An Examination of Greenhouse Gas Reduction Potential at the University of Kansas

An Outline for Creating a Comprehensive GHG Inventory

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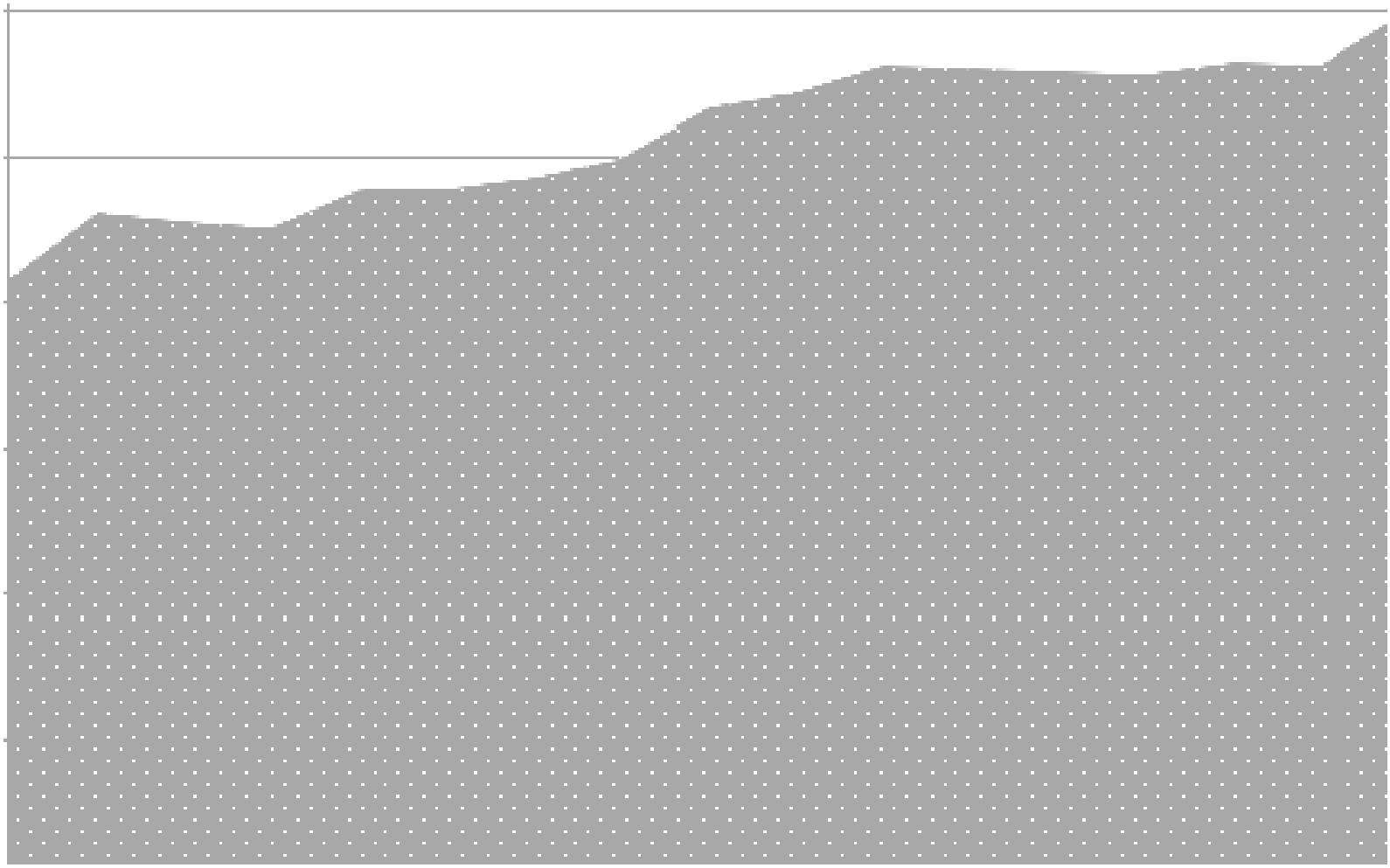


Introduction

As the Global Warming issue started to take off in the mid-nineties, so did the contention surrounding it. Unsure of the backing science's validity and even the feasibility of doing something about the problem, governments and individuals didn't make any drastic moves to prevent global climate change. In 1997, the famous Kyoto Protocol was drafted in Kyoto, Japan. The protocol, yet to be ratified by the United States, called for a reduction in the emissions of greenhouse gases (specifically carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, HFCs, and PFCs) that would be at least 5.2% 1990 levels. The total amount reduction from present emissions depends on the energy use trends of the nation in question and can be quite substantial.

Despite the widespread adoption of the Kyoto Protocol, scientific contention still exists, especially in the United States, over whether or not human beings are significantly contributing to the phenomenon of global climate change. In February of this year, however, the Intergovernmental Panel on Climate Change, or IPCC, released its fourth report. This report asserts that, with "very high confidence," the climate change that has been observed is due to anthropogenic actions. Now, in 2007, with highly credible authority to back it up, the issue of global climate change is prompting serious actions by lawmakers and governmental figures.

However, in the late 1990s and early 2000s, some innovative leaders had already started taking steps toward reducing their overall contribution to climate change. Several institutions of higher education began the process of creating "greenhouse gas inventories." These inventories take into account all of the different processes, occurring within that institution, that lead to the emission of greenhouse gases and ultimately to a portion of change in the global climate. Institutions like Oberlin College, Yale University, Harvard University, the College of

Charleston, Smith College, University of New Hampshire, and Middlebury College have all taken steps to estimate their greenhouse gas, or GHG, emissions. This important first step in a GHG reductions program establishes the vital emissions baseline, from which the institution can set target reductions standards and create an informed project timeline that takes into account the institution's trends in energy use, and more specifically, emissions of greenhouse gases from all centers of operation. Typically, these sources include the broad headings of: energy use- both stationary, on-site sources as well as energy purchased off-site; transportation, including vehicles owned or used by the university as well as commuters; waste, both solid waste and wastewater; synthetic chemicals, including refrigerants and fertilizers; animal management; and land management. Since many institutions decide to follow the standards set by the Kyoto Protocol, data for a GHG inventory must include all data from 1990 to the time the inventory is completed. This task can be quite daunting, as will be discussed later, and is often a major deterrent to the creation of a GHG reduction programs at educational institutions. Often, student interns are hired to complete data collection, or classes are created through which groups of students can work towards completing a GHG inventory.

Since this report focuses on the actions taking place here at the University of Kansas, as well as the potential for improvement in those actions, I will focus on how other institutions have created successful GHG reduction programs, how those programs apply to existing infrastructure at KU, and what steps can be taken to increase the likelihood of a similar program's implementation. To make this comparison, I will introduce several exemplary institutions' programs and explain the process through which they began reducing their GHG "footprint." I will use the format and processes outlined by the Clean Air-Cool Planet program (www.cleanair-

coolplanet.org) since it has been adopted by a number of institutions with successful GHG reduction programs.

This report is designed to function as a resource for future student projects and research. Resource files including two GHG calculators, several reports from institutions with existing GHG inventory programs, and some relevant data from the University of Kansas were submitted with this report.

Model Institutions

Oberlin College - Oberlin, Ohio

Led by the energy and work of notable Professor David Orr, Oberlin College has become an unlikely model for environmental forward thinking and innovation. Oberlin is home to the Adam Joseph Lewis Center for Environmental Studies (AJLC), a first-of-its-kind, high-performance, ecological building that has garnered a number of awards and recognitions, including an American Institute of Architects Build Amercia Award (2001), recognition as one of 30 Milestone Buildings of the 20th Century, U.S. Department of Energy top 10 Green Projects (2002), and a Construction Build Ohio Award (2000). The building itself includes:

- A photovoltaic array to provide clean electricity, some of which is exported to the local power grid during peak daytime production.
- Passive and active heating and cooling systems, including geothermal wells and large south-facing windows to provide indoor climate control with a small impact

- Naturally-landscaped surroundings that provide habitat for native flora and fauna as well as food produced for humans.
- A “Living Machine” water recycling and reuse system based off both modern water purification technologies and principles of wetland ecology.
- A weather monitoring station.
- Building materials selected for their energy consumption and levels of toxicity.

In 2002, following the success of a long campaign to fund and construct the AJLC, Oberlin contracted with the Rocky Mountain Institute to prepare a document outlining a proposal that would make the college completely carbon neutral by the year 2020. This 125-page document outlines the feasibility of dramatically reducing the college’s carbon footprint, even to the extent of becoming carbon-neutral, under several scenarios. The proposal shows how this can be done with minimal costs and even at a potential long-term *profit* gained by selling excess energy produced at the college. Four scenarios are presented:

- Baseline (business as usual) involves “no special effort to save energy or reduce emissions.
- No-Brainers (‘low-hanging fruit’) includes “low cost-efficiency measures.”
- No-Regrets (aggressive energy efficiency and co-generation) includes “aggressive but cost-effective energy efficiency and co-generation measures, requiring significant capital investment.”
- No-Prisoners (carbon-neutral) is “more aggressive and reduces carbon emissions to zero” and involves no purchasing of carbon offsets.

The report also outlines three main strategies for cutting carbon emissions:

- On-site reductions
- Carbon Sequestering
- Carbon offset purchase.

The Climate Neutral by 2020 program also includes a well-designed implementation design that includes a comprehensive carbon inventory, an extensive examination of potential options for carbon reduction, risk assessment, and policy and financing options. Through its 125 pages, the proposal is obviously aimed at a very thoroughly-designed and aggressive campaign to drive the college toward carbon neutrality by the year 2020. The proposal writers recognize the need for large initial investments, but also point out that a very well-designed plan will eventually lead to extensive savings and, through high technology and comprehensive integration, possible profits.

The Oberlin model serves as an example of a very aggressive program that is setting goals well beyond that of any of its peers, especially for its geographic location in the Midwest. There are few institutions that have comparable faculty, staff and student body commitment to reducing their GHG footprint, which has became especially clear as the construction of the AJLC put Oberlin on the "sustainability map," so to speak, and raised the bar on what an educational institution can do to take a responsible stance on climate change.

Harvard University- Cambridge, MA

Harvard's GHG program is one part of a highly extensive, university-wide "Green Campus Initiative." This large program includes provisions for a GHG inventory, high performance and sustainable buildings, a green campus loan fund, renewable energy programs, a green cleaning program, a campus energy reduction program, student internship program, sustainability course, and a graduate green living program. Needless to say, the environmental climate at Harvard is welcoming to new ideas and programs.

However, compared to other institutions that conduct GHG inventories, Harvard falls short since it hasn't set any specific reduction goals or timelines. They simply conduct the survey in addition to existing environmental efforts. The inventory has been conducted retroactively for every year since 1990 and its scope is the impact of the university's two main campuses.

Harvard uses the Greenhouse Gas Protocol tool developed by the World Resources Institute and the World Business Council for Sustainable Development. They chose this particular tool because it's been peer-reviewed and is accepted as a kind of "gold standard" in inventory tools among businesses, governments, and educational institutions. Many universities choose a different tool, covered later in this report, called the Campus Carbon Calculator: a tool distributed by the Clean Air-Cool Planet organization. Harvard used to use this tool, but have since switched to the GHG Protocol tool.

It's important to note Harvard's High Performance Buildings and HRES Sustainable Buildings programs, which both work towards the promotion of energy-conscious buildings on campus. They look at the overall feasibility, as well as cost-effectiveness, or creating or

renovating buildings that have a smaller GHG footprint than traditional buildings. Harvard, with its multiple green roofs and LEED-certified buildings, has a history of lower-impact buildings. These programs, working in conjunction with the Green Campus Initiative, show promise in promoting a more responsible energy portfolio for the university.

Another interesting program is the Harvard's Green Campus Loan Fund: a revolving loan fund that is used to finance conservation programs for the university. In 2000, $3 million was allocated to the fund from the university bank. The fund was doubled in 2005 and doubled again in 2006. The now-$12 million fund can be tapped through an application process and all funding must be paid back within 5 years or less. According to the Green Campus Initiative web site, programs initiated with GCLF money have already saved at annual $700,000.

While not as aggressive toward a carbon-neutral goal as Oberlin, Harvard's far-reaching and comprehensive green program certainly contributes to a reduction in GHGs. Perhaps more importantly, it's leading toward an on-campus climate that is favorable for implementing a carbon reduction program. The Green Campus Initiative's website suggests that, once a good data pool of inventories is created, the university may look towards a program to reduce its carbon footprint by a specific amount. Until then, however, Harvard continues to expand its environmentally-conscious and forward thinking programs.

University of New Hampshire – Durham, NH

University of New Hampshire, or UNH, is home to a robust Office of Sustainability, contributing to a whole host of environmental programs all across the university. The adoption of similar offices seems to be a trend across higher education, even recently at KU. These

offices are effective at centralizing the often highly dispersed processes that define a university's impact on its surrounding environment, including internal energy production, energy purchases, transportation, waste, water services, and countless others. An office of sustainability can function as an effective hub and information center for all of these activities.

The UNH Office of Sustainability works on quite a few existing and proposed projects including a large biodiesel and biocrop program that manages biodiesel buses, biofuel research, and an upcoming program that will convert dining area waste vegetable oil into biodiesel. It also works on the "cat cycles" bike rental program, a new "cogeneration" heat and power facility, energy and climate curriculum, energy efficiency programs for campus buildings, an energy efficient purchasing standard, the GHG inventory, signing of the Presidents Climate Commitment, and a "waste watch" student waste reduction competition.

The UNH Office of Sustainability website, http://www.sustainableunh.unh.edu/index.html, much like the websites for Harvard and Oberlin's programs, provides detailed information about all of the initiatives listed above and serves as a good resource for members of the campus community that may find themselves working on an environmental initiative during their time at the university.

The UNH program is quite comprehensive and sets specific carbon reduction goals, but is still not as aggressive as Oberlin's program proposal. In comparison with KU, the UNH program is probably the closest to its existing and potential conditions. Both institutions have an office of sustainability, some interest in building up the program, and a strong focus on research.

A Framework for GHG Policy Implementation

In this section, I suggest the use of the Clean Air-Cool Planet policy framework along with the implementation guidance of two student activist groups: the Campus Climate Challenge and 2020 Vision. The combination of resources from these three groups provides a solid framework from which student researchers can easily outline a policy proposal and implementation plan.

Clean Air - Cool Planet

The Clean Air-Cool Planet program has been widely adopted throughout institutions of higher education including Tufts University, University of New Hampshire, University of Vermont, Middlebury College, Colgate University, MIT, Smith College, Yale University, and formerly Harvard University. The program also provides online resources including a peer-reviewed GHG inventory calculator. The calculator processes data inputs from the institution's normal energy use, waste patterns, and other processes and calculates GHG emission estimates.

The Clean Air-Cool Planet website also provides a step-by-step guide to "making [an] educational institution more 'climate friendly.'" Steps include:

- Take an inventory of GHG emissions using the Campus Carbon Calculator provided on the site (registration required). This section provides clear directions on how to use collect data, use it to calculate emissions, then analyze and summarize the results.

- Set a GHG reduction target. The site gives a brief background on the Kyoto Protocol and other target-setting measures that institutions should consider when setting their own. It also provides link to case studies and information on budget considerations. Another good resource for reduction targets is the 2020 Vision project, whose mission is centered around oil use reduction goals (http://www.2020vision.org/index.cfm).
- The next step is developing a "Climate Action Plan," which is essentially a pro and con comparison of different GHG reduction measures. The site provides background information and case studies on how to plan for on-campus energy modification, green power and offset tag purchasing, transportation considerations, waste reduction, synthetic chemical management and agricultural program concerns.
- The last step is implementation, which is where the list falls short on usable information. To supplement this, I suggest using the policy implementation resources provided by the Campus Climate Challenge, a nationwide student activism group based on the Student PIRGs (http://climatechallenge.org/).

Campus Climate Challenge Implementation Guide

As a Student PIRG affiliate, the Campus Climate Challenge (CCC) is well-suited to be a model for student organizing and leadership. The Student PIRGs are known for their tenacity for pushing initiatives in a university setting and even getting those initiatives recognized in higher levels of government. The CCC website hosts what they call a "challenge toolkit": a set of

guidelines for organizing students, educating the target community, writing a promising proposal, and winning "policy victories." The toolkit is hosted at http://climatechallenge.org/wiki-sources/challenge-toolkit/. Also included are case studies from other universities, ideas for educational events, tips on developing a proposal, building support, and developing an effective campaign strategy. A very activism-centered organization, CCC fills in where the Clean Air-Cool Planet program leaves off.

The University of Kansas: Where do We Stand?

This section is intended to provide a background on operations and attitudes at the University of Kansas. The names of specific staff and program leaders have been included in order to encourage centralization of contact information for future use.

Student Energy

If there is one area that garners the most support for the implementation of a GHG reduction program, it would lie within the student body. Home to a number of active environmental groups, KU is not short on energy from students. The KU Environs, the Emerging Green Builders, the Student Senate's Student Environmental Advisory Board, Project 2020, Campus Climate Challenge, Step It Up Lawrence, and EARTH have contributed to a university attitude that favors environmental initiatives. One measure of this characteristic is the continued approval of environmentally oriented fees during student elections. Through

incremental fee increases, the student body has consistently supported the university's recycling program, the Environmental Stewardship office.

Student-led initiatives are not uncommon, either. During the 2006-2007 academic year, students began work on a biodiesel research and production initiative, started a greywater service learning course, and drafted and delivered a proposal to start a hybrid police vehicle pilot program. These initiatives have been completely student-led and represent a vast pool of research potential for the University of Kansas. When these successes are publicized, it only leads to a more positive environmental image on campus.

Campus Improvement

Although most likely pushed down the campus improvement priority list by huge issues with deferred maintenance, environmental performance initiatives have been implemented in small doses around campus. The recent construction of a new scholarship residence hall came with a modern, geothermal heating and cooling system. The system, installed in Rieger Hall, came with a large initial price tag but will end up saving energy and money in the future.

Another important set of improvements has come with KU's energy performance contract with Chevron Energy Solutions. Two Chevron employees, Rod Ideker and Rick Sweeney, are employed by the university to determine opportunities for and implement energy conservation measures. So far, this has included the installation of $18.3 million in energy and water conservation measures, according to KU Facilities Operations. These measures include "upgraded lighting, a new steam boiler, window tinting, new and upgraded components for the Building Automated Control System (BACS), improvements to the steam distribution system,

upgrades to the electrical distribution system, and low-flow restroom fixtures." Chevron has also hired several student energy monitors, who are charged with touring campus buildings to observe lighting patterns, computer use patters, thermostat readings, open windows and water use.

Aside from campus improvements, Chevron also conducts energy education activities. They host information booths at environmentally focused events and publish a regular "Energy Saver" newsletter, featuring tips on cutting back energy use, as well as figures on how their efficiency programs are doing.

Center for Sustainability

Initiated with a student project, a "Sustainability Task Force" was created in 2004, consisting of student, faculty and staff representatives from a variety of backgrounds. The task force's aim was to create a proposal for the creation of a new Center for Sustainability, the responsibility of which would be the centralization of all things pertaining to the university's sustainability status or lack thereof. The task force's first proposal for funding was denied, but after an uncertain transition of university staff along with a push by student activist groups, the center was approved in 2006 with the stipulation that it meet certain funding and research criteria during its first years of operation. Now headed by former Environmental Stewardship coordinator Jeff Severin, the KU Center for Sustainability is in the stages of assuming its role on campus.

Much like the Office of Sustainability at UNH, the KU center shows promise for progression in upcoming years. All of the center's stated objectives focus on improving communication on campus in order to promote the tenets of sustainability more effectively. On a

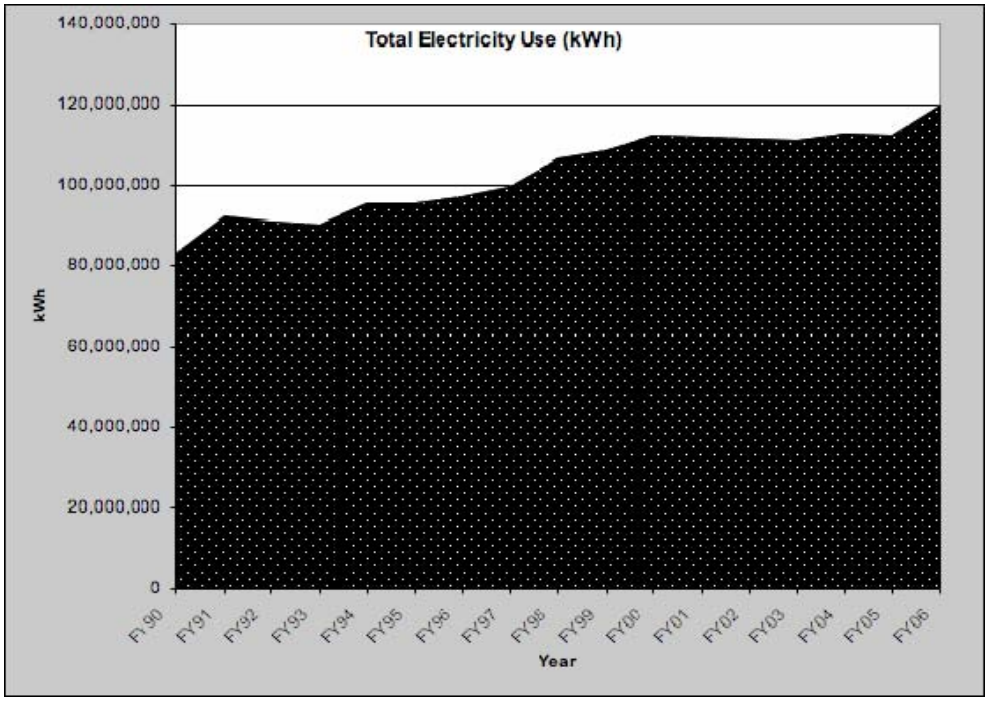
campus as large and decentralized as KU, communication and information access proves to be incredibly important and often lacking.

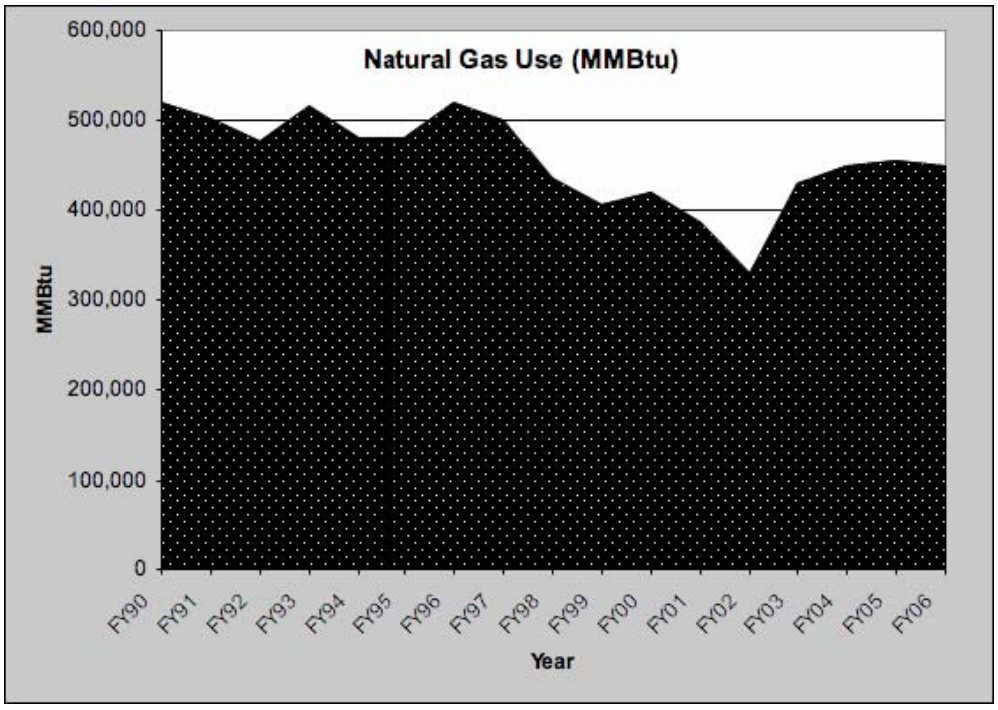
My Findings

Hard Data

Since I only spent one semester looking and had little experience with the labyrinth of university departments at KU, I wasn't able to find the complete data set necessary to use any of the GHG calculators. I did, however, find some clues about the university's energy use trends and energy sources.

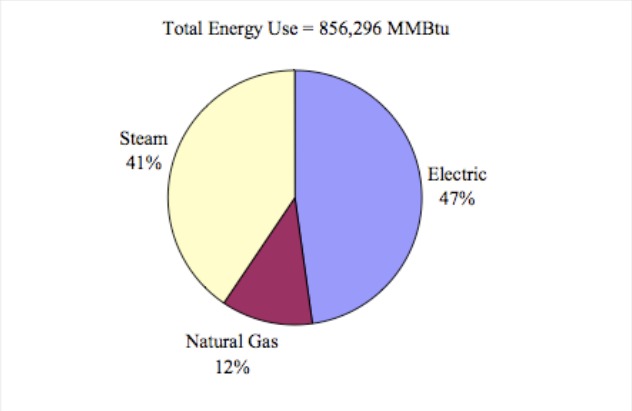
Facilities Operation was able to provide me with total energy use figures, as well as natural gas figures from the years 1990 to 2006. Total electricity use shows a strong, positive trend. The trend in natural gas is less obvious, but appears to be declining.





The trend in electricity use is not atypical among universities. As enrollment goes up, so do demands for electricity. Compounded with higher electricity demand, it's no surprise that energy use, as well as energy spending, has gone up.

Other data was gathered from the Facilities Operations Utility Management Annual Report (2006). This public document outlines the year's energy use and expenditures and gives a little insight into KUs energy and utility climate. The following graphs were taken from the FO Utility Management Annual Report (2006):



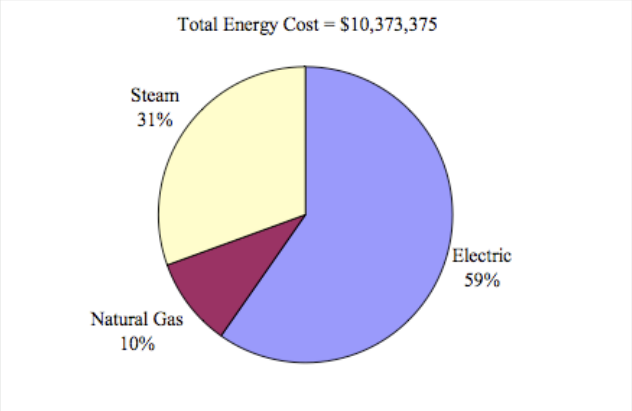


Figure 2: FY06 Utility Cost Distribution

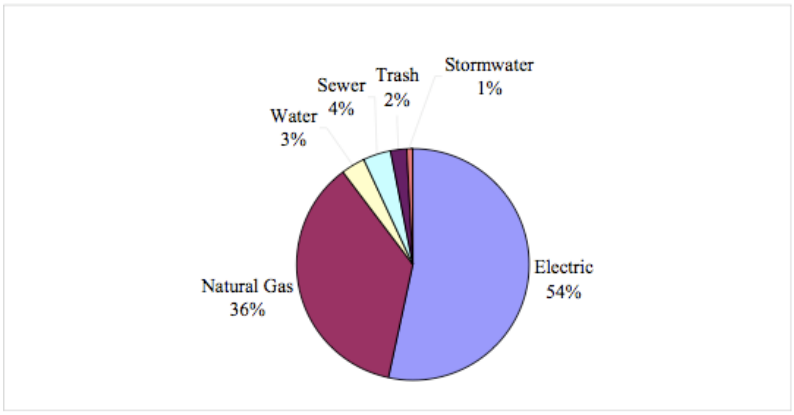
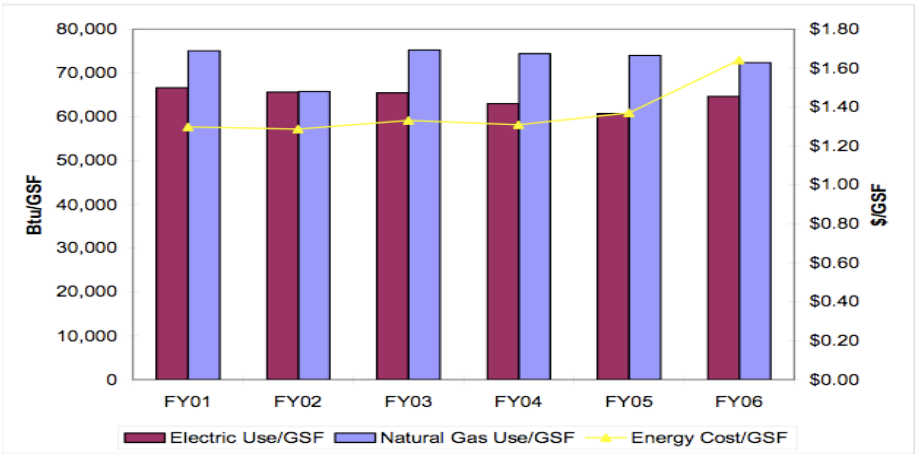
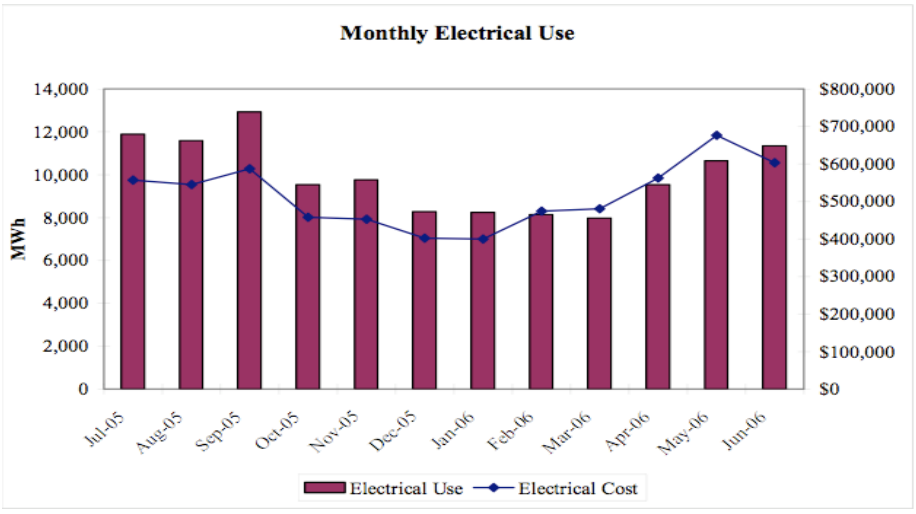


Figure 9: Total Energy Use and Cost as a Function of Gross Square Feet





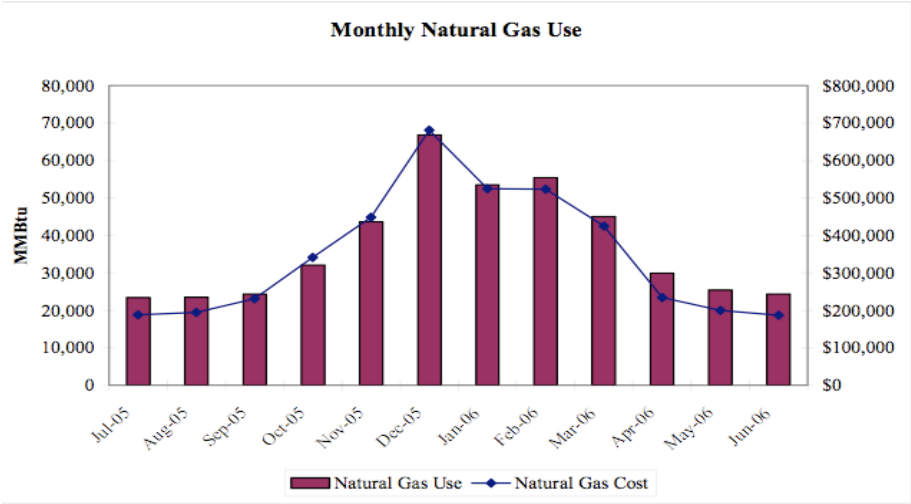
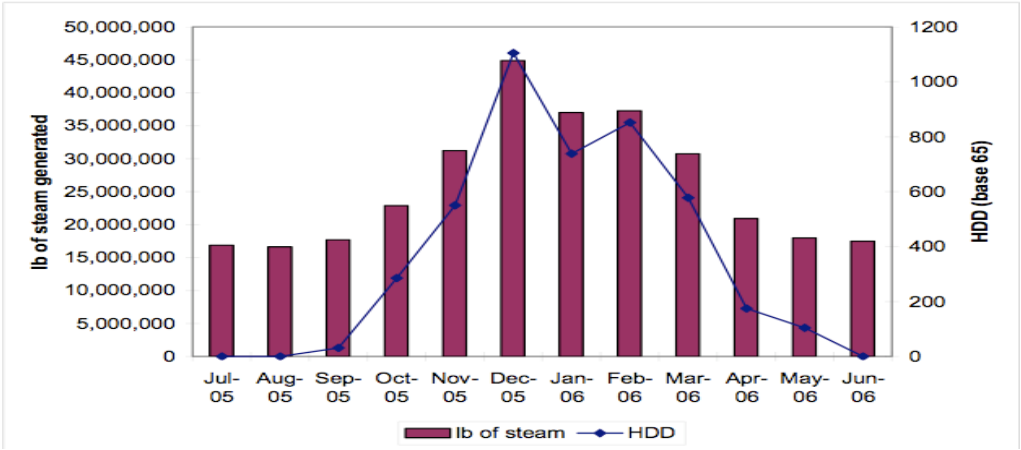


Figure 13: Monthly Steam Generation with Heating Degree Days



The implications of these figures are not surprising. A majority of the university's utility costs are on electricity. However, we use quite a bit of steam which, while inexpensive, is more energy intensive than electricity. Also, we use more electricity to provide air conditioning in the summer, especially when students return in late August. We use more steam and natural gas in the winter to heat the buildings on campus.

It's important to note that the electricity use per square foot is actually decreasing, which may be a sign that Chevron's energy conservation measures are effective. Total energy use goes up because there is more building space each year.

The FO report also notes the Provost's energy conservation measures for the heating and cooling seasons. Passed in 2004, these measures may account for the marked decrease in electricity and natural gas use from 2004 to 2005. These measures provide that during the cooling season:

- Temperature in occupied rooms should not exceed 76 degrees F.
- Where possible, FO should utilize thermostat setback features during low-occupancy periods or when the building is closed.
- Day lighting should be used whenever possible.
- Keep outside doors and windows closed when cooling systems are in use.
- Power management features on computers should be set to put the computer "to sleep" after 5 minutes of inactivity.
- Computers and monitors should be turned off if employees are leaving their workstations for a few hours.
- Computers not accessed remotely, as well as printers, should be turned off at the end of the business day and on weekends.

During the heating season:

- The temperature of occupied rooms should not exceed 69 degrees F.
- Night setback features should be utilized.
- Windows should be firmly shut and locked. Doors should be closed.
- FO will provide plastic film at no charge to departments.

- Day lighting should be maximized.
- The same principles that apply to computers during the cooling should also apply during the heating season.

These simple principles, if put to practice and enforced (which will be observable to Chevron's energy monitors), will constitute a significant reduction in GHG emissions. However, a more effective process would involve permanent improvements to existing facilities, rather than voluntary compliance by facility occupants.

Where Does KU Go From Here?

Given the current understanding of climate change and its causes, the University of Kansas has a moral obligation to work towards reducing its GHG emissions. As a community that numbers in the tens of thousands, policy changes within the university can actually have a significant impact on GHGs in the atmosphere.

From the model universities listed above, it's clear that cutting our carbon is not an ideal out of reach. With a well-designed program and a sizeable capital investment, KU can easily attain a more reasonable level of carbon emissions and even end up saving money. However, KU's current trend of energy conservation only focuses on the "low-hanging fruit" of voluntary, behavioral changes that don't represent a permanent commitment to a reduction in carbon emissions. To make a true commitment, KU needs to institute significant capital changes and improvements to its campus systems. Like Oberlin, KU is faced with its own four potential strategies: business as usual, small changes in behavior (mostly), significant

capital investment-driven improvements, or a no-prisoners stride towards carbon-neutrality. Given the current climate of interest and action on environmental issues, some kind of change in GHG emissions is likely. That change is unlikely to look at all like Oberlin's no-prisoners, carbon-neutral ideal, but any progress is welcome.

KU especially has room for improvement in its building performance. Simple upgrades to window and doors can lead to a tremendous decrease in heating and cooling costs. An upgrade to the university's boiler and steam system, a periodically necessary upgrade, would have a dramatic effect on heating bills.

Transportation is also another area that could easily be improved. Buses are already scheduled to be phased out and replaced with newer, more efficient models. Student initiatives already exist to start biodiesel research and production and students have already researched and proposed a plan for hybrid police vehicles. The work has already begun on these projects.

It's important to note that any set of new initiatives or programs doesn't have to be implemented all at once. Programs can be phased in over time, as part of a comprehensive and long-term plan. KU's policy should reflect this principle and adopt policies with long term, sustainable and climate responsible goals in mind.

To do so, KU will have no choice but to improve its venues for communication. Without some degree of information streamlining, any cross-university policies will be unnecessarily difficult to implement. The new Center for Sustainability will be instrumental in making this transition and should be valued and consulted when policy changes occur.

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