget requests, and track progress against our GHGE reduction goals.

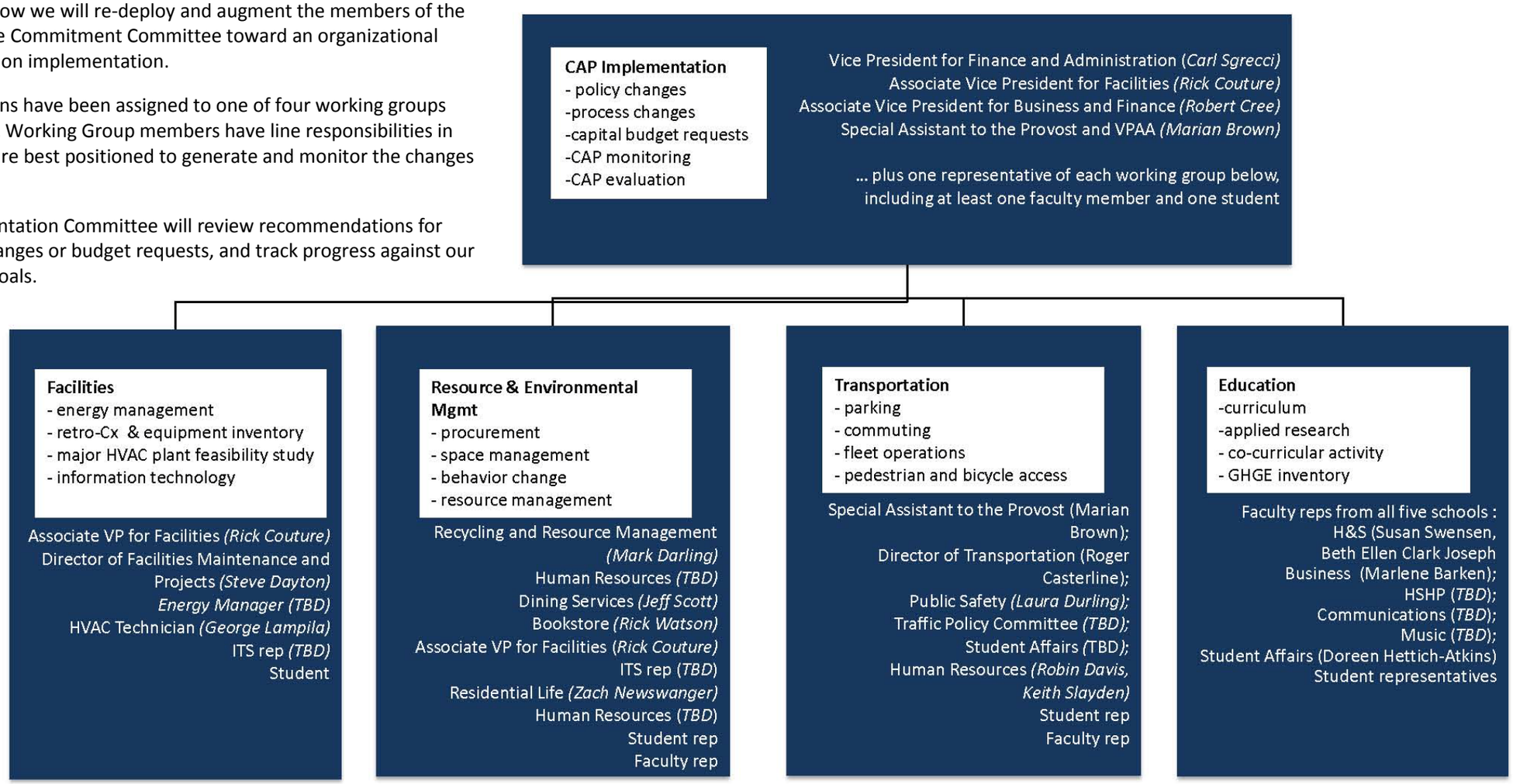


Figure 14: CAP Implementation Working Group Structure

Issues for Discussion and Debate

The ACUPCC CAP process is intended to be an educational tool to help the next generation of leaders understand the trade-offs associated with efforts to achieve climate neutrality. So we have identified some pertinent issues for discussion and debate:

1. How much should we expect faculty, students and staff to change their behaviors to achieve GHGE reductions?
2. What is the likely impact of proposed changes in policy or practice on perceived quality of work life or quality of student life?
3. To what extent should we depend on future technology developments to help us avoid hard choices now?
    a. Should we make a major investment in a central plant so we might burn less carbon-intensive fuels in the future?
    b. If those fuels become available, does that relieve us of an obligation to reduce demand or improve the efficiency of our operations?
4. Should we use offsets to "outsource" reductions? If so, when should we phase them in?
5. What other missions of Ithaca College are more important than reducing GHG emissions? Are these tradeoffs or might they be complementary?

Integrated Planning and Policy Development

This Climate Action Plan needs to be integrated with other campus planning efforts:

- Ithaca College Master Plan
- Ithaca College Integrated Facilities Plan
- Ithaca College Comprehensive Environmental Policy
- Ithaca College Institutional Plan/Bridge Plan

Action Plan for the First Five Years

On the following pages, we have broken out – for both Facilities and Transportation – specific actions among the three fundamental strategies for carbon reduction: reduce demand, improve system efficiencies, and switch fuels. While specific actions may vary, these are the key areas of emphasis for the first five years of our Climate Action Plan:

1. identify low- or no-cost policy and program changes that hold the potential to yield immediate reductions
    a. meter and manage energy use so we are able to document actual energy savings for each building and major systems
    b. retro-commission all existing facilities to ensure that they are operating as designed, and identify potential energy-saving actions
    c. improve programs and policies to support lower-carbon methods of commuting and business travel
    d. improve the fuel efficiency of our fleet vehicles

2. "harden" our long-term GHGE reduction targets – which are now based on soft estimates – after we more effectively characterize energy consumption, system performance and behaviors. The *Building Characterization Worksheet* (p. 47) was developed to capture existing information and will be completed as part of this process.

3. address the significant fork-in-the-road that needs to be resolved as aging HVAC plant needs to be replaced.

The use of financial instruments (offsets or RECs) is a fourth strategy that needs to be explored. We want to explore the viability of investing in community-based offsets as a means to:

(1) offset emissions that cannot be handled cost-effectively through direct reductions, and
(2) support local initiatives and internalize the benefits of offset purchases within our regional economy.

This section concludes with a section titled Education (p. 38-40), which reviews the history of sustainability initiatives at Ithaca College, educational issues associated with CAP implementation, and opportunities to link the Climate Action Plan with educational activities at Ithaca College.

Facilities

The implementation strategy for the Facilities portion of our plan is highlighted in Figure 15. Each action is assigned to one of the three strategies for reducing GHG emissions. Most of the actions will use existing staff resources, and have no incremental additional cost. However, the green-colored boxes represent actions that will require additional operating or capital costs.

The goal for this five-year period is to get a better handle on our operations and prepare ourselves to make more-informed decisions about significant actions to be taken commencing in Year 6.

Year 1

During the first year, we recommend:

- **Meter and manage energy** is probably the most critical initial investment because it will allow us to track the actual performance of actions intended to create long-term, ongoing reductions in both energy use and CO_2e. In Year 1, Energy Management will be assigned and building metering installed.
- To leverage that investment in energy management, we will also **upgrade lighting and direct-digital controls** for HVAC systems. Controls upgrades for lighting and mechanical equipment (which may be done as part of the retro-commissioning process) will help make the energy management function more effective.
- To complement the more-effective monitoring of our energy-using systems, we need a more **complete inventory of our energy-using equipment**. The inventory will be completed as part of the campus-wide retro-commissioning process, which will continue through each of the first 5 years.
- Year 1 will be the time to engage the faculty and researchers in ways to conceive, package, monitor and evaluate **behavior change programming.** Central to this effort, we need to identify best practices for particular space occupancies (e.g., classroom, office, residential), and package these into programming that focuses on the users of those spaces.
- **Institutional policies and processes** will be comprehensively evaluated during Year 1 to assess needed changes. This should be a collaborative

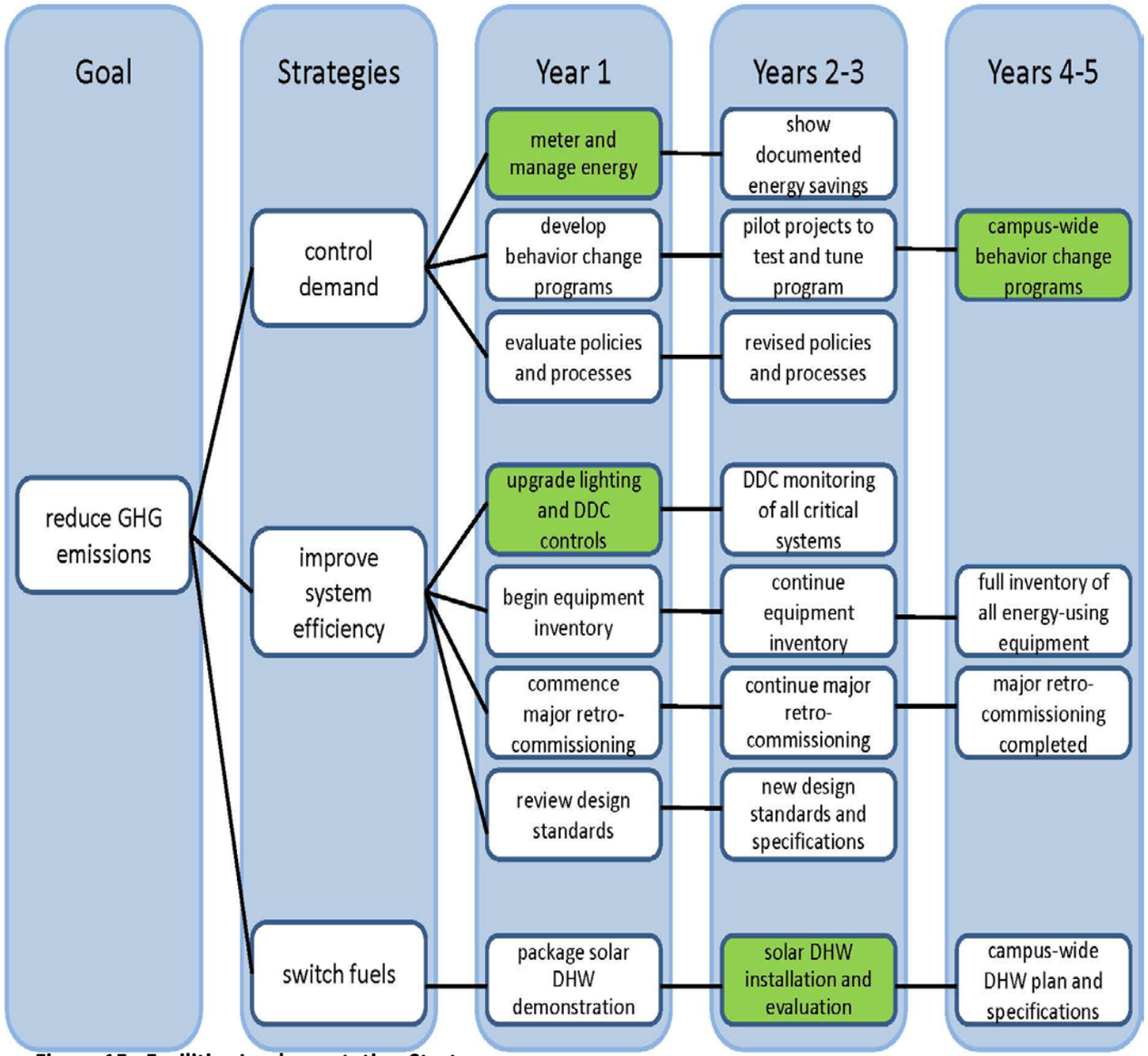


Figure 15: Facilities Implementation Strategy

process that allows us to develop consensus-based revisions for review and implementation in Years 2-3.

• **"Retro-Cx" (retro-commissioning**) is the process of making sure that all our energy-using systems are operating as designed. This core CAP activity – assuring that energy and carbon reductions continue to be delivered – will need to be an ongoing activity.

• Future projects – whether major retrofits or new construction projects – need to incorporate state-of-the-art design features and technologies to assure that our campus-wide carbon reductions are achieved. In particular, we need to minimize that upward trend of *Business-As-Usual* emissions caused by new construction. During Year 1, we'll need to consider **establishing performance criteria**, including **energy-use** and **space-use intensity standards**. We would hope to have those in place by the end of Year 2. The **major HVAC system feasibility study** will yield system design and equipment specifications that should also be incorporated in these design standards, as they will inform many building design choices in the future.

• The potential for **solar domestic water heating** will be evaluated via a **demonstration project** to be packaged in Year 1, then installed and evaluated in Years 2-3. A **small-scale wind-energy demonstration project** may also be packaged during this period, but more as an educational effort. (Large-scale wind energy is evaluated separately herein.)

Years 2-3

By the end of Year 2, we should be able to:

(1) **document energy savings** from our first full year of metering and monitoring performance; and

(2) start **benchmarking building and system performance** using a spreadsheet format developed to characterize the energy use in each campus building.

• **Behavior change pilot projects** directed at specific audiences will be ramped-up during Years 2-3 to test, evaluate and tune our approach. These programs will need to be flexible, robust and respond quickly to ongoing evaluation and feedback.

• Likewise, we should have **revised policies and processes** ready for implementation during this period.

• The cost of **lighting and control upgrades** during Year 1 should quickly be repaid in energy savings that will documented by the end of Year 2. And real-time monitoring of our energy systems will help direct our retro-commissioning work, making those efforts more cost-effective.

• By the end of Year 2, a **feasibility study of alternative approaches to replacing major HVAC plant** should be completed, allowing an immediate and informed choice on whether and how to replace aging underground pipes.

• The **solar domestic hot water pilot project** will be installed and evaluated during this period

Years 4-5

• At the end of this period, **all campus buildings should have been retro-commissioned,** and the **inventory of energy-using equipment completed.**

• Based on the above work, a **plan to implement the actions of the Base Portfolio** should be in place.

• During this period, we should be able to roll out **behavior change programs** that have demonstrated their worth during the pilot period of Years 2-3.

• If the Solar DHW Pilot Project proves successful during Years 2-3, then **solar DHW plans and specifications will be developed** during Years 4-5 for a campus-wide roll-out in Year 6.

Transportation

Many of the pieces of the transportation elements of the CAP are in place today. Yet many of these efforts are informal and not recognized by the broader campus community. The first step of implementation will be to raise awareness of existing efforts and through this process, establish an understanding of the upcoming efforts and agreement on the policies and programs necessary to support those efforts. The implementation plan for transportation is highlighted in Figure 16.

Year 1

Establish broad goals and framework for the **transportation demand management** (**TDM**) elements of the plan. This will be a refinement of the CAP document and should reflect the sentiments of the campus community as well as those of the PCCC and college administration. Specific elements include:

- **Establish TDM goals and framework**. This should include long-term and interim mode splits, and a list of any programs or policies needed to achieve this.
- **Establish parking fee targets and phasing**. Key to the success of TDM goals will be a modification to the existing parking system. This plan should balance the campus community's needs with the need for short-term change and revenue requirements.
- **Establish transit plan and funding**. Improved transit will be important to the long-term reduction of single occupant vehicle (SOV) dependence. There are several options and limitations, particularly in the short term, so establishing goals, expectations and funding will be important.
- **Provide vanpool seed money and support programs**. Vanpool is expected to start soon and support will be important to the success of the program.
- **Establish guaranteed ride home (GRH) program.** While the cost is nominal, such programs are often cited as the single most important program enabling a commute via non-SOV.
- **Establish bike and pedestrian standards and plan**. To increase biking and walking to and from and around the campus, it is important that the supporting infrastructure is ubiquitous. Creation of standards and a long-term plan ensure this.

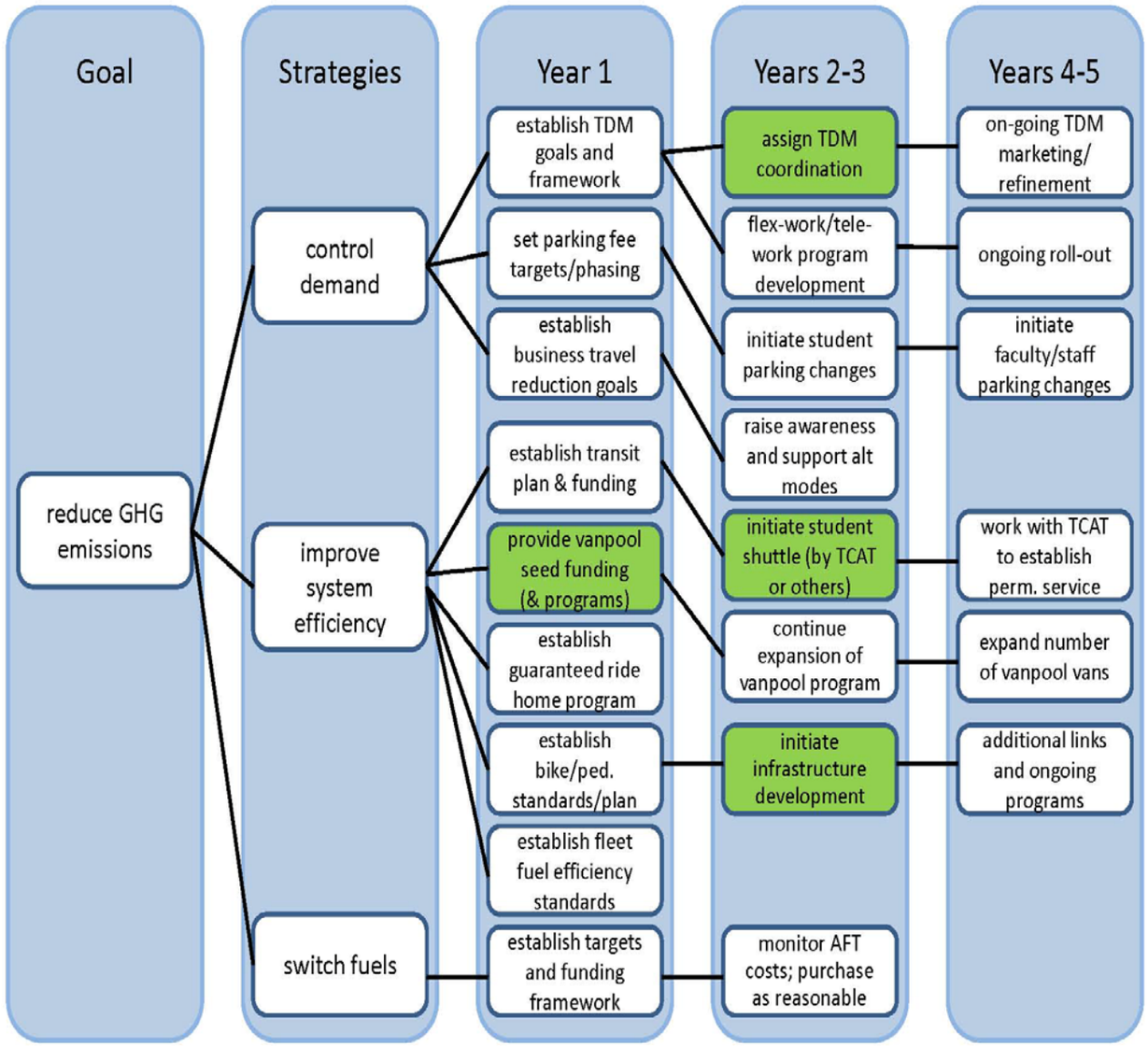


Figure 16: Transportation Implementation Strategy

• Establish **business travel reduction goals and funding framework.**

• Establish **fleet fuel economy standards** and funding framework.

• Establish **targets and funding for fuel switching**. The payoff and viability is not seen high in the short term but standards and a plan of action should be in place to ensure continued monitoring and switching when conditions improve.

Years 2-3

After initial planning efforts and funding procured, the next years will focus on implementation of the plans.

• **Assign responsibility for TDM coordination**. This position will oversee the roll-out of the plans and provide one-on-one assistance to those seeking to change their commute mode. This will initially be a part-time position.

• **Establish and expand flex-work and tele-work programs.**

• **Initiate parking changes.** This will likely include increased student restrictions and fees, and may also include employee parking changes.

• **Initiate student shuttle.** Such a shuttle would service College Circles Apartments and eliminate their need to drive to campus. Depending upon funding and demand, it might supplement/parallel Route 11 public transit service.

• **Initiate pedestrian and bike infrastructure improvements.**

• **Expand staff support for pursuing lower-carbon methods of business travel.** This person would also work to expand awareness of these alternatives. This could initially be the performed by the TDM coordinator.

• **Monitor fleet fuel use reduction** and adjust targets as necessary. This will be an ongoing effort and require both a funding commitment and reporting requirements to ensure success.

Years 4-5

Years four and five represent a growth stage for the CAP programs. Initial efforts should be complete and the focus should shift to laying the groundwork for the long-term success of these and future CAP endeavors. Key actions include:

• **Ongoing marketing, refinement and improvement of** TDM and other support programs. This will likely include expanding programs and benefits to ensure continued reductions in commute emissions.

• **Faculty and staff parking changes**. Any changes to faculty and staff parking not yet phased in should be completed during this timeframe. TDM programs should be sufficiently mature that most employees should have a viable alternative to driving and parking alone.

• **Work with TCAT to expand and enhance campus bus service.** Regardless of how the initial shuttle runs, long-term service, particularly that which serves employees, will most likely best be provided by TCAT.

• **Continued support of vanpool.** As appropriate, provide seed money for additional vans serving the campus.

• **Ongoing pedestrian and bicycle improvements.** This includes partnering with the City of Ithaca and Town of Ithaca to ensure good connections to the campus.

Education

A Rich History of Environmental and Outreach Initiatives at Ithaca (1988-2009)

1988: ICES (Ithaca College Environmental Society) formed. This student group promotes environmental awareness and responsibility on our campus through education, activism, stewardship, and outreach. ICES is still active today, with over 30 active members**.**
See *http://www.ithaca.edu/ices/*

1989: The Environmental Studies/Sciences (ES/S) Program began, promoting sustainability education through courses and experiential learning opportunities both on and off campus. ES/S student enrollment has tripled since 2004, with nearly 100 majors in 2009**.**
See *http://www.ithaca.edu/hs/depts/envstudies/*

1991: REMP (Resources and Environmental Management Program) was formed to increase the scope of resource management at the College beyond recycling to include composting as well as energy and resource conservation. REMP is a division of the Office of Facilities Services, which provides coordination and funding. The REMP Steering Committee includes faculty, staff, and students, many of whom serve as REMP interns or Resource Representatives in residence halls to facilitate REMP programs.
See http://www.ithaca.edu/remp/

2000: Applying Science to Sustainability NSF-CCLI grant: Ithaca College, in partnership with EcoVillage at Ithaca (EVI), received a $150,000 (with matching funds from IC) grant to support curriculum development in environmental studies and sustainability. The grant supported the formation of several new courses, student research projects, curriculum development workshops, a mini-grant program to encourage faculty to incorporate sustainability into their teaching, faculty travel to conferences, and community outreach in the form of lectures, films, and workshops. After the expiration of this grant, the School of Humanities and Sciences created a permanent budget line to partially support the continuation of these activities which are now coordinated through the **Environmental Studies Program and the Partnerships in Sustainability Education**.

2001: REMP authored the **Ithaca College Comprehensive Environmental Policy**, which was subsequently adopted by the College. See *Appendix A*

2003: The **Ithaca College School of Business** formed a **Sustainability Committee** to review the place of sustainability in the business curriculum. In May 2005, the School of Business incorporated sustainability into its mission statement: "Our degree programs align theory with practice within the global and ethical decision-making context necessary to foster *sustainable* enterprises."

2004: The Business School initiated a **sustainability speaker series** and an annual **"Sustainability in Action" Student–Faculty Colloquium** to showcase collaborative research.

2004: Ithaca College held the region's first **Sustainability Summit**, attracting more than 200 attendees from around the world, and **launched the campus Sustainability Initiative.**
See http://*www.ithaca.edu/sustainability/*

2004: IC's collaboration with **EcoVillage at Ithaca** spawned the formation of **Sustainable Tompkins (ST)**, a community-based organization pursuing regional sustainability. ST is going strong, hosting numerous activities every year. See *http://www.sustainabletompkins.org/*

2005: The Finger Lakes Environmental Film Festival (FLEFF) moved permanently to Ithaca College from Cornell. FLEFF, a program to link intellectual inquiry and debate to larger global issues, is dedicated to films with a message. The weeklong Festival has become a major regional event in upstate New York, and the co-directors have created international collaborations and partnerships.

2005: Sustainability Initiative conducted the first campus **inventory of coursework** with significant sustainability content and discovers more than 100 courses available to Ithaca College students across a wide variety of disciplines in all schools.

2005: Tompkins County Renewable Energy Education Alliance (TREEA) formed. TREEA is dedicated to educating the community about energy options and their financial, social, and environmental costs. Their recent work focuses on wind power. Their members come from Ithaca College and the surrounding community. See *http://www.treea.org/wiki/Main_Page*

2006: Ithaca College's affiliation with EcoVillage at Ithaca, Sustainable Tompkins, and other community-based organizations was formalized as **Partnerships for Sustainability Education** to

promote sustainability education, research, and projects.
See *http://www.ithaca.edu/hs/science_in_the_community/*

2006: The Finger Lakes Project was launched to provide professional development and outreach to faculty and staff at Ithaca College and in the region, promoting the integration of sustainability across the disciplines. Each May, a 2-day workshop is held at IC that brings in national and international speakers. See *http://www.ithaca.edu/fingerlakes_project/*

2006: Ithaca College signed the **Talloires Declaration** in response to widespread interest by the campus community.

2007: The Ithaca College Sustainability Group was formed as a group of faculty, staff, and students who are interested in promoting sustainable practices in operations and academics and identifying ways for students to be involved in projects that cross academic and divisional boundaries at the college.

2007: Ithaca College signed the American College and University Presidents Climate Commitment and shortly thereafter convened the **Presidents Climate Commitment Committee,** charged with developing the College's carbon neutrality plan.

2007: Ithaca College, TREEA, and Sustainable Tompkins teamed to host the region's first **Community Forum on Energy,** a day-long symposium and exhibition about renewable energy technology.

2007: Business Sustainability Ambassadors formed to conduct tours of the LEED Platinum School of Business and to find ways for the Business School to reach out into the community and foster sustainable practice.

2007: Ithaca College School of Health Sciences and Human Performances teamed with Sustainable Tompkins to host the region's first **Health and Sustainability Conference** on campus.

2008: The "Bridge Plan" which updated the Ithaca College Institutional Plan cited **"sustainability" as one of the core values of the institution.** The Middle States reaccreditation self-study process also used "sustainability" as a measure of institutional learning.

2008: ES/S was awarded a **$0.5 million grant from HSBC Bank** to promote education in environmental studies and sustainability. See *http://www.ithaca.edu/committochange/*

2008: Ithaca College received the **Sustainability Leadership Award** from the Association for the Advancement of Sustainability in Higher Education (AASHE). Ithaca College won in the category of four-year and graduate institutions with enrollments of 1,001 to 7,500 full-time students.

2008: The President's Council adopted a LEED Silver building policy as an amendment to the Comprehensive Environmental Policy. (See *Appendix A*) Two newly constructed buildings sought LEED Platinum certification, including the Dorothy D. and Roy H. Park Center for Business and Sustainable Enterprise (certified 2008) and the Peggy Ryan Williams Center (certification pending). The Athletics and Events Center will aim for LEED Gold certification.

2008: Ithaca Carshare launched with support from Ithaca College, Cornell University, EcoVillage at Ithaca, the City of Ithaca, and NYSERDA. Ithaca College's Office of Finance and Administration further supports Ithaca Carshare participation by offering qualified Ithaca College faculty and staff driving credits and reduced application fees. See *http://www.ithacacarshare.org/*

2009: Ithaca College participated in the nationwide **Global Climate Change Teach-In,** with a full day of programs sponsored by all of the Schools.

2009: Park School of Communications formed the **Park Sustainability Club**, and launched the **TREES Institute** (Teaching and Research in Environmental Ethics and Sustainability) and held a student photography exhibition.

2009: Ithaca College created a **Department of Environmental Studies and Science.** The designation of the new academic department acknowledges the importance of these majors in the priorities of the College and the role they will play in the future of the School of Humanities and Sciences, within which the department is located. *"There's a palpable energy and vitality that characterize our educational programs in environmental studies and environmental science,"* says Leslie Lewis, dean of the School of Humanities and Sciences. *"It's no wonder we're bursting at the seams with numbers of students. This level of interest is terrific, and contributes to our standing at the forefront of sustainability initiatives."*

2009: In collaboration with **Ithaca College**, Cornell University, Tompkins Renewable Energy Education Alliance, and other local non-profit partners, Sustainable Tompkins will host "We Make Our Future" - a **Finger Lakes Bioneers Forum October 16-18, 2009**. This will be a weekend of events revolving around live national video links to inspire a potent "global-local" approach to our shared planet's future.

Current Challenges and Future Goals for Sustainability Education

Broadening Participation by Faculty: A large number of faculty in the sciences have been involved in the sustainability initiative at the college. Despite efforts to involve faculty from other disciplines, broad faculty participation in sustainability is still needed to affect broad change. Efforts to engage faculty will continue through the work of the **Partnerships for Sustainability Education**, the **Finger Lakes Project workshops**, and the **Ithaca College Sustainability Group**.

Alleviating Workload Issues: Many faculty feel that they do not have the time or energy to engage with sustainability at a level that would lead to meaningful change. Resources aimed at addressing concerns of faculty workload may encourage greater participation in this initiative.

Establishing a Coordinating Office: Many of the sustainability-related activities on campus – particularly the opportunities for experiential learning projects between operational units and academics – would benefit from better coordination. Improved coordination of projects, courses, and operations activities would provide a richer set of experiential opportunities for students.

Recognizing Faculty Engagement in Sustainability: Tenure and promotion decisions are based on scholarly work that often does not recognize sustainability as a scholarly endeavor. Both faculty and administrators may need assistance in understanding how sustainability can relate to scholarship, and how the college may begin to recognize and place more value on this type of work in tenure and promotion decisions.

Fostering Interdisciplinary Interactions: Cross- and inter-disciplinary interaction is at the heart of sustainability education. Administrative structures that prevent interdisciplinary teaching, especially across schools and divisions, need to be removed. The current $(IC)^2$ initiative embodies many of the ideals necessary for successful sustainability education endeavors.

Expand Credit-Bearing Student Research Projects in Sustainability: Not all faculty receive teaching credit for the supervision of student research projects. Without a mechanism for crediting faculty for this mentorship in all departments, this type of activity tends to exist only in areas of the college where teaching load includes student research supervision.

Opportunities to Link the CAP with Educational Programs

1. **Curriculum**
   a. explore principles behind environmental and financial decisions (e.g., stocks and flows)
   b. explore ethical issues

2. **Behavior Change**
   a. identify and catalogue best practices
      i. by energy-using device
      ii. by occupancy type
   b. develop, test, evaluate, and evolve social-marketing programs to encourage the use of best practices
   c. identify common elements to leverage facility and transportation programs
   d. organize and coordinate behavior changes among various groups and constituencies

3. **Policies and Process**
   a. analyze program recommendations to identify complementary policy and process changes
   b. compare and contrast facility design guidelines from other institutions
   c. identify parking fee targets
   d. inventory transportation policy options

4. **Evaluating Technologies**
   a. renewable (solar DHW, solar PV, local wind)
      i. compare and contrast technologies , LEED vs. non-LEED buildings
      ii. develop cost estimates and specifications
      iii. package demo project
      iv. develop educational materials
   b. lighting technologies and day lighting

5. **Retro-Commissioning and Equipment Inventory**
   a. assist in recording information
   b. compile best practices for specific equipment

6**. Tracking and Monitoring Performance**
   a. take periodic meter readings to monitor impacts of selected actions
   b. monitor vehicular traffic/usage patterns
   c. survey patterns of vehicle use

Glossary

Abatement Curve – a diagram depicting the lifetime abatement potential of an action on the horizontal axis and the levelized cost on the vertical axis, typically sorted by increasing levelized cost and/or implementation timeframe

ACUPCC – American College and University Presidents Climate Commitment

Business As Usual (BAU) – a trend line scenario in which programs and practices remain as they are today

Base Portfolio – the set of actions recommended for near-term implementation

CAP – (Ithaca College) Climate Action Plan

Climate Neutrality – having no net greenhouse gas (GHGE) emissions by eliminating net GHG emissions altogether, or by minimizing GHG emissions as much as possible and using carbon offsets or other measures to mitigate the remaining emissions

CO_2e – CO_2 equivalent; a measure which normalizes the effects of greenhouse gases, accounting for the differing global warming potential of each

Compliance Costs – direct and indirect (passed-thru) costs associated with compliance with GHGE reduction legislation

Energy-Use Intensity (EUI) – the energy consumption divided by the gross square footage of a building or campus, typically represented as BTU's/square foot

Finishing Portfolio – the set of actions recommended for medium and long-term implementation intended to achieve goal of climate neutrality, and requiring more detailed evaluation in the future

GHG – Greenhouse Gas(es)

GHGE – Greenhouse Gas Emissions

Grid Footprint Change – anticipated reduction in GHGE footprint of purchased electricity as producers comply with GHGE legislation

HVAC – heating, ventilation and air conditioning; may be used generally to include the mechanical systems and support infrastructure (boilers, chillers, etc)

KwH – The kilowatt-hour (symbolized kWh) is a unit of energy equivalent to one kilowatt (1 kW) of power expended for one hour.

Levelized Cost – a measure of the relative efficiency of actions in reducing GHGE per dollar spent; it is equal to the net present value of the total investment (operations and capital) divided by the net present value of the greenhouse gas reductions over the lifetime of the project (through 2050 for the CAP)

MM – million

MTCDE – metric ton CO_2e, the internationally recognized standard for membership of greenhouse gas emissions

Offsets – projects that reduce the emission of greenhouse gases offsite

PCCC – Ithaca College's Presidents Climate Commitment Committee, the representative campus group responsible for developing the college's Climate Action Plan

Portfolio – the set of actions to be pursued to achieve climate neutrality

Portfolio Sketch – an initial estimate of the actions and their potential level of success

Present Value – a measurement of the value today of a future sum or stream of income and expenses; used to account for the time value of money

REC – Renewable Energy Credits; a commitment to purchase low/no-carbon electricity from the supplier over the grid

Reference Case – achieving climate neutrality using financial actions only (offsets and RECs)

Scope 1 Emissions – GHGE emissions resulting from direct combustion of fuels on the campus, such as natural gas for heating and fuel for vehicles

Scope 2 Emissions – GHG emissions resulting from purchased electricity

Scope 3 Emissions – GHG emissions resulting from any other activity of the College; the ACUPCC requires tracking and reporting emissions from commuting and air travel. However, solid waste emissions are included in our GHGE inventory

Solar Domestic Hot Water – using special solar collectors to heat water used in showers, sinks, dining and laundry applications, and where applicable, radiator heating systems

Solar Photovoltaics – using solar panels to capture sunlight and generate electricity

SOV – single occupant vehicle

Space-Use Intensity (SUI) – the amount of building space consumed for campus operations, typically represented as square feet of building per person, per dollar of budget, etc.

TDM – transportation demand management system; programs to reduce the number of vehicle trips

Therms - units of commercially purchased natural gas. One therm equals 100,000 Btu or about 97 cubic feet of natural gas,

Triple Bottom Line – evaluation of projects along economic, environmental and social aspects, in contrast to typical single bottom line (financial) analysis; sometimes may be referred to as 'plus' indicating institutional factors are also considered

Voluntary Offset – offset of non-regulated emissions; generally any offset purchased for Scope 3 emissions would be voluntary offsets

Wedge Diagram – chart depicting the GHGE reduction potential of each action over time

Table 6: GHGE Abatement by Action

Year	Metering and Energy Management	Behavior Change	Appliance Efficiency Standards	Space Management	Environmental Systems Upgrade	Lighting Upgrades	Geoexchange	Boiler Upgrades	Central Utility Plant	Solar Domestic Hot Water	Wind Power	Central Utility Plant plus EGS	Commuter Travel (Moderate)	Commuter Travel (Reach)	Campus Fleet - Fuel Efficiency	Campus Fleet - Alternative Fuel Vehicles	Business Travel
2010	-254	-65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	-516	-126	0	0	0	0	0	0	0	0	0	0	-9	-17	-9	0	-8
2012	-820	-196	-63	0	0	-94	0	0	0	0	0	0	-18	-33	-19	0	-15
2013	-1,116	-374	-62	-173	0	-207	0	0	0	0	0	0	-27	-50	-28	0	-22
2014	-1,129	-493	-63	-172	0	-327	0	0	0	0	0	0	-36	-66	-36	0	-30
2015	-1,124	-608	-187	-169	-250	-432	-493	-493	0	-120	0	0	-45	-83	-45	0	-37
2016	-1,108	-603	-184	-166	-494	-535	-967	-959	-479	-240	0	-479	-54	-100	-53	0	-45
2017	-1,092	-599	-181	-165	-734	-635	-1,426	-1,402	-934	-360	0	-934	-63	-116	-61	0	-52
2018	-1,079	-595	-178	-163	-967	-733	-1,864	-1,818	-1,364	-480	0	-1,364	-72	-133	-68	0	-59
2019	-1,065	-591	-175	-161	-1,195	-826	-2,284	-2,211	-1,768	-600	0	-1,768	-81	-149	-75	0	-66
2020	-1,051	-588	-172	-159	-1,420	-916	-2,692	-2,153	-2,153	-600	-686	-2,153	-90	-166	-83	0	-74
2021	-1,036	-584	-168	-158	-1,639	-1,000	-3,084	-2,095	-2,095	-600	-1,342	-2,095	-99	-183	-90	-19	-81
2022	-1,020	-580	-165	-157	-1,865	-980	-3,466	-2,052	-2,052	-600	-1,311	-2,052	-108	-199	-96	-36	-88
2023	-1,004	-576	-162	-156	-2,090	-960	-3,834	-2,009	-2,009	-600	-1,281	-2,009	-117	-216	-103	-53	-95
2024	-989	-572	-158	-156	-2,313	-939	-4,188	-1,966	-1,966	-600	-1,250	-1,966	-126	-232	-109	-70	-102
2025	-973	-568	-155	-155	-2,303	-919	-4,189	-1,957	-1,957	-600	-1,220	-1,957	-135	-249	-115	-85	-109
2026	-957	-564	-151	-154	-2,293	-898	-4,190	-1,949	-1,949	-600	-1,189	-1,949	-144	-266	-121	-101	-116
2027	-941	-560	-148	-154	-2,283	-877	-4,192	-1,941	-1,941	-600	-1,159	-1,941	-153	-282	-126	-115	-123
2028	-925	-556	-144	-153	-2,274	-856	-4,193	-1,932	-1,932	-600	-1,128	-1,932	-162	-299	-132	-129	-130
2029	-908	-552	-141	-152	-2,264	-835	-4,194	-1,924	-1,924	-600	-1,098	-1,924	-171	-315	-137	-142	-137
2030	-892	-548	-137	-152	-2,254	-814	-4,195	-1,916	-1,916	-600	-1,067	-1,916	-180	-332	-142	-155	-144
2031	-876	-544	-133	-151	-2,244	-793	-4,196	-1,907	-1,907	-600	-1,037	-1,907	-189	-349	-147	-167	-150
2032	-859	-540	-130	-150	-2,234	-771	-4,197	-1,898	-1,898	-600	-1,006	-1,898	-198	-365	-152	-178	-157
2033	-843	-535	-126	-150	-2,223	-750	-4,198	-1,890	-1,890	-600	-976	-1,890	-207	-382	-156	-189	-164
2034	-826	-531	-123	-149	-2,213	-728	-4,199	-1,881	-1,881	-600	-945	-1,881	-216	-398	-161	-200	-171
2035	-809	-527	-119	-148	-2,203	-706	-4,201	-1,872	-1,872	-600	-915	-1,872	-225	-415	-165	-210	-177
2036	-792	-523	-115	-148	-2,192	-684	-4,202	-1,864	-1,864	-600	-884	-1,864	-234	-432	-169	-219	-184
2037	-775	-518	-112	-147	-2,182	-663	-4,203	-1,855	-1,855	-600	-854	-1,855	-243	-448	-173	-228	-191
2038	-758	-514	-108	-146	-2,172	-640	-4,204	-1,846	-1,846	-600	-823	-1,846	-252	-465	-177	-237	-197
2039	-741	-510	-104	-146	-2,161	-618	-4,205	-1,837	-1,837	-600	-793	-1,837	-261	-481	-180	-245	-204
2040	-724	-505	-100	-145	-2,150	-596	-4,205	-1,828	-1,828	-600	-762	-7,754	-270	-498	-184	-253	-210
2041	-707	-501	-97	-144	-2,140	-574	-4,206	-1,819	-1,819	-600	-732	-7,747	-279	-515	-187	-260	-217
2042	-689	-497	-93	-143	-2,129	-551	-4,207	-1,810	-1,810	-600	-701	-7,741	-288	-531	-190	-267	-223
2043	-672	-492	-89	-143	-2,118	-528	-4,208	-1,800	-1,800	-600	-671	-7,734	-297	-548	-193	-273	-229
2044	-654	-488	-85	-142	-2,107	-506	-4,209	-1,791	-1,791	-600	-640	-7,727	-306	-564	-196	-279	-236
2045	-637	-483	-81	-141	-2,096	-483	-4,210	-1,782	-1,782	-600	-610	-7,720	-315	-581	-199	-285	-242
2046	-619	-479	-77	-140	-2,085	-460	-4,211	-1,773	-1,773	-600	-579	-7,713	-324	-598	-202	-291	-249
2047	-601	-474	-74	-140	-2,074	-437	-4,212	-1,763	-1,763	-600	-549	-7,706	-333	-614	-204	-296	-255
2048	-583	-470	-70	-139	-2,063	-413	-4,212	-1,754	-1,754	-600	-518	-7,699	-342	-631	-207	-301	-261
2049	-565	-465	-66	-138	-2,052	-390	-4,213	-1,744	-1,744	-600	-488	-7,692	-351	-647	-209	-305	-267
2050	-547	-460	-62	-137	-2,041	-367	-4,214	-1,735	-1,735	-600	-457	-7,685	-360	-664	-211	-310	-273

Table 7: Fuel Savings by Action

Year	Metering and Energy Management	Behavior Change	Appliance Efficiency Standards	Space Management	Environmental Systems Upgrade	Lighting Upgrades	Geoexchange	Boiler Upgrades	Central Utility Plant	Solar Domestic Hot Water	Wind Power	Central Utility Plant plus EGS	Commuter Travel (Moderate)	Commuter Travel (Reach)	Campus Fleet - Fuel Efficiency	Campus Fleet - Alternative Fuel Vehicles	Business Travel
2010	$97,412	$28,688	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2011	$201,243	$56,816	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$3,227	$2,761	$0
2012	$328,436	$90,194	$29,163	$0	$0	$43,306	$0	$0	$0	$0	$0	$0	$0	$0	$6,719	$5,747	$0
2013	$456,582	$142,231	$29,172	$48,380	$0	$97,443	$0	$0	$0	$0	$0	$0	$0	$0	$10,094	$8,635	$0
2014	$473,176	$168,524	$30,264	$49,177	$0	$157,237	$0	$0	$0	$0	$0	$0	$0	$0	$13,471	$11,524	$0
2015	$484,011	$194,727	$92,755	$49,163	$73,006	$213,594	$110,276	$143,823	$0	$22,756	$0	$0	$0	$0	$16,851	$14,415	$0
2016	$491,130	$198,334	$93,986	$49,576	$147,242	$273,378	$221,523	$285,649	$142,825	$46,822	$0	$142,825	$0	$0	$20,264	$17,335	$0
2017	$498,696	$202,404	$95,252	$50,119	$223,281	$334,775	$335,045	$426,466	$284,311	$72,384	$0	$284,311	$0	$0	$23,717	$20,289	$0
2018	$507,987	$206,960	$96,885	$50,743	$301,411	$399,222	$450,291	$566,652	$424,989	$99,661	$0	$424,989	$0	$0	$27,192	$23,262	$0
2019	$517,002	$211,556	$98,439	$51,373	$381,441	$465,271	$567,593	$705,666	$564,533	$128,770	$0	$564,533	$0	$0	$30,689	$26,253	$0
2020	$526,015	$216,002	$100,019	$51,931	$462,702	$533,343	$684,887	$701,764	$701,764	$132,336	$399,278	$701,764	$0	$0	$34,207	$29,262	$0
2021	$534,886	$220,102	$101,624	$52,353	$544,214	$603,476	$799,749	$695,816	$695,816	$135,234	$809,345	$695,816	$0	$0	$37,745	$33,492	$0
2022	$544,211	$224,738	$103,252	$53,551	$636,182	$613,147	$923,072	$699,801	$699,801	$138,975	$820,264	$699,801	$0	$0	$41,302	$37,732	$0
2023	$553,973	$229,869	$104,907	$54,904	$733,786	$622,972	$1,052,363	$705,250	$705,250	$143,482	$831,330	$705,250	$0	$0	$44,879	$41,984	$0
2024	$564,107	$235,400	$106,588	$56,381	$837,255	$632,954	$1,187,538	$711,666	$711,666	$148,584	$842,545	$711,666	$0	$0	$48,476	$46,248	$0
2025	$575,211	$241,636	$108,398	$58,062	$862,218	$643,707	$1,232,056	$732,885	$732,885	$154,552	$854,721	$732,885	$0	$0	$52,092	$50,523	$0
2026	$586,675	$248,173	$110,250	$59,833	$888,517	$654,701	$1,279,333	$755,240	$755,240	$160,907	$867,150	$755,240	$0	$0	$55,726	$54,806	$0
2027	$598,596	$255,151	$112,143	$61,739	$916,818	$665,942	$1,330,867	$779,295	$779,295	$167,877	$879,840	$779,295	$0	$0	$59,375	$59,097	$0
2028	$610,638	$262,042	$114,083	$63,608	$944,572	$677,464	$1,380,846	$802,886	$802,886	$174,556	$892,831	$802,886	$0	$0	$63,042	$63,396	$0
2029	$622,843	$268,902	$116,072	$65,457	$972,037	$689,277	$1,429,846	$826,232	$826,232	$181,036	$906,134	$826,232	$0	$0	$66,727	$67,704	$0
2030	$635,404	$276,001	$118,112	$67,375	$1,000,516	$701,390	$1,480,805	$850,438	$850,438	$187,769	$919,759	$850,438	$0	$0	$70,430	$72,021	$0
2031	$627,622	$275,336	$116,178	$67,518	$1,002,641	$689,906	$1,498,508	$852,245	$852,245	$190,713	$902,443	$852,245	$0	$0	$73,783	$75,970	$0
2032	$634,861	$279,108	$117,411	$68,509	$1,017,361	$697,228	$1,523,658	$864,757	$864,757	$193,706	$909,746	$864,757	$0	$0	$77,111	$79,876	$0
2033	$642,215	$282,952	$118,662	$69,521	$1,032,381	$704,654	$1,549,372	$877,524	$877,524	$196,765	$917,143	$877,524	$0	$0	$80,422	$83,752	$0
2034	$649,704	$286,877	$119,933	$70,555	$1,047,735	$712,203	$1,575,702	$890,574	$890,574	$199,894	$924,656	$890,574	$0	$0	$83,722	$87,602	$0
2035	$657,314	$290,879	$121,223	$71,610	$1,063,405	$719,861	$1,602,628	$903,894	$903,894	$203,093	$932,269	$903,894	$0	$0	$87,008	$91,423	$0
2036	$665,047	$294,959	$122,531	$72,687	$1,079,397	$727,629	$1,630,161	$917,488	$917,488	$206,362	$939,978	$917,488	$0	$0	$90,280	$95,216	$0
2037	$672,912	$299,121	$123,859	$73,787	$1,095,731	$735,516	$1,658,333	$931,371	$931,371	$209,704	$947,797	$931,371	$0	$0	$93,541	$98,984	$0
2038	$680,909	$303,366	$125,207	$74,910	$1,112,408	$743,520	$1,687,153	$945,547	$945,547	$213,121	$955,723	$945,547	$0	$0	$96,791	$102,727	$0
2039	$689,041	$307,697	$126,575	$76,056	$1,129,438	$751,646	$1,716,638	$960,023	$960,023	$216,614	$963,759	$960,023	$0	$0	$100,031	$106,447	$0
2040	$697,292	$312,106	$127,961	$77,226	$1,146,802	$759,875	$1,746,761	$974,781	$974,781	$220,181	$971,879	$3,409,096	$0	$0	$103,257	$110,139	$0
2041	$705,672	$316,600	$129,365	$78,419	$1,164,517	$768,216	$1,777,557	$989,840	$989,840	$223,823	$980,097	$3,467,339	$0	$0	$106,471	$113,806	$0
2042	$714,213	$321,192	$130,795	$79,639	$1,182,638	$776,703	$1,809,107	$1,005,242	$1,005,242	$227,553	$988,454	$3,526,988	$0	$0	$109,683	$117,459	$0
2043	$722,866	$325,863	$132,239	$80,882	$1,201,093	$785,282	$1,841,312	$1,020,929	$1,020,929	$231,356	$996,880	$3,587,843	$0	$0	$112,879	$121,082	$0
2044	$731,572	$330,587	$133,688	$82,141	$1,219,794	$793,887	$1,874,046	$1,036,825	$1,036,825	$235,218	$1,005,290	$3,649,657	$0	$0	$116,035	$124,651	$0
2045	$740,312	$335,359	$135,138	$83,415	$1,238,719	$802,496	$1,907,281	$1,052,911	$1,052,911	$239,135	$1,013,658	$3,712,370	$0	$0	$119,142	$128,156	$0
2046	$749,106	$340,186	$136,592	$84,707	$1,257,901	$811,130	$1,941,072	$1,069,216	$1,069,216	$243,113	$1,022,008	$3,776,088	$0	$0	$122,386	$131,795	$0
2047	$757,981	$345,082	$138,055	$86,019	$1,277,386	$819,816	$1,975,493	$1,085,778	$1,085,778	$247,161	$1,030,378	$3,840,952	$0	$0	$125,613	$135,406	$0
2048	$766,930	$350,045	$139,525	$87,352	$1,297,172	$828,549	$2,010,541	$1,102,596	$1,102,596	$251,280	$1,038,756	$3,906,959	$0	$0	$128,822	$138,985	$0
2049	$775,947	$355,072	$141,002	$88,704	$1,317,252	$837,318	$2,046,215	$1,119,664	$1,119,664	$255,468	$1,047,132	$3,974,101	$0	$0	$132,010	$142,531	$0
2050	$785,024	$360,163	$142,483	$90,075	$1,337,620	$846,115	$2,082,512	$1,136,977	$1,136,977	$259,725	$1,055,495	$4,042,369	$0	$0	$135,172	$146,038	$0

Table 8: Incremental Capital Expenditures by Action

Year	Metering and Energy Management	Behavior Change	Appliance Efficiency Standards	Space Management	Environmental Systems Upgrade	Lighting Upgrades	Geoexchange	Boiler Upgrades	Central Utility Plant	Solar Domestic Hot Water	Wind Power	Central Utility Plant plus EGS	Commuter Travel (Moderate)	Commuter Travel (Reach)	Campus Fleet - Fuel Efficiency	Campus Fleet - Alternative Fuel Vehicles	Business Travel
2010	($60,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($18,000)	$0	$0
2011	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($17,467)	$0	$0
2012	$0	$0	$0	$0	$0	($355,000)	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($16,933)	$0	$0
2013	$0	($20,000)	$0	$0	$0	($355,000)	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($16,400)	$0	$0
2014	$0	$0	$0	$0	$0	($355,000)	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($15,867)	$0	$0
2015	$0	$0	$0	$0	($551,053)	($355,000)	($942,609)	($1,102,107)	($4,454,900)	($454,600)	$0	($4,454,900)	($5,000)	($5,000)	($15,333)	$0	($50,000)
2016	$0	$0	$0	$0	($551,053)	($355,000)	($942,609)	($1,102,107)	($4,454,900)	($454,600)	$0	($4,454,900)	($5,000)	($5,000)	($14,800)	$0	$0
2017	$0	$0	$0	$0	($551,053)	($355,000)	($942,609)	($1,102,107)	($4,454,900)	($454,600)	$0	($4,454,900)	($5,000)	($5,000)	($14,267)	$0	$0
2018	$0	$0	$0	$0	($551,053)	($355,000)	($942,609)	($1,102,107)	($4,454,900)	($454,600)	$0	($4,454,900)	($5,000)	($5,000)	($13,733)	$0	$0
2019	$0	$0	$0	$0	($551,053)	($355,000)	($942,609)	($1,102,107)	($4,454,900)	($454,600)	($5,000,000)	($4,454,900)	($5,000)	($5,000)	($13,200)	$0	$0
2020	$0	$0	$0	$0	($551,053)	($355,000)	($942,609)	$0	$0	$0	($5,000,000)	$0	($5,000)	($5,000)	($12,667)	$0	$0
2021	$0	$0	$0	$0	($551,053)	($355,000)	($942,609)	$0	$0	$0	$0	$0	($5,000)	($5,000)	($12,133)	($8,133)	$0
2022	$0	$0	$0	$0	($551,053)	$0	($942,609)	$0	$0	$0	$0	$0	($5,000)	($5,000)	($11,600)	($8,133)	$0
2023	$0	$0	$0	$0	($551,053)	$0	($942,609)	$0	$0	$0	$0	$0	($5,000)	($5,000)	($11,067)	($8,133)	$0
2024	$0	$0	$0	$0	($551,053)	$0	($942,609)	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,533)	($8,133)	$0
2025	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2026	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2027	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2028	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2029	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2030	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2031	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2032	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2033	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2034	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2035	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2036	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2037	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($8,333,333)	($5,000)	($5,000)	($10,000)	($8,133)	$0
2038	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($8,333,333)	($5,000)	($5,000)	($10,000)	($8,133)	$0
2039	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($8,333,333)	($5,000)	($5,000)	($10,000)	($8,133)	$0
2040	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2041	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2042	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2043	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2044	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2045	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2046	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2047	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2048	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2049	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0
2050	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($5,000)	($5,000)	($10,000)	($8,133)	$0

Table 9: Incremental Operating Expense by Action

Year	Metering and Energy Management	Behavior Change	Appliance Efficiency Standards	Space Management	Environmental Systems Upgrade	Lighting Upgrades	Geoexchange	Boiler Upgrades	Central Utility Plant	Solar Domestic Hot Water	Wind Power	Central Utility Plant plus EGS	Commuter Travel (Moderate)	Commuter Travel (Reach)	Campus Fleet - Fuel Efficiency	Campus Fleet - Alternative Fuel Vehicles	Business Travel
2010	($70,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$31,000	$31,000	$0	$0	($20,000)
2011	($70,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$28,879	$22,080	$0	$0	($11,806)
2012	($70,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$26,759	$13,159	$0	$0	($3,661)
2013	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$24,638	$4,239	$0	$0	$4,437
2014	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$22,517	($4,681)	$0	$0	$12,486
2015	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,897	($26,102)	$0	$0	$20,488
2016	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($81,724)	($122,522)	$0	$0	$28,442
2017	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($83,845)	($131,442)	$0	$0	$36,348
2018	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($85,965)	($140,363)	$0	$0	$44,208
2019	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	($88,086)	($149,283)	$0	$0	$52,021
2020	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($60,000)	$62,500	($90,207)	($158,203)	$0	$0	$59,788
2021	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($120,000)	$62,500	($92,328)	($167,124)	$0	$0	$67,508
2022	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($145,396)	$62,500	($94,448)	($176,044)	$0	$0	$75,182
2023	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($96,569)	($184,964)	$0	$0	$82,810
2024	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($98,690)	($193,885)	$0	$0	$90,392
2025	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($100,810)	($202,805)	$0	$0	$97,929
2026	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($102,931)	($211,725)	$0	$0	$105,421
2027	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($105,052)	($220,646)	$0	$0	$112,868
2028	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($107,172)	($229,566)	$0	$0	$120,270
2029	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($109,293)	($238,486)	$0	$0	$127,628
2030	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($111,414)	($247,407)	$0	$0	$134,941
2031	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($113,534)	($256,327)	$0	$0	$142,210
2032	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($115,655)	($265,248)	$0	$0	$149,436
2033	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($117,776)	($274,168)	$0	$0	$156,617
2034	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($119,896)	($283,088)	$0	$0	$163,756
2035	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($122,017)	($292,009)	$0	$0	$170,851
2036	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($124,138)	($300,929)	$0	$0	$177,903
2037	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($126,258)	($309,849)	$0	$0	$184,913
2038	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($128,379)	($318,770)	$0	$0	$191,880
2039	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($130,500)	($327,690)	$0	$0	$198,804
2040	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($132,620)	($336,610)	$0	$0	$205,687
2041	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($134,741)	($345,531)	$0	$0	$212,527
2042	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($136,862)	($354,451)	$0	$0	$219,326
2043	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($138,983)	($363,371)	$0	$0	$226,083
2044	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($141,103)	($372,292)	$0	$0	$232,799
2045	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($143,224)	($381,212)	$0	$0	$239,474
2046	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($145,345)	($390,132)	$0	$0	$246,109
2047	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($147,465)	($399,053)	$0	$0	$252,702
2048	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($149,586)	($407,973)	$0	$0	$259,255
2049	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($151,707)	($416,893)	$0	$0	$265,768
2050	($70,000)	($50,000)	$0	$0	$0	$0	$0	$0	$62,500	$0	($170,792)	$62,500	($153,827)	($425,814)	$0	$0	$272,240

Table 10: GHGE Compliance Savings by Action

Year	Metering and Energy Management	Behavior Change	Appliance Efficiency Standards	Space Management	Environmental Systems Upgrade	Lighting Upgrades	Geoexchange	Boiler Upgrades	Central Utility Plant	Solar Domestic Hot Water	Wind Power	Central Utility Plant plus EGS	Commuter Travel (Moderate)	Commuter Travel (Reach)	Campus Fleet - Fuel Efficiency	Campus Fleet - Alternative Fuel Vehicles	Business Travel
2010	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2011	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2012	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2013	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2014	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
2015	$11,229	$6,072	$1,873	$1,685	$2,502	$4,313	$4,925	$4,928	$0	$1,198	$0	$0	$0	$0	$445	$0	$372
2016	$12,775	$6,954	$2,123	$1,920	$5,702	$6,174	$11,150	$11,061	$5,531	$2,766	$0	$5,531	$0	$0	$607	$0	$514
2017	$14,361	$7,880	$2,375	$2,166	$9,649	$8,347	$18,748	$18,429	$12,286	$4,730	$0	$12,286	$0	$0	$796	$0	$682
2018	$16,006	$8,832	$2,638	$2,415	$14,347	$10,869	$27,652	$26,972	$20,229	$7,114	$0	$20,229	$0	$0	$1,010	$0	$878
2019	$17,661	$9,806	$2,900	$2,669	$19,816	$13,706	$37,884	$36,660	$29,328	$9,943	$0	$29,328	$0	$0	$1,252	$0	$1,101
2020	$19,344	$10,818	$3,162	$2,932	$26,121	$16,862	$49,541	$39,616	$39,616	$11,032	$12,624	$39,616	$0	$0	$1,520	$0	$1,354
2021	$21,229	$11,970	$3,453	$3,231	$33,588	$20,503	$63,206	$42,945	$42,945	$12,288	$27,498	$42,945	$0	$0	$1,835	$380	$1,655
2022	$23,129	$13,152	$3,742	$3,560	$42,291	$22,220	$78,592	$46,520	$46,520	$13,593	$29,726	$46,520	$0	$0	$2,181	$823	$1,992
2023	$25,037	$14,361	$4,028	$3,898	$52,093	$23,921	$95,578	$50,068	$50,068	$14,945	$31,922	$50,068	$0	$0	$2,559	$1,331	$2,367
2024	$26,945	$15,594	$4,310	$4,244	$63,027	$25,597	$114,139	$53,573	$53,573	$16,341	$34,073	$53,573	$0	$0	$2,969	$1,901	$2,780
2025	$28,847	$16,849	$4,587	$4,599	$68,290	$27,239	$124,225	$58,046	$58,046	$17,780	$36,168	$58,046	$0	$0	$3,409	$2,534	$3,233
2026	$30,969	$18,260	$4,894	$4,998	$74,222	$29,060	$135,628	$63,089	$63,089	$19,406	$38,490	$63,089	$0	$0	$3,910	$3,253	$3,755
2027	$33,080	$19,695	$5,193	$5,407	$80,291	$30,838	$147,390	$68,248	$68,248	$21,083	$40,743	$68,248	$0	$0	$4,446	$4,041	$4,323
2028	$35,173	$21,152	$5,484	$5,824	$86,486	$32,565	$159,494	$73,513	$73,513	$22,808	$42,917	$73,513	$0	$0	$5,017	$4,896	$4,940
2029	$37,238	$22,626	$5,764	$6,249	$92,793	$34,229	$171,923	$78,874	$78,874	$24,578	$44,998	$78,874	$0	$0	$5,622	$5,817	$5,605
2030	$39,268	$24,115	$6,033	$6,680	$99,202	$35,824	$184,660	$84,322	$84,322	$26,392	$46,977	$84,322	$0	$0	$6,261	$6,801	$6,320
2031	$41,580	$25,816	$6,337	$7,174	$106,532	$37,632	$199,245	$90,552	$90,552	$28,469	$49,226	$90,552	$0	$0	$6,986	$7,909	$7,141
2032	$43,846	$27,532	$6,627	$7,675	$113,978	$39,353	$214,193	$96,882	$96,882	$30,596	$51,349	$96,882	$0	$0	$7,749	$9,087	$8,020
2033	$45,681	$29,022	$6,844	$8,117	$120,533	$40,641	$227,604	$102,453	$102,453	$32,504	$52,897	$102,453	$0	$0	$8,478	$10,249	$8,885
2034	$47,087	$30,278	$6,989	$8,496	$126,166	$41,505	$239,403	$107,241	$107,241	$34,180	$53,886	$107,241	$0	$0	$9,165	$11,374	$9,726
2035	$48,441	$31,540	$7,120	$8,880	$131,864	$42,282	$251,447	$112,084	$112,084	$35,890	$54,758	$112,084	$0	$0	$9,877	$12,541	$10,612
2036	$50,078	$33,029	$7,285	$9,331	$138,563	$43,259	$265,534	$117,778	$117,778	$37,892	$55,884	$117,778	$0	$0	$10,684	$13,841	$11,623
2037	$51,586	$34,481	$7,422	$9,775	$145,156	$44,074	$279,565	$123,383	$123,383	$39,884	$56,794	$123,383	$0	$0	$11,506	$15,170	$12,674
2038	$52,957	$35,890	$7,531	$10,210	$151,625	$44,720	$293,504	$128,882	$128,882	$41,863	$57,483	$128,882	$0	$0	$12,339	$16,522	$13,762
2039	$54,186	$37,254	$7,610	$10,637	$157,955	$45,193	$307,319	$134,261	$134,261	$43,823	$57,946	$134,261	$0	$0	$13,180	$17,891	$14,884
2040	$55,413	$38,668	$7,680	$11,081	$164,553	$45,607	$321,810	$139,870	$139,870	$45,879	$58,331	$593,351	$0	$0	$14,064	$19,322	$16,080
2041	$56,438	$39,997	$7,712	$11,505	$170,844	$45,798	$335,856	$145,217	$145,217	$47,871	$58,429	$618,586	$0	$0	$14,940	$20,746	$17,296
2042	$57,252	$41,230	$7,706	$11,905	$176,782	$45,758	$349,361	$150,265	$150,265	$49,785	$58,234	$642,768	$0	$0	$15,802	$22,151	$18,522
2043	$58,215	$42,629	$7,709	$12,356	$183,490	$45,776	$364,546	$155,967	$155,967	$51,938	$58,110	$669,982	$0	$0	$16,749	$23,676	$19,878
2044	$59,357	$44,227	$7,723	$12,870	$191,125	$45,863	$381,754	$162,456	$162,456	$54,378	$58,075	$700,845	$0	$0	$17,802	$25,349	$21,391
2045	$60,728	$46,075	$7,753	$13,462	$199,914	$46,041	$401,476	$169,927	$169,927	$57,176	$58,155	$736,244	$0	$0	$18,984	$27,209	$23,097
2046	$62,118	$48,028	$7,769	$14,091	$209,247	$46,137	$422,522	$177,860	$177,860	$60,161	$58,132	$773,988	$0	$0	$20,244	$29,180	$24,936
2047	$63,534	$50,100	$7,771	$14,761	$219,194	$46,147	$445,059	$186,315	$186,315	$63,358	$57,999	$814,371	$0	$0	$21,590	$31,274	$26,925
2048	$64,980	$52,307	$7,756	$15,477	$229,831	$46,060	$469,267	$195,357	$195,357	$66,792	$57,745	$857,711	$0	$0	$23,031	$33,507	$29,081
2049	$66,459	$54,664	$7,723	$16,245	$241,236	$45,865	$495,337	$205,051	$205,051	$70,489	$57,357	$904,348	$0	$0	$24,580	$35,893	$31,422
2050	$67,970	$57,186	$7,670	$17,070	$253,491	$45,546	$523,473	$215,468	$215,468	$74,480	$56,817	$954,641	$0	$0	$26,246	$38,448	$33,970

Table 11: Sample Building Characterization

Energy Utilization Index (EUI)

Year: 2008

Map Number	Building Name	Electrical: Building kBtu/SF/yr	Electrical: Motors kBtu/SF/yr	Electrical: Chiller kBtu/SF/yr	Electrical: Total kBtu/SF/yr	Natural Gas: General kBtu/SF/yr	Natural Gas: Steam Boiler kBtu/SF/yr	Natural Gas: Boiler kBtu/SF/yr	Natural Gas: OAHr kBtu/SF/yr	Natural Gas: Kitchen kBtu/SF/yr	Natural Gas: Total kBtu/SF/yr	All Utilities: Total Estimated Building Performance (kBtu/SF/yr)	Building Snapshot: Building Area SF	Building Snapshot: Year Built	Benchmark Summary: Standard Benchmarks: DOE EIA Benchmarks (kBtu/SF/yr)	Benchmark Summary: Standard Benchmarks: CBECS Database EUI	Benchmark Summary: Standard Benchmarks: Energy Star - Current Site Energy Index (KBtu/Sq.ft)	Meter Summary: Meter Type: Electricity	Gas	Both	None	Shared Meter
20A	Administration Annex				0						0	0.0	10,890	2002	--	91.28					X	
21	Alumni Hall				0						0	0.0	17,554	1989	--	60.85					X	
14A	Boardman Place				0						0	0.0	7,750	2004	--	116.34					X	
Q7	Bogart Hall	17.3			17.3						0	17.3	30,748	1961	90.1	84.79	17.0	X				
Q11	Boothroyd Hall	31.3			31.3						0	31.3	15,925	1983	90.1	60.85	29.8	X				
9	Campus Center				0						0	0.0			--						X	
DH1	Campus Center Dining Hall (see Philips Egbert Hall)										0				--						X	
24	Center for Health Sciences	20.2			20.2	58.3					58.3	78.5	92,000	1999	102.0	78.0		X	X	X		X
23	Center for Natural Sciences (CNS)	65.8			65.8	157.6					157.6	223.4	125,000	1991	139.6	84.9		X	X	X		
27	Center for Public Safety and General Services	74.9			74.9						0	74.9	23,000	2002	79.8	99.1		X				
???	Central Services Building				0						0	0.0	22,000	1983	--						X	
16	Ceracche Center				0						0	0.0	24,119	1968	--						X	
Q8	Clarke Hall	19.5			19.5	59.0					59.0	78.5	23,132	1961	90.1	78.6	52.2	X	X	X		
CF	Compost Facility				0						0	0.0	5,020	2000	--						X	
1	Dillingham Center	23.7	13.8	13.3	50.8	67.9					67.9	118.6	78,746	1968	101.8	106.0		X	X	X		X
E1	East Tower	33.0			33.0		8.5	967.6		0.9	976.9	1,010.0	77,880	1964	90.1			X	X	X		X
Q10	Eastman Hall	14.7			14.7						0	14.7	23,132	1961	90.1		14.6	X				
R	Emerson Hall				0						0	0.0	63,315	1989	--						X	
25	Fitness Center				0						0	0.0	42,333	1999	--						X	
???	Ford Hall				0						0	0.0	141,753	1962	--						X	
3	Friends Hall	14.1	22.8	13.3	50.1	67.9					67.9	118.0	19,476	1961	102.8	107.8		X	X	X		X
11	Gannett Center (Library, Handwerker Gallery)	46.7			46.7	67.9					67.9	114.6	86,529	1965	101.7	106.0		X	X	X		X
T7	Terrace 7	26.8			26.8						0	26.8	19,188	1966	90.1		25.3	X				
T8	Terrace 8	25.7			25.7						0	25.7	15,204	1966	90.1			X				
T9	Terrace 9	32.1			32.1						0	32.1	17,586	1966	90.1		32.1	X				
T10	Terrace 10	49.3			49.3						0	49.3	17,340	1966	90.1		48.3	X				
T11	Terrace 11	27.0			27.0						0	27.0	17,586	1966	90.1		25.6	X				
T12	Terrace 12	34.9			34.9						0	34.9	17,478	1966	90.1		33.3	X				
4	Textor Hall	14.1	22.8	13.3	50.1	67.9					67.9	118.0	11,938	1965	103.1			X	X	X		X
DH2	Towers Concourse and Towers Dining Hall	91.6			91.6		8.5	967.6		0.9	976.9	1,068.5	22,582	1964	118.1			X	X	X		X
22	Warehouse	252.3			252.3						0	252.3	2,200	1983	150.0			X				
W1	West Tower	24.5			24.5		8.5	967.6		0.9	976.9	1,001.4	77,880	1964	90.1			X	X	X		X
12	Whalen Center for Music				0	118.1					118.1	118.1	141,753	1999	103.1				X			
7	Williams Hall	43.7			43.7	49.9					49.9	93.6	71,057	1963	101.6			X	X	X		
-	Exterior Campus Lighting				0						0	0.0			--							
	Circle Apartments														--							
	TOTALS												2,133,011									

Total Buildings: 70

Avg	40.7
No Electrical Data	25.0
Total Buildings	68.0

Combined submeter utility data:

Job Hall - Building Elec	22,582
Job Hall - Elec. Motors	77,880
Job Hall - Chiller	77,880
Job Hall - Gas	178,342

Summary of EUI	
Average	134.0
# Bldgs W/O Submetered Data	23.0
Total Buildings	70.0
Average w/o Towers DH	74.1

Square Footage	
444,252.0	21%
967,560.0	45%
1,516,258.0	71%
1,140,061.0	53%
556,329.0	26%
548,698.0	26%
172,501.0	8%

ummary Table	
Sq Footage W/O Meters	
Footage - BOTH Meters	
ectricity	
as	
ared Meters	
nly electricity	
nly gas	

Meter Summary Table					
Total	43	20	18	23	11
% of All Bldgs	61%	29%	26%	33%	16%
Gas or Electric ONLY	25	2			
% Gas or Elec	36%	3%			

Ithaca College
Comprehensive Environmental Policy

Purpose:

Ithaca College establishes this policy to identify general goals and strategies for a commitment to environmental responsibility. Through enacting and implementing the vision of this policy, Ithaca College will be a positive example and play a significant role in the advancement of environmental responsibility on the campus and in the local and greater community.

Policy:

As established in its Vision and Mission statements, *"Ithaca College strives to become the standard of excellence for residential comprehensive colleges …"* and *"All members of the College community are encouraged to…share the responsibilities of citizenship and service in the global community."* In keeping with this vision and to effectively operate the campus while also working to preserve the rights of present and future generations, the College affirms its commitment to environmental excellence and actively promotes the public's right to a healthy, quality environment. Ithaca College will work toward the goal of balancing fiscal, operational, and environmental responsibility in making decisions and in general College practices. The College acknowledges its role and responsibility to provide educational, social, and financial leadership to achieve the goals of this policy.

Goals and Strategies:

I. Commitment to Environmental Education. The College recognizes the need for the education of all members of the College community concerning the importance of environmental responsibility and the components of this Policy.

A. The College commits to assuring that all members of the College community are aware of the Comprehensive Environmental Policy and understand their role in its implementation.

B. The College recognizes its academic role in fostering leadership by educating the College community about environmental responsibility and by continuing to support environmental education in the curriculum.

II. Environmentally Responsible Purchasing Policies. The College recognizes that one of its primary opportunities to exercise environmental responsibility is through its purchasing choices. The College will strive to obtain maximum value for its expenditures and will work toward obtaining the "best value" by considering short and long-term costs, maintenance, life cycle, and environmental costs in purchasing goods and services.

A. The College acknowledges that environmentally responsible purchasing choices will help create and sustain markets for environmentally responsible products.

B. The College commits to the goal of balancing environmentally and fiscally responsible purchasing choices by considering life cycle costs, long-term implications, and environmental impact of its purchasing policies.

C. Purchasing policies will encourage acquisition of products that minimize waste, have high recycled content, use environmentally responsible production methods, and demonstrate maximum durability or biodegradability, reparability, energy efficiency, non-toxicity, and recyclability.

D. Departments shall specify and purchase ENERGY STAR-certified energy-efficient products in all product categories for which such ratings exist.

E. Departments shall be encouraged to specify and purchase environmentally preferable products that meet or exceed the standards of third-party certification programs for environmental and/or sustainable products where such ratings exist.

III. Efficient Use and Conservation of Energy, Water, and Other Resources. The College recognizes the importance of conservation efforts and efficient use of resources as the primary methods for reducing resource consumption.

A. The College commits to minimizing the consumption of energy, water, and other resources by eliminating wasteful practices and promoting efficient use.

B. The College strives to maximize energy efficiency in existing buildings, renovations, and new construction.

C. The College commits to exploring and implementing well-considered and feasible conservation measures in existing buildings, renovations, and new construction.

D. The College will explore the application of developing technologies for energy systems and renewable energy resources.

IV. Minimizing Solid Waste Production. The College recognizes the importance of minimizing solid waste generation by the community and will establish policies and processes to that end, first through reduction, then through reuse, and finally through recycling.

A. The College commits to waste source reduction, especially at the point of purchase.

B. The College supports reuse of materials to maximize fiscal, environmental, and energy efficiency.

C. The College supports development of food scrap composting and bio-mass resource recovery programs.

D. The College commits to a comprehensive recycling program as the final step in solid waste reduction and as a means to transform waste into a resource.

V. Minimizing Hazardous Waste and Toxic Materials on Campus. The College acknowledges the importance of safe management of hazardous and toxic materials and will continue to establish policies and processes to maintain efficient use, tracking, storage, and disposal of hazardous and toxic materials.

A. The College commits to keeping the presence of toxic materials and the generation of hazardous waste at reasonable levels for work and research on campus.

B. The College supports environmentally responsible disposal of hazardous waste.

C. The College commits to keeping the use of radioactive materials at reasonable levels as needed for research and supports environmentally responsible disposal of its radioactive waste.

VI. Environmentally Responsible Campus Design and Planning Principles. The College recognizes the importance of environmentally responsible practices in developing the physical characteristics of its community. It will consider environmental implications in the development, construction, and operation of campus infrastructure, grounds, and buildings.

A. The College will strive to balance sound fiscal practices and environmental responsibility in the maintenance, development, and planning of campus facilities.

B. The College will work toward the goals of providing landscaping and grounds maintenance practices that use vegetation compatible with the local environment and integrated pest management techniques.

C. The College has an ongoing commitment to facilitating pedestrian travel, bicycle use, and other modes of transportation that minimize environmental impact.

D. All new facilities and major renovations shall incorporate sustainable practices to the degree feasible and shall strive, at a minimum, to meet the equivalent of a LEED Silver rating in their design. Project management teams are encouraged to meet higher LEED rating levels whenever possible.

Follow-up, review and update:

All members of the College community are invited to support the College's efforts to meet the goals of this policy by contacting the Resource and Environmental Management Program (REMP). Operating units, working in concert with REMP, are encouraged to develop departmental policies that will lead to appropriate implementation strategies consistent with the comprehensive environmental policy. REMP is willing to provide leadership to aid departments in policy development, implementation strategies, and timelines. REMP will undertake biannual review of this policy and make recommendations for updates as needed; it welcomes comments and suggestions for changes to this policy.

Effective Date: April 23, 2001 (amended February 2008 to include highlighted sections)

American College & University Presidents Climate Commitment

American College and University Presidents Climate Commitment

We, the undersigned presidents and chancellors of colleges and universities, are deeply concerned about the unprecedented scale and speed of global warming and its potential for large-scale, adverse health, social, economic and ecological effects. We recognize the scientific consensus that global warming is real and is largely being caused by humans. We further recognize the need to reduce the global emission of greenhouse gases by 80% by mid-century at the latest, in order to avert the worst impacts of global warming and to reestablish the more stable climatic conditions that have made human progress over the last 10,000 years possible.

While we understand that there might be short-term challenges associated with this effort, we believe that there will be great short-, medium-, and long-term economic, health, social and environmental benefits, including achieving energy independence for the U.S. as quickly as possible.

We believe colleges and universities must exercise leadership in their communities and throughout society by modeling ways to minimize global warming emissions, and by providing the knowledge and the educated graduates to achieve climate neutrality. Campuses that address the climate challenge by reducing global warming emissions and by integrating sustainability into their curriculum will better serve their students and meet their social mandate to help create a thriving, ethical and civil society. These colleges and universities will be providing students with the knowledge and skills needed to address the critical, systemic challenges faced by the world in this new century and enable them to benefit from the economic opportunities that will arise as a result of solutions they develop.

We further believe that colleges and universities that exert leadership in addressing climate change will stabilize and reduce their long-term energy costs, attract excellent students and faculty, attract new sources of funding, and increase the support of alumni and local communities. **Accordingly, we commit our institutions to taking the following steps in pursuit of climate neutrality:**

1. Initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible.

a. **Within two months of signing this document,** create institutional structures to guide the development and implementation of the plan.
(Climate Commitment task team formed)

b. Within one year of signing this document, complete a comprehensive inventory of all greenhouse gas emissions (including emissions from electricity, heating, commuting, and air travel) and update the inventory every other year thereafter.
(Using the *"Clean Air – Cool Planet"* GHGE inventory tool, inventories have been completed for calendar years 2001 – 2008).

c. **Within two years of signing this document**, develop an institutional action plan for becoming climate neutral, which will include:

i. A target date for achieving climate neutrality as soon as possible.
(100% by 2050)

ii. Interim targets for goals and actions that will lead to climate neutrality.
(25% by 2015; 50% by 2025).

iii. Actions to make climate neutrality and sustainability a part of the curriculum and other educational experience for all students.
(plans developed)

iv. Actions to expand research or other efforts necessary to achieve climate neutrality.
(plans developed)

v. Mechanisms for tracking progress on goals and actions.
(plan developed)

2. Initiate two or more of the following tangible actions to reduce greenhouse gases while the more comprehensive plan is being developed.

a. Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent.
(Policy approved to cover both new construction and major renovation projects.)

b. Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist. (Policy approved)

c. Establish a policy of offsetting all greenhouse gas emissions generated by air travel paid for by our institution. (This policy is still under consideration)

d. Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.
(College supports 100% of bus fare cost for employees; 30% for students)

e. Within one year of signing this document, begin purchasing or producing at least 15% of our institution's electricity consumption from renewable sources.
(This policy is still under consideration.)

f. Establish a policy or a committee that supports climate and sustainability shareholder proposals at companies where our institution's endowment is invested.
(This policy is still under consideration)

g. Participate in the Waste Minimization component of the national RecycleMania competition, and adopt 3 or more associated measures to reduce waste.
(We participate annually in RecycleMania; in 2008-09)

3. Make the action plan, inventory, and periodic progress reports publicly available by providing them to the Association for the Advancement of Sustainability in Higher Education (AASHE) for posting and dissemination. (Climate Action Plan posted)

In recognition of the need to build support for this effort among college and university administrations across America, we will encourage other presidents to join this effort and become signatories to this commitment.

Ithaca College President Peggy R. Williams signed the Presidents Climate Commitment on May 29, 2007