

2007 CAMPUS ENERGY CONSERVATION PLAN

Executive Summary

Utah State University currently spends more than \$9 million a year on energy resources, or more than 2% of the annual University budget. Since 1990 the University has invested over \$3.5 million in energy conservation projects, which currently create savings totaling almost \$2 million per year. In the past 15 years, more than 100 energy conservation projects have been done on campus. These have consistently high net present values and typically have rates of return greater than 30% per year. Energy costs at USU have increased to almost 60% of the total building operating costs. This demonstrates the importance of proactively doing all that can be done to control energy costs. A practice or project that will save energy often creates an improvement in the occupant environment as well. Often an improvement of the thermal efficiency also reduces the infiltration of heat or cold into the space.

Facilities has a number of strategies to reduce and conserve energy. On the Utah State University campus, most major buildings have the Heating, Ventilation and Air Conditioning (HVAC) systems operated by computer over the campus network. The amount of control varies with the age of the building and equipment in the facility. Facility design for new or remodeled space considers energy savings, occupant comfort, and overall value. Building audits are routinely accomplished with energy consumption being an issue. Overall energy usage is monitored by individual building campus wide.

Future opportunities to reduce energy consumption include; installing a wind turbine to generate electricity near the USU south substation at the mouth of Logan canyon; retro-commissioning of existing buildings mechanical systems; operation of USU's co-generation equipment at the Central Energy Plant when prices permit; continuing to transition from individual building chillers to the central chilling system for air conditioning; continuing with high-efficiency lighting upgrades throughout campus; and upgrading of building HVAC and lighting control systems. Opportunities exist in many areas to continue to reduce campus energy consumption and these needs to be a continuous focus for all of us.

Background

Utah State University has spent \$3.5 million over the past 15 years to implement energy conservation systems in an effort to meet the parallel goal of operating campus at a comfort level that is conducive to a teaching and learning environment and saving money. The Facilities organization at USU is constantly looking for ways to lower the energy consumption of the technical equipment that maintains the productivity of our campus functions. This effort is a balance between supporting the occupant function, consumption of energy and improvements that will pay for themselves in savings. Some of the major areas of focus have been:

- A.** The implementation of a control system for mechanical equipment utilizing the campus fiber network. This system allows a level of control over the mechanical equipment in each building depending upon the age of the equipment and the control mechanisms installed. Most building temperatures can be monitored remotely. Fans can be started or stopped and various information regarding chiller operation is available. This information is available at Facilities shops and Central Energy Plant. Technicians can also access the system from their homes to look at problems during evenings and

weekends. Where conditions allow, all buildings have a scheduled night setback or unoccupied setting.

- B.** Approximately 85% of the campus fluorescent lighting has been replaced with electronic ballast and T-8 tubes, which provide better light, require less energy and last longer.
- C.** Building mechanical systems have been renovated and upgraded to improve energy savings. In turn, these savings have been reinvested into the infrastructure. This has been the funding source for many of the energy saving projects. Additionally, USU has procured external funding for conservation work. Energy loans have been received from state energy and federal loans. These have been repaid from subsequent energy savings.
- D.** Design and renovation projects have incorporated new materials and equipment that improve energy conservation. Even replacement of normal equipment such as motors, chillers, etc, are replaced with high efficiency units.
- E.** Commissioning of new facilities and retro-commissioning some older ones has become a regular procedure for the campus. Facilities has a dedicated commission team and have been very successful in addressing energy as well as maintenance and comfort issues in campus buildings.
- F.** There has been sufficient work done with energy suppliers to insure that the University is getting the best market rate available. Under the current legislation, there are limits as to what suppliers are available. But rates have been reduced through this effort to reflect closer to market rate. We continue to monitor the competitiveness of our utility providers.
- G.** USU has worked with the state to develop a statewide chiller replacement program for state facilities. Many of these chillers are 20-30 years old. In 1994-95, USU Facilities staff organized the development of a database of all Higher Education mechanical cooling equipment owned by the state of Utah above approximately 20 tons (horsepower). We conducted an economic analysis of the cost of energy operations and maintenance of those units. The data showed that a majority of the state's obsolete units could be replaced and would generate a positive net present value over a five-year period. The analysis led the state to implement a chiller replacement program for all state facilities. To date, Utah State University has had six chillers replaced as part of this program. It is estimated that USU is saving \$200,000 in energy each year as a result of these chiller replacements.
- H.** USU upgraded the main electrical substations on campus with automatically staged and controlled power factor correction capacitors. The upgrade conserves energy and saves approximately \$100,000 per year in power factor penalties from our local electrical utility supplier.
- I.** In 2002 USU brought a new gas fired heating plant (Central Energy Plant) online. The plant consisted of three high efficient, low emission boilers. The plant was also build with the infrastructure to add a cogeneration unit and chillers to start a central chilled

water system.

- J.** In 2003 USU brought online the central chilled water system with large high efficiency chillers with the capability to use “free” evaporative cooling in the off seasons. To date, we have taken old chillers off line and made the connection to the central system in over 20 buildings. We estimate the savings to be in excess of \$600,000 per year
- K.** For more than 15 years, Facilities has been investigating the potential for a natural gas-fired turbine electrical generation/heat generation facility. There are multiple benefits in the development of a co-generation site to provide an independent electrical energy source for the university, a means to save energy, and potential cost savings for the State. In 2003, Utah State University brought online a 5 MW gas turbine cogeneration system. This system generates electricity for the campus and recovers the waste energy to heat campus.

Campus-Wide Support

Departments, colleges, and other campus units can take leadership of additional conservation efforts. In his letter in October 9, 2006, President Stan Albrecht identified seven practices that each USU employee can adopt that will significantly impact the use of electricity and heating for the university.

1. Turning off lights whenever a room is not in use
2. Turning off computer monitors when leaving for a considerable amount of time
3. Closing blinds at the end of the day
4. Discontinuing use of portable space heaters
5. Turning off printers and copiers when not in use and shortening the time these machines wait to enter sleep mode
6. Closing fume hoods to minimum levels whenever possible
7. Installing independent cooling systems for computer server rooms, to allow, the building system to run more efficiently and to be setback at nights and weekends.

There are many additional opportunities to improve Utah State’s energy-conservation efforts. Please share your ideas with us. Any suggestion can be called in to our customer service office. We have also dedicated resources in Facilities to work with campus faculty, staff and student to find solutions to save energy.

Campus Sustainability Committee Facilities has a representative on the campus wide sustainability committee representing campus energy use and works with University Staff and Faculty to provide a sustainable future for Utah State University and our environment.

American College & University Presidents Climate Commitment In March of 2007, President Stan Albrecht has joined presidents and chancellors throughout the United States in a stand to address global warming by becoming a charter signatory to the American College &

University Presidents Climate Commitment, the first university president in Utah to do so. As a result of this commitment, USU is completing a comprehensive inventory of all its greenhouse gas emissions and is initiating two or more tangible actions to reduce greenhouse gases. This involves several options, including encouraging use of and providing access to public transportation for all faculty, staff, students and visitors.

Facilities Operating Strategies

- A. Building Operating Controls** USU Facilities is working to completely upgrade Heating Ventilation Air Conditioning Systems (HVAC) to direct digital control systems in all major campus buildings. Approximately 50% of this system still needs to be completed. Time and money have been saved by using in-house staff to design and install these systems. With these in place, Facilities can control, monitor and manage space temperatures, schedule fan operation and lighting, and determine night-time setback temperatures campus-wide from any networked computer. The benefits of this ability to remotely monitor room temperatures are energy savings, ease of maintenance, troubleshooting, increased occupant comfort and increased reliability, especially for sensitive research. Facilities at the Central Energy Plant on campus monitor these systems remotely after hours. Facilities staff members can monitor these systems from home to follow up on night and weekend problems. Building fan units are scheduled through this system and every effort is made to conserve energy by shutting down systems on evenings, weekends and holidays. Several fan units are scheduled to come on only when the rooms are actually occupied; e.g., Kent Concert Hall, Morgan Theatre, and the Spectrum arena.
- B. Facilities Energy Committee** Always keeping in mind our energy savings goal, Facilities has an energy committee comprised of engineers and technicians with different expertise who meet regularly to go over building schedules and make sure everything is running at optimal efficiency. Watching outside temperatures, they manage a reset schedule for the water supply temperature, thus keeping the heating supply temperature at a point that will keep the building warm yet save energy. Facilities constantly monitor building temperatures and the programming models that maintain an optimum comfort level as well as conserve energy. This committee also suggests reviews and implements energy savings projects.
- C. Energy Coordinator** Facilities has a dedicated person devoted to monitoring building schedules, audits and working with campus to look for opportunities for energy savings. A recent project being, providing reports to departments on fume hood sash height, to help them better manage fume hood operation.
- D. New Equipment/Buildings** Facilities selects bids on all our major energy-consuming equipment based on a life cycle cost evaluation that considers the initial bid price, estimated annual maintenance cost, and annual energy costs based on manufacturers' efficiencies. This evaluation leads to a "present value" which is used to award the bid. We also consider energy efficiency in our design review of new buildings and remodeling projects. Our design review staff keeps up to date on the ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) standards

for energy-efficient design for commercial buildings and applies these standards to all proposed construction.

E. Utilities Consumption Management USU has established a broad network of energy meters, including individual building meters for electricity, gas, steam, and water. This data is collected monthly for each building and compiled into a summary that is scrutinized annually for year-to-year changes or for excessive usage compared to similar buildings on campus. Total energy consumption per building is then summarized graphically and reviewed for possible conservation projects. This has proved to be an important strategy. Buildings with disproportionate energy consumption also create occupant problems and maintenance cost overruns, and rise to the top of our priority list of conservation projects. We are currently upgrading this system to a new data base that will integrate with our computer maintenance management system.

Future Projects

Wind Turbine Utah State University Facilities has installed a 50 meter anemometer tower to conduct a wind power feasibility study. The tower is located at USU's south electrical substation off of Canyon Road. The study will include wind data collection, wind turbine site recommendation, conceptual design, construction cost estimate and economic feasibility. The anemometer tower was installed in December of 2006. Initial data collection looks favorable. Close proximity to USU's substation and USU owned property in the high wind zone may provide a viable project. USU is studying wind power as another option to diversify energy supply, lower energy costs to help with our energy deficit, and help provide a sustainable environment.

Thermal Storage USU has received funding for additional chiller capacity at the Central Energy Plant. In lieu of adding another chiller, USU is pursuing thermal storage as an alternative to add the capacity and shift energy use to night to reduce electrical costs. Approximately a one million gallon water tank will be added to the system for water to be chilled and stored at night and used for air conditioning during daytime hours.

Lighting Projects We have completed high-efficiency lighting upgrades in more than 3 million square feet of building space on central campus. Our in-house crews have replaced the "T12" fluorescent lamps and older magnetic ballast with the new more efficient "T8" lamps and electronic ballast. Each new fixture saves approximately 35 watts per hour, 175 kWh (kilowatt hrs) a year, or \$8.75 per fixture per year. Many of these upgrades increase and improve lighting levels as well as create energy savings. Future buildings on the list for upgrades include Engineering Lab, Natural Resources, Old Main, Education and Geology.

Retro-commissioning USU is currently commissioning Natural Resources and the Space Dynamics Laboratory. Both buildings have had an energy model completed to help identify and simulate savings opportunities. Through the commission process, many energy projects are identified and completed, such as, controls upgrades and converting to variable pumping systems. Future projects include Science and Engineering Research (SER), Chilled Water Distribution systems, Science and Technology Library and Veterinary Diagnostics Laboratory.

Summary

USU has a strong tradition of energy conservation. Between occupant activities, operating strategies and retrofitting of systems, USU has implemented many important conservation strategies. There are many more opportunities to save energy on the USU campus. One of the real barriers has been lack of funding. Through recently State legislation, the State of Utah's Division of Facilities and Construction Management has revived an energy program to help support energy efficiency projects with a budget to help fund projects. USU is actively pursuing this funding stream. USU will continue to do all that it can as an institution to promote wise energy management. Projects should include occupant awareness and heightened involvement, expanding our building control systems, including more lighting control and occupancy sensors, and supporting the development of appropriate capital spending projects. Many areas are in need of new, more efficient lighting, mechanical equipment, and other building materials. These all provide excellent opportunities for additional energy savings. The attached project list is a summary of the future projects that have been identified in this plan. This project list will change regularly as projects are completed, cancelled, added, etc. Additional projects that surface during this plan review will be incorporated. All departments have the opportunity to provide their ideas and input to make this effort a success.