**2015 Illinois Climate Action Plan**

*Climate Action Plan for the University of Illinois at Urbana-Champaign*

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# Executive Summary

# Chapter 1. Introduction

## History

As we approach the sesquicentennial of our campus, we are reminded that we are stewards of the university’s future. We have clearly thrived over the past 150 years, but we cannot take for granted that the next 150 years will be smooth sailing. One linchpin of our future success is that our campus operations must be environmentally sustainable; that is to say we must be able to sustain them indefinitely (or at least another 150 years) without substantial degradation of the environment we depend on.

Clearly the biggest challenge to our campus sustainability is the climate change that is caused by our emission of greenhouse gases such as CO2. The mounting evidence of the profound impacts of climate change prompted our campus in 2008 to join many of our peers in the American College and University Presidents’ Climate Commitment, formally committing to become carbon neutral as soon as possible, and no later than 2050. It should be emphasized that climate change is by no means the only threat to our sustainability; other very important concerns include water use, decreasing biodiversity, and a declining resource base.

In 2010, our campus developed the Illinois Climate Action Plan (iCAP) in order to make the first inventory of our greenhouse gas emissions and to present a roadmap to a sustainable future. Since 2010 we have made remarkable progress on many fronts, especially in the areas of energy and water conservation, as detailed in this document.

In late 2011, Chancellor Wise commenced the Visioning Future Excellence initiative, a collaborative and comprehensive process that gathered input from over 3000 individuals in order to identify the areas in which the university can best contribute to society’s most pressing needs. One of the major themes that emerged from this process was “Energy and Environment.” In the outcomes report, released in mid-2013, the creation of the Institute for Sustainability, Energy, and Environment (iSEE) was listed as the first new strategic initiative.

The founding Director of iSEE, Prof. Evan DeLucia, was recruited in September 2013, and the Institute was formally created in December 2013, following approval from the Academic Senate, the Board of Trustees, and the Illinois Board of Higher Education. Associate Directors for Campus Sustainability (Prof. Ben McCall) and for Education and Outreach (Prof. Madhu Khanna) were brought on board shortly thereafter.

## Sustainability Process

One of iSEE’s first major steps was to spearhead the creation of a process for developing and implementing policies and initiatives in the area of campus sustainability. This process was prepared in collaboration with Facilities & Services, the Office of the Vice Chancellor for Research, and the Office of the Provost, and was approved by the Chancellor in June 2014.

The heart of this process is a set of six topical Sustainability Working Advisory Teams (SWATeams), each of which consists of two faculty, two staff members, and two students, and is surrounded by a Consultation Group of experts and stakeholders from the campus community. These SWATeams have been charged with proposing new sustainability procedures and initiatives. Recommendations from the SWATeams are transmitted to a newly-constituted iCAP Working Group, which consists of mid-level administrators as well as faculty and student representatives. The iCAP Working Group is charged with evaluating SWATeam recommendations, transmitting those with small or medium budgetary or policy impact to the appropriate campus units, and transmitting high impact recommendations to the Sustainability Council. The Council is chaired by the Chancellor and contains the highest level decision-makers on our campus, as well as faculty and student representatives. Appendix 1 lists the membership of the SWATeams, iCAP Working Group, and Sustainability Council at the time of this writing.

The present revision to the iCAP has been developed with a similar process. The SWATeams prepared recommendations and shared them with the campus community at the iCAP Forum in October 2014. They then provided drafts of the six topical chapters, which the iCAP Working Group synthesized into a complete draft climate action plan. That draft was in turn edited by the SWATeams, and again reviewed by the iCAP Working Group. The resulting version was then shared with the entire campus for a month-long public comment period in February 2015, and a revised version was approved by the Sustainability Council in March 2015, and signed by the Chancellor in April 2015.

Chapter 2 of this document presents an overview of our greenhouse gas emissions trajectory, and outlines many of the steps that can be taken to achieve carbon neutrality. Chapters 3 through 8 present the detailed goals, objectives, and potential strategies for the six topical areas covered by the SWATeams. Chapter 9 discusses current and future strategies for financing the sustainability initiatives described in Chapters 3 through 8. Chapters 10 and 11 discuss our efforts to integrate sustainability into the education our students receive inside, and outside, the classroom, respectively. Chapter 12 discusses the span of sustainability research on our campus, and describes the initiatives currently being undertaken by iSEE to spawn new interdisciplinary research themes. Chapter 13 offers concluding remarks, and suggests ways that members of the campus community can get involved.

With the approval of this 2015 version of the Illinois Climate Action Plan, we make an enhanced commitment to environmental sustainability and proudly recognize the leadership role we play in paving a way toward a sustainable future. The developments of the past five years in climate science, and the fact that we are already experiencing the troubling effects of climate change, provide a new sense of urgency for tackling the climate challenge. As a result, we have decided to accelerate our efforts and commit to carbon neutrality by 2035. When the children of the men and women of the Class of 2015 head to our campus for their freshman year, they will be attending a sustainable and carbon neutral campus that is poised for another 150 years of excellence.

# Chapter 2. Overall status report

## GHG inventory update

The first figure shows an updated version of the “wedge diagram” from the 2010 iCAP (Figure 6, page 40). Aside from a change in labeling, the major difference is the addition of the black dots, which show the actual campus emissions since the diagram was constructed. It is interesting to note that as of FY14 our annual emissions are over 200,000 tons lower than the anticipated business-as-usual trajectory (top curve), but also almost 70,000 tons lower than hoped for at the time the 2010 iCAP was constructed.



1 Figure xx Projected emissions

Greenhouse gas emissions are generally categorized into three “scopes.” Scope 1 consists of emissions resulting from on-campus activities that we have direct control over, and includes combustion at Abbott Power Plant, fleet emissions, and agricultural emissions. Scope 2 consists of emissions resulting from purchased electricity, which we have a moderate degree of control over. For example, we could reduce Scope 2 emissions by entering into Power Purchase Agreements with low-carbon energy sources such as wind farms, biomass power plants, or nuclear power plants. Scope 3 consists of other emissions that occur off campus but as a result of campus activities; these include commuting, air travel, solid waste, and the effects of purchasing goods and services.

The preparation of this revision to the iCAP has revealed that most of our Scope 1 and 2 emissions are well characterized, with the significant exception being agricultural emissions (Chapter 8). Additionally, our Scope 3 emissions, especially those in the arena of transportation and purchasing/waste, need to be better quantified. Since 2008, our campus has been estimating its emissions using the Clean Air Cool Planet calculator, which has been an industry standard for academic institutions. As a result of the uncertainties in our Scope 3 emissions, we focus our discussion in this chapter on Scope 1 and 2 emissions.

## Potential Mitigation Strategies

The central vision of our future is to completely eliminate all Scope 1 and 2 emissions by 2050. As of the metrics available for FY14, about 61% of our Scope 1 and 2 emissions are from Abbott Power Plant, 36% of them are from purchased electricity, and the remainder are from fleet and agricultural emissions. Eliminating emissions from Abbott and purchased electricity will require a combination of reducing our energy demands through conservation and shifting our energy generation/purchasing away from fossil fuels.

In terms of energy conservation, we envision cutting our current energy demand at least in half by FY50. This will require:

* Putting a firm cap on the gross square footage of our campus to prevent growth in energy demands.
* Improving our building standards such that new buildings (when replacing old ones) and major renovations will lead to a decrease in energy use.
* Upgrading existing building systems to reduce energy use, especially when rooms are unoccupied.
* Encouraging and incentivizing significant behavior change and energy-conscious decision-making across campus.

In terms of energy generation and purchasing, we envision gradually shifting to renewable and carbon-free energy sources, and completely eliminating the use of fossil fuels by FY50. As discussed in Chapter 4, it is not yet clear exactly how this is best accomplished, but some key elements are likely to include:

1. Entering into Power Purchase Agreements with suppliers of non-fossil fuel electricity, such as wind farms, biomass gasification plants, or nuclear power plants.
2. Installing considerable photovoltaic generation capacity on our campus.
3. Fully or partially electrifying our heating systems, ideally using high-efficiency heat pumps, so that a significant fraction of our heating needs can be met by non-fossil-fuel electricity rather than by combustion of fossil fuels such as coal and natural gas.
4. Developing biomass combustion on our campus to provide for the balance of our heating needs.

The other two contributions to our Scope 1 emissions should be easier to eliminate. Emissions from our fleet vehicles could be eliminated by switching the fleet to a fuel source that does not require fossil fuels (options include sustainably-produced biodiesel, compressed natural gas from anaerobic digestion of agricultural wastes, and/or non-fossil-electricity). Agricultural emissions could be eliminated by shifts in practices so that carbon sequestration in the soil exceeds the emissions from fertilizers, livestock, and equipment.

Until the Campus Clean Energy Plan (see Chapter 4) is developed, it is difficult to predict the exact trajectory of our Scope 1 and 2 emissions. However, for the purposes of illustration we outline here one possible scenario for the future. We wish to emphasize that this is not a specific recommendation or a prediction, but rather one vision for how all of the items discussed in this iCAP might come together to achieve carbon neutrality.

## A Possible Scenario for Reaching Carbon Neutrality in Energy

1) Conservation: (Chapter 3)

The imposition of a cap on gross square footage prevents any additional growth in either electricity or heating demands. The improvement of building standards results in a decrease in demand as existing buildings are demolished and replaced by new buildings that are more energy efficient. Intensive conservation efforts, both centralized (e.g., retrocommissioning) and decentralized (e.g., behavior change campaigns), lead to even further reductions. Between these efforts, the campus heating and electricity demands linearly decrease from their current values (~500,000 MWh/year each of electricity and heating) to half those values (250,000 MWh/year each) in 2050.

2) Transition from Fossil Fuels: (Chapter 4)

a) A district geothermal system similar to the one at Ball State University is installed in 2025, and a second phase of equal size added in 2035. Each installation provides 80,000 MWh/year of thermal energy by using 20,000 MWh of electricity (with a coefficient of performance of 4). This system also provides the entirety of our chilled water needs as a by-product. Our resulting electricity demand (direct + geothermal) is 290,000 MWh/year.

b) Three biomass burners are installed at Abbott Power Plant (one each in 2030, 2040, and 2050) to cover the remaining 90,000 MWh of our 2050 heating needs, eliminating the use of fossil fuels to generate heat for our campus. This requires ~20,000 tons of biomass per year, which is less than half of the weight of coal we currently burn, and would require ~2,000 acres of land devoted to Miscanthus production, for example. Emissions from biomass burning are part of a closed loop with limited environmental impact.

c) On-campus photovoltaic generation, which is currently about 50 MWh/year, increases to 8,000 MWh/year in FY16 with the commissioning of the ~20 acre Solar Farm. The campus builds another Solar Farm every five years through 2050, with final generation of 64,000 MWh/year. The impacts of the land use (160 acres, or ¼ section) are minimized by combining agricultural production (partial-shade tolerant crops and/or pasture) with the solar arrays. An aggressive program to install photovoltaics on campus buildings leads to an additional 6,000 MWh/year of production, for a PV total of 70,000 MWh/year.

d) A Power Purchase Agreement with a wind farm supplies 100,000 MWh/year to campus, starting in FY16. The total amount of annual zero-carbon electricity purchased through PPAs increases 20,000 MWh/year in FY20 and every five years thereafter, up to 220,000 MWh/year in FY2045.

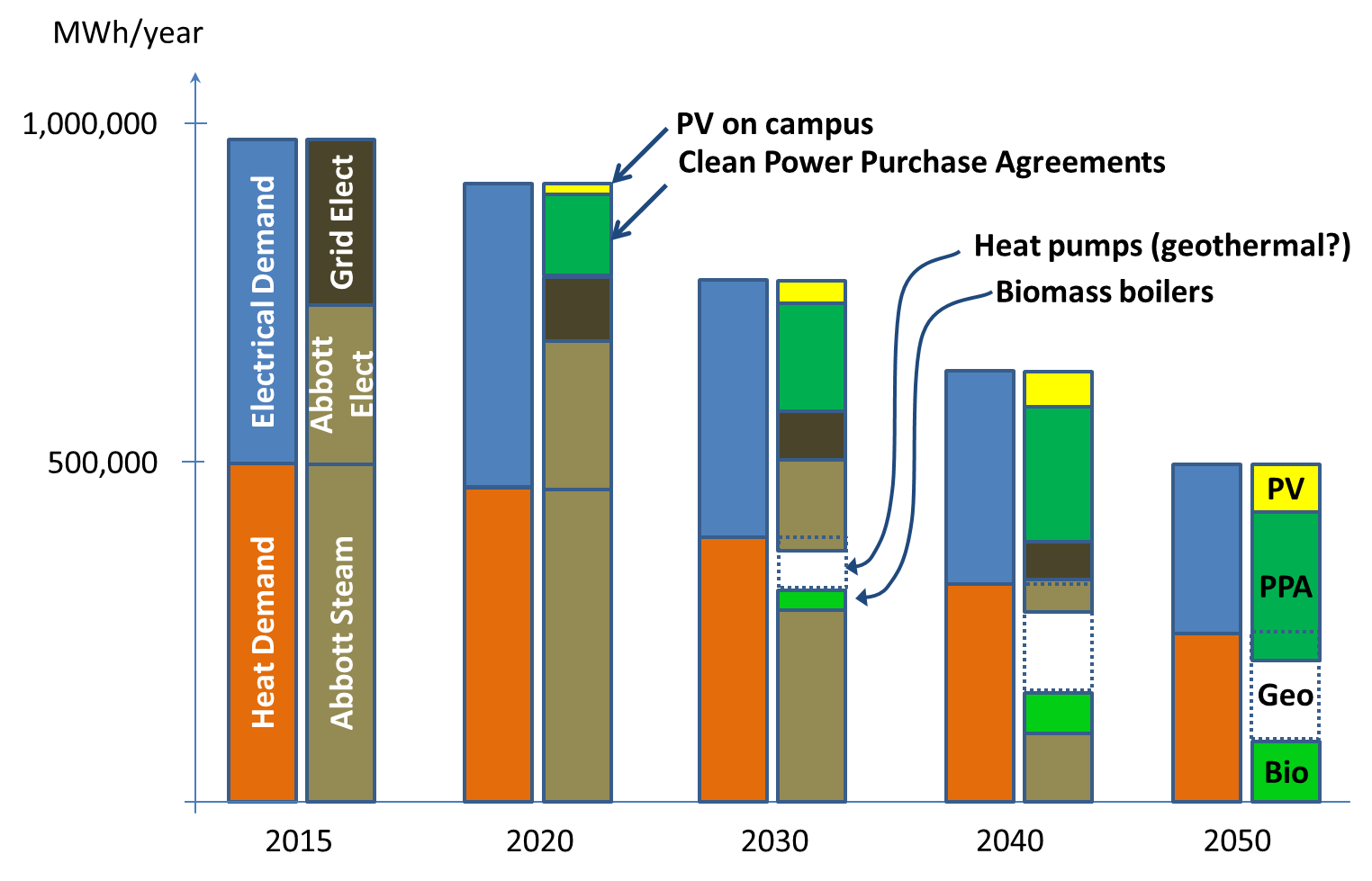
3) Fleet Emissions: (Chapter 5)

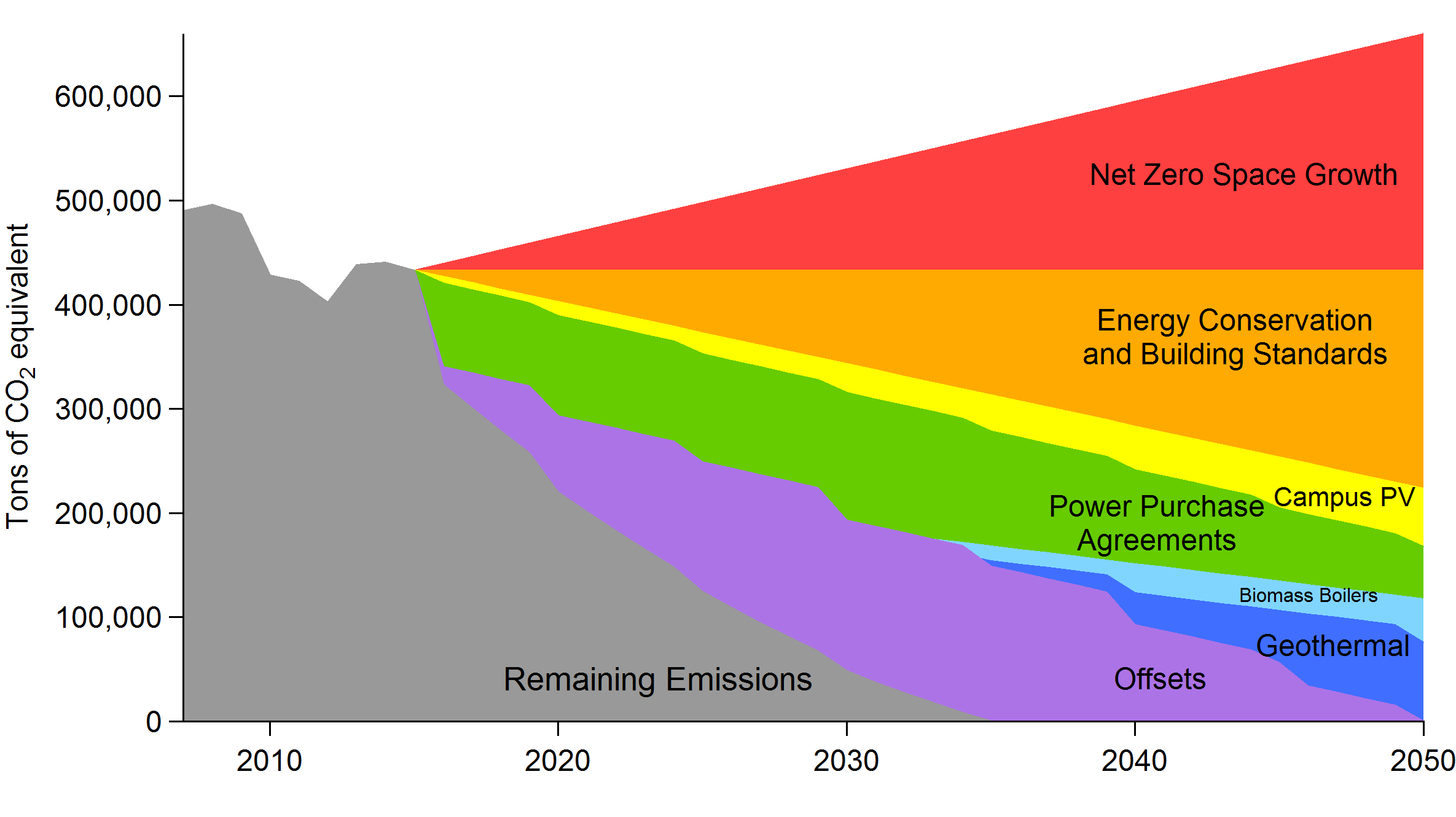
An intensive program is undertaken to completely convert the campus fleet of service and rental vehicles to biodiesel and compressed natural gas from an anaerobic digester, with the result that our fleet emissions are reduced linearly to zero by FY25.

4) Agricultural Emissions: (Chapter 8)

A concerted effort is made to cut agricultural emissions from the South Farms in half by FY20, in half again by FY30, and reduced to zero in FY40, while preserving the excellence of research in crop sciences and animal sciences.

A graphical representation of the resulting shift in energy demand and supply for this scenario is presented below, along with a “wedge diagram” of the resulting Scope 1 and 2 energy-related emissions. We wish to emphasize again that this scenario does not represent a recommendation or a prediction, but is simply to provide a sense of the types of efforts that will be required.





As discussed earlier, Scope 3 emissions are not yet well quantified, and we do not foresee that it will be possible to completely eliminate these emissions. Consequently, we will have to rely on external offsets for these emissions, as described in detail in Chapter 9.

# Chapter 3. Energy Conservation and Building Standards

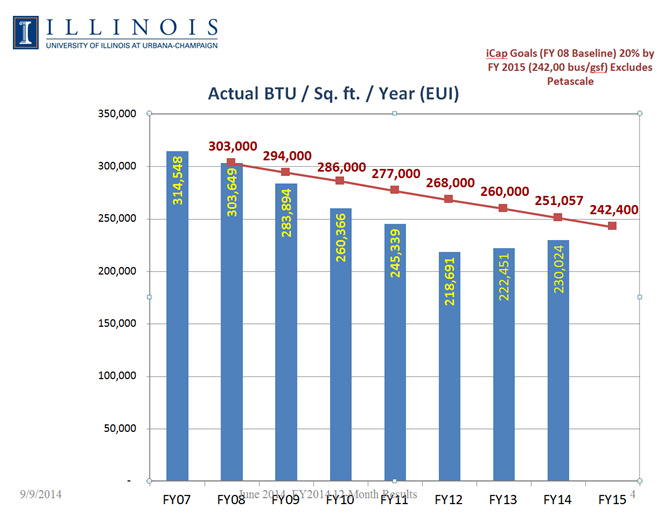
## Introduction



Table xx Distribution of Emission Sources

On this campus, approximately 85 percent of the emissions generated (see Table xx) are a direct result of the energy needed to heat, cool, and provide electricity to campus buildings. Energy Use Intensity (EUI) measures the total energy consumed in a building divided by the building’s gross square feet (GSF). With a current reduction of 23 percent from the FY08 baseline, we are on track to achieve the goal of 40 percent by FY25, as called for in the 2010 iCAP (see Figure xx, below).

This impressive energy conservation result is primarily due to a variety of centrally-funded programs, including: retrocommissioning (RCx), heating ventilation air conditioning (HVAC) improvements, scheduling and control strategies, lighting retrofits, renewed insulation efforts, and new execution methodologies, such as Energy Performance Contracting (EPC).



3 Energy use from fY07 to FY14

While there has been much achieved through these centrally-funded programs, there is a lot more that needs to be done, with both an expansion of the existing programs and a more comprehensive campaign that engages the campus at the college, department, building, and individual levels.

Already, campus has shown that it is capable of successfully tackling the energy demand problem, achieving better than the FY15 goal of 20 percent EUI reduction three years early in FY12. But low-hanging fruit gets picked first, leaving more difficult goals and smaller successes for the future.

## Objectives

The EUI will only reflect a reduction in total energy consumption if the campus gross square footage remains at or below current levels, so the first objective listed here is to prohibit increases in total building square footage. To continue to achieve energy reductions, campus investment in energy conservation will need to increase. Also, behavior change components must be addressed, and individual colleges will need to be engaged and incentivized so that they will seek to buy efficient research equipment, to reduce their individual consumption, and to invest their own funds.

1. Reduce, or at least do not increase, gross square footage from the baseline year of FY10.
2. Engage and incentivize the campus community through a comprehensive energy conservation campaign, with at least 50% of units participating by FY20, and 100% participating by FY25.
3. Strengthen centralized conservation efforts to ensure that Energy Use Intensity is reduced by 40 percent from the FY08 baseline by FY25, 45% by FY30, 50% by FY40, and 55% by FY50.

## Potential Strategies

### 1. Do Not Increase Gross Square Footage

The 2010 iCAP recommended a 'no net increase in space' policy applicable to all space controlled by campus, including auxiliary units and rental space. The proposed Net Zero Growth Space Policy,[[1]](#footnote-1) which has been approved by the Provost’s Non-Instructional Space Task Force, could be formally adopted by the Provost and incorporated into the Campus Administrative Manual before the end of FY15. When buildings are demolished or leases are vacated (post-2010), their gross square footage would be added to a “square footage bank” held by the Provost’s office. The Provost may “retire” this square footage in order to effect a gradual reduction in campus gross square footage, or may make allocations of this square footage to offset individual projects that would otherwise increase gross square footage. Such an allocation from the bank would represent a negative square footage contribution to the project to enable it to result in no increase in gross square footage.

The campus could prevent the need for increases in square footage by judiciously examining existing and new space requirements at a departmental level. Campus could establish a space marketplace that incentivizes no net growth in campus square footage by providing rewards for space reduction and enabling efficient space swaps. Campus could review best practices from other campuses, including programs that require departments and/or colleges to lease space from a centrally managed entity. This strategy would help reduce space requirements to only the amounts that need to be used and/or are funded for their use.

The proposed Net Zero Growth Space Policy would also have the benefit of limiting potential energy expenditure, allocation of resources for construction materials and process, and urban sprawl by limiting new facilities construction.

### 2. Engage the Entire Campus Community

To date, the successes in energy conservation have been accomplished largely through centrally funded programs by facilities staff. Meanwhile, there are myriad opportunities for the 50,000 or more people in the campus community to assist with these conservation efforts. To meet the energy conservation objectives listed above, the entire campus community needs to be informed and engaged. This could be accomplished through a comprehensive energy conservation campaign, engaging colleges, departments, administration, and individuals throughout campus. The EUI for buildings, departments, and colleges could be communicated to campus, individualized reduction goals could be set, and conservation strategies could be identified and prioritized by simple payback period.

The energy conservation campaign could incorporate behavior change incentives, educational programs about energy conservation options, and strong communication about the successes and failures across campus. Many of these components have been started, from the Illini Energy Dashboard to the Energy Conservation Incentive Program (ECIP). However, there are still thousands of people on campus who are unaware of the Climate Commitment and the urgent need to conserve energy. By developing this comprehensive energy conservation campaign in a highly visible and engaging way, we can begin to see major changes in behavior of the campus community.

#### Revise the Illini Energy Dashboard project

The Illini Energy Dashboard project, which connects real-time energy meters for buildings to an open-access internet site, went live in December 2011. There are now 41 buildings with meters displaying real-time energy utilization energy usage for electricity, steam, and/or chilled water. Historical information and comparative usage by building is also available on the website. This real-time energy information could be integrated into electronic building displays throughout campus, so the building occupants are aware of the energy usage in their space and how that utilization compares with an average day and other campus facilities.

The direct costs associated with this expansion include the cost to install real-time meters, the staff time to connect the meter to the dashboard, and the building-level costs for displaying the information within the buildings. Additional costs would include a revision to the website display, which has been suggested by a team of students from the College of Business. Campus could create a major revision to the Illini Energy website to increase student understanding and engagement, using the following student vision statement:

“Illini Energy will be an information hub, bridging the gap between all sustainability efforts at UIUC. As a user, I can quickly view all of the progress that is being made to make this campus more energy efficient, and also view individual action items to do my part in shrinking our carbon footprint.”[[2]](#footnote-2)

#### Expand the Energy Conservation Incentive Program

Much like the direction those students recommend for the Illini Energy Dashboard, F&S is working toward a broader impact for the ECIP awards. Launched in FY13, the ECIP awards share the savings from energy conservation in buildings with the building occupants. This program includes the Energy Advancement Category for rewarding building occupants who helped contribute to energy conservation through participating in some of the centrally managed conservation efforts, such as retrocommissioning. ECIP also includes the Occupant Action Category for rewarding building occupants who achieved energy reductions through the personal actions of building occupants and through department funded conservation projects.

F&S will continue to promote energy conservation under the ECIP program, through a consistent annual communication program, in cooperation with iSEE. The existing program includes an annual announcement of the eight winning buildings during Campus Sustainability Day in October, building specific presentations to deliver the award plaque and alert the building occupants during spring, and facility upgrade projects using the incentive funding awarded during the spring and summer. The expansion envisioned for this program is to create a consistent messaging campaign about energy conservation for campus, using the ECIP as the base message. This includes educational materials about how various user groups on campus can reduce energy demand, a consistent messaging system throughout the year, and updates to previously established energy reports and messages to reflect ECIP. To summarize annual progress in this area, campus could produce an annual report on the overall energy conservation program.

#### Consider Decentralized Energy Billing

While the ECIP program awards building occupants with a share of the energy cost avoidance for the top performers, it does not put the burden of annual energy costs (or the direct benefit of reducing annual energy costs) on the college or departmental budget. Compelling arguments have been offered that decentralizing the energy costs across campus, to college or departmental budgets, would help incentivize behavioral change through budgetary responsibility. There are many additional considerations that need to be addressed in order to fully understand the anticipated impact of such a shift in the budgetary system for campus facilities. One challenge is to understand how the overall maintenance funding for campus would be handled if energy costs are born by individual units, but maintenance priorities are set by campus. Before the campus moves to implement decentralized billing, a thorough evaluation of the expected energy savings and financial expectations needs to be completed. The first step could be a study of the pros and cons of implementing decentralized energy billing, by a task force comprised of academics, engineers, and students, to determine whether and how decentralized billing should be implemented on our campus.

#### Support Peer-to-Peer Competitions

Whether or not the campus moves to decentralized energy billing, the need to engage the entire campus community remains a high priority for attaining the major reductions in energy demand that our campus needs. Peer-to-peer competition can be a highly effective approach to realizing behavior change. Success by one group can encourage another to strive to match or do better. This idea is especially true in an institution with highly competitive students, faculty, and administrators, such as the University of Illinois. We are utilizing this concept through existing programs, such as the ECIP and the Certified Green Office program, but we need to do more. By notifying the campus community of conservation successes and failures, including those of other universities, the campus can increase awareness and competition both on and off campus. The campus could increase awareness of the existing conservation competitions, from Eco-Olympics to Green Your Crib, and augment efforts to spread awareness around this issue. Additionally, new competitions will be formed, with leaders in various roles throughout campus. For example, a competition about reducing research lab energy demand (primarily associated with fume hood requirements) could be developed and communicated by the campus administration. Likewise, a competition for reducing energy demand by departments could be developed and communicated by the participating colleges.

#### Designate Building Energy Maintenance Staff

As part of the overall engagement campaign, individuals within colleges and/or departments could be tasked with the responsibility for energy maintenance for a group of buildings, in support of achieving and maintaining the EUI reductions. These people could be responsible for keeping an eye on the buildings from an energy management perspective. This type of paradigm shift for building management is important for realizing and sustaining energy conservation reductions.

### 3. Reduce Energy Use Intensity

In addition to engaging the whole campus community in energy conservation, we need to expand the centrally funded programs, primarily with additional staff and money. The following strategies could be pursued in order to achieve additional energy reductions.

#### Expand the use of Energy Performance Contracting

An Energy Performance Contract (EPC) is a partnership between the university and an Energy Services Company (ESCO) to execute an energy reduction project in addition to addressing deferred maintenance backlog deficiencies. ESCOs provide all of the services required to design and implement a comprehensive project at the customer facility, from the initial energy audit through the long-term guarantee of project savings. The EPC provides campus with a set of energy efficiency measures, accompanied with guarantees that the energy savings produced by the project will be sufficient to cover the full cost of the project over the term of the contract.

As of FY14, two EPC projects had been completed with energy cost avoidance estimated in excess of $2 million annually. There is already a long-term plan in place to address 20 buildings utilizing the EPC delivery method. Targeted buildings are primarily research facilities with large energy and deferred maintenance deficiencies. Projected costs associated with the current EPC plan have been estimated at over $120 million. Moving forward, funding could be allocated to perform the necessary work associated with the long-term plan. Of the estimated $120 million, approximately $50 million should be allocated to properly address both energy and deferred maintenance deficiencies.

Upon completion of the current EPC plan, a cost-benefit analysis of expanding the EPC program, including auxiliary units, could be completed. This analysis would be part of the larger energy conservation campaign, by engaging the auxiliary personnel.

#### Finish the Campus Lighting T-12 to T-8 Upgrades

Converting lighting to more energy efficient fixtures has a typical payback period of less than three years. This campus has over 100,000 fluorescent bulbs that were upgraded from the T-12 fixture to the more energy efficient T-8 fixture. By the end of FY14, about 93 percent of campus fluorescent lighting fixtures had been upgraded to improve interior lighting and to reduce maintenance and energy costs.[[3]](#footnote-3) This program was supported by the Illinois Department of Commerce and Economic Opportunity (IL DCEO), the Illinois Clean Energy Community Foundation (ICECF), and campus funding sources such as Deferred Maintenance funding and the Revolving Loan Fund. The energy savings have been significant and the campus will work to complete this overall project before the end of FY16.

#### Strengthen the LED Campus Program

With the October 2012 fiftieth anniversary of the discovery of the LED, Chancellor Wise committed this campus to becoming an LED Campus:

“One of those things, I’m happy to say, is to deliver on a pledge to become the first major research university to commit to LED technology as its major source of lighting. This will make us the first LED university campus in the United States, with interior and exterior wayfinding fixtures to be replaced by 2025 and with the majority of all lighting to be LED by 2050.”[[4]](#footnote-4)

This requires that the majority of all lighting on campus utilizes LED technologies by FY50. Cost avoidance by implementation of LED technologies typically provides a payback for initial investment within three to seven years. The campus recently invested $100,000 in LED way-finding signs for XX buildings. As a part of this movement towards LED use, adaptive bi-level lighting was been installed in parking lot E15, and is now considered regularly for all exterior lighting upgrades. The Facility Standards could be updated to require that all lighting-related alteration and capital projects use LEDs. Additionally, the campus could increase funding for the LED transformation, so that the majority of all lighting on campus is LED by FY25.

#### Expand Retrocommissioning (RCx)

RCx is an in-depth analysis of a building's HVAC systems and controls with a view to restoring or optimizing conditions for energy conservation, sustainability, and client comfort satisfaction. The RCx program has been very successful on our campus, with 45 buildings retrocommissioned and an average energy reduction of 27.8 percent and a cost avoidance of $4.3 million per year.[[5]](#footnote-5)

The next step in the RCx program will increase implementation of room occupancy sensors, along with HVAC occupancy sensors and smart room temperature control systems, with specific emphasis on direct digital control systems and fault diagnostic software.

Campus could increase funding for RCx so that all buildings on campus can get a comprehensive commissioning. This commissioning needs to be accomplished before some additional strategies take place. Also, auxiliary space accounts for approximately 5 million GSF and funding could be allocated to implement RCx in these facilities. Additionally, campus could study deep retrofits in existing buildings, such as Everitt Lab and the Mechanical Engineering Building.

#### Expand Maintenance Programs

Many of the energy conserving strategies described in the 2010 iCAP fall under the responsibility of the Building Maintenance department at F&S. These include improvements to building envelopes, weatherization sealing, increased insulation for roofs and pipes, and steam trap maintenance. Since FYxx, campus has provided base budget funding for full-time pipe insulators, working every day to repair or replace insulation throughout campus. Currently, there are four employees doing this work, and campus could double the funding for this to provide a total of eight full-time pipe insulators. Likewise, there are Steam Distribution Operators and Pipe Fitters currently conducting a Steam Trap Program on campus, and campus could expand the stream trap maintenance program to achieve energy savings more quickly.

#### Expand the Preventative Maintenance (PM) Program

Because several energy conservation projects require ongoing maintenance to sustain the level of expected energy savings, follow up PM is vitally important for continued energy efficiency performance. Campus has increased PM funding from less than 2 percent of the Building Maintenance Budget Allocation (in FY01) to just over 20% of the Building Maintenance Budget Allocation in FY15, with $3.95 million. There are now 50 full-time PM employees, with 13 additional FTE doing Asset Assessments and PM related work on HVAC and Building Electrical Distribution Systems. Use of up-to-date technology is incorporated, including thermographical inspections of electrical gear and laser alignment of HVAC equipment. Necessary repairs are then completed to improve operation of the equipment being inspected.

Campus could continue to increase funding for the PM program, with $750,000 recurring funding made permanent in FY16, and a steady increase in base budget funding for Maintenance in support of expanded PM efforts, to double the current allocation for PM by FY30. The campus could also complete an annual report of the PM program to publicize the funding, projects, and associated energy efficiency results.

#### Formalize a Fume Hood Efficiency Program

There are currently about 1,700 fume hoods in operation on campus and the majority of these are constant-air-volume hoods without heat recovery that operate all day, every day throughout each year. The 2010 iCAP estimated that – by performing a systematic evaluation of use schedules, taking unused hoods offline, removing some unneeded and antiquated hoods, and converting to variable-air-volume (VAV) systems – up to 70% of the energy currently attributable to fume hoods could be avoided.

Campus could develop an energy conservation management program for the fume hood inventory. This would entail an examination of the use of existing fume hoods, identification of fume hoods that could be retired, and identification of energy efficient technologies that maintain research safety. It could also include installing VAV systems in laboratories, with occupancy sensors that allow the use of lower ventilation rates in unoccupied spaces. With this program in place, campus could potentially reduce operational fume hood energy demand by 20% in FY20, 45% in FY30, and 70% in FY40.

#### Utilize Energy Performance Standards

The campus currently features nine LEED® certified facilities, with an additional seven buildings in the certification process.[[6]](#footnote-6) While the utilization of this certification program has helped raise awareness of sustainable building standards, the campus would benefit from moving away from that program and towards performance based building standards. The campus Facility Standards[[7]](#footnote-7) already incorporate sustainable building practices and could be enhanced to include a new building standard of net zero energy performance for all new campus buildings and major renovations by FY16.  Additionally, campus could investigate the options for instating performance contracting incentives for the Architect Engineers (AEs) of all new campus buildings and renovations, where the AEs receive incentives if the buildings meet energy performance design goals.

#### Institutionalize Information Technology (IT) Efficiency

According to the Energy Use Policy the administrative IT energy use guidelines are as follows:

“Printers, monitors, projectors, copy machines, and other office equipment should be turned off when not in use. Shutdown of computers entails multiple considerations which are discussed in detail in the CITES document “Guidelines for Energy Conservation and Computing Equipment” for energy efficiency.” [[8]](#footnote-8)

These guidelines could be updated to reflect a heightened emphasis on energy efficiency and general sustainable practices. Campus could continue to implement low-energy computing equipment, server virtualization, the consolidation of IT facilities, reduction in the total number of server instances, and computer power management software in computer laboratories and other campus computers. The campus could also complete and publicize an annual report of the IT energy conservation program, including funding, projects, and energy efficiency results.

## Conclusion

Energy conservation represents an enormous opportunity to both reduce GHG emissions and to save money on campus. As easy and ‘low-hanging’ projects get completed, continued savings will also require larger-scale investments and an increasing dedication to conservation as recommended above. The success in energy conservation from FY08 to FY14 was a great start; however, without a much stronger and more consistent message to the campus community, energy conservation will always be limited by our highly-decentralized campus organizational structure. To achieve our goal of carbon neutrality by 2050, a comprehensive energy conservation campaign is an imperative.

In the near term, campus needs to allocate additional funding resources to the energy conservation campaign. The campus-wide energy conservation campaign would require funding support for upgrades to the Illini Energy dashboard upgrade, real-time energy displays in buildings, campaign coordination, peer-to-peer competitions with incentives. The dashboard upgrade costs may range from $50K to $100K for the website redesign. The real-time energy displays could be incorporated into existing digital displays, with a minimal cost impact. The campaign coordination staff would need funding for a centrally coordinated effort and advertising and promotional funding, estimated at approximately $75K per year. Funding for peer-to-peer competitions would be dependent on the competition scope and should be directly related to the anticipated energy conservation results. The costs could range from $2,000 for a small scale departmental program to $300,000 for the current ECIP awards program.

Additionally, the expansion of the centrally-funded energy conservation programs is needed. By considering the variable campus utility rates for energy in FY15[[9]](#footnote-9) and the total energy avoided by all the energy conservation efforts in FY14 compared to the FY08 baseline, the existing energy conservation programs have saved campus $16.6 million through avoided energy costs in this year alone. The expansion of the existing centrally-funded energy conservation programs would produce additional savings, and could be prioritized as follows, based on anticipated impacts on energy conservation and the ease of implementation: increase PM funding, increase RCx funding, increase EPC funding, allocate funding for fume hoods efficiency, and increase funding for the LED Campus.

# Chapter 4. Energy Generation, Purchasing, and Distribution

As shown in Chapter 2, the single largest source of campus greenhouse gas (GHG) emissions is energy generation and purchasing, which provides essential heating, cooling, and electricity for our campus operations. Eliminating these greenhouse gas emissions will be accomplished through a combination of conservation efforts (detailed in Chapter 3) and a complete transformation away from fossil fuels in our energy generation and purchasing. Given that we expect to be able to cut our energy needs (and hence energy emissions) in half, the other half of our reductions must come from clean energy. Hence, conservation and clean energy are equally important efforts for reducing our campus greenhouse gas emissions.

The majority of energy generation on campus comes from the burning of coal and natural gas at Abbott Power Plant, which cogenerates steam and electricity[[10]](#footnote-10). The electricity generated on campus is supplemented by the purchase of grid electricity.

Abbott Power Plant has two natural gas turbines with heat recovery steam generators, and is in the process of installing one new natural gas boiler, with a second planned. These, together with three coal boilers, will generate all the steam used on campus, and cogenerate electricity. Chillers, mostly electric, generate chilled water for cooling. In the heating season, Abbott Power Plant is typically operated at a level sufficient to meet the campus’s steam needs (which largely go towards heating buildings), and electricity is co-generated as a by-product to maximize the efficiency of the plant. The remainder of the campus’s electrical need is purchased from the grid. In the cooling season, when our electrical needs are high and our heating needs are low, our electrical demand exceeds the limit of our grid import capabilities, and Abbott Power Plant is operated to generate the difference.

For ease of comparison and understanding, we will use the units of megawatt-hours (MWh) to discuss all energy needs, both steam and electrical. For reference, the average Illinois household uses about 38 MWh per year, between electrical and heating fuels.[[11]](#footnote-11)

The FY14 total (electricity and steam) energy usage of campus was 982,695 MWh, which is equivalent to that of roughly 25,000 households. Our electricity usage was 481,484 MWh, of which 275,894 MWh was generated by Abbott and 205,590 MWh was purchased. Of this amount, approximately 53,000 MWh was used to produce chilled water for cooling buildings and equipment. The FY2014 steam usage of campus was 501,211 MWh.

Assuming that our conservation efforts (Chapter 3) will cut our energy needs in half, we will have to find ways to produce and/or purchase roughly 250,000 MWh/yr of electricity and 250,000 MWh/yr of heat in a carbon-neutral manner. How will our campus meet these needs?

It is conceivable that by 2050, carbon capture and sequestration (CCS) technology may become economical and widespread, which would allow the continued use of fossil fuels without releasing greenhouse gases. However, it is also conceivable that CCS technology will not become viable. Furthermore, it is clear that humanity is depleting the Earth’s reserves of fossil fuels, and that the increasing rate of extraction of such fuels cannot continue indefinitely. The exact timeframe of the peak of fossil fuel extraction is not clear, but it is almost certainly less than a century, and some analysts predict that it will be within a decade. Additionally, the extraction of fossil fuels is often accompanied by various types of environmental damage. As a result, we conclude that fossil fuels must be eliminated from our campus energy production and purchasing systems, and we commit to doing so by 2050.

Appendix 2 gives an overview of energy options for our campus that could help curtail the use of fossil fuels. The best prospects for heating include the use of air-source and/or geothermal heat pumps to enable carbon-free electricity to serve a portion of our heating needs, the combustion of renewably-generated biomass (produced on-campus or off-campus), and perhaps solar thermal. In terms of on-campus carbon-neutral electricity, the major option is solar photovoltaics, although electricity from biomass (via combustion, gasification, or anaerobic digestion) may also play a role. The purchasing of carbon-neutral electricity from off-campus appears at present to be a very likely prospect. Such purchasing can take the form of Power Purchase Agreements (PPAs) with wind farms, nuclear power plants, or other carbon-neutral sources, or long-term contracts for the purchase of Renewable Energy Certificates (RECs) that can accompany separate purchases of electricity from conventional power plants.

## Energy Emission Goals

Campus has made good progress in reducing GHG emissions since FY08, largely due to improvements in the energy efficiency of buildings. Looking ahead, we expect to see continued reductions due to improvements in energy efficiency and additional energy conservation efforts, as described in Chapter 4. However, in order to achieve zero GHG emissions, it is also necessary to change the way we generate, distribute, and purchase power.

Our total annual greenhouse gas emissions from energy production and purchasing have decreased by 11% since FY08. This is primarily due to the reduction in heating demand (as measured by steam delivered to campus) of 208,176 MWh since FY08, a 29% reduction. Campus electrical usage has increased slightly (6%) since FY08, but this increase includes the new electricity demand from the National Petascale Computing Facility, which uses approximately 76,000 MWh/year; without Petascale, our electrical usage would have decreased by nearly 11%.

The goals for emission reductions from energy production and purchasing from FY20 to FY50 are as follows.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Fiscal Year** | **Emissions (Tons CO2e)** | **% change from FY08** | **Emissions after offsets**  **(Tons CO2e)** | **% change from FY08** |
| 2020 | 347,019 | -30% | 260,264 | -48% |
| 2025 | 297,445 | -40% | 148,722 | -70% |
| 2030 | 247,870 | -50% | 61,968 | -88% |
| 2040 | 123,935 | -75% | 0 | -100% |
| 2050 | 0 | -100% | 0 | -100% |

Achieving these goals will require that the campus community work together to continue and expand energy reduction efforts, fund renewable energy generation, and understand the short-term and long-term benefits of establishing a carbon neutral campus.

## Objectives

Determining the best way to replace our reliable, safe, cost-effective, fossil-fueled combined heat and power system with a large-scale zero-GHG-emission system is a daunting task. The 2010 iCAP called for a detailed study that examines campus energy generation and distribution. An outside architecture/engineering firm was hired in 2012 to produce a Utilities Production and Distribution Master Plan, with the following project scope:

*“The Illinois Climate Action Plan (iCAP) completed in 2010 identifies several goals related to energy production and distribution on the University of Illinois at Urbana-Champaign campus. The Professional Services Consultant shall perform a study that will be interactive with the sustainability goals in the iCAP with strategic planning for the execution of phased projects to safely and reliably meet the current and future campus energy needs and develop a comprehensive utility master plan for the utility production and distribution systems for the University of Illinois at Urbana-Champaign campus.”[[12]](#footnote-12)*

Due to delays in the preparation of the Utilities Production and Distribution Master Plan, at the time of this writing (December 2014) we do not yet have a draft for review.

Once the Utilities Production and Distribution Master Plan becomes available, we expect it to be an important input in the preparation of a comprehensive plan for clean energy generation for our campus. The Energy Generation, Purchasing, and Distribution SWATeam will synthesize the results from the Utilities Production and Distribution Master Plan, together with the results of topical Consultation Groups (described below), into a recommendation for a Campus Clean Energy Plan. The Plan will then be reviewed by the iCAP Working Group and the Sustainability Council, following the established procedures for campus sustainability policies. Additional approvals may be required by the University administration and the Board of Trustees.

Regardless of the details of our Campus Clean Energy Plan, there will be a substantial need for electricity, and we should immediately pursue a dramatic increase in the use of solar photovoltaics on campus. Not only do solar photovoltaics provide decades of free, carbon-neutral electricity, but they also produce the most electricity during times of day and days of year when wind energy production is low. It should be noted that completion of the first Solar Farm, together with the rooftop solar on the ECE building and the North Campus Parking Deck, will yield approximately 10,000 MWh per year.

In the short term and possibly even the long term, it will be necessary to purchase renewable or other zero-carbon energy from off campus. A third objective is therefore to increase the amount of purchased energy that comes from zero-carbon sources, including wind farms, nuclear power plants, and biomass power plants.

1. Create a Campus Clean Energy Plan for energy generation, purchasing, and distribution to achieve zero greenhouse gas emissions. The Energy Generation, Purchasing, and Distribution SWATeam will develop a recommended plan during FY15 and FY16, and this will be reviewed by the iCAP Working Group, the Sustainability Council, and the campus and university administration, with final approval by the end of FY16.
2. Expand on-campus solar energy production. By FY20, produce at least 12,500 MWh, and by FY25 at least 25,000 MWh, from solar installations on campus property. These targets represent 5% and 10% of our expected 2050 electricity demand, respectively.
3. Expand the purchase of clean energy. By FY20, obtain at least 120,000 MWh, and by FY25 at least 140,000 MWh from zero-carbon energy sources.

## Potential Strategies

To meet the emission goals and objectives listed above, the following strategies are recommended.

### 1. Create a Campus Clean Energy Plan

The campus community has considerable intellectual resources that can be brought to bear on the future of energy generation, purchasing, and distribution. The Energy Generation, Purchasing, and Distribution SWATeam has formed consultation groups consisting of faculty, staff, students, and other interested individuals, centered around each of the most promising clean energy technologies. Input from these consultation groups, together with the Utilities Production and Distribution Master Plan being prepared, can be synthesized into a Campus Clean Energy Plan, over the next year.

Below we list the most promising technologies for use on our campus, around which the consultation groups have been formed. Because wind and nuclear energy will be more effectively purchased from off campus, these technologies are not included in this section.

#### Geothermal heating and cooling

As it appears that it would be difficult to directly and entirely replace our present steam production system with a carbon-free equivalent, we must examine the electrification (at least in part) of our thermal energy production system. One very promising technology for this involves the use of geothermal heat pumps.

As a great example of what can be accomplished with current technology, we consider Ball State University, which commissioned a large-scale district geothermal heating and cooling system in 2012. It uses large heat-recovery chillers to simultaneously produce chilled and hot water, which is pumped through 3,600 vertical wells of depth up to 500 feet. The Earth serves as a large-scale thermal energy storage system. The system has a design coefficient of performance of 3.8 for heating and 2.9 for cooling, meaning that for each unit of electric energy consumed 6.7 units of heat are moved. Ball State University is at almost the same latitude as our university, so the same performance can be expected here.

A geothermal system would dramatically reduce the use of fossil fuels on campus, but would increase the campus demand for electricity. The amount of GHG emissions associated with heating and cooling would then depend on the source of the electricity to run the geothermal system. Purchasing the necessary electricity from our local grid region may not lead to a significant reduction in emissions, as the majority of nearby electricity producers burn mostly coal. However, the main attraction of geothermal is that it provides a path to zero carbon emissions as the amount of non-fossil-fueled electricity increases, both on and off campus.

#### Air-source heat pumps

Many campus buildings are heated by steam but cooled by window air conditioners. If these were replaced by air-source heat pumps, each room could be both heated and cooled by the same unit. The required capacity of the heat pumps could be reduced by a deep retrofit of the building, including replacing the windows with high quality double pane windows, reducing the size of oversized windows, and adding insulation to the interior or exterior of poorly insulated walls. Rooms could be conditioned only when occupied, producing further energy savings. There would be no need for ductwork to distribute the cooled air, and such a system would have ancillary health benefits in reducing the transmission of airborne disease.

As with geothermal technology, the amount of GHG emissions associated with heating and cooling these buildings would depend on the source of the electricity used to run the air-source heat pumps.

#### Biomass

Biomass can replace coal for direct combustion, or replace natural gas if it is first used to create biogas through gasification. In 2013, the University of Missouri commissioned a 100% biomass-fueled boiler in their combined cooling, heat, and power plant, initially utilizing waste wood as the primary feedstock. Eastern Illinois University installed a gasifier in 2011, but it is not yet working reliably. These example projects highlight two necessary conditions for the success of biomass: establishing a sustainable supply chain and utilizing a reliable technology.

Due to the large acreage required to grow enough biomass to meet campus energy demands, some fraction of the biomass would likely need to come from off campus. This could be in the form of dedicated energy crops or agricultural waste. One must take into consideration the energy cost of growing, harvesting, processing, and transporting the biomass. While burning the biomass is carbon neutral if it is regrown, the growing, harvesting, processing, and transporting steps release greenhouse gases if they involve fossil fuels or certain fertilizers. On the other hand, the carbon sequestered on the land that supports the biomass can potentially be a carbon sink.

#### Solar Photovoltaics and Solar Thermal

Solar energy is a proven technology that has become significantly more cost effective in recent years. There are some existing installations of solar photovoltaics (PV) and solar thermal on campus now, and some installations currently in the implementation process. A consultation group is working to identify the best locations for installation of additional photovoltaics on campus, and to help expedite those installations. Solar thermal is also being considered where appropriate.

#### Hot water campus distribution system

A study of the benefits of a possible transition from steam to hot water thermal distribution was recommended by the 2010 iCAP, which suggested that this transition, either central or distributed, can have considerable savings for individual buildings. Since our current cogeneration system at Abbott is thermal load driven, this transition will become more important and more cost effective as campus buildings become more thermally efficient. An analysis could be conducted for a possible long-term transition from the current steam thermal systems to hot water. Both central and distributed systems could be evaluated, especially considering the potential interactions with the use of geothermal heat pump systems.

### 2. Expand On-Campus Solar Energy Production

The campus has a 33 kW photovoltaic array on the roof of the Business Instructional Facility and a 14.7 kW ground-mounted array at the Building Research Lab. During FY15, we began installation of a 300 kW array on the roof of the new Electrical and Computer Engineering Building, and the 5.88 MW Solar Farm on the south campus. There is also a solar thermal array on the roof of the Activities and Recreation Center. There are many other buildings, parcels of land, and parking lots that are well positioned to host significant photovoltaic and/or solar thermal arrays. Although each array in itself would make a small contribution to campus energy generation, taken together the contribution could be large.

#### Identify best solar locations and implement solar projects

The solar consultation group is identifying the best places to install the next round of photovoltaic projects, and planning to move forward on several projects simultaneously. Also, solar thermal may make sense in some situations, as well.

#### Require solar PV on rooftops for new construction and major renovations

The best time to plan for the installation of photovoltaics on a building is during the design phase. The campus could implement standards requiring that all new construction and additions include solar photovoltaics on the roof. In some cases it may also be effective to install photovoltaics on the exterior walls of the buildings.

### 3. Expand the Purchase of Clean Energy

In the near term and possibly even in the long term, it will not be possible to meet our emissions goals entirely with on-campus clean energy generation. We must therefore purchase some off-campus renewable and other zero-carbon energy.

#### Enter into Power Purchase Agreements

A Power Purchase Agreement (PPA) is a contract with an energy generation facility. A long-term PPA with a renewable energy generation facility could enable the construction of new renewable energy generation. At the time of this writing, the most economical renewable PPAs are for wind energy from large farms of wind turbines, but we expect that other types of renewable PPAs may become affordable in the future.

Although nuclear power is not considered renewable, an existing nuclear power plant produces no carbon dioxide emissions, and can help us meet our emissions goals. A PPA with a nuclear power plant would enable us to legitimately claim that we are using energy from a zero-carbon source.

Campus has already begun working through F&S and PEI to investigate the potential for entering into PPAs with zero-carbon energy providers in order to help meet our emission reduction goals.

#### Renewable Energy Certificates

Because electrical output from both renewable and non-renewable power sources are combined together in regional transmission grids, it is essentially impossible to guarantee that a certain purchase of electricity comes from a particular power source. To address this uncertainty, the industry developed the concept of a Renewable Energy Certificate (REC), which represents the environmental attributes of one MWh of renewable electricity generation. This allows customers to choose to pay a premium for the “green-ness” of renewable power, even when the exact source of their purchased electricity is uncertain. It also allows the operators of renewable energy plants the possibility to recoup the additional cost of using renewables as opposed to conventional energy sources such as coal and natural gas.

Only the owner of RECs can claim that they are using renewable energy; for example, if a wind farm operator sells its electricity to one party but the associated RECs to a second party, only the second party can claim to be using green energy. To qualify as renewable, any energy the campus purchases must be bundled with RECs, and the campus must retain the RECs for any renewable energy we produce. Therefore, the forthcoming Solar Farm will count towards our renewable energy goals only so long as we do not sell the associated RECs.

Another method to increase our use of renewable energy is to separately purchase “unbundled” RECs, without purchasing power from the same generation source. For example, we could purchase power from a coal plant, but purchase a corresponding number of RECs from a wind farm (in this case, the wind farm would sell their electricity without the environmental attributes to a customer who is not willing to pay for green energy). The purchase of unbundled RECs clearly reduces our carbon footprint according to generally accepted carbon accounting procedures, but it is not always clear that such a purchase has a real impact on the climate.

At the time of this writing, there is exceptionally low demand for RECs in our local grid region, while at the same time a significant number of wind farms have been built and are profitable even without selling RECs (due in large part to a federal tax credit for wind production), leading to a very large supply of RECs. In the absence of effective standards to require the purchase of renewable electricity, the market for voluntary RECs is “thin,” and the prices are very low. A reasonable argument can be made that the same amount of wind energy would be produced whether or not our campus purchases unbundled RECs in this environment, and thus such purchases have no real climate impact.

According to industry experts, when unbundled RECs are purchased as part of a long-term contract, this can facilitate the construction of new renewable energy generation facilities and thus a compelling argument can be made that the RECs purchase is having an “additional” impact on the climate. Long-term RECs contracts would also have the economic advantage of “locking in” the current low prices. Conversely, the voluntary purchase of short-term unbundled RECs from existing facilities may not have a real impact on the climate system, but may simply provide extra profits to wind farm operators with existing profitable assets. The campus will need to carefully consider whether unbundled RECs in short-term contracts help achieve our climate goals, if the impact of such contracts to incentivize new production cannot be clearly demonstrated.

## Conclusion

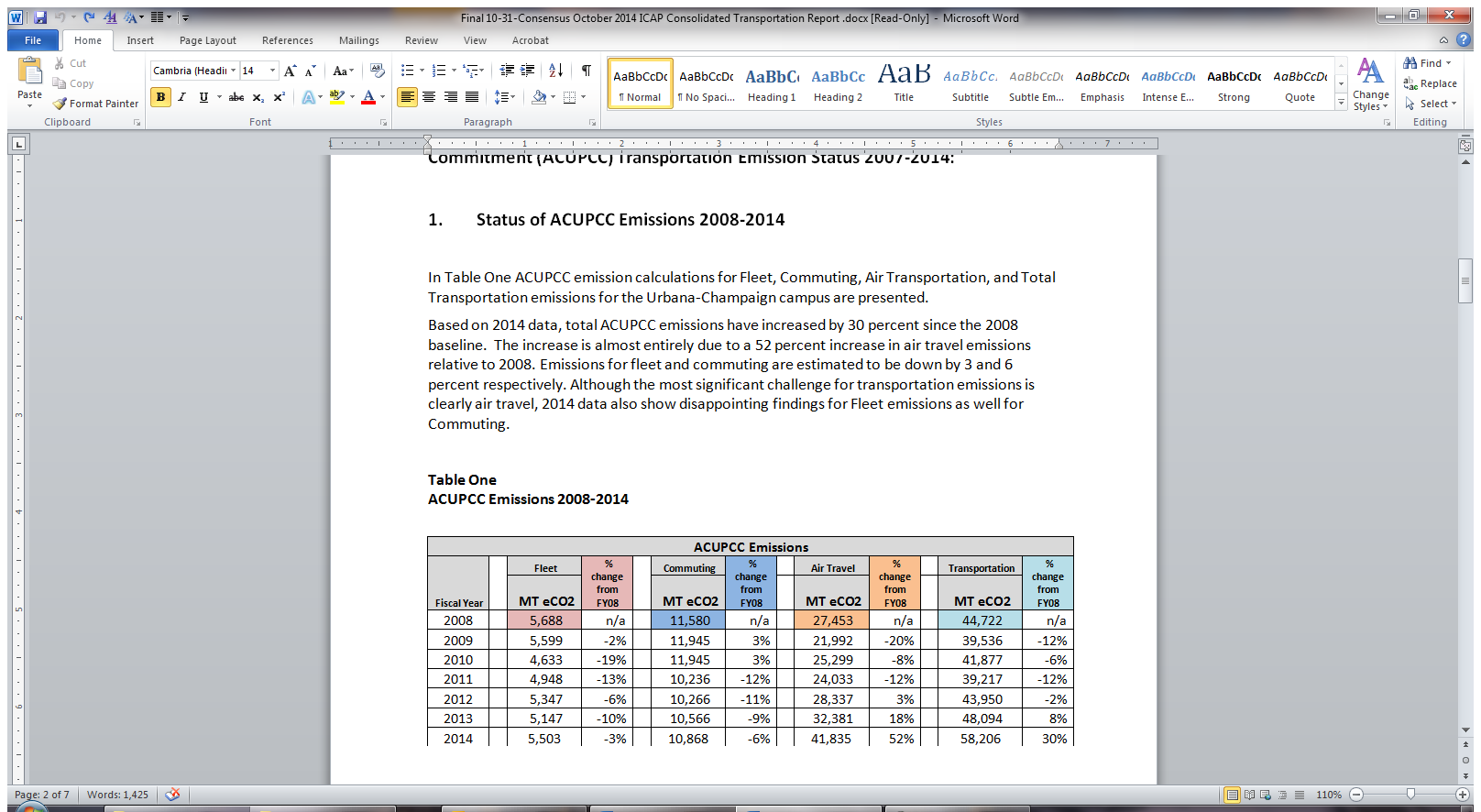
There are many options available to the campus in terms of zero-carbon energy production and purchasing, and at the time of this writing it is not clear what combination of them will make the most sense logistically and financially as we move towards carbon neutrality. As a result, there is a clear need to develop a Campus Clean Energy Plan to provide a roadmap.

It appears likely that the ultimate plan will include a combination of (1) electrification of our heating needs, through the use of geothermal and/or air-source heat pumps, (2) the use of biomass to provide the balance of our heating needs, (3) on-campus solar photovoltaic and perhaps solar thermal arrays, (4) power purchase agreements for zero-carbon electricity from off-campus sources including wind farms and nuclear power plants, and possibly (5) the purchase of Renewable Electricity Certificates (RECs), preferably using long-term contracts.

# Chapter 5. Transportation

## Introduction

Based on FY14 data, transportation emissions have increased by 30 percent since the FY08 baseline. The increase is entirely due to a 52 percent increase in air travel emissions relative to FY08, as the emissions from the fleet and commuting are estimated to be down by 3 and 6 percent, respectively. Although the most significant challenge for transportation emissions is clearly air travel, FY14 data also show disappointing results for fleet emission reductions, as well as for commuting. The historical emissions since the baseline of FY08 from the campus fleet, student and employee commuting, air travel, and total transportation emissions for campus are presented in Table xx.



7 Table XX Fleet, Community, Air Travel and total Transportation Emissions

There were impressive reductions in fleet emissions in FY10, which have declined in recent years. This is likely related to the reduced financial resources available to campus departments during FY10. Fleet utilization seems to have a direct correlation to the available budget for travel. Anecdotally, it was apparent in FY10 and FY11 that departments were carpooling more often to off-site business meetings, to save money. With the recent financial rebound of many campus departments, fleet utilization is rising again. The campus needs to address fleet emissions primarily from an equipment approach, but also with complementary behavior change efforts.

There were also impressive reductions in student and employee commuting emissions in FY11, when the transportation mode choice survey indicated a shift to fewer single-occupancy-vehicle (SOV) trips. The emission increases from commuting in FY14 are due only to increases in the number of people on campus since FY11. To continue to reduce commuting emissions, campus needs to implement a comprehensive mode-shift behavior change campaign.

These minor reductions that have been achieved with motor vehicle emissions have been overshadowed by a 52 percent increase in emissions from air travel. Given the centrality of air travel to the academic mission of the university, it is unlikely that GHG neutrality can be achieved for transportation, without resorting to the purchase of carbon offsets to adjust for air travel emissions. Options for carbon offsets are discussed in Chapter 9.

## Emission Goals

The 2010 iCAP listed the goal of reducing transportation emissions by 30 percent relative to the FY08 baseline by FY15. To achieve this would require the purchase of carbon offsets for air travel. Because campus has not yet purchased any carbon offsets, the new transportation goals anticipate an incremental offsetting program. Fleet emissions and commuting emissions have reduction goals established separately.



8 Table xx Transportation Emission Goals – NOTE: THIS NEEDS TO BE REDONE!!!

In order to provide an indication of the relative efficiency of transportation energy strategies, the campus will evaluate and report on both absolute and relative emission results, providing data for fleet, commuting, and air transportation adjusted per capita and per vehicle whenever possible.

## Objectives

These objectives are based upon systematic changes in the fleet emissions, purchased carbon offsets for air travel, and incremental improvements in commuting emission reductions through a comprehensive mode-shift campaign.

1. Reduce air travel emissions by 25% from the FY08 baseline by FY20, 50% by FY25, and 100% by FY35.
2. Reduce emissions from the campus fleet by 20% for departmentally-owned and car pool vehicles and 5% for the truck pool by FY20.
3. Convert the campus fleet to renewable fuels by FY25.
4. Reduce single-occupancy-vehicle mode shift to 45% by FY20, 40% by FY25, and 35% by FY30 for faculty and staff.
5. Implement the Campus Bike Plan on the schedule noted in that plan. Notable deadlines include full implementation of new bikeway facilities by FY25, bike parking within 150 feet of every building in the core of campus by FY20, and bike rentals by FY20.
6. Appropriately staff sustainable transportation efforts through the hiring of a Sustainable Transportation Coordinator.

## Potential Strategies

Reducing transportation emissions will require campus funding for air travel offsets, implementation of low emissions technologies for the fleet, and encouraging mode-shift away from single-occupancy-vehicles. The campus will reduce commuting emissions with incentives, infrastructure changes, and the implementation of the Campus Bike Plan.

### 1. Reduce Air Travel Emissions

The campus mission often relies upon in-person visits to other towns, states, and countries. The most time-efficient travel mode is often air travel, and it is unreasonable to expect university faculty, staff, and students to eliminate air travel entirely. The benefits of international conferences, research, and study abroad are enormous and these trips often contribute to major emission reductions globally through innovation and dissemination of new technology. However, there are certainly some situations on our campus when a plane trip can be replaced with a train trip or a video conference, without sacrificing the impact of efforts to support the university’s mission.

To encourage a reduction in air travel, the campus could implement a program to provide incentives for departments that reduce their annual air travel emissions. The program would include a method to track annual airline travel emission estimates per department, through the DMI system, and an annual report of the per capita airline travel emission estimates and the total estimate for the campus. The program would also educate the campus community on the alternatives to air travel, such as trains, and video conferencing. Additionally, campus could improve the facilities and services supporting online conferencing and other virtual meeting technology.

For the remaining GHG emissions associated with air travel, campus could purchase offsets, as described in Chapter 9. The amount of offsets to purchase would be incrementally increased over time such that air travel emissions are reduced by 25% from the FY08 baseline in FY20, 50% in FY25, and 100% in FY35.

### 2. Reduce Fleet Emissions in the Next Five Years

The campus fleet includes departmentally-owned vehicles, the car and truck pool vehicles, and the heavy equipment pool. The vehicular fleet is primarily cars and vans, while the heavy equipment pool is generally diesel fueled large equipment, such as garbage trucks and back hoes. To increase low emissions vehicles in the campus fleet, campus could increase low-emission vehicles by 20% in the vehicular fleet and 5% in the heavy equipment pool.

The campus could require and activate anti-idling equipment for all new class 6 and above trucks. Campus could increase the use of biodiesel blends in fleet vehicles. Campus could increase the use of electric vehicles and departmental bicycles (including electric bicycles) with cargo trailers to move individuals and small tools and equipment across campus. To encourage the use of these low emission options, campus could provide incentives to departments or individuals who make use of them.

### 3. Convert the Fleet to Renewable Fuels within Ten Years

The GHG emissions from the fleet totaled 5,621 metric tons in FY14. These emissions resulted from burning 463,257 gallons of gasoline, 121,611 gallons of diesel, and 24,914 gallons of E85 fuel. To eliminate these emissions campus could switch the entire fleet to fuel sources that do not require fossil fuels. Options for this may include sustainably-produced biodiesel, compressed natural gas from anaerobic digestion of agricultural wastes, and electricity from zero-carbon sources such as solar and wind.

### 4. Reduce Single-Occupancy Vehicle Usage

To reduce commuting emissions, campus could strengthen the comprehensive mode-shift behavior change campaign. This campaign was initiated on campus in FY08, when the Transportation Demand Management department was established. Through coordination with the cities of Urbana and Champaign, the CUMTD, and local advocacy group Champaign County Bikes (CCB), there has been a noticeable shift in mode choice for the campus community. The survey results in FY11 showed the impact of this collaborative and concerted effort toward a reduction[[13]](#footnote-13) in single-occupancy-vehicle mode-share for faculty and staff, shifting from 74% in the 2007 survey[[14]](#footnote-14) to 52%. Because this data point is the metric tied most directly to the resulting commuting emissions, the objective for mode shift is based upon this metric. However, the strategies needed to accomplish this shift encompass multiple transportation modes and behavior shift programs.

#### Encourage Car-free Commuting

Campus could provide additional opportunities for employees and students to purchase less than full-time parking privileges at a reduced cost. This would enable commuters to take advantage of healthy commuting options, public transportation, and ridesharing when time, weather, and other circumstances permit. Campus could also provide incentives for commuters using low emission vehicles, including designated parking spaces close to entrances and preferential consideration for parking spaces in lots with waiting lists.

Guaranteed Ride Home programs address a common concern for commuters transitioning away from reliance on a personal vehicle, i.e., the ability to get home quickly in case of an emergency. The program would provide a free ride by taxi, in case of emergency, with the flexibility to stop at a hospital or day care provider, if needed. The campus could work with CUMTD to implement a Guaranteed Ride Home program for employees living within the CUMTD borders who do not purchase an annual parking permit.

Another available program to reduce reliance on SOVs is the Zipcar car-sharing program. This program was initiated in FY09 by the campus, the City of Urbana, the City of Champaign, and the CUMTD, through a car-sharing RFP process. It has been very successful so far, and campus could encourage its expansion.

#### Encourage Ride Sharing and Transit for Faculty and Staff

The mass transit mode-share for faculty and staff is currently only 10 percent. This could be increased through a clear communication program focused on campus employees, explaining the benefits of riding the CUMTD. The campus would implement this communication program in collaboration with the CUMTD. Also, campus could adjust policies related to employee work hours, to allow for an increase in transit utilization.

The car-pooling mode-share for faculty and staff is currently only 11 percent. Campus could increase ride sharing by implementing van pooling for commuters living in nearby towns, with low emission vehicles. Ride sharing could also be increased by providing incentives and support for employees who rideshare.

#### Support Public Use Electric Vehicle Charging

In this region of the electric grid, an electric vehicle typically emits fewer GHG emissions than a conventional gas-fueled vehicle of similar size.[[15]](#footnote-15) The Parking Department is supporting sustainability through implementation of public use electric vehicle charging spaces. The campus could support additional electric vehicle charging infrastructure, as warranted.

### 5. Implement the Campus Bicycle Plan

This campus is currently designated as a bronze level Bicycle Friendly University, by the League of American Bicyclists.[[16]](#footnote-16) Campus could fully fund the implementation of the 2014 Campus Bicycle Plan, using the Five E’s to improve bicycling to-and-from and on-campus. The Five E’s are:

* Engineering – This includes bikeway improvements, bike parking areas, and bike fix-it stations.
* Education – This includes dissemination of bike-related informational resources of various types, and bike-related classes.
* Encouragement – This includes the primary mode-shift efforts for transitioning people on campus from single-occupancy vehicles to active modes of transportation, such as Bike Month and building a culture for good cycling behavior, through programs like the Campus Bike Center.
* Enforcement – This includes bicycle registration programs, and enforcement of both the Illinois Rules of the Road and the UI Bicycle Ordinance.
* Evaluation and Planning – This includes tracking progress toward being a Bicycle Friendly University, such as counting bikes through the Every Bikes Count census events, gathering public input through the online bicycle feedback form, and prioritizing bike-related needs for campus.

The Campus Bicycle Plan includes specific objectives surrounding the overall effort needed. Notable deadlines include full implementation of new bikeway facilities by FY25, and bike parking within 150 feet of every building in the core of campus by FY20.

#### Implement a Bike Sharing Program

Small-scale departmental bike share programs are feasible and cost-effective. They allow faculty, students, and staff to travel around campus during the workday without using a car. Campus could develop guidelines and best practices to make it easier for individual departments to either start their own bike share program, or to buy into a campus-wide bike sharing program. A promotional campaign could be conducted to encourage more departments to participate, with the goal of increasing the number of departmental bike-sharing bikes to 60 by FY20. Additionally, campus could work with community partners to explore the implementation of a community-wide bike sharing program.

### 6. Appropriately Staff Sustainable Transportation Efforts

The five strategies outlined here (reducing air travel emissions, reducing fleet emissions, converting the fleet to renewable fuels, a comprehensive mode-shift campaign, and implementing the Campus Bicycle Plan) would require an additional full-time staff person. The Sustainable Transportation Coordinator would be responsible for:

* Developing and implementing an incentive program to reduce air travel
* Working with Garage and Car Pool and other units to increase the use of electric vehicles and bicycles
* Working with Garage and Car Pool to explore renewable fuels for fleet conversion
* Encouraging mode shift away from SOVs, including coordination of incentive programs
* Education and outreach efforts related to the Campus Bicycle Plan

The Sustainable Transportation Coordinator would also work with the TDM Coordinator to stay informed about infrastructure improvements and collaborative programs in the community.

## Conclusion

We aim to completely eliminate our Scope 1 transportation emissions from the campus fleet, substantially reduce our Scope 3 emissions from commuting through an aggressive mode-shift campaign and the full implementation of the Campus Bicycle Plan, and reduce our Scope 3 emissions from air travel through incentives for units to switch to videoconferencing when feasible. As described in Chapter 9, we would gradually offset our remaining Scope 3 emissions.

It is difficult to estimate the costs for the fleet conversion at the present time. The total implementation of the Campus Bicycle Plan is estimated to cost approximately $5 million, in addition to ongoing program and maintenance expenses of about $100,000 per year.

# Chapter 6. Water and Stormwater

**Introduction**

The links between energy and water are both explicit and subtle. The explicit ones are those that are involved with steam production, chilled water production, and the like. The subtle interconnections are the embedded energy use in water extraction, purification, transportation, and wastewater treatment, along with water use that is part of producing electricity. In addition, water can itself be creatively used as a means for storing, modulating, and transferring energy between different sub-systems. With the above in mind, a worthwhile challenge for the campus is to reduce the use of all inputs – energy, water, and materials – simultaneously, recognizing that such an approach offers the most flexibility to achieve not just GHG reductions but potentially insulate the campus from externalities such as drought, spikes in energy prices, and the like.

It is important to recognize that our campus is a major user of water within the local community. Much of this water is drawn from the nearby aquifers such as the Mahomet aquifer, which serves as the primary water source for many communities in the Central Illinois region. As the flagship institution of higher education in Illinois, and one of the leading research institutions in the world, it is a moral imperative for the campus to practice responsible stewardship of the natural resources it depends on. A progressive agenda on water conservation and reuse, along with stormwater management, has the potential to create a wider ripple effect in the future by providing a local platform for multi-disciplinary scholarship integrated with sustainable real-world practices. This will provide the campus with a competitive advantage in attracting highly qualified staff and students from around the world, while also advancing ground-breaking research that provides new solutions to the ever growing global need for water resources.



4 table xx Water reduction goals

## Goals

Since FY08, campus surpassed the 20 percent water conservation goal for FY15 established in the 2010 iCAP (see Table xx). This was achieved by a variety of water conservation efforts around campus including detection and repair of leaks in the water distribution system. It is notable that these reductions in total water use were achieved in spite of increases in both the number of campus users and the total square footage of campus buildings. The new water conservation goals are shown in table xx.

We also establish a new goal to increase sustainable management of stormwater runoff through reuse and infiltration/recharge, and to reduce the nitrate levels of agricultural runoff and subsurface drainage.

## Water Conservation Objectives

While the water reductions achieved so far have been impressive, reaching even further reductions will involve greater effort and expense. Water conservation has been the main tool for reducing water use on our campus. Looking ahead, water conservation can continue to provide further water use reductions, but it is expected to have diminishing effects because the easy high impact changes have already been implemented. Thus, additional tools for water use reductions are needed.

An investigation is needed to assess the maximum reduction achievable by water conservation alone, using a bottom-up approach to estimate consumption by end-users and available best practices for water efficiency. This research should also include a plan for water reuse as this can be a major strategy for reducing campus demand of fresh water. Additionally, the work should integrate the physical and natural elements of campus topography to reduce water demand on campus and facilitate reuse.

To achieve our water and stormwater goals, we will:

1. Obtain and publicize more granular water use data, including quantity and quality, by FY16.
2. Reduce water use in all cooling towers by at least 50% by FY20, from the FY08 baseline.
3. Incorporate water demand requirements into facilities standards by FY16.
4. Implement a pilot project to showcase the potential of water reuse and/or non-potable water use by FY20, with the objective of implementing a broader program by FY25.
5. Implement a major stormwater capture project by FY20.
6. Reduce nitrates in agricultural runoff and subsurface drainage by xx% from the FYxx baseline, by FY20.
7. Use the campus as a living laboratory for water use, develop curricula that will engage students in learning, evaluating and developing best practices.

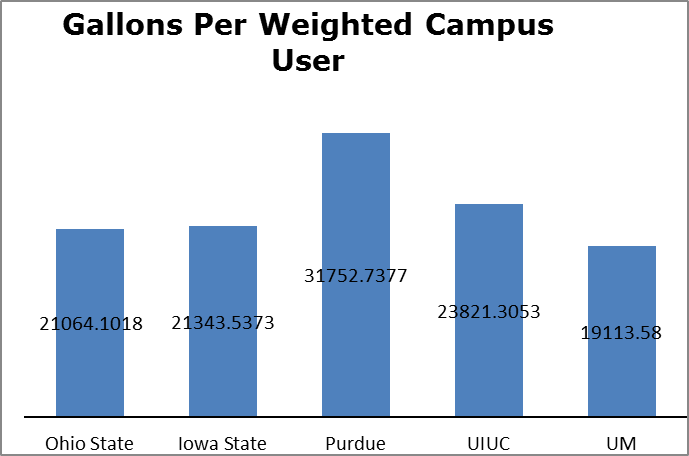
## Potential Strategies

### 1. Obtain and Publicize Water Data

#### Use of Relative Metrics

In order to quantify our water use reductions and to identify further opportunities, the campus could report not only on the absolute potable water usage, but also on water use relative to the number of weighted campus users and relative to gross square footage of building space.

These new water conservation measures would allow us to establish our campus as a leader in water conservation through comparative analysis with peer institutions, as illustrated in Figure X. For example, our FY14 usage per weighted campus user was 23,821 gallons; our FY25 goal would correspond to 18,618 gallons (assuming no growth in users), which would be the lowest of the institutions shown in Figure X.



6 Figure xx Gallons per person as of FY14?

#### Data Display

The campus could publicly display water quantity and quality data to encourage transparency, instructional use, and campus-wide participation in water conservation activities. The site interface could be modeled after the current energy dashboard to facilitate consistency, and could potentially be implemented in tandem with the energy dashboard to leverage the interest of current users of that system.

### 2. Reduce Cooling Tower Water Use

In FY11, the Student Sustainability Committee (SSC) sponsored a project to identify water conservation opportunities in our campus cooling tower operations. By increasing the number of times water can be recycled through a cooling tower before it is rejected, it was estimated that the overall water use can be reduced by \_\_%. We could implement such a program in one cooling tower by the end of FY16, and extend this to all cooling towers by FY20. As cooling towers currently represent \_\_% of our water usage, this program would have a dramatic effect on our water usage.

### 3. Incorporate Water into Facilities Standards

This should briefly summarize the current role that water plays in our facilities standards, and then describe what changes should be made. This should emphasize that this will apply to all new construction and renovations on our campus, including auxiliaries. Should this include anything about irrigation?

### 4. Water Reuse and Non-Potable Water Substitution

Potable water consumption on campus can be reduced by water reuse or by the substitution of non-potable water for potable water. We could implement a pilot project by FY20 to showcase the power of this approach, with a broader rollout on campus by FY25.

#### Water Reuse

Water reuse includes using water multiple times in a cascade of applications that generally have less stringent water quality requirements (i.e., reusing washing water for toilet flushing). It can also include some purification steps that increase the water quality as needed for the subsequent reuse application. The benefits of water reuse include a reduced draw on the aquifer, and reduced energy and chemical consumption from water treatment processes.

Currently, this campus does not practice a significant amount of water reuse and does not have a specific strategy for increasing water reuse. This is in large part because the current regulatory structure in the State of Illinois generally requires variances to the plumbing code to allow for water reuse; however, this regulatory structure is changing, and such variances are now being routinely granted. Given the potential of water reuse to significantly reduce net water consumption, it could be vigorously pursued as a part of the overall water use reduction strategy on campus.

#### Substitution of Non-Potable Water

Certain uses for water, especially irrigation, do not require water that is potable. The campus could actively investigate opportunities to use untreated raw water, sump pump discharge, wastewater from cooling towers, stormwater, and/or gray water in appropriate applications.

### 5. Stormwater Capture

Another opportunity to increase the sustainability of campus water utilization is to include stormwater management practices in campus sustainability efforts. Initial investigations show a strong potential to increase stormwater capture, infiltration, and reuse of stormwater around campus. Various best management practices and green infrastructure systems can promote passive irrigation, and enable additional water conservation at campus facilities.

The campus could complete an inventory of current landscape performance relative to existing pavement and landscape surfaces and features, against the long-term transition toward a water-positive campus environment.

Although green stormwater infrastructure need not be expected to have a financial payback in addition to an environmental payback, the transition to such infrastructure may be guided by calculating the full cost/benefit of traditional versus sustainable campus landscape maintenance and operations. Such an analysis should include the current and future economic values of stormwater that can be captured with green infrastructure as well as GHG emissions reductions by reuse of captured storm water, and compare with the installation and operating costs of traditional stormwater reuse infrastructure.

The campus could integrate rainwater capture strategies with other campus sustainability commitments and objectives such as carbon sequestration. Many native plants not only require little to no irrigation, but they also improve stormwater infiltration that can help to recharge the aquifer. Some also serve to sequester carbon.

The campus could utilize the Sustainable Sites Initiative (SITES) as a rating system for all projects on campus, to promote education and to assist with coordination in developing high-performing sustainable landscapes.

### 6. Agricultural Runoff and Subsurface Drainage

Fertilizer applications in our agricultural practices have profound environmental impacts that are often not fully appreciated. In addition to direct greenhouse gas emissions, nitrogen applications also lead to increased nitrate concentrations in agricultural runoff and subsurface drainage, which ultimately drain to the Mississippi River and create a “Dead Zone” in the Gulf of Mexico that is greater than 5,000 square miles in extent. By FY20, the campus could substantially reduce our contribution to this problem, and serve as a model for agricultural operations in the Mississippi watershed. The strategy may require both changes to the timing and extent of fertilizer applications and the installation of equipment to treat subsurface drainage in tile.

### 7. Educational Initiatives

We already use the campus as a living laboratory to provide classroom opportunities related to water use on and off campus. We could expand the educational initiatives to develop, implement and study specific water use reduction projects on campus. Potential campus landscape programming and curriculum development should be explored.

We could also promote water conservation efforts through collaborations between campus units such as the Prairie Research Institute (PRI) and outside agencies such as Alliance for Water Efficiency, Water Reuse Foundation, Water Environment Federation, American Water Works Association, etc.

Finally, we could develop materials that promote outreach and education with constituents on the co-benefits of green infrastructure implemented on a system-wide basis. We could include orientation for sustainable water use in residence halls, potentially alongside implementation of more water efficient installations.

## Conclusion

As mentioned, our campus has made great strides in conserving water through leak repairs and low-flow fixtures. Further success in this area will require attention and effort in broader areas. The strategies outlined here provide a pathway to a reduction in potable water use through reuse in many ways and through improved stormwater management practices.

# Chapter 7. Purchasing, Waste, and Recycling (Zero Waste)

## Introduction

Our campus has committed to reducing the environmental impacts from the products and services we purchase and discard. These impacts are generated when our vendors produce and extract natural resources, process and transport them to us, and later collect them to be disposed of as waste. Reducing our campus’s purchases and decreasing waste that ends up in landfills will reduce GHG emissions, improve use of natural resources, educate students about sustainable practices, and contribute to other environmental benefits. Addressing sustainable materials management requires our campus to engage in a “life cycle” approach that considers the energy used for production and transportation of our purchases, as well as the impacts of wasteful practices such as landfilling a recyclable item.

Zero Waste is widely understood to mean diverting over 90% of solid waste from a landfill. According to the Environmental Protection Agency, solid waste’s definition includes animal manure, landscape waste, and typical municipal solid waste (MSW) from buildings and exterior waste bins. With this definition, in FY14 we had a **total diversion rate** of 85.60 percent, as shown in Table xx above. However, the more common national understanding of recycling would not account for special recyclables from our animal research areas, landscape/yard waste, battery recycling, construction waste, lamps, bicycles, text books, etc. The total waste from building and exterior waste bins compared to the portion of that MSW pulled out of the landfill stream for recycling is the MSW diversion rate. In FY14, the **MSW diversion rate** was just 31.08 percent, shown in Table xx to the left.



Table xx Waste Diversion Rate History



10 Table xx MSW Diversion Rate

Since FY08, we have seen many achievements in the Zero Waste arena. In 2009, we switched from sending landfill waste to a site in Clinton (which did not recover methane emissions) to a site in Danville (which does recover methane emissions for electricity generation). According to the Clean Air Cool Planet emissions calculator, this change yielded a substantial benefit in greenhouse gas emissions from the landfilled waste – going from 14,697 metric tons of GHG emissions in FY08 to a negative (saving of) 172 tons of GHG emissions in FY09, even though total landfilled volume increased over 20 percent in the same time, as shown in Table xx below

The Housing Department’s dining halls now use trayless service, aerobic digesters, and some small-scale vermi-composting to reduce food waste and divert it from landfill. We started participating in the national RecycleMania competition, with Game Day Challenges and e-waste collections. Also, we have implemented innovative programs, such as Nitrile glove recycling and reuse of laboratory chemicals. Likewise, we adopted policy statements on zero waste, recycled content of office paper, certified cleaning products, and standards for computers.

While there have been several positive initiatives in this area, there is a lot more that can be done to improve the campus’s performance on several measures related to purchasing and waste. Unfortunately, campus policy statements, environmental purchasing standards and preferences are not well-known, utilized, or enforced. As of FY12 (??) 70 percent of office paper purchased on campus had no recycled content, purchases of office paper decreased only 3.2 percent from FY12 to FY14, and purchasing practices do not apply environmental preferences for vendors or products.



Table xx Waste Emission History

The manufacturing and transportation of purchased goods has a significant impact on global GHG emissions. Therefore, the campus will identify methods to increase the reuse of already purchased goods.

Going forward, campus could use a comprehensive Zero Waste Program, which would reduce waste, starting with sustainable purchasing practices, and ending with an emphasis on waste-related measurements, accountability and incentive programs. This program could be communicated clearly to all colleges, departments, employees, and students and enforcement measures could also be implemented.

The campus could establish a comprehensive Zero Waste Program that encourages waste minimization, implements and enforces sustainable procurement policies, encourages reuse of materials, and increases landfill diversion rates. Campus would report on progress annually, and apply systems analysis in selecting actions to minimize emissions from purchasing, waste and recycling. This includes measuring the performance of campus units on purchasing, waste, landfill, recycling of specific commodities, and other product reuse; developing accountability, training, and incentive programs for waste reduction by campus units and students; and raising awareness of waste reduction goals through events and communications.

## Zero Waste Goals

Our campus goal in the arena of Purchasing, Waste, and Recycling can be quite simply stated: by FY50 all campus purchasing decisions will take environmental attributes into account, and no waste will be sent to landfills.

## Zero Waste Objectives

The comprehensive Zero Waste Program will include sustainable procurement components, targeted reuse programs, clear recycling education with incentives for participation, and specific targets focused on waste minimization. Therefore, the objectives for waste minimization cover all these aspects.

1. Develop and apply environmental standards to certain categories of purchases. By FY16, campus standards should be developed for purchases of office paper, cleaning products, computers, other electronics, and freight/package delivery services. At least 50% of purchases in these categories should meet campus standards by FY20, and 75% by FY25.
2. Reduce and ultimately eliminate waste going to landfills. This involves reducing non-durable goods purchases, effectively re-using materials, and diverting waste from landfills. In the latter category, campus should increase the diversion rate of municipal solid waste to 40% by FY20, 60% by FY30, 80% by FY40, and 100% by FY50, while also increasing the total diversion rate to 90% by FY20 and 95% by FY25.
3. Continue to utilize landfills with methane capture.
4. Appropriately staff Zero Waste efforts through the hiring of a full-time Zero Waste Coordinator.

## Potential Strategies

### 1. Develop and Apply Environmental Purchasing Standards

#### Develop Campus Environmental Purchasing Standards

Decisions about the purchasing of many products are handled in a very decentralized fashion on our campus. The University purchasing process ensures that such purchases meet various federal and state requirements, but the process does not currently take environmental attributes into account.

The campus could develop standards for the purchases of certain categories of products; for example office paper (at least 30 percent recycled content), cleaning products (Green Seal), computers (EPEAT Silver), other electronics (Energy Star), and freight/package delivery services (EPA SmartWay). These would be clear standards that will be easy for end users to utilize, and the purchasing process would be modified in such a way that whether a particular purchase complies with the campus standard could be tracked.

#### Track Compliance with Campus Standards

The university purchasing process could be enhanced in order to explicitly track purchases that comply with campus environmental standards, so that it would be straightforward to measure (for example) what fraction of our computer purchases are EPEAT Silver.

#### Utilize Standards from Other Organizations

The campus could also apply sustainable purchasing tools and standards provided by the U.S. General Services Administration, U.S. Department of Energy, U. S. Environmental Protection Agency, State of Illinois Central Management Services, and other certifying organizations. It could also utilize and expand purchasing contracts that apply certified environmental standards and preferences, including contracts available for State of Illinois agencies and collectives of universities.

#### Promote Sustainable Purchasing

A campaign could be initiated to engage campus units and vendors in an effort to reduce purchases and associated emissions. This campaign could also solicit and apply students’ suggestions on reducing paper and other products used in classes and buildings. Ultimately, campus could revise the iBUY and other purchasing systems to curtail purchases of products and services which fail to satisfy selected certified environmental standards and preferences. The campus could also consider applying surcharges to encourage environmentally preferred purchases and recycling.

### 2. Reduce and Ultimately Eliminate Landfill Waste

Reducing, and ultimately eliminating, landfill waste will require a combination of reducing non-essential purchases, improving reuse of materials that have already been purchased, and increasing recycling.

#### Reducing Non-Durable Goods Purchases

The campus could reduce purchases of office paper and computers, by encouraging need-based printing and extending the replacement cycles for computers. A realistic target could be a reduction of purchases in these categories relative to a FY15 baseline by 15% by FY20 and 30% by FY25.

The campus could also implement a ban on single-use bags and the sale of bottled water. The latter could be implemented as soon as vendor contracts are up for renegotiation or by FY20, whichever comes first.

#### Reuse Materials

The campus could implement a program to extend the replacement cycles for computers and other electronic products. This would involve educating the campus community about the benefits of postponing the purchase of new equipment, enhancing options for transferring the equipment to other users on campus, and investigating the potential for transferring equipment to non-campus users, in cooperation with Central Management Services.

The campus could also increase the reuse of materials on campus by developing a durable-goods cataloguing system. The Surplus department on campus already offers the reuse of various products, such as furniture, and campus could increase this program’s capacity as well as its visibility and utilization. Campus could work with students to widen and encourage use of surplus goods by all departments.

#### Raise Recycling Rates across Campus

To increase awareness of waste management, campus could measure the performance by campus units (such as specific building, department and auxiliary) on purchasing, waste, landfill, recycling of specific commodities, and other product reuse. Later, campus units could be asked to participate in a waste stream characterization study that will help them develop plans to decrease wastes and increase recycling, and conduct trainings to increase engagement efforts.

Campus could implement incentive programs for waste reduction by campus units and students and raise awareness of waste reduction goals through consistent communications and events such as more zero-waste sports and cultural events.

#### Increase Visibility of Recycling

The campus could institute uniform signage for recycling and landfill bins across campus; bins could be strategically placed around campus buildings and grounds to increase visibility of current waste diversion efforts. The number and locations of recycling bins could be increased by pairing them with trash bins, and reducing the total number of landfill bins. In the ideal case, every landfill bin on campus would be paired with one or more recycling bins.

The campus could also undertake a campaign to increase awareness of special recycling categories, such as glass, food waste, electronics, batteries, and nitrile gloves.

#### Increase Options for Recycling

The campus could also expand the categories of waste that are recycled on campus. Some examples include expanding the glass recycling initiative, by consulting new vendors for competitive prices, developing new recycling options for plastics #3-7, and developing stryofoam recycling.

### 3. Methane Capture at Landfill

The Clean Air Cool Planet calculator assumes that 100 percent of the methane emissions from our landfilled waste is recovered by the Danville landfill equipment. This assumption overstates the actual reduction in emission by 10 to 40 percent (for FY14, from 1,681 to 6,727 metric tons of GHG emissions). According to the U.S. EPA, a landfill gas recovery energy project captures “roughly 60 to 90 percent of the methane emitted from the landfill, depending on system design and effectiveness.”[[17]](#footnote-17) Also, carbon dioxide is emitted from electricity generation using landfill gas.[[18]](#footnote-18) However, a landfill with methane capture does reduce total GHG emissions from waste, so campus could continue to utilize landfills that incorporate methane capture equipment.

### 4. Appropriately Staff Zero Waste Efforts

The strategies outlined here would require an additional full-time staff person. This Zero Waste Coordinator could coordinate the campus efforts to improve the sustainability of our purchasing practices, to encourage the reuse of materials both on and off campus, and to improve recycling rates to ultimately achieve zero landfill status. The Zero Waste Coordinator would interface with University Purchasing, Facilities & Services, and units and students across campus.

## Conclusion

The campus will emphasize waste-related measurements, accountability, incentive programs, communications and systems analysis for campus units and students. In addition to reducing global GHG emissions, the recycling program will earn revenue for campus and avoid landfill-tipping fees. With the comprehensive Zero Waste Program, enforcement of sustainable procurement standards and expansion of our recycling programs, campus would be able to significantly reduce the indirect environmental impacts of its purchasing practices, and eliminate our use of landfills.

# Chapter 8. Agriculture, Land Use, Food, and Sequestration

## Introduction

This campus comprises 4552 acres and 6 residence dining halls. This acreage includes \_\_\_\_ acres of land use for crop production and research, \_\_\_\_ acres used for animal husbandry or research, and \_\_\_\_\_\_ acres of managed landscape. The residence halls serve approximately 25,000 meals daily. Because of the volume of production, land management and food services, these areas deserve serious consideration in regard to GHG emissions and mitigation strategies.

Campus GHG emissions associated with agricultural practices add up in several ways, from production, processing, transportation, marketing, consumption, and waste. Emissions from landscape management come primarily from lawn and garden maintenance, as well as snow and ice removal. Land utilization practices also impact the environment through infrastructure for transportation modes, methods of stormwater management, irrigation needs, and negative impacts on biodiversity and ecosystem services. Emissions related to food consumption also come from production, processing, transportation, marketing, consumption, and waste. Carbon sequestration is the purposeful removal of greenhouse gases from the atmosphere, which can be accomplished through the use of perennial plantings, including native plants and trees, that store carbon in the soil.

## Emission Goals

To date, the estimates of our agricultural emissions have been limited to those from animal husbandry/research practices in the context of the Clean Air Cool Planet calculator. We are concerned that our emissions are not accurately calculated, as all of the manure generated by our animal husbandry/research is used as fertilizer for our crop land. There are at least 3,000 acres of farmland, most of which receives fertilizer, pesticide applications, tillage, etc., and all of these practices need to be accurately accounted for in our emissions inventory. Likewise, we need additional data for other land management practices, food procurement, and sequestration possibilities. Thus, a critical first step will be a complete assessment of our baseline emissions in FY15. Our long-term goal in the arena of Agriculture, Land Use, Food, and Sequestration (ALUFS) is then to reduce these emissions (from the FY15 baseline) by at least 30% by 2020, 50% by 2025, 70% by 2030, 90% by 2040, and 100% by 2050. Ideally, our agricultural and land use practices will ultimately result in *negative* greenhouse gas emissions by sequestering carbon into our soils.

## Objectives

Our short term objectives in this area are:

1. Perform a comprehensive assessment of GHG emissions from agricultural operations and develop a plan to reduce them, by FYxx.
2. Expand the specification of native plantings in campus landscaping standards.
3. Incorporate sustainability principles more fully into the Campus Master Plan.
4. Develop a Natural Heritage Garden on the main campus to showcase the biodiversity of our region.
5. Implement a project that examines the food service carbon footprint for Dining and other on-campus food vendors to increase local food procurement to 40% by 2020.
6. Determine the sequestration value of existing plantings and identify locations for additional plantings, with a specific objective of converting at least 50 acres of U of I farmland to agroforestry by FY20.
7. Reduce nitrates in agricultural runoff and subsurface drainage by xx% from the FYxx baseline, by FY20.

## Potential Strategies

### 1. Assess and Reduce Agricultural Emissions

The ALUFS SWATeam could commission an Agricultural Emissions Consultation Group of campus experts, including crop scientists, animal scientists, ecologists, and others, to perform a comprehensive assessment of the greenhouse gas emissions from the South Farms. This assessment would include the identification or development of an agricultural emissions calculator that can be used on an annual basis to estimate our emissions, along with the identification of the appropriate group of stakeholders in the relevant units who will annually provide the required input data. This work would result in an accurate FY15 baseline for measuring our future performance.

This Agricultural Emissions Consultation Group could also be charged with identifying specific actions that can be taken to reduce our emissions. One group of actions may include changes to agricultural practices, such as the use of cover crops or the timing of fertilizer applications. Another category is technological changes, such as the use of renewably produced biodiesel in farm vehicles or the construction of an anaerobic digester to convert agricultural, landscaping, and food waste into energy.

### 2. Native Plantings Across Campus

A Native Plantings Consultation Group could be formed to evaluate existing campus landscaping standards and to identify ways in which these standards should be changed to increase the use of native plantings across campus. This group would include experts at F&S, PRI, and other faculty and staff with relevant expertise. Expansion of native plantings would have benefits in terms of reduced maintenance and irrigation needs, as well as in increased biodiversity, for example pollinators.

### 3. Sustainability in the Campus Master Plan

The current Campus Master Plan does not fully reflect our sustainable land and facility use goals. Sustainability will be an important overlay of the campus fabric. Additional stakeholders must be engaged in further updates or revisions to the Campus Master Plan.

### 4. Natural Heritage Garden

Most faculty, staff, and students view East Central Illinois as a place that is primarily conducive to two species: corn and soybeans. Before FY20, the campus could develop a substantial Natural Heritage Garden that showcases the many and varied species that are native to this region of the country, allowing our community to regularly experience the biodiversity and natural wonder of native Illinois flora and fauna. The Natural Heritage Garden would also serve as a powerful educational tool for courses ranging from landscape architecture to ecology.

### 5. Reduce the Carbon Footprint of On-Campus Food

Dining Services has made excellent progress in terms of procuring foods locally and continuing to look for methods to reduce environmental impact. Dining already procures 26% of food from sources within 150 miles of campus, which includes 95% of all the produce grown on the Sustainable Student Farm. Presently, these efforts have been focused on increasing the fraction of local food, but without explicit consideration of associated greenhouse gas emissions.

With the assistance of relevant academic specialists, Dining Services could develop a Food Footprint for their operations. This report would reveal the GHG emissions from food services, and inform future efforts to increase local food purchase, including which food purchases contribute most to emissions and should be avoided.

The campus could also utilize the results of this report to engage with other vendors on campus in procuring local foods and reducing the greenhouse gas emissions associated with their services.

The campus could also make a concerted effort to work with local farmers to develop robust markets for local foods, and local food processing facilities, which will enable a greater utilization of local foods both by our campus and our community.

The environmental footprint of the aerobic digesters used in Dining Services could be assessed, to determine whether this is the best option for disposing of food waste, or whether vermi-composting or traditional composting might be better.

### 6. Increase Carbon Sequestration on Campus

The campus could actively investigate means of sequestering carbon in the soils of our campus. Some avenues to be explored include:

* Completing an inventory of trees and other plantings on the main campus, to determine the carbon sequestration already occurring and to guide future plantings to maximize sequestration.
* Investigating the production and use of biochar as a soil amendment, which increases agricultural production while also sequestering carbon.
* Assessing the sequestration of the extensive perennial crops at the Energy Farm.
* Developing agroforestry, or woody perennial polyculture, as a means to sequester carbon while simultaneously producing energy crops (e.g., wood from coppicing poplars) and/or food crops (e.g., hazelnuts and fruits) and also providing valuable ecosystem services. A project has just been funded by iSEE to convert 30 acres of traditional crops to a perennial polyculture research site.

### 7. Agricultural Runoff and Subsurface Drainage

Fertilizer applications in our agricultural practices have profound environmental impacts that are often not fully appreciated. In addition to direct greenhouse gas emissions, nitrogen applications also lead to increased nitrate concentrations in agricultural runoff and subsurface drainage, which ultimately drain to the Mississippi River and create a “Dead Zone” in the Gulf of Mexico that is greater than 5,000 square miles in extent. By FY20, the campus could substantially reduce our contribution to this problem, and serve as a model for agricultural operations in the Mississippi watershed. The strategy may require both changes to the timing and extent of fertilizer applications and the installation of equipment to treat subsurface drainage in tile.

## Conclusion

The strategies recommended here would help us to more accurately quantify our emissions from agriculture, land use, food, and sequestration. In turn, we can then identify the best alternatives for mitigating these emissions to reach net zero emissions by 2050.

# Chapter 9. Financing

A variety of financing mechanisms are currently in place to provide funding for sustainability projects, and are briefly reviewed here:

#### Campus Utilities Budget

We currently spend $98 million per year on utilities and energy services for the campus. This recurring budget has been a successful source for funding conservation projects. This includes formal programs such as retrocommissioning, and ad hoc allocations for “quick payback” (less than 6 months) projects through the Office of the Provost.

#### Energy Performance Contracting

As described in Chapter 4, energy performance contracting allows the campus to pursue capital-intensive projects in energy efficiency that offer a payback of less than 20 years, using the cost savings from reduced energy consumption to pay off the initial investment. EPC does require the campus to assume additional debt, although there is a guaranteed stream of energy savings to retire that debt.

#### Deferred Maintenance

The campus has a stream of funding from the Academic Facilities Maintenance Fund Assessment (a student fee) that is dedicated to reducing our backlog of deferred maintenance. Where possible, these funds are preferentially being deployed to address deferred maintenance projects that also reduce energy use, and thereby reduce greenhouse gas emissions.

#### Central Campus Budget

The Office of the Provost has made commitments outside of the above mechanisms in support of various sustainability initiatives on campus, such as for LED exit signs and for the Bike Center.

#### Student Sustainability Committee

The Student Sustainability Committee (SSC) is a student-led campus committee charged with the distribution of two student fees: the Sustainable Campus Environment Fee and the Clean Energy Technologies Fee. The SSC allocates over $1.1 million per year to fund projects that improve campus sustainability.

#### Revolving Loan Fund

The Revolving Loan Fund (RLF) was set up in FY12 in response to a specific recommendation in the 2010 iCAP. The RLF was established with funding from the Student Sustainability Committee (SSC) and the Office of the Chancellor, as a source for utility conservation projects that pay themselves back through utility savings in less than 10 years. The Office of the President has since committed additional funds, and the RLF has grown through grant contributions. At the beginning of FY15, the RLF balance was $3.2 million.

#### External Grants

Our campus has been quite successful in applying for grants from the Illinois Department of Commerce and Economic Opportunity and the Illinois Clean Energy Community Foundation to advance our sustainability objectives. Since tracking of sustainability-related grants began in 2008, we have received over $14 million for projects that are either complete or in progress.

#### Private Donations

To date we have had only limited success in obtaining private donations for sustainability projects, and this is clearly an area in which we have room to improve. One highly visible success story in this category is the installation of an impressive native prairie at Florida & Orchard.

#### Sale of Carbon Credits

In 2014, we agreed to retrospectively sell our carbon emission reductions for FY2012, 2013, and 2014 to the Bonneville Environment Foundation, as part of the Chevrolet Campus Clean Energy Campaign. This sale, together with a match from the Office of the Provost, is expected to yield over $1 million that will be used to drive even further emission reductions on our campus. The downside of this approach is that we will not be able to claim the reductions we worked so hard to achieve during that period; but the upside is that we will be able to claim them going forward, and we will have additional funds to reduce emissions.

## Financing Goal

Our campus goal for financing sustainability is quite simple: we want to ensure that our emission reductions are limited only by technology and our ingenuity, not by financial constraints. All of the best ideas for reducing our greenhouse gas emissions, as vetted by our established process of review by the SWATeams, the iCAP Working Group, and the Sustainability Council, should be matched with the funding necessary to make them happen.

## Objectives

1. Expand both the amount and availability of funds that can be used for sustainability projects that offer a financial payback.
2. Develop a Climate Action Fund for our campus, which will fund projects that have a “carbon payback” period less than 20 years, will drive our net emissions to zero by 2035 through the purchase of carbon credits, and will incentivize campus units to reduce their emissions.
3. Develop funding mechanisms for projects that do not offer a rapid financial or carbon payback, but which are nevertheless important for improving campus sustainability.

The campus should review and potentially expand the RLF and consider establishing a similar auxiliary revolving loan fund. Colleges, departments, and business units that wish to conserve energy should be able to utilize the RLF to finance their conservation projects.

## Potential Strategies

### Funding Projects with Financial Payback

Providing adequate funding for projects that pay themselves back in a reasonable period of time, and then generate what is essentially an indefinite revenue stream of energy savings, should be an easy decision for a campus to make.

#### Increase the Revolving Loan Fund

Our campus finds itself in a challenging financial situation, with uncertain prospects for state funding given the state’s significant financial challenges. Nevertheless, at the present time the campus does hold some cash reserves, thanks to careful stewardship. This is therefore the ideal time to make a significant expansion in the RLF. A one-time strategic investment in the RLF will lead to a significant reduction in utility expenditures for decades to come, and will strengthen the campus’s financial position going forward. A 2011 study showed that the median annual return on investment (ROI) on RLFs is 32%, demonstrating that these funds “significantly outperform average endowment investment returns while maintaining strong returns over longer periods of time.” We suggest that the RLF be increased to at least $10 million; this would put us in the company of exceptional peers such as Caltech ($8M), Harvard ($12M), and UCLA ($15M).

***Expand the Reach of the Revolving Loan Fund***

An increase in the RLF will need to be accompanied by an active outreach campaign to units across campus, including auxiliaries, so they are aware of this resource. The administrators of Harvard’s RLF have cited the challenge of “promoting the fund across a decentralized campus,” but yet they have “experienced average annual returns of 30 percent, saved the university $4.8 million dollars annually, and reduced Harvard’s environmental footprint.”

Currently, RLF projects are reviewed and funded on an ad hoc basis, whenever a substantial balance is available. In order to make it easier for units and auxiliaries to participate in the RLF process, we will ensure that major RLF proposals are reviewed for funding on a regular schedule, at least twice per academic year.

In order to make the RLF available to a wider cross-section of projects, we will also create a streamlined, off-cycle process for small projects. For example, when an individual researcher in a department is faced with the decision to purchase a more expensive but higher efficiency piece of equipment, as opposed to a less expensive and less efficient alternative, RLF funds should be easily accessible to encourage efficiency even with a higher up-front cost.

#### Increase Energy Performance Contracting

Energy Performance Contracting has been enormously successful, and offers the potential of dramatic energy savings across campus. Given that debt incurred by EPC comes with a guaranteed stream of energy savings to service the debt, and then continues to generate savings after the debt is retired, the use of this methodology should be aggressively expanded.

### Climate Action Fund

The campus will create a new Climate Action Fund (CAF) in order to internalize the externalities associated with our greenhouse gas emissions and to drive us towards carbon neutrality.

#### Explanation of Carbon Offsets

Carbon offsets, or carbon credits, allow the exchange of carbon emission reductions through a financial transaction. For example, entity A may wish to reduce its carbon emissions, but find that it is more expensive to reduce the emissions from its own operations than to pay entity B to reduce its emissions. Thus, entity B can reduce its emissions, have those emissions verified and validated by a third-party organization, and then sell those emission reductions to entity A. Entity A can then make environmental claims about its emission reductions, while entity B can no longer claim those emissions. As discussed earlier, UIUC is engaging in such a transaction, acting as the “entity B” in this example, with Chevrolet serving as “entity A.”

Our campus could elect to purchase carbon offsets from other entities (for example, companies that capture methane emissions from landfills, or plant trees to capture atmospheric CO2). In fact, at some point we will certainly have to do so in order to become carbon neutral, as some of our emissions (for example, air travel) cannot be realistically reduced to zero. We could decide to simply purchase enough carbon credits to offset our entire emissions and become carbon-neutral. With current bulk prices on the voluntary offset market in the $3/ton range, this would require an annual expenditure in the neighborhood of ~$1.5 million to achieve and maintain carbon neutrality.

#### Concept of Carbon Payback Period

Rather than simply purchasing offsets for all of our emissions, we believe it is better to take a (large) portion of the funds that we would use to purchase offsets, and invest those funds in projects that will permanently reduce our own campus emissions.

We introduce here the concept of the carbon payback period, which is the amount of time it will take for a particular project to reduce our campus emissions by the number of tons that the project cost would otherwise purchase in the form of carbon offsets. For example, if a hypothetical project costs $300,000 and current carbon offsets cost $3/ton, the project cost could be used to purchase 100,000 tons of carbon offsets. If that project will generate annual emission reductions of 10,000 tons per year, then the carbon payback period (the time it takes to reduce total emissions by 100,000 tons) is 10 years. The concept of the CAF is to fund on-campus projects that have carbon payback periods of 20 years or less.

#### Implementation of Climate Action Fund Assessments

Each year, iSEE will coordinate the usual process of tabulating campus greenhouse gas emissions. It will also determine, perhaps through an RFP process, the current market pricing for verified carbon offsets. The campus will make a contribution to the CAF equal to the product of the annual emissions and the price of carbon offsets – that is, the total market value of our greenhouse gas emissions. In FY15, this contribution will be made at the campus level on behalf of all of the units that are responsible for the emissions. Over a ten-year period, these contributions will be gradually transferred to the units responsible for the emissions, such that by FY20 the units will pay half of the market value of their emissions, and by FY25 they will pay the full market value of their emissions. This approach will help incentivize units to take their own actions to reduce their emissions. The majority of the emissions, and thus the majority of the assessments, will arise from the use of energy; at present energy costs are borne centrally, so that component of the assessments would also remain centralized. Individual units would only be responsible for contributing for their emissions due to air travel, use of the campus fleet, agricultural practices, etc.

#### Allocation of Climate Action Fund

Initially, up to 100% of the annual CAF funds would be invested in on-campus emission reductions projects that have carbon payback periods of 20 years or less. Over time, the fraction of CAF devoted to on-campus projects will be gradually reduced, and the balance of funds will be used to purchase external carbon offsets, thus allowing us to reach carbon neutrality by 2035. Specifically, the maximum fraction of the CAF to be spent on internal greenhouse gas reductions will be calculated as (35-FY)/20: 100% in FY15, 95% in FY16, 50% in FY25, and 0% in FY35.

Allocations of CAF funds to on-campus emission reduction projects will be made by the Climate Action Fund Allocation Committee (CAFAC). Projects can be proposed to the CAFAC by any campus unit (including F&S and auxiliaries), but must quantify the carbon payback period. The CAFAC will select those projects that have the shortest carbon payback period, but they may only select projects that have a carbon payback period of 20 years or less. Additionally, projects cannot be accepted if they meet the criteria of the RLF, unless RLF funds are exhausted for that year. If there are not enough projects meeting these criteria in a given year, all unallocated funds will be used to purchase external offsets.

### Funding Projects without Payback

Certain sustainability-related activities need to be funded even though they do not offer financial payback or carbon payback; examples include stormwater management projects and projects to increase the biodiversity of our campus. These are worthy and important projects, but are not eligible for funding through the RLF or CAF. Other projects will struggle to find funding because they have very long financial or carbon payback periods; examples might include the improvement of bicycle infrastructure. This section describes funding mechanisms that can be utilized to support such projects.

#### Income from Student Fees

Certain issues are important enough to the student body that they are willing to impose fees on themselves to address them. Examples include the long-standing Sustainable Campus Environment Fee and the Clean Energy Technologies Fee, which are allocated by the Student Sustainability Committee, and the new bicycle fee that was approved in a student referendum in November 2014. While the campus does not advocate for new fees, we must acknowledge that the funds from these fees are well-suited to supporting projects that are ineligible for RLF or CAF funding.

#### Central Campus Funding

We recognize that some projects and activities will require special commitments from campus, especially issues that are of great importance to students (e.g., bicycle infrastructure). Ongoing administrative costs, such as those for the Sustainable Transportation Coordinator and Zero Waste Coordinator proposed in Chapters 6 and 7, may also fall into this category. iSEE, Facilities & Services, and other impacted campus units will work with the Office of the Provost to identify funding for activities proposed in this iCAP or through the SWATeam process that do not have other funding avenues.

#### Private Donations

To date, there has not been a concerted effort to approach either individual donors or private foundations to fund campus sustainability projects. This is clearly an area with great potential for our campus, especially considering our exceptional performance and visibility in the sustainability arena. Donors and foundations are more likely to be willing to fund projects that have intangible value but major impact on campus sustainability.

#### Arbitrage of Carbon Credits

Carbon emission reductions from campuses are “boutique” and carry a premium on the voluntary carbon offset market. We may be able to sell our campus’s emission reductions, and then turn around and purchase the same amount of carbon credits from other entities at a lower price. The proceeds from this arbitrage (which would not affect our campus emissions) could be used to fund sustainability projects that do not fall under the purview of the RLF or CAF.

## Conclusions [needs work]

Too often creative discussions about sustainability projects are quenched by the question “how are you going to pay for that?” We need to free our minds from that question, and get to work solving the tough challenges involved in bringing our campus to carbon neutrality as soon as possible.

# Chapter 10. Education Inside the Classroom [under construction]

# Chapter 11. Education Outside the Classroom [under construction]

# Chapter 12. Sustainability Research [under construction]

# Chapter 13. Conclusion and Call to Action [to be written]

**Appendix. Glossary and Acronyms [to be written]**

aerobic digester:

ECIP Energy Conservation Incentive Program

EPC Energy Performance Contract

ESCO Energy Services Company

EUI Energy Use Intensity

GHG Greenhouse gases

iCAP Illinois Climate Action Plan

iSEE Institute for Sustainability, Energy, and Environment

MSW Municipal solid waste

PPA Power purchase agreement

PV Photovoltaic

RCx Retrocommissioning

REC Renewable Energy Certificate

steam trap:

vermi-composting:

1. Link to a page about this somewhere… portal? Provost? iSEE? [↑](#footnote-ref-1)
2. <https://icap.sustainability.illinois.edu/project-update/business-instructional-facility-recommendations> - need permission to post online from Madhu Viswanathan and team [↑](#footnote-ref-2)
3. Add citation of source calculation [↑](#footnote-ref-3)
4. <https://illinois.edu/blog/view/1109/80742> [↑](#footnote-ref-4)
5. <http://www.fs.illinois.edu/docs/default-source/retro/energyprojectsummary_varrate-rpt-1.pdf?sfvrsn=0> [↑](#footnote-ref-5)
6. LEED® is a registered trademark of the U.S. Green Building Council. [↑](#footnote-ref-6)
7. Link to facility standards [↑](#footnote-ref-7)
8. <http://www.energymanagement.illinois.edu/pdfs/EnergyUsePolicy.pdf> [↑](#footnote-ref-8)
9. <http://fs.illinois.edu/docs/default-source/Utilities-Energy/fy15-utility-budget-and-rate-approval.pdf?sfvrsn=0> [↑](#footnote-ref-9)
10. Of our total energy usage in FY14, 51% was from steam produced at Abbott, 28% was from electricity cogenerated at Abbott, and 21% was from electricity purchased from the grid. An estimated 5.4% of the energy was used to produce chilled water, mostly in electric chillers. [↑](#footnote-ref-10)
11. http://www.eia.gov/consumption/residential/reports/2009/state\_briefs/pdf/il.pdf [↑](#footnote-ref-11)
12. Program statement for Utilities Production…master plan [↑](#footnote-ref-12)
13. <http://icap.sustainability.illinois.edu/project-update/mode-shift-update> [↑](#footnote-ref-13)
14. <http://www.ihavemiplan.com/results/index.html> [↑](#footnote-ref-14)
15. <http://www.afdc.energy.gov/vehicles/electric_emissions.php> [↑](#footnote-ref-15)
16. <http://bikeleague.org/content/new-league-staff-amelia-neptune> [↑](#footnote-ref-16)
17. U.S. EPA, “Landfill Methane Outreach Program, Basic Information – It directly reduces greenhouse gas emissions” <http://www.epa.gov/methane/lmop/basic-info/index.html>. [↑](#footnote-ref-17)
18. Id. [↑](#footnote-ref-18)