UIC

CLIMATE ACTION PLAN

UIC UNIVERSITY OF ILLINOIS AT CHICAGO

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Executive Summary

As part of its commitment as a signatory to the American College & University Presidents' Climate Commitment, UIC must develop and initiate a comprehensive plan to achieve climate neutrality. This plan, UIC's Climate Action Plan, is a list of strategies, goals and actions that will reduce greenhouse gas emissions.

The UIC Climate Action Plan is a strategic document that outlines specific mitigation strategies to reduce UIC's greenhouse gas emissions from 2004 levels by 40% in 2030 and by at least 80% in 2050, without accounting for offsets. This long-term plan will be evolving and will require updates based upon available technologies, new regulations and political administrations, the economy, behavioral changes and institutional factors.

Scientists, leaders, politicians, businesses and communities recognize that climate change is one of the most serious issues facing the planet today. Mayor Richard M. Daley has made a commitment to enhance the environment and make Chicago the most environmentally friendly city in nation. To do this the city must reduce its greenhouse gas emissions and UIC, an institution that aspires to be the nation's premier urban public research university and has a Great Cities Commitment, is committed to do so as well.

UIC specific mitigation strategies to reduce its greenhouse gas emissions include:

- Energy Efficiency and Conservation
- Clean and Renewable Energy Sources
- Improved Transportation Options
- Improved Grounds Operations
- Recycling and Reduced Waste Streams
- Employment Strategies

The UIC Climate Action Plan also discusses the importance of education, research and public engagement in order for UIC to be a responsible steward of the environment through its operations, academics and research.

The UIC Climate Action Plan may outline strategies but unless these actions are implemented, UIC's greenhouse gas emissions will remain the same or more likely increase over time. The success of the UIC CAP depends on the individual actions of its faculty, staff and students. The UIC CAP provides the opportunity to use the campus as a laboratory, an educational tool for UIC faculty, students and staff.

UIC's Climate Commitment

In April 2007, Chancellor Sylvia Manning selected and charged the Campus Task Force on Sustainability, a committee comprised of faculty, students and staff, to provide a candid evaluation of UIC's current sustainability programs and initiatives, compare UIC's environmental performance to recognized benchmarks and recommend a pathway to environmental stewardship at UIC. Chancellor Manning indicated that within a larger context, a program of campus sustainability would touch upon physical infrastructure, organization, management and academic mission in such a way that the principles were incorporated into decision-making.

There were three major reasons for forming a UIC sustainability initiative:

1. UIC's educational mission, as expressed through the 2010 Strategic Plan, asks that UIC's students be prepared as leaders of society. Students learn in many ways, in classrooms and laboratories, but also though the educational priorities set by the administration. Sustainability is one of the most important and pervasive issues at the present time, and UIC should be a leader in teaching this issue both in the curriculum and through its actions.
2. There are genuine opportunities to realize significant cost savings through energy and material procurement and usage policies. Such policies can result in lower energy costs and greenhouse gas emissions, improved material efficiencies, and better services.
3. UIC is in a unique position to partner in this endeavor with the city and many institutions in the region that have already launched sustainability initiatives. Such partnering is consistent with UIC's Great Cities Commitment and presents opportunities for further enhancing UIC's strength across the campus.

Initially 27 faculty, staff and students were asked to serve on the Campus Task Force on Sustainability. However, when the campus learned about the formation of this committee, additional faculty, students and staff volunteered their time and service. The final committee, chaired by Joseph Muscarella, vice chancellor for administrative services and Thomas Theis, director, Institute for Environmental Science and Policy, was comprised of 35 faculty, staff and students.

In December 2007, the Campus Task Force on Sustainability made its final recommendations to the Chancellor and Vice Chancellors. One of the key recommendations was to establish a central office to coordinate sustainability and campus environment efforts and hire a sustainability professional.

Specifically, the Task Force recommended that the sustainability position have the following functions:

- Coordinate sustainability efforts among various offices
- Implement the task force recommendations
- Oversee recycling (coordination, promotion, grant writing and reporting, vendor recommendations/bids)
- Coordinate outreach efforts for students, faculty and staff (web site, events coordination, student organizations, internships)
- Cultivate and develop community partnerships (City of Chicago, Center for Neighborhood Technology, etc)
- Measure, monitor, and report performance annually (baseline and response to initiatives)
    - Surveys
    - Recycling data
    - Greenhouse gas inventories
    - Energy usage
    - University-wide savings due to sustainability efforts
- Develop campus-wide policies and facilitate incorporating sustainability concepts into individual departmental policies
- Research and implement funding mechanisms for sustainability projects

Prior to the completing its final report, the Task Force recommended that, after consulting with the vice chancellor for research and the provost, Chancellor Manning sign the American College & University Presidents' Climate Commitment (ACUPCC). UIC became an inaugural signatory to the ACUPCC when

Chancellor Manning signed this statement on September 14, 2007, which recognizes that colleges and universities must provide leadership in their communities by modeling ways to minimize global warming emissions and by providing the knowledge and skills to students to address the critical challenges and develop solutions to the issues we face today.

As of August 2009, over 650 colleges and universities, representing over 35% of the American student body, have signed the ACUPCC. As part of this commitment, college and universities need to initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible, initiate two or more tangible actions to reduce greenhouse gases while the more comprehensive plan is being developed and to make that plan and progress reports publicly available by providing them to the Association for the Advancement of Sustainability in Higher Education (AASHE).

Seven tangible actions are proposed by the ACUPCC, from which colleges and universities need to select at least two to initiate on their campuses. The vice chancellor for administrative services and the Office of Sustainability used the Task Force's final report, which included an assessment of UIC's sustainability efforts on campus, to determine actions which were most feasible for the campus. UIC's tangible actions, as part of the ACUPCC commitment are:

- *Formalize the current practice that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent.*
- *Encourage the use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.*

Another aspect of the commitment is to set a target date when the institution aims to become carbon neutral, based on scientific recommendations and institutional factors. According to the Intergovernmental Panel on Climate Change, in order to limit the global mean temperature increase over historical norms to 2-2.4°C (the temperature at which there is a high probability of catastrophic impacts), global emissions need to be reduced 50-85% below 2000 levels by 2050.

Many colleges and universities are making the commitment to be carbon neutral by 2050. UIC's climate action plan outlines strategies to reduce its greenhouse gas emissions by 40% in 2030 and by at least 80% in 2050. Total carbon neutrality may require the use of carbon offsets. This long-term plan will be evolving and require updates based on available technologies, new regulations and political administrations, the economy, behavioral changes and institutional factors.

Another recommendation of the Task Force was to create a permanent Chancellor's Committee on the status of the environment or campus sustainability. Interim Chancellor Eric A. Gislason established the Chancellor's Committee on Sustainability and Energy (CCSE) in spring 2008 to set priorities, suggest new initiatives, monitor UIC's progress towards goals and actions, assist with the preparation of reports for the campus climate commitments, help with the accountability of relevant sustainability initiatives and promote environmental awareness on campus.

The interim Chancellor delegated the responsibility to report on UIC's commitments to the campus to the Office of Sustainability via the Chancellor's Committee on Sustainability and Energy. Further, the Provost tasked the Associate Chancellor for Sustainability with the responsibility for monitoring UIC's progress on energy-saving programs.

In cooperation with the Illinois Green Government Coordinating Council, chaired by then Lieutenant Governor Pat Quinn, and universities and community colleges across Illinois, UIC signed the Illinois

Sustainable University Compact on February 7, 2008. The Illinois Sustainable University Compact invites universities and community colleges across Illinois to pledge to accomplish at least six goals out of list of twelve by December 21, 2010. After consultation with the vice chancellor for administrative services and the interim associate chancellor for sustainability, Interim Chancellor Eric A. Gislason signed the Illinois Sustainable Universities Compact pledging to accomplish the following six goals as outlined in the Compact, by December 31, 2010:

- *Join the U.S. Environmental Protection Agency's ENERGY STAR Challenge to increase energy efficiency on campus.*
- *Pledge that all new buildings constructed on campus will earn the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) certification.*
- *Promote more sustainable transportation options, such as purchasing hybrid and flex-fuel vehicles whenever practical, using renewable fuels for our campus fleet and establishing successful car-sharing and carpooling programs on campus.*
- *Reduce carbon emissions on campus and look into joining a greenhouse gas emission reduction and trading system.*
- *Increase the amount of overall waste recycled on campus by at least 15%.*
- *Purchase non-toxic cleaning products whenever practical.*

The Chancellor delegated the responsibility to report on the pledges to the Illinois Green Government Coordinating Council to the Office of Sustainability. Since signing this Compact in February 2008, UIC has made substantial progress toward these goals. The campus fleet includes many hybrid and flex-fuel vehicles and UIC is offering incentives that promote sustainable transportation (see Strategy 3). UIC is also in the process of converting to non-toxic cleaning products in all cleaning areas where possible. The of Illinois 2009 Annual Report states that sustainability is a top priority for the University and that "Future new construction, remodeling and renovation projects of $5 million or greater will be LEED® Silver certified. Projects under $5 million are expected to comply with LEED© silver as much as possible." In many ways, the goals of the ACUPCC and the Illinois Sustainable Universities Compact supported the current efforts and initiatives already initiated on campus.

In January 2009, Dr. Paula Allen-Meares assumed the position of Chancellor of UIC. She continued the charge of the previous chancellors and demonstrated UIC's commitment by signing the Declaration on Earth Day, April 22, 2009. This agreement is the first official statement developed by university administrators committing to sustainability in higher education. By signing this international declaration, UIC commits to implement a 10-point action plan to incorporate sustainability and environmental literacy into its teaching, research, operations and outreach.

Introduction

Scientists, leaders, politicians, businesses and communities recognize that climate change is one of the most serious issues facing the planet today. At the United Nations Conference on Environment and Development held in Rio de Janeiro in June 1992 (more commonly referred to as the Earth Summit), an international treaty was developed. This treaty, the United Nations Framework Convention on Climate Change, aimed to stabilize greenhouse gas emissions in the atmosphere to prevent global warming. This treaty did not set any limits on greenhouse gas emissions for individual nations or enforcement provisions; however, the treaty provided for "updates" that would set limits. The update or amendment that did set limits is the Kyoto Protocol, which was adopted in December 1997 and entered in force February 2005. The United States has signed the Kyoto Treaty but it has not ratified the agreement, despite contributing so many of the world's greenhouse gas emissions.

However, the trend is changing. Energy and the environment are priorities of President Obama's administration. Carbon cap and trade systems have been implemented in the European Union and are being considered in the United States, Japan and other countries. Being "green" is becoming trendy and even considered a characteristic of the millennial generation.

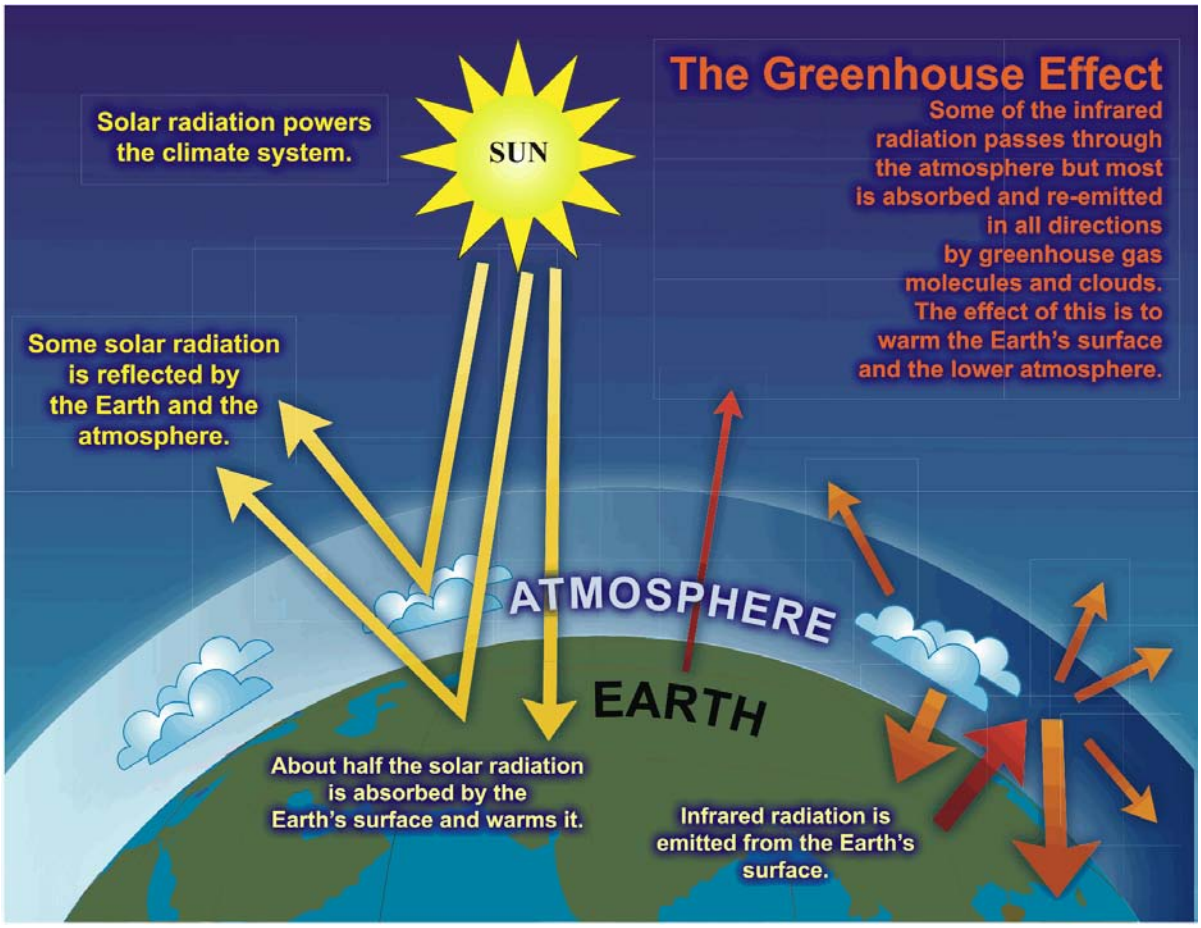
Many cities in the United States have made the environment a priority. Over 930 cities have signed the U.S. Conference of Mayors Climate Protection Agreement, which commits cities to meet or beat the greenhouse gas emission reduction target suggested for the United States in the Kyoto Protocol, a 7% reduction from 1990 levels by 2012. The City of Chicago has signed that agreement.

Mayor Richard M. Daley has made a commitment to enhance the environment and make Chicago the most environmentally friendly city in nation. To do this the city must reduce its greenhouse gas emissions and UIC, an institution that aspires to be the nation's premier urban public research university and has a Great Cities Commitment, is committed to do so as well.

One tool to do this is to develop a climate action plan. A climate action plan is a list of strategies, goals and actions that will reduce greenhouse gas emissions. UIC recognizes that as part of the local and global community, it should be a responsible steward of the environment and minimize its environmental impact both now and in the future. This UIC Climate Action Plan (CAP) outlines the steps that UIC needs to take to reduce its greenhouse gas emissions. However, the success of the UIC CAP depends not only on the efforts of the institution but by UIC's faculty, staff and students as well. Individual behaviors and actions are crucial to UIC reducing its carbon footprint.

Greenhouse gases are gases in the Earth's atmosphere that trap the sun's energy and heat the Earth's atmosphere. The greenhouse gas effect is a naturally occurring phenomenon that helps protect life on Earth from the extreme temperatures in space. However, changes in human activities over the past 150 years, such as rapid industrialization and deforestation, have resulted in higher levels of greenhouse gases entering the planet's atmosphere. These changes in atmospheric composition bring on changes in the global climate, generally due to global warming.

Figure 1: The Greenhouse Effect (Source: Intergovernmental Panel on Climate Change)



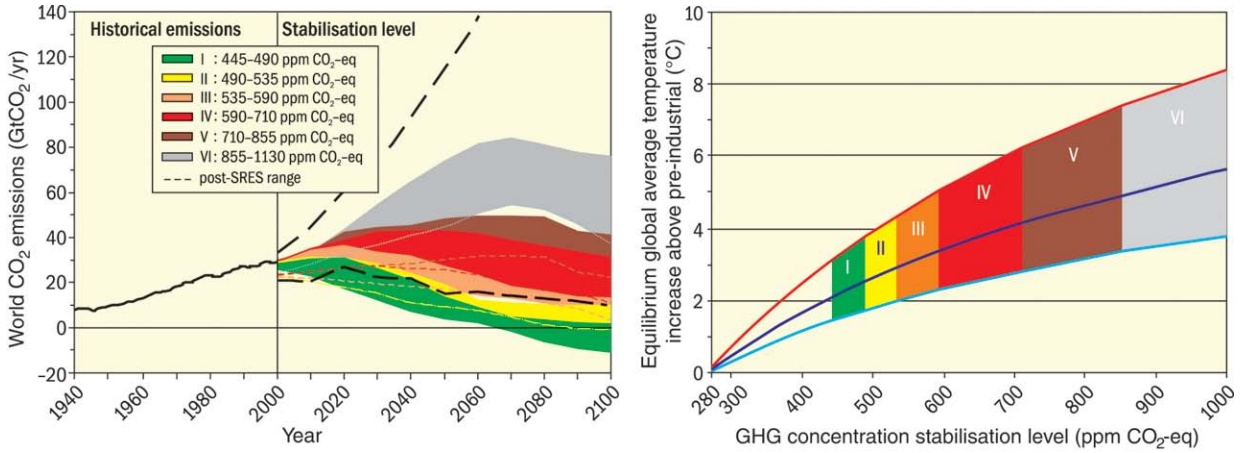
Greenhouse gases include carbon dioxide, methane, nitrous oxide, hydrofluorocarbon, perfluorocarbon, and sulfur hexafluoride. Each gas has a different a different global warming potential (GWP) which is a measure of how much it is likely to contribute to global warming in comparison to carbon dioxide. For example, methane has a GWP of 72 which means it is 72 more potent a greenhouse gas than carbon dioxide. According to Change in Chicago: Projections and Potential Impacts, the levels of CO_2 in the atmosphere have increased 30% and the levels of methane have more than doubled. In this document we report emissions as carbon dioxide equivalents (e CO_2) in order to account for the GWP.

There are two main sources of greenhouse gases in Chicago: buildings and transportation. Seventy percent of all greenhouse gas emissions come from buildings or the energy produced to support them. Transportation accounts for 21% of the greenhouse gas emissions, mostly from the burning of fossil fuels to operate vehicles, buses and trains. Most of the remaining greenhouse gas emissions come from waste and industrial pollution.

The Intergovernmental Panel on Climate Change estimated that the world's greenhouse emissions reached 25 billion metric tons or gigatons ($GtCO_2$) in 2000 (see Figure 2). According to the Environmental Protection Agency, the United States contributes more than 7 billion metric tons in 2005. Chicago's greenhouse gas emissions in 2005 totaled over 36 million metric tons, an average of 12.7 metric tons for each Chicagoan. During that same year, UIC's emissions were almost 246,000 metric tons of carbon dioxide equivalents, an average of 7.9 metric tons per faculty, student and staff member. Since there is some lag time between when the emissions occur and when the CO_2 concentrations

increase, and subsequently the temperature increases, we have not yet seen the full impact of our emissions. In the same way, drastic decreases in emissions will be required to keep the global temperature increase within a few degrees. Atmospheric concentrations of CO_2 were 379 parts per million (ppm) in 2005 (green band in Figure 2), which would lead to an increase of 2.0 to 2.4 degrees Celsius from pre-industrial times. In order to keep the temperature increase near or within that level, we need to reduce global emissions by 50 to 85% (from 2000 levels) by 2050. From the institution to the individual, each contributes to the carbon footprint and each should contribute to its reduction.

Figure 2: Global CO2 Emissions for 1940 to 2000 and emissions ranges for categories of stabilization scenarios from 2000 to 2100 (left); Corresponding relationship between the stabilization target and the likely equilibrium global average temperature increase above pre-industrial (right). (Source: Intergovernmental Panel on Climate Change)



Approaching equilibrium can take several centuries, especially for scenarios with higher levels of stabilization. Colored shadings show stabilization scenarios grouped according to different targets (stabilization category I to VI). The right-hand panel shows ranges of global average temperature change above pre-industrial, using (i) 'best estimate' climate sensitivity of 3°C (black line in middle of shaded area), (ii) upper bound of likely range of climate sensitivity of 4.5°C (red line at top of shaded area) (iii) lower bound of likely range of climate sensitivity of 2°C (blue line at bottom of shaded area). Black dashed lines in the left panel give the emissions range of recent baseline scenarios published since the SRES (2000). Emissions ranges of the stabilization scenarios comprise CO2-only and multigas scenarios and correspond to the 10th to 90th percentile of the full scenario distribution. Note: CO2 emissions in most models do not include emissions from decay of above ground biomass that remains after logging and deforestation, and from peat fires and drained peat soils. ***(Source: Intergovernmental Panel on Climate Change)***

In 2008, the City of Chicago's Climate Task Force released the Chicago Climate Action Plan, as well as supporting research documents, outlining the impacts global climate change may have on the Chicago region, which includes UIC. The Chicago Climate Action Plan makes assumptions and plans for adaption to climate change based upon two scenarios:

- Scenario A – fossil fuels remain the primary source of power and CO_2 concentrations rise to almost 1000 parts per million (ppm) at the end of the century, a 160% increase from today's 385ppm;

- Scenario B – Chicago shifts rapidly towards low-emissions and renewable energy technology and CO_2 concentrations rise to 550ppm at the end of the century, a 43% increase from today's 385ppm.

According to the Climate Task Force, climate warming is already occurring in Chicago. Since 1980, the average temperature has risen by about 2.6°F, trees and plants flower earlier in the spring, frosts occur later in the fall, the amount of winter ice on Lake Michigan is decreasing and heavy rainstorms are increasing in frequency.

While it is impossible to predict exactly when or how intense climate changes will impact Chicago, it is nearly certain at this point that changes will continue to occur. The Climate Task Force outlines the following impacts in the city, which will impact UIC as well:

Temperature/Weather

- Seasonal and annual temperatures are likely to increase; there is a high likelihood of average temperature increases of 1-1.5°F in the next 30 years and 7-8°F in Scenario A or 3-4°F in Scenario B by the end of the century.
- There will be more variability in temperatures from year-to-year with an increased frequency of very hot summers.
- The number of very hot days (over 90°F) is projected to increase as well, from today's level of 15 days per year to eight weeks under Scenario A and five weeks under Scenario B.
- There could be in an increase in humidity, making the temperature seem warmer than it actually is during the heat waves.
- The length of the growing season is projected to expand with the last day of the spring frost moving earlier in the year by 30 days in Scenario A and 20 days in Scenario B.
- Increases in winter and spring precipitation are likely with projected increases of 10% by mid-century and 20-30% by the end of the century in both Scenarios.

Health & Welfare

- As the temperatures get warmer, the atmospheric circulation pattern changes and summers last longer, this will cause air quality to decrease and affect respiratory illnesses and disease.
- If no mitigation steps are taken, there is a risk of an increase in heat-related deaths (many remember the heat wave in Chicago in 1995, which resulted in over 700 heat-related deaths).
- Warming temperatures and changing atmospheric circulation patterns may increase the risk to exposure of vector-borne diseases, such as West Nile virus.

Infrastructure & Economy

- As temperatures and precipitation rise, so will most economic costs (e.g., road repairs and maintenance, snow removal and energy demand for heating and cooling).
- As temperatures warm, there is likely to be a shift in the energy demand with a decreasing demand for natural gas in the winter and increased demand for electricity during the summer.

Like the City of Chicago, UIC is committed to reduce its greenhouse gas emissions, which is documented by the institution's commitments to sustainability – the ACUPCC, Illinois Sustainable University Compact and the Talloires Declaration.

UIC's Carbon Footprint

A greenhouse gas (GHG) inventory is an accounting of greenhouse gas emissions associated with the operations of the entity. For UIC, greenhouse gas emissions are generated from on-campus energy production; purchased electricity, natural gas service to buildings for laboratories and cooking, transportation (including air travel and commuting), waste, agriculture; and refrigerants.

The GHG inventory was conducted for UIC in 2007 for FY2005-2006. This inventory included 117 buildings on the 242 acre Chicago campus . The goal was to calculate a baseline level of GHG emissions. A second, more comprehensive inventory was completed in April 2009 that includes data from the UIC Commuter Survey conducted in the fall of 2008. The results are shown in the table and charts below. Most of UIC's GHG emissions – 83% – are from buildings (electricity, heating, cooling, and other building gas consumption). Transportation accounts for 16% and waste accounts for 1%. The subsequent sections will discuss the trends in these areas.

Data was collected from numerous sources on campus and calculated by using the Carbon Calculator v6.2 by Clean Air-Cool Planet, which includes the six greenhouse gases defined by the Kyoto Protocol.

Table 1: Summary of UIC's Greenhouse Gas Emissions FY04 through FY08 in CO_2 Equivalents (e CO_2) metric tonnes.

		eCO_2 (Metric Tonnes)				
		2004	2005	2006	2007	2008
Scope 1	Co-gen Electricity	129,031	113,805	81,847	91,635	82,513
	Co-gen Steam	74,010	71,810	75,018	81,639	90,104
	Other On-Campus Stationary	3,885	3,740	2,900	2,525	3,455
	Direct Transportation	1,644	1,644	1,830	1,609	1,472
Scope 2	Purchased Electricity	18,496	12,895	13,443	23,719	48,139
Scope 3	Faculty / Staff Commuting	19,454	18,904	19,119	20,684	22,225
	Student Commuting	22,679	20,103	18,704	19,090	20,997
	Solid Waste	1,729	1,717	1,711	1,835	1,778
	Scope 2 T&D Losses	1,829	1,275	1,330	2,346	4,761
Totals	Scope 1	208,570	190,998	161,595	177,408	177,544
	Scope 2	18,496	12,895	13,443	23,719	48,139
	Scope 3	45,692	41,999	40,863	43,955	49,760
	All Scopes	272,758	245,892	215,901	245,081	275,443

Scope 1 – includes all direct sources of GHG emissions from sources that are owned or controlled by UIC, including (but not limited to): production of electricity, heat, or steam; transportation or materials, products, waste, and community members; and fugitive emissions.

Scope 2 - includes GHG emissions from imports (purchases) of electricity, heat or steam – generally those associated with the generation of imported sources of energy.

Scope 3 - includes all other indirect sources of GHG emissions that may result from the activities of the institution but occur from sources owned or controlled by an outside company, such as: business travel, outsourced activities and contracts, emissions from waste generated by the institution when the GHG emissions occur at a facility controlled by another company, e.g. methane emissions from landfilled waste and the commuting habits of community members.

Figure 3: UIC GHG Emissions by Scope and % Non-Nuclear Purchased Electricity Mix

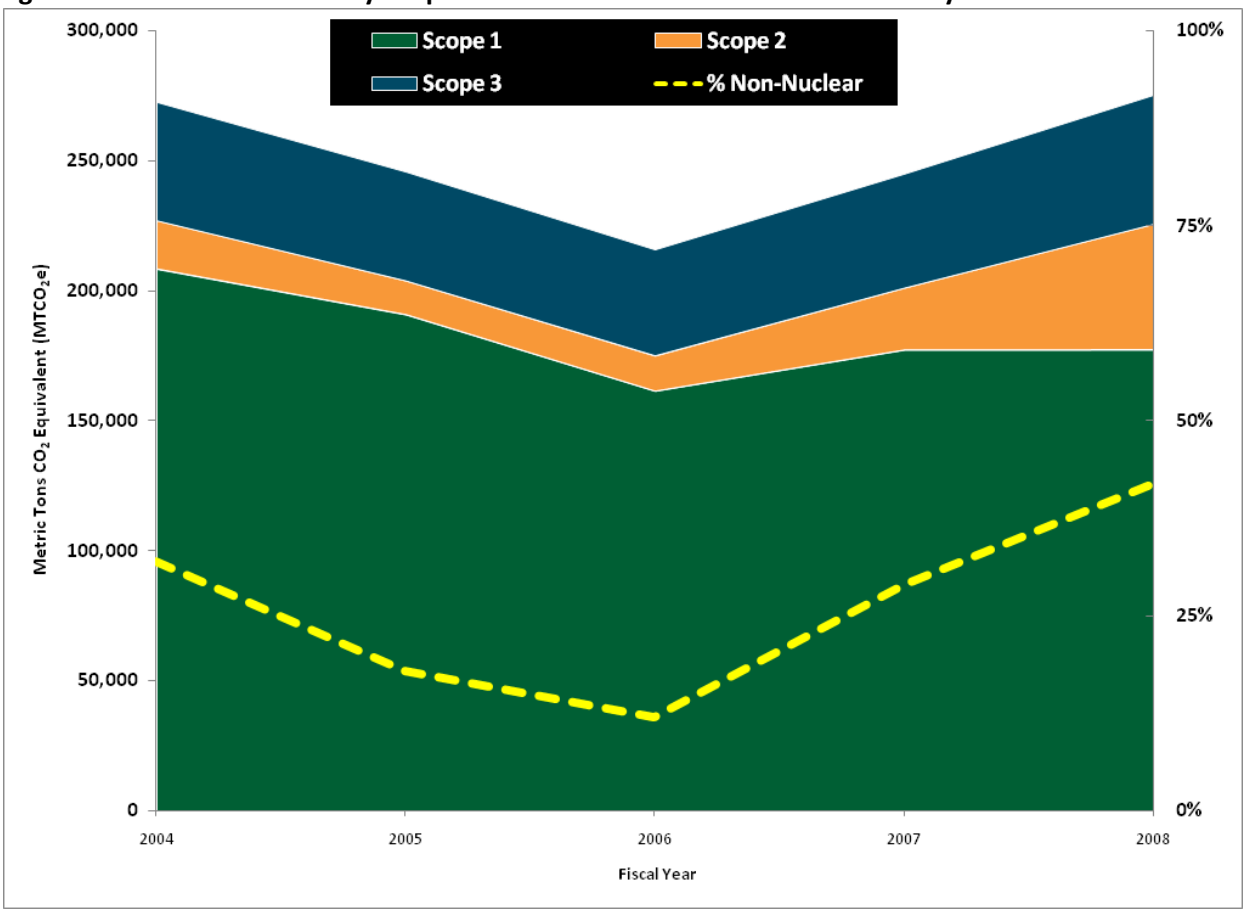


Figure 3 illustrates the emission changes over years from FY04 – FY08. The dip in emissions in 2006 is quite notable. However, examination of the data shows that overall energy consumption remained stable or increased slightly over this five year period. The dip can be explained by the emissions from electricity purchased from Commonwealth Edison (ComEd). The reported power sources by ComEd show a decrease in the non-nuclear component in 2006. The higher the nuclear component, the lower the GHG emissions, since nuclear power has no carbon emissions (nuclear power does have other emissions of environmental concerns, i.e. radioactive waste that are not accounted for by a GHG inventory). The major factor affecting UIC's emissions is related to the purchase of electricity.

Figure 4: Sources of Greenhouse Gas Emissions for FY04 for UIC's Chicago Campus

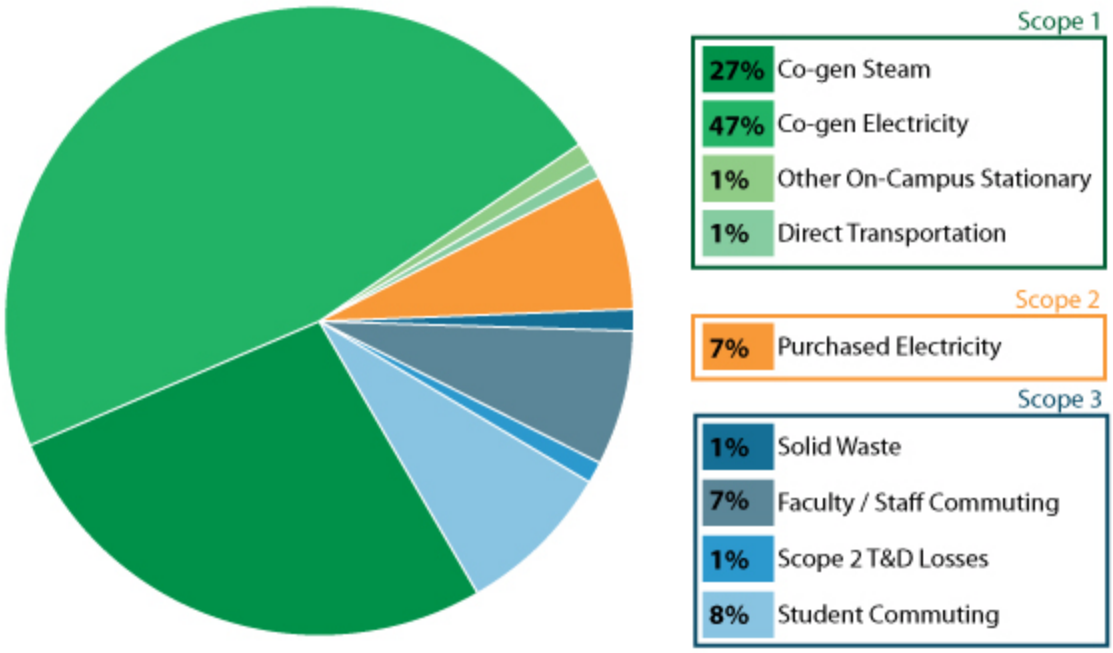
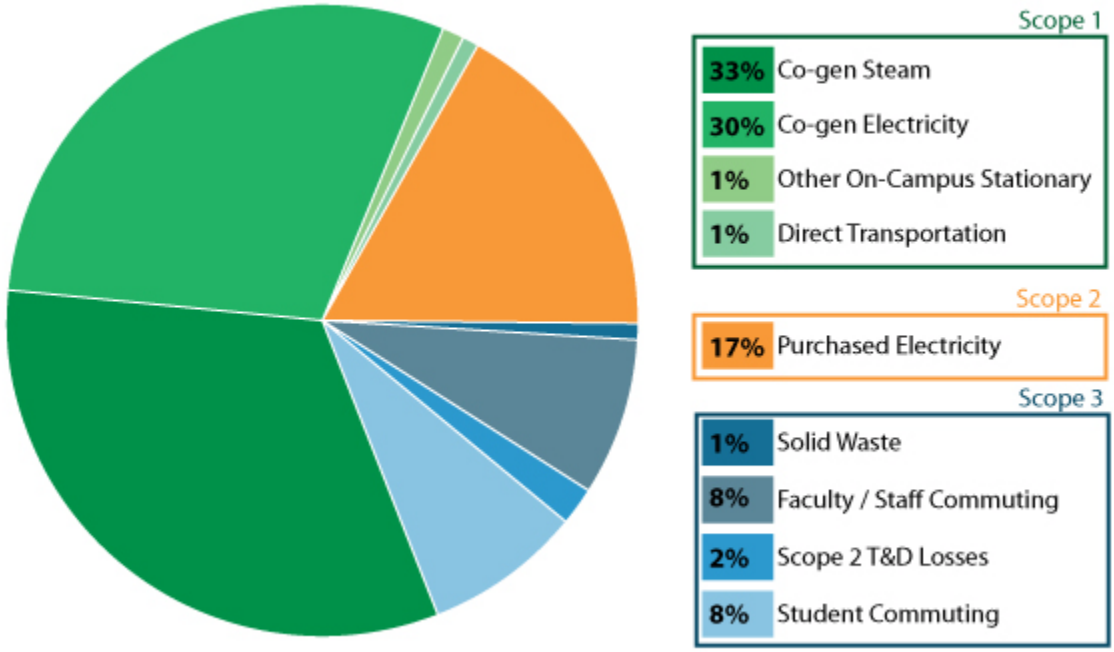


Figure 5: Sources of Greenhouse Gas Emissions for FY08 for UIC's Chicago Campus

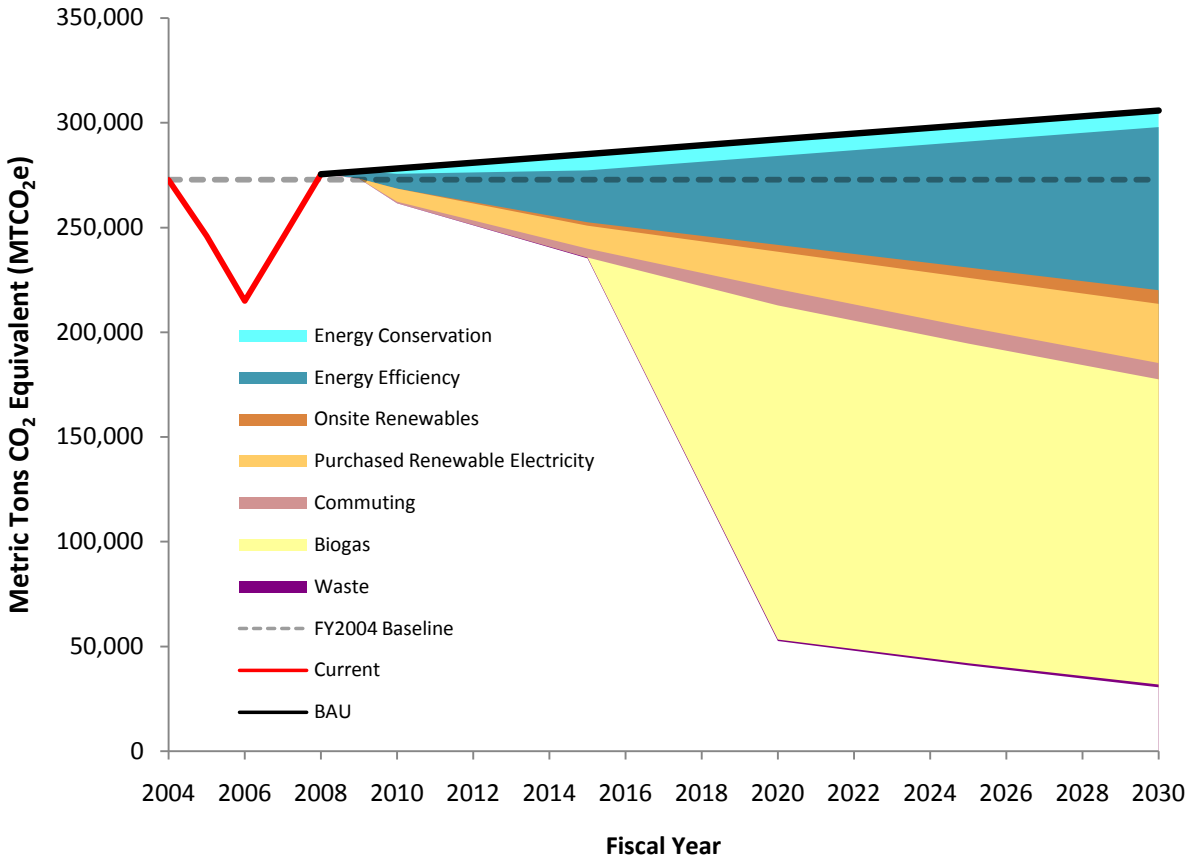


The GHG inventory dates back to July 2003 as data prior to that time was not readily available. Overall energy data for the campus and trends in transportation and parking indicate that emissions were likely to have been higher prior to July 2003 and these factors will be discussed later. Given the data available, it is proposed that FY04 constitutes the baseline year for calculations and reductions.

Now that a baseline has been established and emissions resulting from UIC's activities have been identified, UIC can develop strategies and actions to reduce its GHG emissions. The UIC Climate Action Plan outlines these strategies, sets goals and recommends both short-term and long-term actions.

In order for UIC to be carbon neutral by 2050, carbon offsets may have to be purchased and renewable energy has to be utilized or purchased. Figure 6 outlines the reduction in GHG emissions if all strategies are implemented and interim target dates for reductions until 2030. The black line denotes Business As Usual (BAU) which represents the projected emissions, if the campus continues to grow, and thereby increase its energy consumption, at a rate of 0.5% per year. The colored wedges that spread out below this line represent the projected effect that the different strategies outlined in this report would have on our GHG emissions.

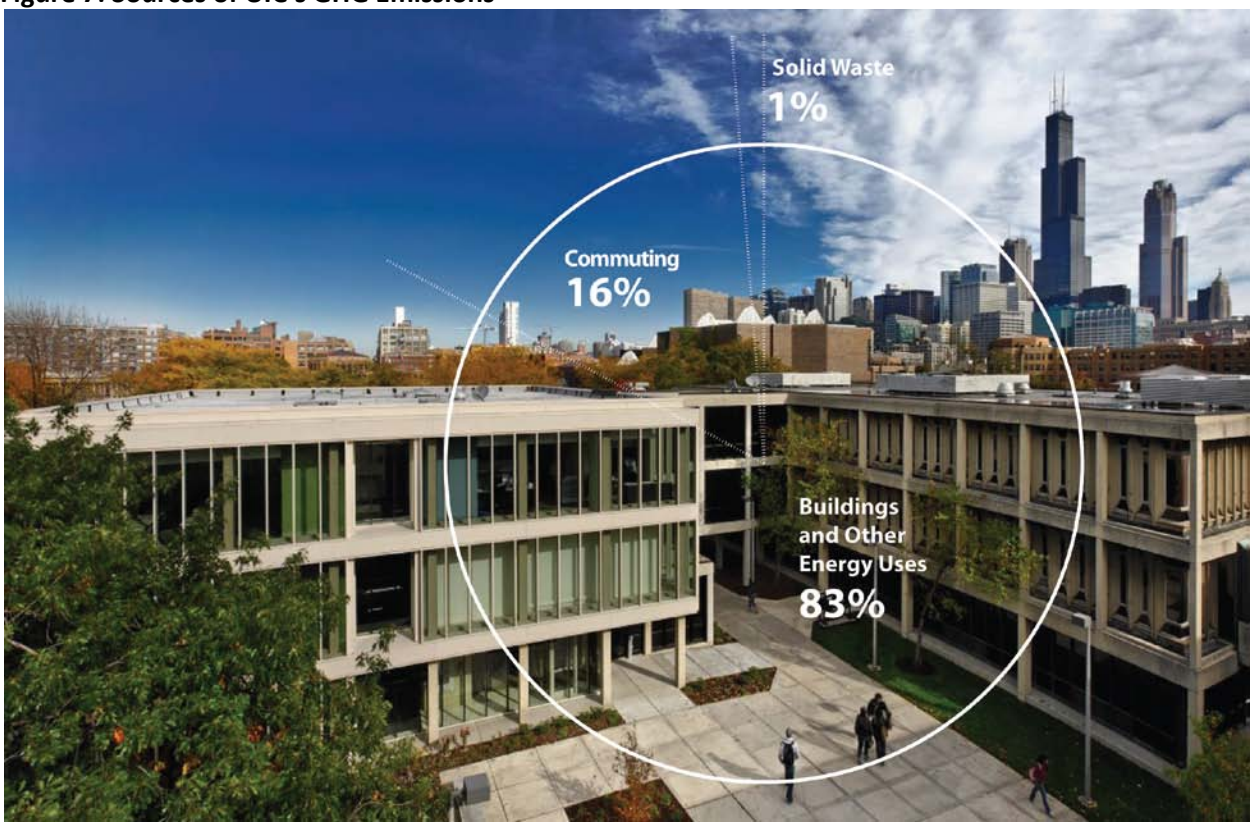
Figure 6: UIC's Projected GHG Emissions Reductions



Progress reports and updates to this plan are crucial as this will provide a more accurate projection of reductions in the future.

Clearly, the areas that can have the most impact in reducing GHG emissions are buildings and electricity. Reducing energy use and increasing energy efficiency will decrease the amount electricity and gas used and purchased for the campus. Renewable energy sources such as solar, wind, and biogas have zero or reduced carbon emissions in contrast to conventional energy sources such as coal, petroleum and natural gas. This plan describes strategies in energy conservation and efficiency and clean and renewable energy sources.

Figure 7: Sources of UIC's GHG Emissions



UIC is conveniently located close to public transportation and has ample parking facilities. However, there are strategies to improve our transportation options both on-campus and in our commute and opportunities to participate in more active transportation.

UIC encompasses over 240 acres, which includes green spaces that require landscaping, watering and pest management. The UIC CAP outlines grounds options that include strategies not only that are less harmful to the environment but promote a sustainable campus and can mitigate the urban heat island effect.

Waste accounts for only 1% of UIC's GHG emissions, however there are other compelling reasons to reduce our waste stream. Recycling is the most visible "sustainable" or greening program on campus and the first one that is criticized by the campus community. By preventing the creation of waste in the first place, reusing, and recycling, we save natural resources and energy used in the production and

transportation of these materials, therefore reducing the waste stream. These efforts reduce upstream GHG emissions that are not accounted for in UIC's inventory. Recycling is a simple, no-cost environmental action that each person may participate on campus. UIC's recycling program, formerly known as UICycle, has been in place since 1994, as required by Section 20/3.1 of the Illinois Solid Waste Management Act (415 ILCS 20/1 et. seq.). This legislation mandates that all Illinois state funded colleges and universities participate in a waste reduction planning process.

The UIC CAP also suggests other areas that can reduce GHG emissions while promoting a positive work environment. Lastly, the UIC CAP discusses outreach, education, research and engagement. The CAP may outline strategies but unless these actions are implemented, UIC's GHG emissions will remain the same or more likely increase over time.

The mitigation strategies that are listed in the UIC CAP were recommendations of the Chancellor's Committee on Sustainability and Energy subcommittees, specifically Energy and Utilities, Transportation and Grounds, Recycling and Waste Management, Purchasing and Services and Outreach and Marketing. Each subcommittee is comprised of faculty, staff and students who work, teach, conduct research or have a general interest in these areas.

This development of the UIC CAP was a reiterative process. The recommendations were shared with upper level administration, comments were sent back to the subcommittees and the associate chancellor for sustainability updated the Chancellor and vice chancellors during the development process. The draft of the UIC CAP was posted online for public comment from April – August 2009. There were numerous presentations, seminars, workshops and class presentations in spring 2009 to discuss the UIC CAP and to solicit input for the mitigation and outreach strategies.

The success of the UIC CAP depends on the individual actions of its faculty, staff and students. The UIC CAP provides the opportunity to use the campus as a laboratory, an educational tool for UIC faculty, students and staff.

GHG Emissions Mitigation Strategies

Strategy 1.0 Energy Efficiency and Conservation

Buildings and the energy required to support them (electricity, heating, cooling, and other building gas consumption) account for most of UIC's greenhouse gas emissions. In 2008, UIC had 117 buildings, which accounted for 83% of total GHG emissions. This is the area with the most opportunity for impact. Reducing energy use and increasing energy efficiency will decrease the amount of electricity used and purchased for the campus. The goal is to reduce GHG emissions from buildings by 40% by 2030.

Table 2: UIC's GHG Emissions from Buildings

		eCO_2 (Metric Tonnes)				
		2004	2005	2006	2007	2008
Scope 1	Co-gen Electricity	129,031	113,805	81,847	91,635	82,513
	Co-gen Steam	74,010	71,810	75,018	81,639	90,104
	Other On-Campus Stationary	3,885	3,740	2,900	2,525	3,455
Scope 2	Purchased Electricity	18,496	12,895	13,443	23,719	48,139
	Total	**225,423**	**202,249**	**173,209**	**199,518**	**224,211**

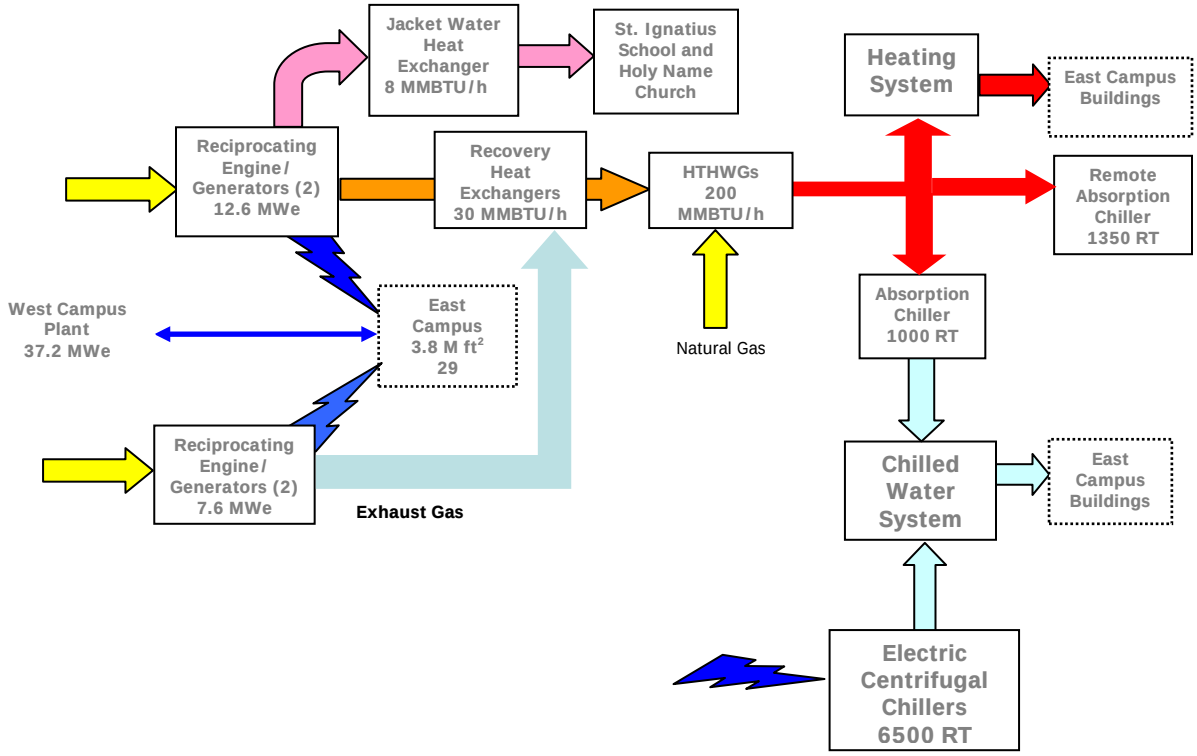
The ability of power plants to produce energy at a reduced cost compared to retail rates created a unique arrangement for power generation at the University of Illinois. Utility Operations, a unit in the University of Illinois (University Administration) operates power plants on the UIC campus with the capability to cogenerate.

Figure 8: Power Plant – West Campus

Cogeneration is the simultaneous production of heat and electrical power in a single thermodynamic process. Instead of discarding the heat produced by the electrical power production process, it is captured and used to provide space heating and hot water heating, humidification, cooling (via absorption chillers), as well as other uses, thus eliminating the added expense of burning fuels for the sole purpose of space heating.

The UIC plants run primarily on natural gas which is cleaner than coal and fuel oil when considering hazardous air pollutants particulates and carbon dioxide. When operated under economically advantageous conditions, cogeneration can be beneficial and helps lower the emission of carbon and sulfur dioxide pollutants into the air.

Figure 9: East Campus Power Plant - Diagram



The plant on the east campus was installed with a combined heat and power system in 1993. Since then, there have been three major upgrades and the plant now generates 20.2 megawatts (MW) of electricity. With the success and experience of the east campus plant, the west campus plant was upgraded in 2001 and now has the capacity to generate 37.2 MW of electricity.

Figure 10: West Campus Power Plant - Diagram

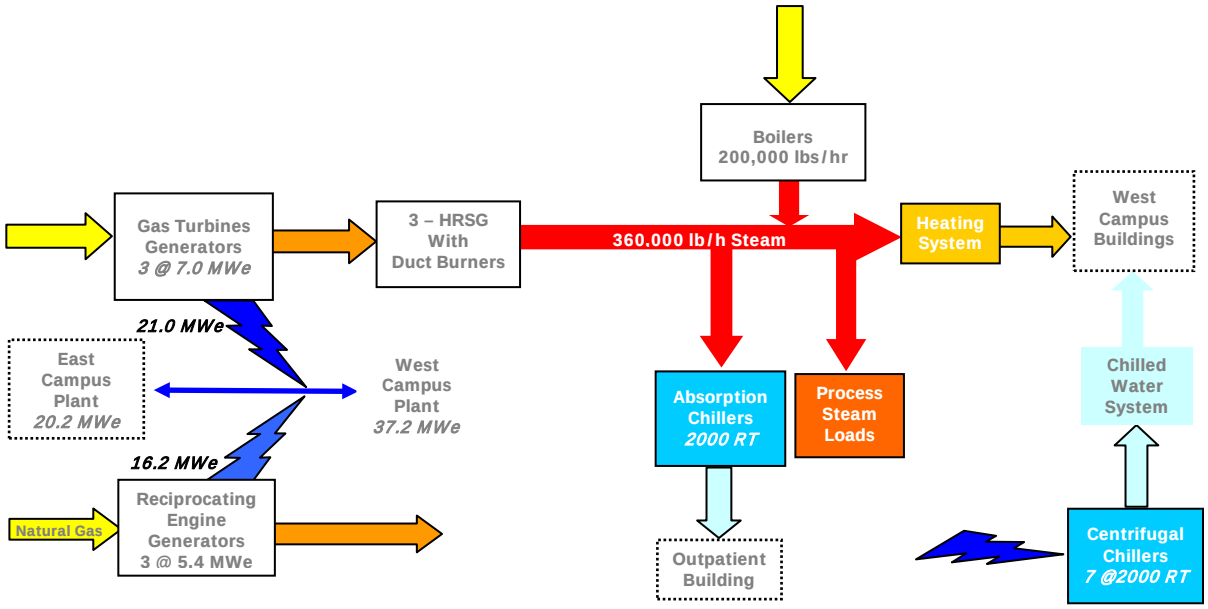


Figure 11: Turbine #1 in Power Plant – West Campus

The majority of the buildings on the east side of campus are heated year-round with high temperature hot water produced at the east power plant. The majority of the buildings on the west side of campus are heated with superheated steam produced at the west power plant. During the cooling season, generally April through October, the majority of the buildings on the east and west campuses are cooled with chilled water produced at these centralized plants.

In September 2008, the American Physical Society released a report, FUTURE: Think Efficiency, which states that commercial and residential buildings produce 36% of our nation's carbon emissions. The Energy Information Administration projects that energy consumption will increase another 30% by 2030. Reducing building energy consumption is the first step on the path to reducing GHG emissions.

According to the Climate Action Plan, buildings account for 70% of all city emissions and are the primary target for greenhouse gas (GHG) reductions. Chicago is targeting a reduction of 30% GHG by 2020 with eight actions, including retrofits and conservation. Like the City of Chicago, buildings are the primary target for GHG reductions at UIC.

Full implementation of energy efficiency projects is predicated on UIC's ability to measure and analyze its own consumption as closely as possible. Energy audits of campus buildings would aid this effort and identify worst-performing targets. Metering of individual buildings would facilitate accountability, linking the usages and costs of individual colleges to the overall campus consumption.

Currently due to deferred maintenance, buildings are not functioning efficiently. For example not all fan systems are running, and cooling may not be adequate. A baseline needs to be established that would indicate a desirable level for buildings which considers factors such as indoor air quality and temperature. Once that baseline and energy level is determined, goals for reducing energy consumption may be established.

Previous studies on energy efficiency of the campus have shown a range of potential for energy savings through energy efficiency projects. However, these studies relied on utility data from meters that have not been updated, calibrated or tested over the years since their installation. Additionally, the data may not have been adequately verified. Some buildings are not as well monitored. Yet, it is worth noting the findings of these studies.

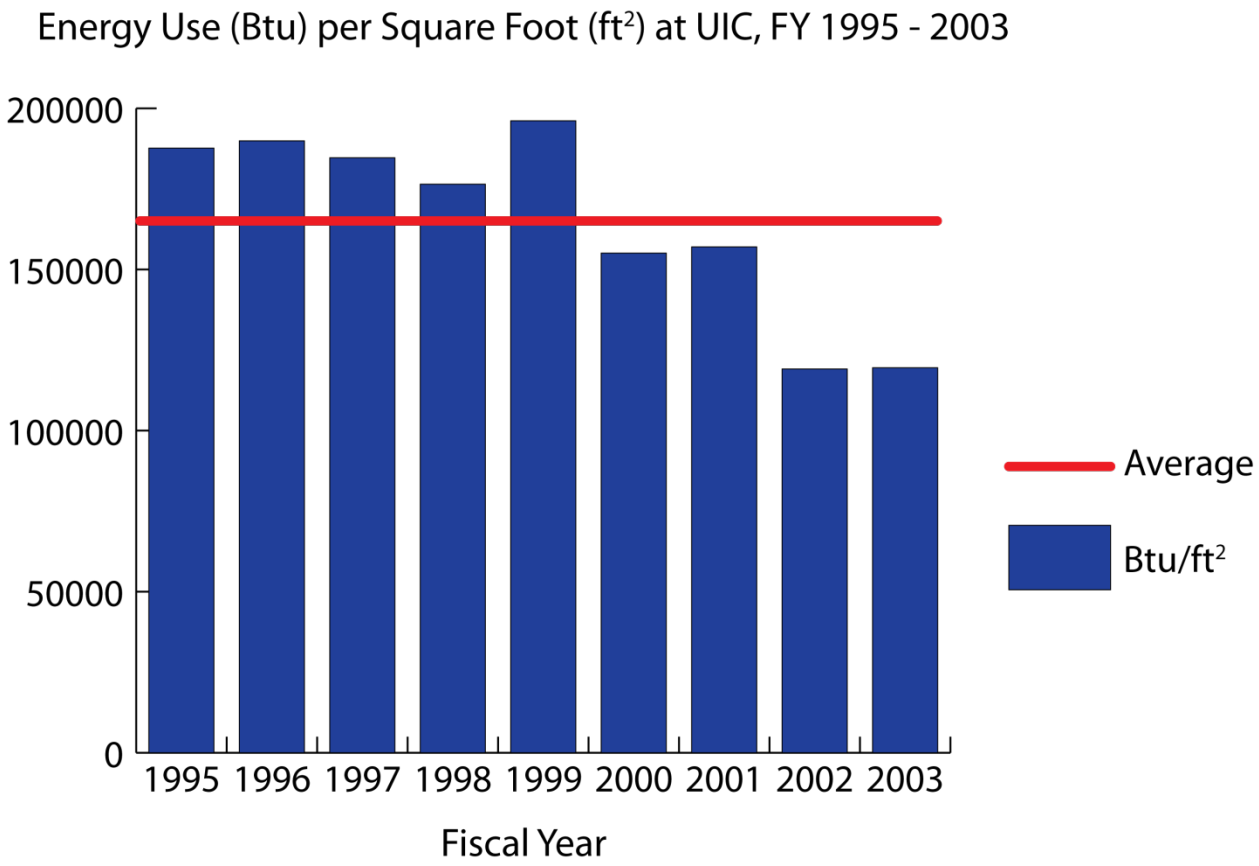
Larsson Thesis, 2003

Carolina Larsson, a Master of Science student in engineering biology at the Institute of Technology, Linköping University, investigated the energy consumption on the east campus and compared the energy use to similar buildings in the United States to determine the building energy efficiency and the potential for energy savings. Her study revealed that 24 out of the 32 buildings studied showed poor energy efficiency with 16 buildings having energy saving potentials of more than 50% and eight buildings having savings potentials of 35-50%.

Illinois Public University Report (2003)

This study examined the energy costs and energy efficiency at Illinois public universities. In FY03 UIC's energy usage was about 120,000 Btu/sq ft., ranking second lowest among 13 state universities. The study suggested that "simple implementation of proper maintenance practices and increased efficiency training, independent of any significant capital improvements, can save…as much as 5% of total energy costs." Further, the report recommended that universities include an aggressive operating and maintenance (O&M) component in their overall energy cost reduction plans.

Figure 12: UIC's Energy Consumption FY95 – FY03



The Energy Resource Center (ERC) Study, June 2006.
This study consisted of a complete walk-through assessment of University Hall (UH) and the Molecular Biology Research Building (MBRB) identifying all energy users. The ERC identified energy conservation opportunities available for both buildings and developed detailed costs savings to determine project paybacks. The studies verified energy consumption of major energy systems through submetering and projected the potential campus-wide energy savings from using the results of the completed work.

By installing programmable or setback thermostats, converting heating, ventilation and air-conditioning (HVAC) systems to variable air volume (VAV), retrofit lighting, installing occupancy sensors and other upgrades and conversions, the ERC estimated a total savings of $1,063,350 (1,230,854 MMBtu) for these two buildings. By applying the recommendations to other buildings on campus at an estimated cost of $207 million, the ERC projected a savings of $21 million per year (almost a 10-year payback).

The study points out the drawbacks in the utility cost accounting due to cogeneration and cites that the actual benefit of a campus-wide energy management program cannot be determined until a consistent and transparent method of generating utility unit costs is developed.

Review and Benchmark of Utilities Operations
During FY09, the University of Illinois contracted with Science Applications International Corporation (SAIC) to conduct a comprehensive review and benchmark of utilities operations for all three of the University of Illinois campuses (Chicago, Urbana-Champaign and Springfield). SAIC developed and

analyzed improvement options and submitted formal recommendations concerning how utility costs for the University can be reduced and managed through (a) optimizing the mix of produced and purchased energy; (b) cost effective investments in utility production facilities; (c) cost effective investments in utility distribution facilities; (d) utility consumption reduction measures; and (e) campus utility metering systems. The utility consumption reduction measures or energy conservation measures that were identified suggest a 34% energy savings could be realized. These findings and others will be referenced throughout the UIC CAP.

1.1 Retrofits

In order to retrofit buildings for energy efficiency, a baseline is needed. Historically at UIC, the costs of energy usage did not require metering at the building level. Metering at the State building level is not required for individual building usage since each building/department does not hold its own energy budget. Although a significant portion of buildings possess meters, the majority of meters have not been maintained, calibrated, upgraded or replaced over the years. However, there have been several recent initiatives that have led to metering projects associated with State buildings.

1.11 Metering Project

To resolve the metering deficiencies, UIC's facilities management group and the utilities director are working on an important project to evaluate existing metering and installing new meters in our largest, energy-consuming State buildings on campus. This includes the metering of electricity, steam or high-temperature hot water and chilled water.

The buildings where the meters are being installed comprise 70% of the square footage of our state-owned campus buildings (41% of the total campus square footage) and approximately 80% of the energy consumption in the state-owned buildings. As the meters are being installed or updated, they are fed into a computer system that will allow building engineers and utilities to monitor the energy consumption in real time and detect unusual trends that could indicate problems with the systems in those buildings. This will allow for the prioritization of projects and locate "hot spots" for energy consumption. Also, by having this data, UIC will have a baseline for evaluating energy projects. Currently, there are discussions about re-metering the auxiliaries buildings as well.

Figure 13: Electric Meter

The following buildings are part of the metering project:

East side

- Science & Engineering South

- Art and Architecture Building
- Physical Education Building
- Science & Engineering Laboratory East
- Science & Engineering Laboratory West
- University Hall
- Behavioral Sciences Building
- Student Services Building (via ComEd)
- Engineering Research Facility
- Education, Performing Arts and Social Work
- Richard J. Daley Library
- Science & Engineering Offices
- Grant Hall
- Lincoln Hall

West side

- UIC Hospital
- Clinical Sciences Building
- Molecular Biology Research Building
- College of Dentistry
- School of Public Health & Psychiatric Institute
- Outpatient Care Center
- College of Medicine East Tower
- College of Medicine West Tower
- College of Medicine Research Building
- Clinical Sciences North
- College of Pharmacy

The SAIC recommendations regarding metering suggest that UIC expand the initiative to all buildings larger than 100,000 square feet including state supported and auxiliary buildings. This would result in 84% of the total campus floor area being metered. The second recommendation is to establish a meter calibration program to help maintain the accuracy of the readings and establish confidence for billing purposes.

1.12 Shadow Billing

One of the many benefits of the metering project is that it will capture reliable data. This will allow UIC to track individual building energy consumption and report that data to that colleges and administrative units that occupy the space. It is anticipated that when colleges and administrative units are able to see how much energy they are consuming, this will heighten the awareness of the real costs of energy utilization and reinforce UIC's efforts to promote conservation and efficiency by students, faculty and staff.

Currently, colleges and departments do not pay for electricity or utilities. This is an opportunity for an incentive program with the colleges as part of the shadow billing. Departments will be more willing to save and conserve energy if the actual savings are realized. On average, 59% of a UIC building's GHG emissions are due to electrical consumption. Some of that electrical consumption is associated with central buildings systems. However, the remainder is due to lighting and plug loads (e.g., computers, office and laboratory equipment) that are controlled primarily by building occupants. If there is a credit or incentive program for conserving energy that is passed along to the departments, this may increase

the participating in energy conservation programs, increase the likelihood of departments to pay for more expenses software and programs to help minimize energy usage (e.g., for computers) as there will be some financial incentive or return on investment.

1.13 Lighting Upgrades

The most prevalent message in energy efficiency is "replace the light bulbs." Replacing traditional incandescent light bulbs with compact fluorescent light bulbs can save energy. UIC has many fluorescent light fixtures (the long bulbs) in its buildings. Thanks to an investment by UIC of $1,066,000 supplemented by $933,000 in grants from the Illinois Clean Energy Community Foundation and $150,000 in rebates from the Illinois Department of Commerce and Economic Opportunity, over 36,000 bulbs and half as many ballasts will have been replaced with more efficient ones during FY06-FY10. In addition, nearly all incandescent light bulbs that have compact fluorescent bulb replacements, including those with dimmers, have been replaced. UIC Facilities Management has a policy to purchase only energy-efficient bulbs.

The major lighting projects consist of replacing T12 fluorescent lighting fixtures with high efficiency electronic ballasts and T8 lamps. To illustrate the savings in replacing fixtures, there were over 8,200 fixtures installed in University Hall in 2007, replacing T12 lamps with T8 lamps. This resulted in an estimated savings 1,564,000 kWh last year and at a rate of 11 cents per kWh, UIC will save over $172,000/year in electricity costs.

Other lighting efficiency projects should include reducing excessive light loads and installing occupancy sensors for lights would also eliminate energy wasted in vacant rooms.

UIC will continue the lighting upgrades and projects for building, including those buildings not scheduled for energy performance contracting. According to the SAIC study, approximately 12,758,000 kWh of electricity ($1,084,000) could be saved annually through lighting upgrades. If we assume that this would reduce the amount of electricity UIC purchases and this would translate to 7,450 metric tonnes of CO_2.

1.14 Heating, Ventilation and Air Conditioning (HVAC) Projects

HVAC projects will improve the efficiency of the systems, provide better control of temperatures, and make those areas more comfortable for building occupants. Numerous projects are planned and in process to improve the HVAC systems across campus, including upgraded and automatic mechanical systems, which may help reduce heating and cooling loads in buildings.

- **Coil Replacements** – UIC will be performing an analysis to determine the scope of this project to replace heating and cooling coils in various buildings that are in the most need of repair.
- **Molecular Biology Research Building** – UIC has replaced all current air conditioning and heating controls with current state of the art digital controls. This provides the opportunity to better control temperatures throughout the building, allowing for implementation of energy conservation measures.
- **College of Nursing Building** – Upgrades to more efficient units are planned for the HVAC System in the basement through third floor. In addition, direct digital control valves and sensors will replace the old fan coil control valves, allowing for better control of temperatures on these floors.
- **Education, Performing Arts and Social Work Building** – HVAC System upgrades are underway to install more efficient units.

In the selection of projects to alleviate deferred-maintenance issues on the campus, preference should be given to projects that have ability to achieve greater energy efficiency and therefore reduce greenhouse gas emissions. In addition, these projects save energy, they address deferred maintenance problems, improve building comfort, and reduce maintenance calls.

1.15 Building Envelope

The building envelope (e.g., walls, windows, foundations, doors, and roofs) greatly affects how efficient a building will be in maintaining comfortable interior temperatures. Insulation in walls and seals around windows and doors are prime factors. Low-emittance coatings (microscopically thin, virtually invisible, metal or metallic oxide layers deposited on a window or skylight glazing surface primarily to reduce the U-factor by suppressing radioactive heat flow), gas-fills, and insulating spacers and frames can significantly reduce winter heat loss and summer heat gain through windows.

Double-pane, insulated glass windows significantly reduce the load on the heating and cooling systems and drafts, which in turn, reduces energy demand. One current project is the replacement of windows on the east façade of the College of Medicine West Tower. These projects are most financially beneficial when leveraged as part of other renovation projects.

1.2 Monitoring and Maintenance

UIC should make a commitment to perform maintenance and repairs on its current systems. The maintenance budgets and personnel have been severely cut over the years. By not properly performing maintenance of HVAC systems, UIC is not operating as efficiency as it could be. Additionally, there are already a number of building monitoring systems in place that continuously scan the systems for problems and issues so they can be immediately addressed rather than waiting for phone calls or requests. Adequate staffing is required to do this. Monitoring and maintenance also is important when considering energy performance contracting.

1.3 Energy Performance Contracting

Energy projects can have a good return on investment. Since there are predicable energy cost savings, energy service companies (ESCOs) offer services to plan, finance, design, and implement initiatives. A portion of these savings are used to pay back the initial investment. This is an attractive alternative for colleges and universities who are not able to finance large or expensive initiatives through capital investment and ESCO energy projects can generate substantial savings, if there is careful contracting and monitoring. Many universities, such as the University of Buffalo (SUNY) and other Illinois public institutions, such as Eastern Illinois University and Governors State University have contracted with ESCOs to finance projects.

The University of Illinois is in the process of investigating performance contracting to finance and implement energy conservation and efficiency projects on campus. Responses to a request for qualifications for ESCOs were reviewed and a number of qualified firms were identified. Pending continued Board of Trustees and University Administration support, UIC will select two to three buildings in which an ESCO will be used to implement energy-savings projects.

However, the University must support the maintenance of the projects after the ESCO contract expires. Once the contract is fulfilled by the ESCO, the University will need to continue to meet those commitments by providing adequate resources in order for those systems to maintain their energy efficiency. These systems tend to be high-tech and require less staff time to maintain than the older systems.

1.4 Water Conservation

UIC is currently installing low-flow toilets and automatic faucets in some of the buildings. All residence halls, south campus, Grant Hall, West Side Office Research Building and College of Medicine Research Building have low-flow toilets. Approximately 25-35% of the other buildings on the east campus have been replaced with low-flow toilets. Full implementation of these bathroom fixtures would lead to one of the largest potential water and energy savings, particularly in the taller buildings on campus.

UIC's building engineers are also reducing water and electricity consumption through an operations and maintenance program for a number of chillers that operate in the campus buildings (outside of the power plants). By properly treating chilled water, whether in the facilities or in the central loop, a reduction in circulation rates can be achieved that saves both water and electricity. Also, equipment has been installed to collect and return condensate from the steam lines that serve UIC's buildings. By returning more condensate and reducing the evaporation factor and by being more efficient with the chilled water and energy, water and cost savings is being realized.

UIC will continue to seek out water and energy savings in its building operations and document those savings.

1.5 Establish Green Building Standards

University of Illinois President B. Joseph White has directed that all new construction projects and major renovations be at least LEED® (Leadership in Energy and Environmental Design) Silver Certified. This is in line with the Building Guidelines for State Construction, which has been mandated for all new state-funded building construction and major renovations of existing state-owned facilities.

This means that all future new construction, remodeling, and renovation projects at UIC of $5 million or greater will be LEED® Silver Certified. New construction, remodeling, and renovations totaling less than $5 million should comply with the LEED® Silver requirements to the greatest extent practicable. Under this directive new buildings should be constructed to be significantly more energy efficient than the current standards and most likely will utilize renewable energy. UIC's energy policy uses the scope of the projects at 10,000 square feet rather than $5 million which is consistent with the state Capital Development Board standards.

Green building standards are being developed and will be incorporated into the UIC campus building standards.

1.6 Green Roofs/Reflective Roofs

Most of UIC's roofs have intense solar heat gain (energy) because of their relatively flat exposure to the sun. The intense solar gain raises the temperature of the roof membrane (sometimes near 200°F), which increases cooling load in the building and shortens life of the roof.

UIC is lowering its cooling costs and extending roof life by putting a reflective coating on its roofs, as they are reroofed. Light colored and reflective roof coatings reduce the heat load on buildings during the summer. Also, new and more efficient insulation will be installed. The insulation will reduce the heat load in summer, decreasing the energy demand required for cooling these buildings.

Green roofs are another way to reduce heat load. A small green roof has been created on the patio/roof surface of the Art and Architecture building. Sections of the elevated plazas that are being replaced on

the Behavioral Sciences Building will have green roofs as well. In addition to reducing heat load, green roofs can capture significant amounts of water that would otherwise run off the roof.

Figure 14: Green Roof on Art & Architecture Building

All roof replacements will utilize reflective coatings or green roofs to the extent possible.

1.7 Energy Conservation by Faculty, Students & Staff

UIC can immediately reduce electricity and heating fuel consumption through a campus-wide program to raise awareness of energy sustainability. This initiative would start with a specific, well-publicized target reduction goal – a 2% percent reduction per year for the next three years – and then use a diverse toolkit of methods to achieve that goal.

In March 2008, UIC participated in Earth Hour and during that hour, UIC used 3.7% less electricity during that hour compared to the same hour on the previous four Saturdays. This is a strong indicator that with an awareness campaign, there is a potential savings for reducing energy consumption by modifying behavior alone.

The Office of Sustainability is launching an energy conservation awareness campaign in fall 2009 that will target UIC students, faculty and staff in different ways, with the focus to increase individuals' knowledge of how their own actions contribute to the UIC's environmental impact and empowering them to reduce these impacts by changing their own behavior. The goal of the campaign, UNPLUG, is to reduce UIC's energy consumption by 2% by behavioral actions alone, such as turning off lights and unnecessary equipment. The Office of Sustainability will sponsor workshops and events throughout the year that highlight energy conservation and monitor UIC's progress towards its goal.

The campaign will emphasize that UIC is striving for culture change, a real shift in the way faculty, students and staff think about energy in their role at UIC and their responsibility for saving energy on campus. The campaign will be creative and persistent to get the message out and focus on various themes to motivate, such as the environment (climate change), finances and being trendy ("green" is cool).

In terms of marketing this conservation awareness campaign, the Office of Sustainability will utilize as many media as possible, including its website, emails, presentation, creative signage, Facebook, Twitter, YouTube, contests/competitions and outreach events/demonstration projects.

Summary
While an initial investment is required for most of these projects, the return on investment in energy savings may be realized within a few months to a few years. A few of these projects have multiple benefits such as improved indoor air quality, temperature, reduced maintenance costs, water conservation and protection from the elements. These efficiency and conservation strategies combined can lead to an approximately 40% reduction in energy consumption and greenhouse gases by 2030.

Strategy 2.0 Clean and Renewable Energy Sources
Power plants at UIC produce electricity, steam, high temperature hot water and medium temperature water for heating, cooling and electrical loads. The plants primarily run on natural gas but also use some diesel oil to start up engines. The plants generate electricity when it is cost-effective to do so, which is determined by the cost of natural gas and purchased electricity. Due to a combination of organizational factors, UIC currently purchases electricity on the real-time market from Commonwealth Edison (ComEd). The mix of power sources utilized by ComEd is generally a low-carbon source of electricity and does reduce UIC's carbon footprint. However, the mix of power sources from ComEd varies from year to year and from FY04-FY08 there has been an overall increase in CO_2 emissions per kWh. Further, UIC does not have an input into the electricity mix utilized by ComEd.

Currently, steps are under way to allow UIC to purchase blocks of electricity and to possibly buy and sell directly from the grid. The SAIC study (described in Strategy 1) evaluated options for producing vs. purchasing power until FY2023. This report suggests that fixed natural gas contracts make the purchase of electricity more cost effective. A change in demand of 20% in either direction would affect this projection. The addition of a carbon tax was evaluated in the $12-15/ton range starting in 2012 increasing to $15-18/ton by 2020. Given this, the cost of generation is projected to be lower than the market because natural gas emits less CO2 than coal-fired plants used by Commonwealth Edison. The report projects the regional costs of electricity to rise 50% in the next 15 years. This could influence how UIC may purchase renewable energy sources. Energy service contracts (ESCOs) could also include a renewable component as part of a building retrofit.

The clean and renewable energy strategies must considered in this current context. The ability to purchase from a variety of power generators will offer significant opportunities for greenhouse gas reductions.

2.1 Modify Power Plants
Options for utilizing renewable fuel sources for UIC's power plants are limited as Chicago is a non-attainment area for ozone and particulate emissions. This means that permitting for different fuel sources is quite difficult since nitrous oxide and sulfur emissions must be kept to a minimum. However, there may be some alternatives that UIC could consider. UIC may identify potential gasification choices (e.g., switchgrass) for campus power plants or biogas generated as a by-product of an industrial or waste management process.

UIC should evaluate the potential of renewable fuel sources of energy for the on-site cogeneration plants. By replacing natural gas with biogas in all cogeneration plants, there could be a 63% reduction in GHG emissions by 2050. In fact, UIC could achieve these reductions sooner (2015-2020) if utilizing renewable fuel sources becomes a strategic goal. Establishing a business partnership early on with a company that will generate biogas as a by-product of their processes will demonstrate UIC's leadership in climate action.

2.2 Build Renewable Electricity Generation

Rooftops or parking lots may be good locations for solar photovoltaic (PV) arrays. UIC is installing its first PV system on Lincoln Hall. It is anticipated to supply approximately 51.48 kW of renewable energy or approximately 10% of the electricity utilized for that building. The project will be used to evaluate the feasibility of PV on campus.

Figure 15: Photovoltaic (PV) Panels on Parking Structure

Photo courtesy of J. Caravette

Urban wind as a resource has not been well-studied and current thinking in the wind energy business is that it is not economical to utilize wind in urban areas. However, there are potential research projects that could be developed in this area such as studying wind speed and direction at numerous sites on campus. Also, research and development of new types of turbines is ongoing and technology may develop that can utilize this resource.

Another consideration would be to collaborate with the other University of Illinois campuses or other universities to develop and build its own renewable energy resources. A coalition of campuses could be formed, including one campus located in a good wind resource area. If a wind farm is developed in this good wind resource area, a coalition could utilize net aggregate metering by interconnecting locally, thus reducing transmission costs. It should be noted that current net aggregate metering legislation currently does not include universities, but this could change in the future.

Additional benefits of on-site renewable energy include educational opportunities for students and the community on renewable energy and the potential for on-site research projects for faculty.

Based upon the evaluation of the renewable feasibility studies and projects, 2.5% of UIC's electrical consumption should be provided by on-site renewable sources by 2020; 5% of UIC's electrical consumption should be provided by on-site renewable sources by 2030.

2.3 Geothermal Heating and Cooling

UIC is currently renovating small classroom buildings and converting them to geothermal heating and cooling. The first building, Grant Hall reopened in September 2007. Since then, the efficiency of the building has been closely monitored and the desired temperature of 70-72°F has been maintained.

Figure 16: Grant Hall

Photo courtesy of C. Steinkamp (2007)

The use of geothermal energy allows UIC to heat and cool the building for about half the energy consumption of a conventional year round heating and cooling system. Due to the level of success and savings demonstrated by Grant Hall (partially funded by the Illinois Clean Energy Community Foundation) the well field has been expanded to serve another classroom building, Lincoln Hall (currently under renovation to be LEED Silver certified) and subsequently Douglas Hall. Lincoln Hall has a completion date of summer 2009 and Douglas Hall is scheduled to begin the year-long renovation in summer of 2010. These buildings will operate on one geothermal well system that has already been installed. The funding for these renovations is from the Academic Facilities Maintenance Fund Assessment for the operation and maintenance of classroom space and from development funds.

An additional benefit of geothermal energy includes the ability to regulate space temperatures during real time, providing greater comfort especially during transition seasons. This makes for a much better learning space.

With the ongoing evaluation of the projects and subject to the availability of funds – three more buildings, Stevenson, Jefferson, and Henry Halls would potentially be targeted for renovation and

installation of geothermal systems. Generally, geothermal systems are limited by the land available for well fields and are best suited for the smaller campus buildings.

2.4 Purchase Electricity from a Renewable Electricity Provider

Rather than purchasing a traditional mix of electricity, a purchase of renewable power can be made. The State of Illinois has a goal to purchase a larger portion of electricity from renewable sources 25% by June 1, 2025. In addition, legislation set goals for investor-owned Illinois utilities, which is known as the Illinois Renewable Energy Portfolio.

Illinois Renewable Energy Portfolio Standard:

- At least 2% by June 1, 2008;
- At least 4% by June 1, 2009;
- At least 5% by June 1, 2010;
- At least 6% by June 1, 2011;
- At least 7% by June 1, 2012;
- At least 8% by June 1, 2013;
- At least 9% by June 1, 2014;
- At least 10% by June 1, 2015; and
- Increasing by at least 1.5% each year thereafter to at least 25% by June 1, 2025.

The renewable portfolio standard does not apply to the University of Illinois owned utilities, such as the cogeneration plants. However, it applies to investor-owned Illinois utilities such as Commonwealth Edison, the company from which UIC purchases electricity.

One of the strategies in Chicago's Climate Action Plan is to procure enough renewable energy generation to reduce Chicago's electricity emissions by 20% by 2020. UIC should align its electrical purchases with this mandate. Therefore, 25% of UIC's purchased electricity should be from renewable sources by 2025.

Summary

In this rapidly changing energy environment, new and more reliable renewable energy opportunities are likely to arise. Opportunities for funding and incentives are also anticipated. UIC must position itself to utilize these new prospects.

Strategy 3.0 Improved Transportation Options

Approximately 17% of UIC's carbon footprint is due to transportation: 8% from faculty and staff commuting, 8% from student commuting and 1% from the campus fleet. Faculty, staff and students driving alone to campus account for 60% of the transportation GHG emissions.

Table 3: UIC's GHG Emissions from Transportation

		eCO_2 (Metric Tonnes)				
		2004	2005	2006	2007	2008
Scope 1	Direct Transportation	1,644	1,644	1,830	1,609	1,472
Scope 3	Faculty / Staff Commuting	19,454	18,904	19,119	20,684	22,225
	Student Commuting	22,679	20,103	18,704	19,090	20,997
	Total	**21,098**	**20,547**	**20,948**	**22,293**	**23,697**

UIC's emissions from transportation (17%) are somewhat lower than the City of Chicago in which 21% of the GHG emissions were from cars, buses and trains. There are a number of strategies that can be used to reduce UIC's carbon emissions from transportation. These recommendations are guided by a report prepared by the Chancellor's Committee on Sustainability and Energy, Transportation and Grounds. The full report is listed in Appendix A.

Based on a commuter survey conducted by the Office of Sustainability in the fall 2008, 67.5% of UIC staff drive a portion of their commute to campus. Of those staff who drive, 11.5% carpool with at least one other person. Not as many UIC faculty drive to campus (55.5%) but they are less likely to carpool (10%). Students drive their personal vehicles to campus the least (30%) with only 3.5% carpooling. However, students are most likely to use public transportation to get to campus (20% travel by bus at least one leg of the trip and 26.5% use a CTA or METRA train). Slightly more than 8% of faculty and staff use buses for at least one leg of their trip to campus and 20% take CTA or METRA trains. Faculty are most likely to take the METRA (4%), followed by staff (3.33) and students (1.8%).

A study conducted by UIC's Urban Transportation Center (UTC) during the fall of 2008 for student U-Pass users at UIC found that approximately 60% of the students were moderate users of the CTA (32-106 rides per semester) and about 20% were high intensity users (>106 rides per semester).

UIC's Office of Sustainability has partnered with the Chicago Metropolitan Agency for Planning and will work with them to increase the accessibility of the UIC community to public transit.

UIC is currently developing a new master plan for the campus for the next 20 years. As part of this process, a consultant group has been hired, which includes a transportation team. The Office of Sustainability is working closely with the master planning process and providing input so the plan will support sustainable transportation. Key areas to be considered in the master planning processes include bike and pedestrian accessibility and infrastructure, proximity to public transit when siting new buildings, parking, street closures, CTA stations design and services and commuting between the east and west sides of campus.

3.1 Expand Transit Incentives

Currently UIC offers three major types of transit incentives: (1) students enrolled full-time are eligible to receive a U-Pass that provides unlimited access to the CTA rail and bus system during that semester (the student pays a fee, currently $95,for the U-pass benefit); (2) faculty and staff may opt to use a pre-tax transit benefit of up to $230 a month for transit vouchers for the CTA, Pace and Metra; (3) UIC operates a free intercampus shuttle that services the south, east and west campuses and surrounding areas. There is also a commuter bus shuttle that operates in the morning and evening rush hours,

which provides transportation between the campus and downtown railway stations. There is a fee to use this service.

UIC is investigating ways to improve the campus shuttle to increase the usage by faculty and staff; including real-time tracking (so riders can see where the buses are along their routes), more frequent service and shorter routes. Also, UIC is evaluating incentives for faculty and staff such as increasing the flexibility of travel benefits, a transit-challenge day and educational outreach efforts that highlight the potential savings of public transit (up to $400 per month) to increase the use of public transportation for faculty and staff to commute to work.

3.2 Make Walking and Biking Easier

Approximately 8% of faculty, students and staff ride bicycles to campus. Of these faculty, students and staff respondents, 3.6% cycle year round and 18% cycled at least once. More than 66% of those surveyed expressed interest in cycling to campus and would be more like to cycle if they felt safer, lived closer, and had improved access to cycling related facilities.

Eighteen percent (18%) of faculty, students and staff surveyed in the fall of 2008 said that they have biked to and around campus at least once last year and 3.6% bike to campus year round. More than 66% of respondents are interested in biking to or around campus and would be more likely to cycle if they felt safer, lived closer, and had improved access to cycling related facilities. In order to foster more active transportation, UIC needs to make walking and biking to campus easier.

UIC is part of an active transportation program with the Chicago Department of Transportation. This is a collaborative effort with DePaul University, Loyola University, Northwestern University and the University of Chicago to promote walking, biking and transit use on campus in additional to organizing transportation project on each campus. This includes organizing outreach activities such as UIC Transportation Day, UIC History Tour de Campus, How to Bike in the City workshop and other events that promote active transportation.

Figure 17: UIC History Tour de Campus, April 2009

To address the parking needs of bicyclists, destination oriented, sheltered and secure bike parking needs to be developed. The installation of an adequate number of bike racks, appropriately placed, should continue on campus. Bike paths need to be better delineated across campus to reduce bike-pedestrian conflict and a safe, bike-friendly route developed between the east and west campuses. Hopefully, these issues will be addressed in the master planning process. To supplement the master plan, the Office of Sustainability is seeking funding and other opportunities to secure more bike parking on campus.

If UIC faculty, staff and students increased bicycling and walking (or taking public transportation) by 30%, it would reduce its GHG emissions from commuting by 18%.

3.3 Car Sharing/Car Pool Program

Currently, UIC does not have a car sharing or car pool program. The Office of Sustainability will work with other units on campus, such as Campus Parking to study the feasibility of developing a car sharing or car pool program on campus, based on the needs of the community. There are models in the Chicago metropolitan area, such as the PACE program that UIC may investigate. In order to encourage car-pooling, parking incentives for car-pooling faculty, students and staff must be implemented.

3.4 Continue to Improve Fleet Efficiency

The Department of Transportation and Grounds, Facilities Management participates in the Illinois Green Fleets Program. The Green Fleets Program is a voluntary program in which businesses, government units, and other organizations in Illinois promote clean, green, domestic and renewable fuel and vehicles. In addition, there is a Federal requirement that 70% of new vehicle acquisitions must be flex-fuel vehicles. UIC has been purchasing a combination of hybrids and E-85 flex-fuel vehicles to meet that requirement.

In Fall 2008, the campus fleet was comprised of 233 vehicles which includes 4 biofuel grounds trucks, 10 compressed natural gas (CNG) buses, 2 CNG vans, 3 diesel buses, 24 other diesel vehicles, 26 E-85 vehicles, 4 hybrid Ford Escapes, 1 hybrid Malibu, and 5 hybrid Priuses. UIC operates its own garage and fueling station that supplies gasoline, diesel, and compressed natural gas.

Some of the campus shuttle buses run on natural gas. The Transportation and Grounds Department is continuing to look at ways to make this operation more efficient, including purchasing hybrid vehicles for the campus.

During the summer of 2009, an intern from the Illinois Environmental Protection Agency is conducting a feasibility study of using vegetable oil generated by the campus dining services to use as biofuel for campus vehicles. UIC is currently in discussions with FreeEV.com to receive a few solar electric powered vehicles, the only solar electric powered vehicles on the market. The Transportation Department may use these vehicles for the grounds crew and other appropriate functions.

Other strategies to continue to improve fleet efficiency include investigating the possibility of partnering with car-sharing services like I-Go and Zipcar to provide vehicle services, use smaller shuttles between campuses and use shorter routes (e.g., Taylor Street).

3.5 Reduce Business Travel

Reducing business travel will help UIC reduce its carbon footprint but it will also help to reduce cost during these resource-challenged times. Videoconferencing and teleconferencing are alternative ways to conduct meetings, particularly within each campus in the University of Illinois system. Other technologies are available, such as eRooms, a web conferencing system at UIC.

The University of Illinois campuses, Chicago, Urbana-Champaign and Springfield are all serviced by Amtrak. When travel is necessary, the use of the Amtrak is a good alternative that reduces the amount of cars on the road and in many cases, is less expensive than driving. The University of Illinois should also considering joining travel award programs for benefits.

UIC does not have a good baseline when it comes to business travel. Since units are decentralized on the purchasing level, travel is not tracked in a uniform way. To help set goals for business and air travel, UIC needs to have a baseline, which will also help accurately calculate its carbon footprint. The Purchasing Office may want to implement some sort of tracking database or ask departments to uniformly code business travel; however, this would be difficult to enforce.

3.6 Anti-Idling Regulations/Guidelines

Reducing idling on campus could significantly impact the air quality on campus and reduce campus fleet fuel consumption. Diesel exhaust is a mixture containing hundreds of different components, including vapors and fine particles, over 40 of which are considered toxic air contaminants (*Lung Association*). Exposure to airborne particles, such as those in diesel exhaust, is often linked to increased hospital admissions for many respiratory and heart diseases, particularly among children and the elderly. Nitrogen oxides are a major contributor to ozone production, smog, and are greenhouse gases which contribute to climate change.

In Illinois, idling regulations stipulate affected geographic areas, temperature limitations and idling time limits. Fines are issued to the vehicle operator via any state or local police agency for vehicles in the

public way. UIC idling guidelines could be developed to complement (or exceed) existing regulations and could be enforced by campus security.

Reductions in idling can be accomplished by educating campus staff and visitors to the campus. There are many resources available for guidance, including the US Dept. of Energy's National Idling Reduction Network (://www1.eere.energy.gov/vehiclesandfuels/resources/fcvt_national_idling.html).

For UIC, goals can be created for fuel consumption and reduction combined with an awareness campaign for the campus community and vendors who deliver to the campus. Signage can increase awareness in strategic locations such as parking lots and near entryways. Anti-idling in UIC's own fleet could reduce GHG emissions by 5%.

Cleaner alternatives include electric, liquefied natural gas or compressed natural gas buses and trucks. Also, many diesel vehicles can be retrofitted with filters which capture particulates. Funding opportunities exist and may be pursued to defray retrofit costs.

Summary

Additional benefits of active transit include a healthier lifestyle, reduced costs to the commuter, reducing parking maintenance and construction costs, and reduced air pollution.

Behavioral changes by faculty, students and staff will have the most impact to reduce UIC's GHG emissions from transportation. By making biking, walking and taking public transportation easier to, from and between campuses, UIC can encourage and advocate active transportation.

Strategy 4.0 Improved Grounds Operations

Many of the grounds options are adaptation and mitigation techniques for the effects of climate change. One example of climate change is the increased frequency of heavier rains and flooding. Green technologies can enhance the capacity of the water infrastructure to manage flooding. Other opportunities related to grounds operations can reduce the urban heat island effect, occurring when the average temperature is higher than suburban and rural areas due to the presence of a lot of pavement, dark rooftops and less greenery and trees. Plants also mitigate CO_2 emissions since they require CO_2 for photosynthesis and produce oxygen, thereby sequestering CO_2 emissions.

4.1 Capture Stormwater Onsite

Capturing stormwater onsite is one way to reduce stormwater flow into Chicago's combined stormwater and wastewater sewer system. This water flows to the Metropolitan Wastewater Reclamation District plants where the combined flow is treated as wastewater. However, when rainfall is high the plants cannot process all the wastewater at once so it is stored in the deep tunnel system. If the tunnel system capacity is exceeded, then the combined stormwater and wastewater is released untreated into Lake Michigan. This impacts the water quality of the lake which is used for both recreational purposes and as Chicago's drinking water source.

Alternatively, there are techniques that enhance the ability of water to filter through the ground and flow into the groundwater system, where it eventually flows in the lake. This can be done by utilizing rain barrels or cisterns to capture run-off from building roofs. Typically, that water is used to irrigate landscaping in the area and eventually infiltrates the ground water. UIC has installed a cistern to capture run-off from the roof of the UIC Forum, which is used to irrigate landscaping around the building.

Stormwater run-off from low-lying areas, near driveways or in parking lots can also be directed to bioswales and rain gardens. This reduces the amount of stormwater that must be pumped and the energy required to pump it. Further treated wastewater flows ultimately to the Mississippi River and to the Gulf of Mexico and on into the ocean, rather than replenishing our local freshwater source, Lake Michigan.

Another technique to capture stormwater is utilizing green roofs. The rooftop gardens capture the rain in their soil reducing the amount of run-off. In addition, green roofs reduce the heat island effect and insulate the buildings, reducing the energy needed to heat and cool them. In 2008, a green roof was installed on the Architecture and Arts Building and another green roof is planned for the Behavioral Sciences Building.

Permeable pavement also captures rain where it falls and should be considered for use in parking lots and other paved areas whenever feasible.

4.2 Reduce/Eliminate Irrigation

The reduction or elimination of irrigation, by planting species that are most suitable for UIC's climate and, perhaps, changing our expectations for how green the grass needs to be can save both water and the energy required to pump it. If irrigation must be used, stormwater (or grey water) applications should be considered.

4.3 Use Native Species

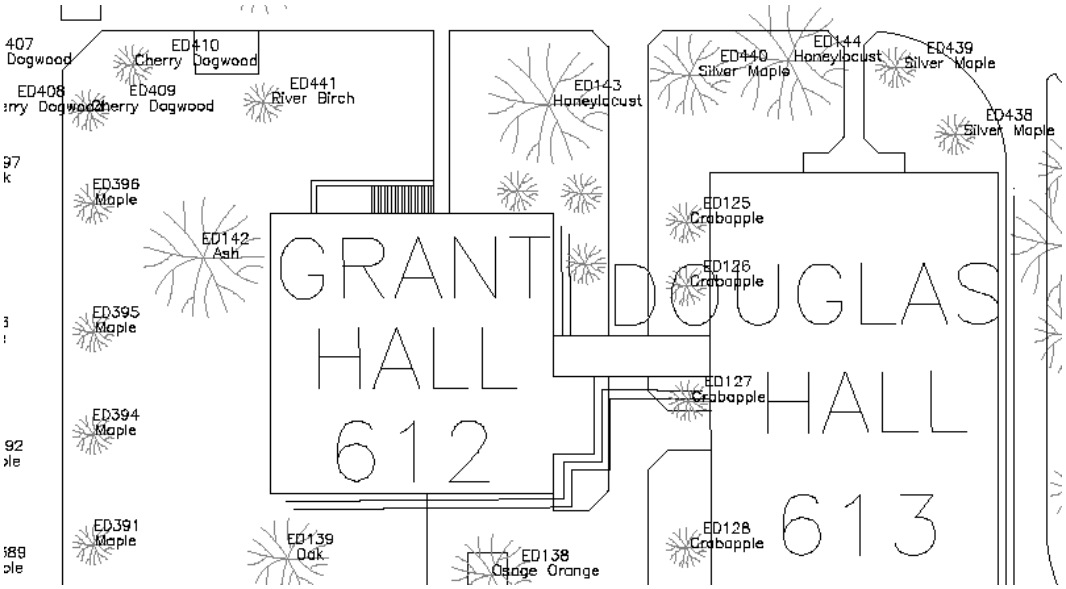
As mentioned above, planting species most suitable for UIC's climate such as native species reduces the need for irrigation. It is becoming more and more common both in the city and on campuses to find plantings that were grown before the area was developed. In Illinois, these are generally prairie and woodland (for shaded sites) plants. If managed well, these areas can be quite beautiful and self-sustaining with very little maintenance required. This reduces the need for irrigation and power landscaping equipment (which are a source of greenhouse gas emissions).

4.4 Tree Care Plan

At UIC, there is an area of opportunity to improve the sustainability of our campus by understanding and planning the best care possible for our trees. UIC has over 5,100 trees on campus and currently does not have a tree care plan. To guide the development of a plan, UIC can reference the Urban Forestry policies, procedures and practices for tree planting and management and to create areas of research, education and passive recreation on campus.

The current campus tree inventory should be verified and expanded to include girths, species, tree condition information and historical tree locations. UIC should develop tree care plan program, which include arboriculture practices, tree protection and preservation policies to establish, protect, maintain and remove trees and plants on campus. A Grounds Advisory Committee should be established to assist in implementing campus tree care plan and landscape guidelines.

Figure 18: Tree Inventory Map near Grant Hall and Douglas Hall



4.5 Integrated Pest Management

UIC should implement an integrated pest management system. According to the U.S. Environmental Protection Agency, Pest Management (IPM) is an approach to pest management that is effective and environmentally sensitive. IPM programs take a common sense approach that utilizes current, "comprehensive information on the life cycles of pest and their interaction with the environment." IPM coordinators use this information to manage pest damage. This approach is proven as the most economical and also poses the least possible risk to people, property, and the environment. Finally, it is important to note that IPM utilizes all appropriate pest management options including pesticides where appropriate.

Summary

In order to promote the awareness of and value of the landscape and grounds at UIC, faculty, staff, students, alumni and the community should be engaged in environmental projects through volunteerism and community service, which may reduce the impact of high-start up costs for new and/or improvement grounds projects on campus. Other activities could include volunteer tree plantings, tree maintenance and clean up days and sponsoring an Arbor Day event.

Strategy 5.0 Recycling and Reduced Waste Streams

Approximately 1% of UIC's greenhouse gas emissions are due to its waste stream.

Table 4: UIC's Emissions from Solid Waste

		eCO_2 (Metric Tonnes)				
		2004	2005	2006	2007	2008
Scope 3	Solid Waste	1,729	1,717	1,711	1,835	1,778

Landfilling solid waste generates methane emissions, a strong greenhouse gas. Sometimes those emissions are captured and flared; other times they are captured and used for power generation. This all depends on the type of landfill.

To reduce greenhouse gas emissions, the amount of waste sent to a landfill needs to be reduced. Composting waste materials will also offset carbon emissions. In order to achieve zero waste, there has to be composting. While greenhouse gas emissions due to the waste stream are small at UIC, there are still a number of ways that UIC can reduce its current waste stream and increase composting. Also, recycling is one of the most visible ways to promote sustainability.

5.1 Establishing Recycling Goals

UIC has a campus-wide recycling program for paper, cardboard products and bottles and cans. Data for all these commodities collected by outside vendors are reported back to UIC, as are data for non-recyclable waste such as municipal waste and potentially infectious waste from the hospital. The Office of Sustainability collects the data and uses it to calculate the recycling rate, which is the total amount of recycled material divided by the total amount of landfilled material.

In 2008, UIC signed the Illinois Sustainable Universities Compact. By signing this document, UIC commits to increasing its recycling rate by 15% by the year 2010. The most recent data allow us to calculate a baseline recycling rate for the fiscal year 2008 of 21%, which sets UIC's goal to a 36% recycling rate by December 31, 2010.

The increased recycling rate will be accomplished by a series of strategies (but not limited to):

- Expand the full recycling program (paper, cardboard, bottles and cans) to include all campus buildings. Currently, some buildings only recycle paper and cardboard products. Where needed, the collection procedures will be adjusted to increase performance (e.g., increased frequency of pickups to avoid overflowing containers).
- Encourage the reduction of paper use through use of electronic modes of communication, advocating two-sided copying and recommending the default setting on printers be set at duplex.
- Reduce the disposables usage by individuals and units, e.g. making ceramic mugs available rather than disposable cups.
- Encourage units, departments and colleges to establish "green teams." The of the Vice Chancellor for Research has established a green team and has set goals, such as purchasing 100% recycled paper, making processes paperless and reducing the amount of disposables used. This is an excellent model to coordinate staff and faculty efforts on the departmental level.
- The University of Illinois Medical Center at Chicago has launched a Practicing Green Healthcare Team, which will work to develop procedures to expand the hospital recycling program, to reduce hospital waste and evaluate other green initiatives targeted to the healthcare sector.
- Increase the awareness and educational outreach of the importance of recycling. There are large amounts of items that could be diverted from the waste stream and be recycled.

Figure 19: UIC Recycling Bins – College of Medicine West Tower

Photo courtesy of Anders Abelmann

The Office of Sustainability will continue its outreach efforts through the means of its website, blog, and newsletter. In 2009, more educational materials will be posted on the website for use by the UIC campus community. The EcoReps, the "green" representatives in campus units and departments, will continue to undergo training as they serve as liaisons for the Office of Sustainability to the campus. The Office of Sustainability will also increase the visibility of recycling at campus events.

5.2 Composting

Dining services on campus generates large amounts of waste. The waste generated during the preparation of food is the most lucrative fraction for composting as it is easier to separate compostable items and the risk for contamination is less (compared to disposable dinnerware). A feasibility study will be conducted during summer 2009 to evaluate the technology, economics and operational alternatives for composting. There is a great interest in composting on campus from Sodexo (the campus dining services) to Facilities Management. In addition, the Urban Farm affiliated with Jane Addams Hull House began composting its food waste in spring 2009.

5.3 Sustainable Food Purchases and Use of Biodegradable Packaging

As a means of decreasing the environmental impact from food services, UIC is investigating the use of biodegradable alternatives instead of non-recyclable polystyrene dinnerware and packaging in its dining services, catering, and convenience stores. In 2009, there was an expo which highlighted sustainable food service products. The Chancellor's Committee on Sustainability and Energy, Recycling and Waste Management subcommittee is strongly urging the student centers, Sodexo and others on campus to move towards these alternatives.

UIC will continue to work with Sodexo, its dining services provider, to purchase and use more locally grown food and free trade coffee on campus. Purchasing locally grown food will reduce the environmental impacts from transportation and support local food vendors.

5.4 Collecting and Converting Vegetable Oil

UIC dining services produce large volumes of vegetable oil every year. Other colleges and universities have demonstrated the feasibility of converting this oil into fuel (i.e. for use in landscaping equipment or intra-campus transportation vehicles). Apart from the apparent positive environmental impact from such a program, it would also provide an excellent opportunity for student participation and research. As mentioned the transportation section, this summer an intern from the Illinois Environmental Protection Agency has conducted a pilot study that lays the foundation for an on-going vegetable oil recycling program. The Transportation Department plans to utilize biodiesel from food service vegetable oil waste produced at the Environmental Health and Safety facility. The anticipated production is about 90 gallons a week.

Figure 20: Biodiesel Laboratory

Photo courtesy of Britt Mork

5.5 Develop a User-friendly Property Management System

Currently, there is a system for departmental transfers of surplus equipment and furniture. Informally, departments may advertise via the faculty/staff listservs or other methods indicating which equipment or furniture is available for a transfer. UIC also has a warehouse for surplus. Departments submit a requisition to have the extra furniture and equipment removed and stored at the warehouse, which then becomes available to other units. Departments may visit the warehouse to see what furniture and equipment is available, submit the appropriate paperwork with the Office of Business and Financial Services (OBFS) and a delivery is scheduled to bring the furniture and equipment to the department.

The OBFS Property Accounting department is currently developing a web-based system to facilitate transfers between departments and requisitions from the surplus warehouse. In the interim, the Office of Sustainability will work with the surplus warehouse to increase the visibility of its inventory to the campus.

5.6 Expand the Waste Minimization Program

Hazardous waste is generated across campus from a variety of sources. To reduce the amount of waste, UIC will expand its hazardous waste minimization program. This program will include procedures and activities that span the lifetime of products, from education and training for personnel involved in purchasing of hazardous chemicals, to procedures for separating hazardous waste from municipal waste to reduce the economic and environmental impact from disposal.

The Environmental Health and Safety Office is in the process of implementing a solvent recycling program on campus. Laboratories will be able to distill solvents to a grade pure enough for reuse. By reusing the solvents, there will be cost savings from reduced new solvent purchases and reduced hazardous waste disposal costs will be realized. Further, there will be reduced emissions from transportation of the virgin and waste materials since they will form a closed loop on campus.

Figure 21: Environmental Health and Safety Office – Still

Photo courtesy of Britt Mork

Currently, the Environmental Health and Safety Office administers a chemical redistribution program. This program takes unused chemicals in good condition from laboratories that no longer have a use for them and make them available to other laboratory personnel. This program also realizes cost savings and reduced emissions by reducing the amount of materials disposed of and purchased.

Furthermore, the waste minimization program will also evaluate recycling efforts specifically related to the laboratory environment, such as switching to sustainable and/or recyclable disposable plastic tools and containers. The Office of Sustainability will continue to collaborate with the Environmental Health and Safety Office to promote redistribution of chemicals and used laboratory equipment. Laboratory researchers are encouraged to implement waste minimization within their laboratory procedures.

5.7 Construction Debris

The of Illinois 2009 Annual Report states that sustainability is a top priority for the University and that "Future new construction, remodeling and renovation projects of $5 million or greater will be LEED® Silver certified. Projects under $5 million are expected to comply with LEED© silver as much as possible." Goals for the LEED© certification process include diverting construction, demolition, and packaging debris from landfill disposal.

The ways to achieve points in this category include recycling of construction waste and reusing materials in renovation or new construction projects. In addition, the City of Chicago's Construction or Demolition Site Waste Recycling Ordinance mandates that at least 50% of construction and demolition debris be diverted from landfill. If we choose to comply with the city ordinance, UIC needs accurate measurements from the waste haulers currently contracted by UIC. Facilities Management, the Office of Capital Programs, and the Office of Business and Finance should develop procedures and language in its contracting with outside haulers to ensure compliance with the city ordinance and to track the recycling weights and rates.

5.8 Purchasing Policies

UIC should adopt and define "sustainable purchasing," which is the process by which organizations buy goods and services taking into account not only the economic value for money (price, quality, availability, functionality) but also the environmental, social, and ethical impacts of these goods and services - at local, regional, and global levels.

UIC should place an emphasis or preference on environmentally preferable products, products that have a lesser or reduced effect on human health and the environment. The Office of Sustainability will work with the Purchasing Office to develop a resource or database of green products and/or a list of environment-friendly vendors, cross-referencing them with Minority and Female Business Enterprise Program (MAFBE) suppliers.

UIC may want to consider establishing guidelines, such as purchasing at minimum 30% post-consumer recycled content paper or the use of Forest Stewardship Council (FSC)-certified paper for printed publications.

For electronic equipment, such as computers, printers, fax machines and copies, department should follow Electronic Products Environmental Assessment Tool (EPEAT) requirements, which include energy conservation, labeling, materials selection and packing considerations. Departments should participate

in toner recycling programs and implement recycle packing requirements that reduce waste. When purchasing appliances, UIC should purchase ENERGY STAR or Green Seal-certified equipment.

Request for proposals should have in the specifications a clause about how the company is committed to or supports the environment or other sustainable initiatives. For relevant products and services, sustainability should be a criterion in the evaluation of proposals.

Purchasing has many areas of opportunity through policies, procurement and guidelines, to focus on reduction, reuse and recycling, which would decrease UIC's carbon footprint.

Summary

While solid waste accounts for the least amount of UIC's GHG emissions, recycling is the most visible and tangible outreach effort in sustainability. Many of these mitigation strategies require campus-wide change, collaboration, design and implementation to make an impact. However, once implemented, all faculty, staff and students will benefit and the goal of zero waste is possible.

Strategy 6.0 Employment Strategies

Most of the previous strategies are actions that have a direct relationship with generation of GHG emissions: energy, transportation, grounds and recycling and waste management. There are employment-related changes that have potential to reduce GHG emissions (Scope 3 emissions). UIC is the 15th largest employer in Chicago with more than 14,000 employees.

Fortunately, many efforts to reduce GHG emissions can also promote a positive work environment and enhance UIC's efforts to remain a destination employer for all. Some of these strategies may not be applicable to offices providing patient care, laboratory and research work or front-line customer service. For those offices that do have flexibility, alternative employment strategies may be considered.

6.1 Telecommuting

Telecommuting is an arrangement where the employee has the flexibility to work from a location other than the office, most often from home, where commuting to work is replaced with telecommunication or electronic communication. Reducing employee travel reduces GHG emissions. Units and departments may consider having eligible employees telecommute one day a week. With laptops, technology and Wi-Fi, telecommuting is a viable option and may attract and retain women and men with familial obligations (such as small children or aging parents) while increasing productivity. It is recommended that a campus-wide policy be developed on telecommuting.

6.2 Flextime

Flextime is a variable work schedule that differs from the standard work day hours. Flextime may help working parents tend to day care drop-off and pick-ups and allow workers to commute during non-rush hours. Alternatively, flextime may allow employees the opportunity to take non-rush hour public transportation. Flextime may allow employees to work 10 hour days and have one day off each week, thereby potentially reducing commuting GHG emissions.

6.3 Childcare Center

UIC is fortunate to have the UIC Children's Center with two locations on campus, which provides full-day early childhood education to 90-95 preschool-aged children of faculty, students and staff. By having childcare on campus, in addition to recruiting and retaining faculty and staff, it reduces GHG emissions as faculty and staff only have to make one trip for work and day care.

The age range for the children at the UIC Children's Center is two years and nine months to six years old. There is no infant care on campus. There has been considerable discussion about the possibility of infant care on campus and a study was conducted by Bright Horizons, Inc. in 2006 and updated in 2008. There is an interest for infant care on campus; however, the cost of establishing a facility in the short-term is not a practical option. The Care Committee Report has suggested immediate, no cost actions as well as long-term goals for UIC to continue to investigate the possibility having of infant care on campus.

Summary

These are just suggestions for departments to consider, if feasible, which may reduce an employee's carbon footprint commuting to and from campus. Each department is unique in its operations and units are encouraged to think of other strategies that they may implement, which may have the potential to reduce GHG emissions.

Education, Research, and Public Engagement

Education

UIC strives to be a responsible steward of the environment, through its operations, academics and research. Consistent with UIC's mission to address the challenges and opportunities not only facing Chicago but all Great Cities and to foster scholarship and practices that reflect and respond to the increasing diversity of the U.S. in a rapidly globalizing world, UIC needs to provide an educational opportunity for its students in sustainability.

Students need to be environmentally literate, know what their carbon footprint is, how their actions and behaviors contribute to climate change and know how to implement mitigation strategies in their own lives. Green jobs and technology are emerging and students need to be trained in those disciplines and technologies to compete and excel in today's society.

UIC should focus its efforts on education in the following areas: content of learning, context of learning and the process of education. These recommendations are from AASHE and should be adopted at UIC.

Content of Learning

What do we want the students to learn? The content of learning should reflect interdisciplinary thinking. There is no degree or concentration in sustainability at UIC; some faculty argue that sustainability is a way of thinking not a major. Undergraduate students may choose to major in earth and environmental sciences, environmental engineering, economics or urban planning and policy – all important concepts to learn to be educated in sustainability. However, there needs to be some formal curriculum in this area.

The Institute for Environmental Science and Policy is conducting an academic and research survey to see what classes are currently offered by departments that are sustainability-focused or related and what current research is being conducted. Once the list of classes is completed, it will be posted on the Office of Sustainability's website and faculty research will be updated and posted on the Institute for Environmental Science and Policy's website. UIC needs to get an accurate assessment of what is currently available for students before making curricula recommendations.

There is an excellent set of content recommendations for sustainability education in the *Report*, a 1995 document presented to President Bill Clinton's Council on Sustainable Development. In that report, education leaders recommended teaching and learning experiences that enable students to understand:

- How the natural world works.
- The interdependence of humans and the environment.
- How to assess the effects on humans and on the biosphere of human population dynamics; energy extraction, production and use; and other human activities such as agriculture, manufacturing, transportation, building and recreation.
- The relationship of population, consumption, culture, social equity and the environment.
- How to apply principles of sustainable development in the context of their professional activities
- Technical, design, scientific and institutional strategies and techniques that foster sustainable development, promote energy and natural resource efficiency and conservation, prevent and control the generation of pollution and waste, remediate environmental problems, and preserve biological diversity.
- Social, cultural, legal and governmental frameworks for guiding environmental management and sustainable development.

The list of outcomes, which could add to knowledge and understanding about global climate change include:

- The causes and consequences of climate change.
- Its severity and urgency.
- The key role played by energy policy and practice.
- Behavioral, technological, policy and political solutions.
- The role of institutions, businesses, governments, citizen and professional organizations, and individuals to address this problem.
- Personal empowerment to become a change agent.

Context of Learning

Every moment is a teaching moment. There are a variety of ways to incorporate sustainability and climate change into the context of learning, from curricula to co-curricular activities. Opportunities include:

- Freshmen orientation.
- Requiring students to take courses introducing these concepts.
- Providing elective courses on these concepts to all students.
- Integrating these concepts into existing courses.
- Offering existing courses to more students.
- Creating new multidisciplinary and interdisciplinary courses.
- New programs, institutes, and colleges.
- Integration across the curriculum.
- Themed semesters.

Process of Education

Just as there are a variety of ways to provide a context of learning, there are different ways to process the education, emphasizing the active, experiential and inquiry-based learning and real-world problem solving to issues and challenges facing our local and global communities. Other pedagogical methods include student-based research projects and partnerships with local nonprofits and the community.

These are some specific ideas that AASHE proposed to help “green” academics:

- Establish a sustainability graduation requirement.

- Include students and faculty on design committees for new buildings (or research projects intended to look at alternatives to new construction).
- Have students or classes help conduct UIC's greenhouse gas inventory or campus environmental audit.
- Develop student-faculty-facilities teams to research "deep efficiency" for existing buildings and renewable energy applications on campus.
- Invite students and faculty to join and fully participate in campus sustainability committees, such as UIC's Committee on Sustainability and Energy.
- Participate in national climate change awareness raising and action initiatives like "Focus the Nation" and the "National Teach-In on Global Warming."
- Encourage and empower student environmental activism and clubs, such as UIC's seven student organizations with sustainability in its purpose or mission.
- Organize an annual campus climate summit.
- Invite nationally renowned expert speakers on climate change and sustainability to campus.
- Create Student Life residential environmental education initiatives.

In order to provide students with the educational tools and to create change, these key factors need to be in place:

- Broad administration support (e.g., integral to mission, rewards/incentives for faculty, putting someone in charge of coordination) for this intellectual direction.
- Broad involvement of faculty across the arts, sciences, humanities, social sciences, engineering and graduate professional schools.
- Involvement of key staff members, e.g. facilities staff who can provide "campus as learning lab" experiences for students.
- Faculty and staff development workshops.
- Strong connection of formal education to practice of sustainability on the campus and with local and regional communities.
- Strong student support and involvement and encouragement for student-based initiatives.
- Ongoing attention, measurement of progress and re-adjustment.

Research

UIC is one of the nation's major research institutions with a total of $331.5 million in annual research expenditures and an annual operating budget of $1.75 billion. In FY07, according to the National Science Foundation, the campus ranked 49th in the nation in federal research expenditures. While, almost 80% of UIC's research funding has been from the National Institute of Health the past five years, there has been a focus of interdisciplinary research at UIC.

This past year, the Institute for Environmental Science and Policy held a series of roundtable discussions to address the current status of interdisciplinary research at UIC. The barriers and obstacles to interdisciplinary research are real and need to be addressed. Sustainability research requires collaboration among faculty in different disciplines and the ability to collaborate with ease. Incentives would help stimulate this field of interdisciplinary research at UIC.

The Institute for Environmental Science and Policy and the Office of the Vice Chancellor for Research, Research Development Services sponsored the first roundtable focused on interdisciplinary research. The intent is to have researchers in a variety of fields, come together to share ideas and develop possible collaborations. After the course and research survey is completed, UIC hopes to have a better

idea of environmental research being conducted on campus and have the sustainability roundtable meet each semester.

AASHE has some suggestions for advancing sustainability research at institutions that UIC may want to consider:

- Identify climate change research as a major institutional priority.
- Create new major research initiatives in the area of climate change and sustainability.
- Make a priority commitment to hire new faculty with expertise and interest in climate change and sustainability; the Institute for Environmental Science and Policy has six joint appointments in four colleges on campus.
- Establish fellowships or other financial support mechanisms for research related to climate change and sustainability; the Institute for Environmental Science and Policy offers fellow programs and seed money for faculty doing interdisciplinary sustainability research.
- Provide climate change and sustainability oriented research opportunities for students.
- Connect research initiatives to the challenges faced in the operations components of the climate action plan, such as the development of renewable energy technologies and local sources of biofuels, carbon neutral engine technologies for autos and aircraft, hyper-efficient building systems to make GHG-neutral, net-energy producing buildings the norm rather than a rare exception, etc.
- Celebrate, reward, and publicize research on climate change and sustainability.

Public Engagement

Community engagement is a high priority of UIC, especially given its Great Cities Commitment and mission. UIC has a responsibility and unique opportunity to contribute to the well-being of urban life. There are many opportunities for faculty, students and staff to collaborate with other institutions and the community in the area of sustainability, which AASHE recommends:

- Create a collaborative of local and regional colleges and universities working together to encourage, help and support each other achieve GHG emissions reduction goals. The sustainability coordinators have formed such a coalition; the statewide public university coordinators meet quarterly to share ideas. In the Chicago area, UIC is supporting an initiative to bring college sustainability coordinators together. The Active Transportation Alliance – Intern program is a similar collaboration with Chicago area universities, in which UIC is a participant.
- Initiate service-learning and community service activities for students related to climate change and sustainability; the Office of Sustainability is looking at the possibility of partnering with Student Leadership Development and Volunteer Services to participate in the Co-Curricular Transcript Program and UIC Experience.
- Encourage faculty to participate in public service activities that assist local governments, community organizations, businesses, and institutions to reduce GHG emissions and address climate change – and reward those activities when considering promotions or tenure.
- Convene an annual regional climate change summit.
- Develop town-gown community climate partnerships or initiatives to mobilize community leaders and use campus intellectual, financial and leadership resources to move the surrounding community to address greenhouse gas emissions and sustainability.
- Engage in the public policy process to lobby for policies at all levels of government that will make it easier for campuses to achieve their climate goals since deep cuts in GHG emissions will not be possible on or off campus unless there are broader societal shifts.

- Develop programs to assist students, faculty and staff to upgrade their own residences through improved energy efficiency and better utilization of solar energy to reduce greenhouse gas emissions.
- Create a regional clean energy demonstration and resource center to inspire, educate, and assist members of the wider community to use conservation, efficiency, and solar energy to improve energy affordability and comfort while reducing greenhouse gas emissions; UIC's Energy Resources Center currently offers many of these services.
- While avoiding green-washing and exaggeration, widely publicize campus climate protection activities and success stories to motivate other community actors to get involved addressing climate change

Summary

Education, research and public engagement are crucial to the success and implementation of the UIC CAP. The mitigation strategies reduce UIC's GHG emissions. The educational aspects ensure that our students become responsible stewards of the environment, interdisciplinary research focuses on solutions, our staff work in a place that promotes a positive culture and environment and our community becomes engaged.

Implementation Structure

The Office of Sustainability will oversee the implementation of the UIC CAP and help facilitate discussions and coordination between the departments involved in the mitigation strategies.

The vice chancellor for administrative services and associate chancellor for sustainability will work with the provost to report and implement energy mitigation strategies. The Chancellor's Committee on Sustainability and Energy will continue to monitor UIC's progress towards goals and actions and assisting with the preparation of reports for the campus climate commitments. The Steering Committee for the CCSE is comprised of the Chancellor and Vice Chancellors and this group may ensure timely completion and implementation of mitigation strategies. The UIC CAP should be reviewed on an annual basis, with the reports due by end of each academic year (August).

Barriers and Solutions

There are many barriers to the implementation of the UIC CAP. The growth of the campus will mean a growth in building. New buildings need to be at least LEED® Silver Certified or better as UIC as the new buildings ultimately have to be carbon neutral so they do not contribute to an increase in emissions.

The growth of the campus also means a growth in information technology (IT) and plug demand. IT issues must be examined for energy efficiency and conservation as well.

There are union barriers to outsourcing services, which may provide more sustainable services. However, if UIC views preserving campus jobs as a goal vs. more sustainable alternatives from the outside, this should be explicit.

One huge barrier is the inability to allocate savings from mitigation strategies, particularly energy, to the unit level even with improved metering as (1) there is not an ability to track at the unit level and (2) it is hard to estimate what smaller savings at the building or department level will mean at the cogeneration plant level.

There are limited renewable options in the urban environment. Geothermal is limited by space. Wind is not a good urban source with today's technology and solar has limited effectiveness in Chicago's climate. However, UIC does have a lot of flat roof and parking lots that could utilize PV panels for renewable power.

Costs and Financing

After a number of years without a capital bill in Illinois for buildings, a bill was approved in FY10. To the extent appropriate and feasible, funds should be prioritized for projects that will result in energy savings. Additional funds have been made available through the American Recovery and Reinvestment Act. UIC will fund other strategies in the UIC CAP with departmental budget requests and grants from federal and state government, foundations or business partners such as Illinois Department of Commerce and Economic Opportunity, Illinois Clean Energy Foundation, Illinois Environmental Protection Agency, the US Environmental Protection Agency, Chicago Department of Transportation and the Congestion Mitigation and Air Quality Program. If UIC engages with an energy performance contractor, those mitigation strategies may be self-financed by the contracts.

UIC needs to expand its financial philosophy; universities by nature are not risk-taking institutions. Change is slow and many of the mitigation strategies, particularly energy, have a financial payback. These strategies, while not the low hanging fruit should be considered to implement first and the savings may be used for other improvements on campus.

The Office of Sustainability does have a foundation account, "Campus Sustainability Fund" but many universities are establishing a revolving funds account that is replenished by the savings generated by conservation measures and annual budget allocations. The students at the University of Illinois at Urbana-Champaign have established a sustainability fee to be used for projects on campus and there is some discussion among students at UIC to have a similar fee at the Chicago campus.

Tracking Progress

The Office of Sustainability has the responsibility of tracking the progress and data of the CAP, conducting UIC's greenhouse gas inventory and administering the annual campus commuter survey. This requires the assistance of many departments on campus; the Office of Sustainability will provide the coordination for this data collection. The Chancellor's Committee on Sustainability and Energy will provide oversight and monitor UIC's progress towards the plan and make recommendations to the Chancellor, when appropriate.

The Office of Sustainability will have an annual summit or half-day conference to present to the campus the progress it has made on sustainability initiatives.

Communications Strategy

The UIC CAP will be approved and submitted to the ACUPCC in September 2009. The next step is to communicate the plan and more specifically, the behavior changes needed by UIC faculty, students and staff to ensure the implementation and success of the CAP.

Keeping with the theme of using the campus as a laboratory, the Office of Sustainability will seek input from the department of psychology and other faculty who conduct research in behavioral change to see what are the most effective strategies, words and communications that induce change.

The communications strategy involved many concepts in social marketing and networking. Facebook, Twitter, YouTube, MySpace, blogs and other social networking tools need to be utilized as part of the communications strategy.

Summary

While the Office of Sustainability will oversee the implementation of the UIC CAP, it will require the collaboration and cooperative efforts of many departments, units, faculty, student and staff. The successful implementation requires establishing a baseline, monitoring progress, reporting on the progress and holding all of the UIC community accountable for its actions and contributions to reducing GHG emissions.

Conclusion

The UIC CAP provides the framework to implement strategies and actions to achieve carbon neutrality. UIC's goals to reduce GHG emissions by 40% in 2030 and by at least 80% by 2050 from 2004 levels are bold and achievable. To obtain carbon neutrality (100% emissions reductions), most likely carbon offsets will need to be considered. However, with the evolving technology and changing regulatory horizon, the need for offsets may be eliminated or reduced. The most desirable strategies for reducing emissions and becoming carbon neutral have been described in this plan.

There will be barriers to implementation, including cost and financing but with new technology, increased efficiencies and a commitment by the campus, UIC may become a leader among large, public urban research institutions in sustainability.