

# Sustainability and Energy: The University of Kansas



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## TABLE OF CONTENTS

<b>List of Figures</b> .....	ii
Figure 1. Energy by Building Type.....	3
Figure 2. Utility Cost Distribution.....	4
<b>List of Tables</b> .....	ii
Table 1. Westar Energy Sources.....	7
Table 2. Energy use by Building Type.....	8
Table 3. Savings from Chevron Contract.....	9
<b>ABSTRACT</b> .....	1
<b>1.INTRODUCTION</b> .....	1
<b>1.1 Electricity and Natural Gas</b> .....	2
<b>1.2 Utilities Distribution</b> .....	3
<b>1.3 Costs</b> .....	4
<b>2.GOALS</b> .....	4
<b>3.METHODOLOGY</b> .....	5
<b>3.1 Formulate a comprehensive understanding of how campus uses power</b> ..	5
<b>3.2 Evaluate efficiency of power usage on campus</b> .....	5
<b>3.3 Evaluate current conservation initiatives and investigate alternative sources of power</b> .....	5
<b>3.4 Investigate conservation practices/initiatives at other campuses</b> .....	6
<b>3.5 Propose conservation strategies</b> .....	6
<b>4.RESULTS</b> .....	7
<b>4.1 University of Kansas Lawrence Campus Energy Use</b> .....	7
<b>4.2 Analysis of Energy Efficiency on University of Kansas Campus</b> .....	9

<b>4.3 Investigation of Alternative Sources of Power and Conservation Measures</b> .....	10
<b>4.4 Alternative Energy Applications at KU Campus</b> .....	11
<b>4.5 Investigation of Conservation Practices/Initiatives at Other Campuses</b> ..	12
<b>4.6 Proposing alternatives</b> .....	13
<b>5.RECOMMENDATIONS</b> .....	14
<b>5.1 Behavior</b> .....	14
<b>5.2 We Bleed Crimson and Blue...and Green? KU Sustainability Cup: Saving Money and Energy Through Competition and Awareness.</b> .....	15
<b>5.3 Potential Alternative Sources of Energy at KU</b> .....	15
<b>6.CONCLUSION</b> .....	16
<b>7.ACKNOWLEDGEMENTS</b> .....	16
<b>8.REFERENCES</b> .....	17

# Energy and Sustainability: The University of Kansas

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**ABSTRACT.** The purpose of this project was to gain a detailed understanding of how energy is used and consumed on The University of Kansas' main campus and West campus. A thorough investigation behind the campus and its energy usage was conducted that surveyed many issues dealing with infrastructure, efficiency, conservation, as well as alternative forms of energy. The University of Kansas has undertaken many measures to use power in a more sustainable manner through building upgrades, energy audits, public awareness campaigns, and alternative forms of energy. Using our results and research as well as contrasting The University with specific colleges across the nation that specialize in energy conservation/sustainability, we determined that greater public awareness, continued building modifications as well as utility payment re-distribution were some feasible recommendations that The University of Kansas could employ.

**KEY WORDS:** energy, conservation, alternative-forms, non-renewable resources, KU, consumption, utility costs

## 1.INTRODUCTION

The ideal of sustainable progress or the ability to meet current demands without compromising those of the future is one that has applications across all aspects of society. When considering energy issues, the ideal of sustainability becomes very important. As both the American population and global population continue to grow, it will become more important to be mindful of the processes behind energy resource extraction and production. Environmental consequences associated with unsustainable energy production processes include air pollution, mercury contamination, and the depletion of non-renewable resources. While the concept of sustainability is important for the conservation of the environment and natural resources, applying the concept of

sustainability to energy production raises questions of feasibility, environmental consequences, and long-term benefits. The University of Kansas represents a large, complex institution which has many demands when considering energy as well as many opportunities to promote greater sustainability.

When considering the layout of the University of Kansas in Lawrence, many might look at it as just a diverse set of large buildings each with many associated uses that serve the purpose of educating the thousands of students who attend yearly. But what escapes the average individual are the specifics behind each building, especially regarding the technology employed and the amount of energy required to run these processes on a daily basis. Along with the operation specifics of each energy producing system come the costs that accumulate from the continued use of these buildings/equipment. When considering the environmental impacts from energy extraction/production and future budget limitations for the University, it became important to understand the infrastructure of energy use at the University of Kansas, and develop ideas for improving energy sustainability in the future.

In the United States, the main form of energy production comes from the burning of coal, which has major implications on the environment and global climate change. The burning of coal produces several criteria pollutants, as outlined by the National Ambient Quality Standards of the Clean Air Act of 1970 (Environmental Law and Policy, 2007). These criteria pollutants include sulfur dioxide, carbon dioxide, mercury, and lead which can have substantial adverse effects to the quality of water, air, and soil. Carbon dioxide is of concern in particular for global climate change because of its status as a greenhouse gas. The average American household consumes 8,900 kWh of electricity in a year on average and it takes nearly eight-tenths to a full pound of coal burned to produce one kilowatt-hour of electricity at 32-40% efficiency (Craig Hansen, Personal Communication, 11 March 2009). On a larger scale than the average American family, The University of Kansas consumes nearly 11 million kWh of electricity which requires about 45,000 tons of coal for generation. Consequently the consequences of energy production become even more alarming when considering the large complex system of buildings and uses taking place at the University of Kansas.

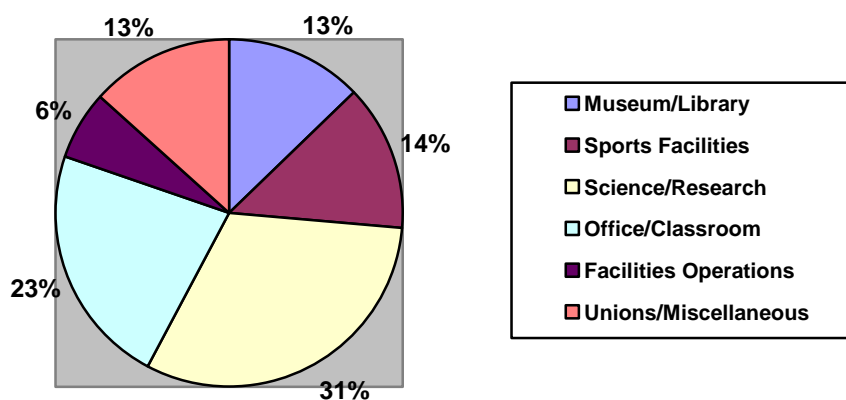
### **1.1 Electricity and Natural Gas**

The University of Kansas relies on outside providers for all of their utilities, including electricity and gas. However, KU owns the campus infrastructure that delivers these two forms of energy to all the buildings. The University of Kansas employs three electrical distribution systems throughout campus, the largest being reserved for the main campus, while West Campus utilizes two smaller systems. The largest system supplies power at two different feeds on the main campus, Burt Hall and the Boiler Plant. In addition to the electricity systems in place on campus are the nearly 16,000 feet of insulated piping which connect fifty-four buildings on the main campus to the power plant. Natural gas is pumped to the power plant on the main campus by high pressure lines owned and operated by Kansas Public Service (Utility Report, 2006). In this facility, natural gas is used to fuel four large boilers (two- 48,000 lbs/hour, one- 50,000 lbs/hour, one 15,000 lbs/hour) which produce 216,000 lbs/hour of steam that is used for heating and hot water in buildings on campus. Not all the steam produced in the main

power plant is used when traveling through the pipe systems, so the condensate is collected during the traveling process and returned back to the power plant for future use. Several buildings on campus are not connected to the insulated pipelines and they require natural gas to be pumped into the building for heating and hot water production. The usage patterns for electricity and natural gas on campus is worthy of mention: peak consumption for electricity occurs in summer with the lowest demand during winter. Natural gas, on the other hand, is much more dependent on weather conditions, but usually reflects the opposite trend of electricity with peak consumption occurring in winter (Annual Utilities Report, 2006).

## 1.2 Utilities Distribution

The variety of buildings on both the main and West Campus have vastly different energy uses and requirements. For example, science and research related buildings typically use and demand more energy because of the number of laboratories and experiments that require constant energy flow as opposed to a more classroom-based building that usually varies in energy use depending on the time of day. Figure 1 shows the relative breakup of electricity usage amongst the different types of buildings on campus.

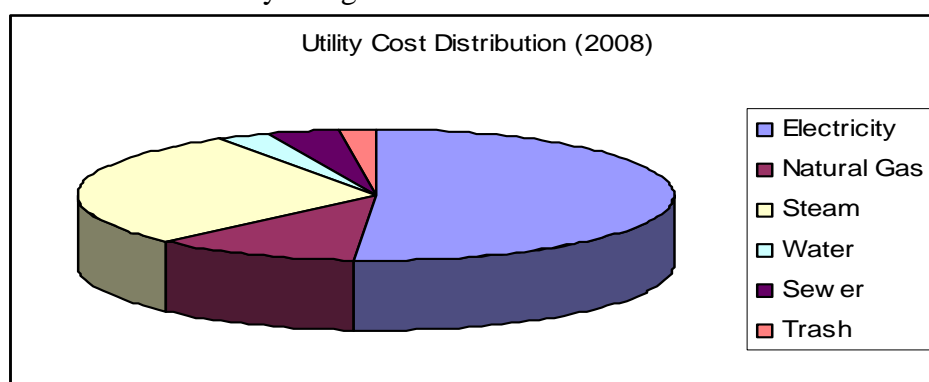


**Figure 1. Energy by Building Type (2008)**

As expected, science and research related buildings make up the heaviest energy users on campus (31%) followed by classroom/office buildings (23%) (Energy by Building Report, 2008). Understanding the distribution of energy use by building type can be an important factor in determining the areas where power is used most heavily, as well as areas that can be improved upon for future conservation efforts.

### 1.3 Costs

The cost that comes with energy demands is closely associated with any discussion on power-related issues. Electricity and natural gas prices have been on the rise for the past couple of years and the future outlook will see a continuation in this increasing trend in energy costs. In 2006 the University of Kansas spent \$10,372,694 on utilities alone, which was a greater than 1.7 million dollar increase from the year before (Utility Report, 2006). Data from the 2008 energy survey show similar increases of nearly \$824,450 dollars from the 2006 estimates to bring total utility costs for the campus to \$11,197,144 in 2008. The eleven million dollar figure is the total utility bill for campus, which includes other areas, such as water and sewer; however, Figure 2 breaks down the utility costs by distribution. This demonstrates that the majority of University utility costs are for electricity and gas.



**Figure 2. Utility Cost Distribution (2008)**

Of the nearly \$11 million spent on utility costs in 2008, 63% of those costs were accounted for by electricity and natural gas alone. The general trend in rising energy costs can be accounted for by two different occurrences: rate changes for the specific utility and expansion of building space on campus. Rates changes accounted for 83% of the increased utility costs, with electricity rates rising by \$.01/kWh and natural gas prices rising \$1.85/MMBtu over the 2005-2006 fiscal year (Utility Report, 2006). Remodeling and newly constructed additions to buildings accounted for the other 17% of the increase which added another 148,785 square feet of building space and accounted for \$300,000 in additional utility costs (Utility Report, 2006). If a trend in rate changes increases in the future then it will be likely that costs for total utilities paid by the university will also increase.

## 2. GOALS

This report will evaluate the energy use of KU, paying special attention to issues of efficiency, sources of energy, and conservation efforts. This report seeks to achieve the following goals:

- Formulate a comprehensive understanding of how the KU Lawrence campus uses power
- Evaluate efficiency of power usage on campus
- Evaluate current conservation initiatives and investigate alternative sources of power
- Investigate conservation practices/initiatives at other campuses
- Propose conservation strategies (Recommendations)

The purpose of our project is to examine not only all alternatives to the University of Kansas' current consumption practices, but ones that will actually provide sustainable, feasible and long-lasting benefits for KU.

### **3. METHODOLOGY**

#### **3.1 Formulate a comprehensive understanding of how campus uses power**

In order to achieve a comprehensive view of energy use at KU, we gathered information from both primary and secondary sources and examined energy use from global and local perspectives, also considering the financial standpoint of energy consumption. First, we did background research to enhance our basic knowledge of sources of power and their associated positive and negative externalities. Subjects such as environmental consequences, cost, federal funding, and use habits were some of the main topics of research. Most of the background information we gathered was from general internet research and scholarly articles.

Secondly, we needed to know how this information applied to KU energy use specifically. Craig Hansen, the former KU Facilities and Operations Manager, helped us to understand how energy was distributed and used on campus, as well as which energy sources KU relied on the most and which alternative energy sources were viable options. He also provided information on energy expenditures, metering and general energy use habits on a campus-wide basis.

#### **3.2 Evaluate efficiency of power usage on campus**

Our interview with Rod Ideker of Chevron Energy Solutions helped us to learn which energy conservation efforts and efficiency improvements are both feasible and effective. We learned which processes/equipment are heavy energy users, as well as measures that can be taken to improve efficiency and decrease energy use.

Additionally, we gathered information on campus energy consumption through first hand observation. Our group took walk-through tours of buildings that were shown to be the largest energy users on campus – Malott and Haworth Halls. During the surveys, buildings were examined for things such as lit, unoccupied rooms, needless light

use/over-lighting, average thermostat temperatures, employment of sensor lighting, equipment use, the use of reflectors to enhance lighting, etc. Observations were then compared between group members, then between buildings.

### **3.3 Evaluate current conservation initiatives and investigate alternative sources of power**

To evaluate current conservation initiatives, we investigated the efficiency efforts being used in the Chevron energy audit taking place on KU campus. This was done through the previously mentioned interview with one of the Chevron energy consultants, Rod Ideker (Rod Ideker, Personal Communication, 23 March 2009).

Our investigation of alternative sources of power involved first examining available options, then evaluating their application to KU campus. The foundation of this research was the general knowledge gained through our background as Environmental Studies majors. Our chosen academic field provided us with basic information about the options available for alternative sources of power. Our interview with Craig Hansen helped us to determine which options had potential for development (or were currently being utilized) at KU (Craig Hansen, Personal Communication, 11 March 2009) .

### **3.4 Investigate conservation practices/initiatives at other campuses**

This section of our project involved a comparison of sustainability practices employed on other campuses to those at the University of Kansas. This allowed us to not only discover how “green” KU campus truly is in terms of energy use, but also learn about new ways to further sustainable energy projects and foster conservation.

### **3.5 Propose conservation strategies**

After a thorough examination of the data we collected, we determined recommendations for improving energy conservation and efficiency at KU.

## **4. RESULTS**

### **4.1 University of Kansas Lawrence Campus Energy Use**

The University used a total 111,400,887 kilowatt hours (kWh) of electricity and 121,794 cubic feet (Mcf) of natural gas across all facilities in the 2008 fiscal year (Energy Report 2008). A kilowatt hour is a measure of energy which represents the energy spent by running a one thousand watt device, such as a coffee pot, for one hour. Because it is a measure which expresses both amount and time, a kilowatt hour can represent energy conservation achieved both through lower operational energy demand and decreased usage. The total cost of electricity and natural gas accrued by the university in the 2008 fiscal year was \$7,054,143 out of a total utilities budget of \$11,197,053 (Energy Report 2008).

The University purchases all of its power from Lawrence’s electrical utility supplier, Westar Energy. Westar is an energy company which sells power to 675,000

people in a coverage area which spans 10,130 square miles in east and east-central Kansas (Westar). The average cost of energy purchased from Westar by the university is \$0.06 per kWh. Renewable energy credits which tag a portion of energy from wind farms can be purchased for an additional \$0.01 per kWh (Craig Hansen, Personal Communication, 11 March 2009).

### Westar Energy Production Capacity by Source

Coal	3,500 Megawatts
Natural Gas	1,800 Megawatts
Nuclear/Wind	700 Megawatts
maximum energy production is 6,000 Megawatts,	
natural gas supplemented during high demand in summer	

**Table 1. Westar Energy Sources**

The University of Kansas uses 111,400,887 kWhs of electricity annually. This is a sizeable amount compared to the 8,900 kWh which the average American household consumes annually. On average, 70% of this energy is created by coal power plants and 15% by natural gas power plants. That is about 17,000,000 kWhs generated from burning natural gas, and 80,000,000 kWhs produced from the combustion of coal. Because a coal power plant requires about a pound of coal and gallon of water to generate one kWh, the University accounts for about 80,000,000 lbs. of coal and 80,000,000 gallons of water annually (Craig Hansen, Personal Communication, 11 March 2009). The burning of this much coal and natural gas results in around 45,000,000 kg of atmospheric carbon dioxide. This level of emissions is the equivalent of about 9,500 average American households (Electrical Energy, 2007).

There are a variety of buildings across campus that all have individual power requirements, some being much greater than others. Laboratory buildings are the most energy intensive on campus. Malott Hall and Haworth Hall are the two highest buildings on campus in terms of total energy usage, while Simons Biosciences Research labs and the Multidisciplinary Research facility have the highest cost of energy per square foot. Laboratory buildings house equipment which requires prolonged and extreme temperature modifications such as refrigerators, incubators, and freezers set to -80

degrees Celsius. Laboratory buildings also experience heavy usage by students and faculty who employ lighting, centrifuges, fume hoods, and various other lab equipment. Libraries such as Anschutz, Spencer Research Library, and Watson generally have high energy requirements because a closely regulated climate is needed for book preservation. The temperature in libraries is maintained within a four to six degree range, even at night, and constant ventilation is required to rid the air of gases produced from decaying paper (Rod Ideker, Personal Communication, 23 March 2009). Sports facilities such as Robinson, the Student Recreation Center, and Memorial Stadium are another category of buildings which use high amounts of energy. This can be attributed to special demands like intense lighting and electrical exercise equipment. Classroom buildings such as Wescoe, Strong, and Fraser use relatively low amounts of electricity, especially when considering their heavy usage (Energy Report 2008).

### **University of Kansas Energy Usage by Building Type**

<b>Building Type</b>	<b>Total Power Usage (kWh)</b>	<b>Total Cost</b>
Science/Research	35,159,588	\$1,780,053
Office/Classroom	25,107,974	\$1,314,626
Sports Facilities	15,127,960	\$762,009
Unions/Miscellaneous	14,986,366	\$785,645
Museum/Library	14,143,747	\$722,657
Facilities Operations	6,875,252	\$367,160

**Table 2. Energy Use by Building Type (Energy Report 2008)**

Electricity is channeled from Westar's grid to campus buildings through three sub-stations. Although energy is allotted to many separate buildings with various requirements, the university pays for power as a lump sum of total usage. The facilities and operations department monitors the electrical demands of each building on campus through monthly readings of meters installed in every building. Thirty percent of the buildings on campus, either because they use especially high amounts of energy or have new construction added to them, have multiple meters which allow a more precise understanding of how energy is distributed within that building. The facilities and operations department monitors energy campus wide and does not employ individual monitors for buildings or any subdivided area. Seventy percent of the buildings on campus are heated through the central steam plant, while thirty percent use local natural gas furnaces (Craig Hansen, Personal Communication, 11 March 2009).

## 4.2 Analysis of Energy Efficiency on University of Kansas Campus

Given practical restrictions such as limited funds, limited staff, and a decreasing budget, the University of Kansas is doing a reasonably good job of using energy efficiently. Several studies have been conducted, efforts undertaken, and initiatives continue to be introduced which aim to streamline energy consumption on campus. These range from infrastructure renovations to computer hibernation settings and will be discussed in detail. There remain measures which the university could be taking to make energy conservation more sustainable in the long-term, but they are not cost effective enough to be realistically implemented.

In 2002, the University hired energy consultants from Chevron Energy Solutions. Chevron performed an energy audit of every campus building analyzing patterns of usage, outdated machinery, etc. Chevron and the University entered into a contract guaranteeing \$1.5 million of energy savings annually over 18 years (table 3). The Chevron consultants retrofit 20,000 florescent lighting units with reflectors which decreased the per unit wattage by 100 and overall wattage by 2,000,000. They consolidated the water cooling loads for Malott, Haworth, Dole, Summerfield, and Stauffer-Flint Halls into the campus's central chiller and turned off the chillers in those buildings (Rod Ideker, Personal Communication, 11 March 2009). Also, more buildings have been added to the University's system of automated climate control. The heating, air conditioning, and ventilation in these buildings are able to be regulated in a much more logical manner based on data reflecting building inhabitation patterns.

**Table 3. Energy Savings from Chevron Contract (First Four Years)**

	Electricity	Gas
Year 1: \$906,297	15,043,739 kWh	32,422,600 ft <sup>3</sup>
Year 2: \$994,631	13,292,950 kWh	60,831,000 ft <sup>3</sup>
Year 3: \$949,661	14,497,189 kWh	44,019,200 ft <sup>3</sup>
Year 4: \$945,185	14,517,885 kWh	43,054,000 ft <sup>3</sup>

CO2 emission were reduced by an average of 28 million lbs. per year (Rod Ideker, Personal Communication, 23 March 2009)

**Table 3. Savings from Chevron Contract**

Chevron is not the only agency concerned with energy efficiency on campus. Much of the reason that the university does an adequate job of conserving energy can be attributed to the fact that there are so many parties concerned with the issue. The facilities and operations department spearheaded campaigns to fit computers with optimal hibernation settings, and encourage people to turn off the lights in unoccupied classrooms and offices. Energy conservation is also monitored by the University's Center for Sustainability and the Student Environmental Advisory Board.

### **4.3 Investigation of Alternative Sources of Power and Conservation Measures**

To discover better ways to conserve energy on the University of Kansas campus and perhaps be more sustainable in general, we must first understand the basics of current alternative energy sources. The major alternative energy sources today are from solar, wind, geothermal, tides, hydroelectric, and waves.

Solar energy is the light and heat from the sun's rays that reach the earth. This sunlight can be converted into other types of energy like electricity and heat. One process that can convert large amounts of solar into electricity is by using thermal collectors to heat water to create steam in order to generate electricity (Chevron 2009). Sunlight can be manipulated in a few ways to produce power. The two most popular ways using modern technology are by converting sunlight into a direct current using photovoltaic cells or directing sunlight into concentrated beams using parabolic troughs and other variations to produce heat like the previous example using steam.

One very popular form of renewable energy is wind. The basic process behind using wind to produce energy is very simple. Essentially, wind energy is harnessed by allowing wind to pass through or by a turbine. The wind will turn the turbine which is the means of generating electricity.

One sometimes forgotten source of renewable energy is geothermal. Some locations across the globe are able to harness the earth's heat to generate power. The main way that is used is by using the heat from volcanic and geothermal hot spots on or under the surface to produce steam that is used in power plants to run turbines and produce electricity. Often, water and steam are naturally present above these risen geothermal reservoirs of heated earth (often molten rock) and can be drilled like oil or natural gas (Chevron 2009). Other sources of geothermal heat, besides molten rock near the surface, are from radioactive decay of certain minerals and direct solar energy absorbed and released by the earth. Geothermal energy, however, is most often extremely dependent on location; therefore geothermal cannot be harnessed everywhere.

Tidal power, wave power, and hydroelectric power use different forms of water forces to generate electricity. The processes of generating energy from tides and hydropower are very similar. Energy from tidal water movement is used to spin turbines that produce electricity. Hydroelectric power is harnessed by the spinning of turbines from other water movement. This is most commonly used with the creation of dams. Water is allowed to flow through and fall over the turbines, causing them to spin and create electricity. Energy can also be collected from the simple process of stream or river power used to turn turbines. Of the renewable energies used, hydropower is the most commonly used in the United States (EIA 2008). Wave power is somewhat different from these two. One way to capture power inherent in waves is by creating electricity producing buoy structures. The natural rising and falling motion of waves causes the buoy to move up and down as well. Like a turbine, this movement produces electricity within the buoy and can be transmitted to shore via submerged power lines. Instead of riding the waves and creating a turbine like process, another way to harness energy from wave power is by generating electricity from the direct pressure of waves hitting a structure. "The Pelamis Wave Energy Converter is a semi-submerged, articulated structure composed of cylindrical sections linked by hinged joints. The wave-induced

motion of these joints is resisted by hydraulic rams, which pump high-pressure fluid through hydraulic motors via smoothing accumulators. The hydraulic motors drive electrical generators to produce electricity” (Pelamis 2009). Like the buoy structures, the electricity generated can be sent ashore through a submerged seabed cable.

#### **4.4 Alternative Energy Applications at KU Campus**

As of March 2009 Anschutz Library will be using wind energy for one year. The renewable energy and sustainability fee included in student’s tuition fees made it possible to buy wind energy from Westar as a part of the University’s ongoing initiative to use renewable energy. There has been a push for more wind energy use on campus by facilities operations and Chevron Energy. Rod Ideker (Personal Communication, 23 March 2009) had mentioned a proposal for KU to install wind turbines on West Campus but also said that the wind turbines would be very costly and there could be problems with Westar in putting excess power back into the grid. This is not to say that this proposal has been turned down or that wind energy is not still being strongly considered.

##### **Co-generation**

Co-generation is a process in which excess steam from boilers is captured by a generator and used for not only heating and hot water, but for energy also. This is a very simple way to maximize energy use on campus that Chevron has begun to implement. Not all buildings can use this method though, as the generator needed may not be able to be installed properly given the layout of the building. This process is being used in a few buildings on campus today and is being considered for other buildings that rely on steam and can afford to have the generator installed.

##### **Solar**

In our interview, Craig Hansen had mentioned that a project to build a solar field on university property north of the river had been proposed but was still being discussed (Craig Hansen, Personal Communication, 11 March 2009). Largely the feasibility of the project and the length of time it would take for the project to return its cost in savings. Craig projected that the payback time would most likely be over twenty years as most commercial solar panels that are available today are still not efficient enough for large scale operations such as this. Regardless, it is still an option that is being carefully considered for the future.

##### **Geothermal Energy**

Both Rieger Scholarship Hall and Linley Hall currently use a form of geothermal heating and cooling to supplement air conditioning needs. Geothermal energy utilizes the temperature of the ground to produce warm or cool air given the season. A series of pipe are put generally 400 feet beneath the ground where the temperature is constant all year around. In the winter water circulation within the piping is sent down where it is heated by the ground temperature and is sent back up where the heat is compressed and used for heating. During the summer months the system is reversed as the hot water from the surface is sent down to be cooled by the earth and is again sent back up to be compressed and used for cooling.

#### **4.5 Investigation of Conservation Practices/Initiatives at Other Campuses**

To help generate alternative energy for KU, we researched alternative energy usage, conservation, and sustainability on other university campuses nationwide. Generally, American universities have enacted such energy-saving initiatives using three of the more popular alternative sources of power; Wind, solar, and biomass. We also found universities that have relied solely on technological renovations and conservation awareness and competition.

St. Olaf's College of Northfield, Minnesota undertook a project to construct a 1.65 megawatt wind turbine to supply renewable energy to the campus (St. Olaf 2009). A 1.65 megawatt turbine is a significant amount of energy production at a campus level, considering Westar has a total production capacity of 6,000 megawatts and supplies power to basically the eastern half of Kansas (Craig Hansen, Personal Communication, 11 March 2009). The total cost of this project was \$1.9 million. Through a grant received by Xcel Energy's Renewable Development Fund, St. Olaf College was able to save \$1.5 million. Xcel Energy, their grant funder, is a Midwest electric power and natural gas provider. The wind turbine generates 6 million kilowatt-hours of electricity annually. This one turbine provides nearly one-third of St. Olaf's electricity purchases (St. Olaf 2009). The location of this large turbine is in a farm field a mere 1200 feet from one of the campus buildings.

With regards to solar energy, the University of Colorado in Boulder installed its first photovoltaic system in 2004 with an installed capacity of 7.5 kilowatts. This photovoltaic array system generates nearly 150% of the University of Colorado Environmental Center's electricity requirements. Like St. Olaf College, this renewable energy project was funded in part by the Excel Energy Renewable Energy Trust Fund along with the CU Student Union Finance Board and an energy pledge card campaign (Apollo 2009).

At the University of Iowa in Iowa City, the power facility, which supplies 100% of the campus' heat and 30% of its electricity by burning coal, has started supplementing its coal fuel mix with biomass. The biomass used is oat husks, or the outer shell of oat grains (Apollo 2009). The power facility has replaced between 25,000 and 30,000 tons of coal with biomass each year. These supplements save the University of Iowa over half a million dollars in fuel cost every year. Not only does it save money, the addition of the oat husks has reduced the facility's emissions of NO<sub>x</sub>, SO<sub>2</sub>, CO<sub>2</sub>, particulate matter, and volatile organic compounds. The reduction in emissions now allows the University of Iowa to sell its emissions offsets on the Chicago Climate Exchange.

The University of Michigan in Ann Arbor has completed extensive energy efficiency projects and renovations in 123 of its campus buildings. Such projects include lighting upgrades, efficient appliance procurement, adjustments to mechanical systems, and adjustments to environmental control systems. At the completion of the renovations, the university was expected to save \$9.7 million per year in energy costs (Apollo 2009).

In attempts to promote direct energy conservation and awareness, Harvard University compels its students who live in many of its Houses to compete in a yearly energy conservation competition called the Green Cup. This program calls for inter-House competition to determine the university's "most environmentally conscious

House” (Harvard 2009). The winners of the competition are rewarded with the actual Green Cup and other prizes. This year’s reward includes \$1040 for the winning House. There are many criteria for this competition. However, with regards to energy use, the Houses participate in improvements in simple energy conservation, creation of “Eco-Projects” on campus, reduction in environmental impact, and participation in a Campus Sustainability Pledge.

#### **4.6 Proposing alternatives**

We have learned from our research that the University of Kansas has already begun numerous projects and has taken many measures to conserve energy and become more sustainable. It has also become apparent how important public awareness of energy use can be to the conservation effort. The use of lights, computers, copiers, coffee pots, and many other appliances are the leading cause for unnecessary energy use. Rod Ideker estimated human activity and use of such appliances account for five to ten percent of total energy use (Rod Ideker, Personal Communication, 23 March 2009). Therefore, the University could potentially save this five to ten percent if the general public simply turned off these appliances after use or employed conservation modes of computer and copiers.

In order to gauge the attitudes and opinions of the KU population regarding energy consumption, we created a five question survey evaluating energy use habits and administered it to thirty faculty members. The first question was: Do you turn off the lights when you are not using a room? Of the twenty people interviewed ninety five percent of people said they did turn the lights off. The second question was, would you support a small amount of money taken out of your paycheck to go toward sustainability projects and general conservation measures? Sixty-four percent of people said they would not mind if the amount was indeed small. One calculus T.A. was quoted saying “This should be left up to the State.” Another professor agreed in saying, “I would be fine with this, but only because I can afford it. I would worry that this could be a strain on Facilities Operations employees and Student Hourly employees.” The third question was, would you support the posting of the utility use within the department for all employees to see the overall department use? Seventy percent thought this would be a good idea, but one professor of economics stated that “This should not be made public; the listing would have to be posted only for the department. I doubt the University would want that information to be made public.”

The fourth question; would you be willing to temporarily move you office or have offices moved into your department in order to consolidate buildings during the summer months to cut down on energy use? 100 percent of those interviewed said no, all giving reasons as to why. The fifth question asked for the person to rate their knowledge of energy use within the building on a scale of one to five, one being low. The vast majority rated themselves a two when considering all operations of the building, but one to two rated themselves a five very comfortably.

Overall, people seemed more than willing to make their contribution, but felt a lack of knowledge or ability to do so. Most wanted to talk about their ideas and what they thought were the largest drains of energy within their department but in the end it became

more obvious that public awareness and participation plays a big role in the conservation of energy thus far.

## **5. RECOMMENDATIONS**

### **5.1 Behavior**

In our firsthand observations of energy use on campus, much of the over-use taking place could be directly contributed to the action (or inaction) of the students and faculty of KU. With energy drains such as excessive lighting and equipment left on in unoccupied rooms, first hand users can be the most valuable instruments in energy use reduction. Creating a general awareness of power use can be done through:

1. The posting of utility bills to building faculty
2. Reminders near light switches that the lights are to be turned off when the room is unoccupied
3. Instructions on how to put computers in a low-power state such as “Hibernate” mode on or near the computers
4. Mass education measures – e.g. a bulk email to all faculty or an information sheet distributed with paychecks that informs campus staff of KU energy costs, what they can do to help lower them and the variety of benefits that come from doing so.

According to Rod Ideker, Chevron Energy consultant, KU students and faculty are already unusually receptive to environmental concerns such as resource overuse and recycling (Rod Ideker, Personal Communication, 23 March 2009). A campaign of energy consumption reduction will probably be well received on such a campus. It is likely that there may simply be a gap in awareness about the issue of energy use which must be filled in order to create any sort of lasting change.

Where personal responsibility ends, modifications of lighting and other equipment can continue to reduce KU’s inefficient consumption of energy. The use of sensors and reflectors can dramatically increase the efficiency of indoor lighting. Of the efficiency improvement measures that we examined, these modifications were shown to be more feasible and effective than other options. Furthermore, we feel that the costs of modification can be overlooked in the interest of long-term sustainability.

Finally, as a combination of both personal responsibility and administration oversight, we propose a restructuring of utility billing that will make each department more responsible for their energy use. The current utility billing set-up directs all costs to one central entity – we feel that if each building (therefore each department, in most cases) were responsible for its own utility bill, much more consideration would be taken in implementation of conservation efforts. If a department was only allotted a certain amount within their budget for energy fees, it would pay a price for not being conscious of its consumption habits. However, while we feel that this proposal would have a tremendous impact on campus-wide energy use, it would likely be met with a great deal of resistance by the individual departments.

### **5.2 We Bleed Crimson and Blue...and Green? KU Sustainability Cup: Saving Money and Energy Through Competition and Awareness.**

One recommendation we would like to suggest for the University of Kansas is a conservation and sustainability competition on campus. The general idea behind this competition would be like that of Harvard's Green Cup. This type of action would be very feasible on the Lawrence campus in multiple ways. The only cost for a competition would be the winner's reward and perhaps advertisement across campus. After that, there would be nothing but gain because this type of competition depends on personal awareness and action. Therefore, the more people that participate on campus, the more money the University is likely to save in energy costs and others (depending on other competition criteria).

There are a number of options available to ensure that this competition is well-received. First, like Harvard, you can promote this competition between the on campus dorms. Other sectors of the campus can also be made to compete from within. For example, competition between the Greek houses, or competition between on campus buildings and/or departments could be implemented. The only foreseeable issue arising within the competition is the fact that each building has a unique power use and some use a much different amount of energy than other buildings. The processes present within and the sizes of buildings would allow for a certain approach to determining their level of participation within this potential competition. It may be quite simple to determine winners based on base percentage of power saved, or even gross total. Perhaps there can be a number of differing categories in which participating parties can compete. We believe this would be highly successful on the KU campus due to the competitive nature of the student body and faculty alone. To be named the most energy efficient, sustainable, or green dorm, fraternity, sorority, department, or building is enough by itself to create a driving force within the individuals participating for the amount of energy and money saved by pure conservation to be worthwhile. Like Harvard's Green Cup, again, the announcement of winners each year would be another great addition to Earth Day activities, awareness, and celebration.

### **5.3 Potential for Alternative Sources of Energy at KU**

There are two significant obstacles which need to be addressed before consideration can be given to the University of Kansas generating its own power. The first is the issue of "net metering". "Net metering" is a utility billing system in which a private entity who, in a given month, provides a surplus of energy and actually puts power on the grid, is compensated with energy credits by their utility company. This system currently does not exist in Kansas and requires State legislation for its implementation (Craig Hansen, Personal Communication, 11 March 2009).

The second consideration is that of funding. The University has prime potential locations for solar panels on roofs and a wind turbine on West Campus. For example, a solar system could be installed on the roof of Wescoe which could provide about 75% of Wescoe's energy demand. However, this system would cost around \$2.5 million. A 1.5 to 2.5 megawatt wind turbine on West Campus could generate around 8% of the entire campus's energy needs (Energy by Building Report 2008). This project would likely cost between \$10 and \$20 million (Rod Ideker, Personal Communication 23 March 2009). These measures would be immensely valuable to the University's energy sustainability

status, but remain entirely hypothetical without investigation into major funding contributions.

The University also has the option of purchasing wind credits from the wind farms which Westar energy operates. This is KU's most viable and realistic initiative. The 2007 Student Senate proposal which called for enough energy credits to be bought to power Anschutz library passed with 90% approval. This resolution required a student fee of \$1.27 per student per semester (Thompson). Additional buildings could be added to this initiative at the following costs: the Kansas Union for \$0.05 per credit hour, Watson Library for \$0.04 per credit hour, Wescoe for \$0.21 per student per semester, and Watkins for \$0.24 per student per semester (The Winds of Change). The fact that the first vote passed with 90% in favor indicates that further proposals for the optional purchase of wind credits would have support among the student body.

## **6. CONCLUSION**

Campus consumes a significant amount of energy which comes primarily from unsustainable, polluting sources. Additionally, insufficient conservation efforts create higher costs for both for those working and studying on the KU campus. Increasing energy bills will cut into decreasing the University budget, which in turn will likely increase fees for students. The costs are not only in terms of dollars; increased greenhouse gas emissions and decreases in air quality from pollution are costs that may not be as easily apparent, but are equally important. Conservation efforts and utilization of alternative energy source on KU campus are less extensive than many comparable universities.

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