

Energy Conservation and Sustainability Initiatives at the University of Northern Iowa: Past, Present, and Future

Conservation is not a new idea in Cedar Falls. In fact in 1915 the Iowa State Teacher's College (now UNI) offered one of the first two collegiate-level conservation courses in the nation. In 1990, President Constantine (Deno) Curris was one of the 20 original signers of the Talliores Agreement, which was the first official commitment to environmental sustainability in higher education that has since been signed by over 300 universities in over 40 countries.¹ The University of Northern Iowa has been involved in energy management since the 1970's. At the UNI, a variety of strategies have been employed to maximize energy conservation and increase sustainability measures over the years and new ideas continue to be implemented. Sustainability entails the support of human well-being using methods that are congruent with preserving natural systems where possible. Just a few of the efforts utilized at UNI include direct energy conservation include centralized building controls, "green" building standards, alternative fuel vehicles, co-generation and programs to educate the community and the University's students.

Sustainability practices include recycling programs, utilizing pervious pavement, integrated pest management, construction of bioswales, composting, pollution prevention programs and selling excess inventory. The University of Northern Iowa is presently working steadfastly on conservation measures and sustainability initiatives, and maintaining these goals in future endeavors is a primary focus as well. These goals can always be revised and improved upon as technology changes in nearly every aspect of

life at the university and the UNI looks to continue the efforts to be at the forefront of developing ways in which to cost effectively conserve energy.

In September of 2006, UNI President Benjamin Allen created the University Energy Conservation Committee to enhance energy efficiency measures and to promote environmental awareness. The committee includes faculty, staff, students, and community representation. The committee has three task groups that focus on engaging the campus community, auditing campus practices, and compiling best practices. The committee also identified the need for a sustainability office and the position of Assistant Director/Energy will be created to provide leadership, recommend programming, research available data and to make recommendations to promote responsible energy decision-making and awareness on campus.² At the behest of the Energy Conservation Committee, the UNI joined the Association for the Advancement of Sustainability in Higher Education (AASHE) in the spring of 2007.³

The power plant at UNI supplies the campus with both steam and electricity. Comprehensive utility studies and reports in 1974, 1977, 1984, 1988, 1991, and 1999 have supported long-range planning in developing the production and distribution systems has resulted in numerous improvements over time.⁴ In the 2005/06-fiscal year UNI consumed 61,703 kilowatt-hours (kWh) of electricity, of which 24,215,884 kWh were produced by the UNI power plant.⁵ Approximately 40% of the electricity used by the University is generated on campus and 100% of the steam used on campus is generated by the campus power plant. Over the years different things have been done to increase efficiency and reduce pollutants related to the power generated on campus. The power plant at UNI has four boilers. Boilers one and two burn natural gas or fuel oil and

produce steam at a lower pressure than boilers three and four. Boilers one and two are used as stand by and peaking solutions for campus steam demands. Boiler number three burns coal or fuel oil. Boiler four utilizes natural gas as a start –up fuel and coal as the primary fuel. Boiler four is also equipped to burn petroleum coke, a byproduct of the oil refining industry. Prior to its being utilized as a fuel, petroleum coke was disposed of in landfills and utilizing it as a fuel, diverted the material from the waste stream. This is an example of finding a use for a waste product to reduce the amount of waste being put into a landfill.

Petroleum coke costs less per BTU than coal and UNI blends petroleum coke with coal on a 20-30% basis to reduce the cost of generating power. Boilers three and four produce steam that is routed to the turbine generator to produce electricity for use on campus. UNI has what is called an “extraction” turbine because after the steam passes through the high pressure stages part of it is “extracted” and piped out to campus instead of heading to the cooling tower. This steam is then used for heating water, buildings, kitchens, or running absorption chillers. After the remaining thermal energy of the steam is used around campus and the steam is reduced to condensate water, it is returned to the power plant for re-use.⁶ This process is known as co-generation and is much more efficient (approximately 70-80%) and economical than a typical power plant (around 40%).⁷ Pollution levels from total suspended particulates (TSP), nitrogen oxide (NOx), and sulfur dioxide (SOx) have dropped dramatically due to technological improvements provided with boilers three and four since 1980. TSP has been reduced by 92% using fabric baghouses on both boilers. Boiler four utilizes lower combustion temperatures and

limestone injection to reduce NO_x by 52% and SO_x by 64%, and overall reduction in these three pollutants is 65% since 1980.

Timeline of Power Plant Improvements

- 1978 – Boiler #3 installed with a higher operating efficiency and fabric baghouse cutting particulate emissions.
- 1982 – Co-generation capability installed allowing the production of steam and electricity that improved the utilization of natural resources.
- 1987 – Original power plant demolished eliminating inefficient steam production and a major source of pollution.
- 1990 – Boiler #4 became operational, implementing a new design that significantly reduces NO_x and SO_x emissions. Baghouse used to control particulate emissions.
- 1994 – Use of petroleum coke introduced to reduce the amount of coal being burned in boiler #4; reduced cost due to petroleum coke being cheaper per MMBtu. Using coal blended with petroleum coke has also reduced NO_x emissions.⁸

New or improved ways of generating energy at UNI are being studied in terms of ways to lessen negative environmental impacts. In the winter of the 2007-08 academic year, tests were conducted with aid from Innovative Business Engineering to examine the current co-generation model and the possibility of using biomass, a renewable energy source, to displace the use of coal and petroleum coke in boiler #4. The results of the

study have yet to be compiled and submitted to the Iowa Department of Natural Resources (IDNR). Future plans are in progress to experiment using biodiesel fuels instead of number two fuel oil at the power plant. Currently the program is waiting for a request for permit variance from the IDNR before the tests can begin.⁹

In December of 2007, Thomas A. Wind of Wind Utility Consulting presented results of an evaluation of wind energy options open to the University. Topics covered in the presentation included an overview of wind energy in Iowa, the general development and wind energy feasibility study steps, wind turbine sizes, locating a proper site for the wind turbine, wind assessment and economic evaluation. Examples of colleges and schools in Iowa with wind energy are also included in the overview in addition to options and costs for UNI. The presentation can be found online at <http://www.vpaf.uni.edu/energy/docs/wind.pdf>.

Federal Aviation Administration height restrictions limit options close to campus for UNI due to the proximity of the Waterloo Municipal Airport. Options for UNI include a lower turbine positioned close to campus or a larger turbine located farther away from campus. Average cost per kWh from the UNI power plant is approximately \$0.04, and average cost of kWh purchased from Cedar Falls Utilities is approximately \$0.05. Tom Wind estimates costs per kWh from wind energy would be around \$0.10.¹⁰ With the University's electrical usage around 63 million kWh, the cost of wind energy is not currently feasible, but in the future as power costs more to purchase due to increased restrictions on emissions, it may make wind generation costs more comparable.¹¹

UNI utilizes a centralized building automation system known as Direct Digital Controls (DDC) to conserve energy use in campus buildings. The centralized controls

system controls lighting, ventilation, heating, and cooling. The system implements an unoccupied energy conservation cycle during the evenings, weekends, and holidays. In addition, equipment controlled by the automation system can be turned off or slowed down during severe warm weather in a load shedding effort to avoid electrical peaks.¹²

UNI works at integrating Leadership in Energy and Environmental Design (LEED) standards into new and existing buildings on campus. LEED is a system of point-scoring buildings for energy conservation and environmental preservation developed by the U.S. Green Building Council. Buildings are evaluated based on such things as sustainable site, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality and innovation in operations. Buildings are scored in different categories and then broken into levels of compliance (certified, silver, gold, platinum).¹³ Other projects implemented at UNI include light emitting diode (LED) lights to replace incandescent lights in exit signs, trying motion sensitive power strips, implementing vending misers on vending machines to conserve energy and utilizing “green” cleaning products.¹⁴

The majority of the vehicles in the UNI motor pool can run on regular gasoline and E-85 ethanol blended fuel. The use of ethanol began around seven years ago and by 2010, 100% of the vehicles on campus will be ethanol fuel compatible. The E-85 fuel requires a tax subsidy from the government to justify it because the vehicles get approximately 3 or 4 fewer miles per gallon.¹⁵ The physical plant truck fleet, Price Lab School buses and other diesel-powered vehicles utilize a B5 (biodiesel) fuel mix.¹⁶ The University recently added two electric hybrid Toyota Prius cars in the rental fleet on a trial basis to develop data on fuel efficiency.

UNI has an award winning recycling program. UNI received the IRA Best School Recycling Program Award in 2007 from the Iowa Recycling Association.¹⁷ Paper used on campus has been recycled for 18 years. Approximately 270,000 pounds of paper was recycled in fiscal year 2007, for which the University was paid \$8,526. The average value was around \$63 per ton, and in addition, the recycling allowed the avoidance of landfill tipping fees that run about \$38 per ton. Net value for the recycling of mixed paper in 2007 was over \$100 per ton. Cardboard is also recycled on campus and in 2007 an additional \$2,000 of revenue was realized. The revenues generated from these recycling programs are used to defray costs in the University's refuse operations.¹⁸ The City of Cedar Falls and UNI also have partnered in a recycling collection initiative located west of Hudson Road and north of the UNI power plant. Cedar Falls invested in the containers, truck, and cement pads and UNI provided the land, site maintenance, and trash removal. Plastics, plastic grocery bags, glass, tin cans, newspapers, magazines and cardboard can be recycled at the University site. After the city recovers its initial investment, UNI and Cedar Falls will share in the profits.

A UNI student group called Green Project UNI also helps with site maintenance and recycling on campus.¹⁹ Various other products are recycled on campus at UNI including fluorescent light tubes, lead batteries, small lithium batteries, cellular phone batteries, and power tool batteries.²⁰

The Grounds Unit at UNI employs multiple initiatives to support sustainability and energy conservation as goals. Integrated pest management is one area where progress has been made. Problems are dealt with by scouting and then responding to infestation (weeds) to make the process responsive as opposed to utilizing preventative

blanket spraying of the entire area. The amount of chemicals, work and time spent is reduced by spot treating problem areas for weeds. Bioswales are also used at a variety of campus locations, particularly near parking lots and other non-permeable surfaces, to prevent pollution. A bioswale slows the flow of water to prevent erosion, allow filtration, and even temperature regulation. Pervious pavement has also been installed in places in campus plazas and parking lots. Pervious pavement allows precipitation to seep through it into the ground, so large amounts of run-off or standing water are avoided. The University also uses a compost system where leaves, branches, and sticks are mulched and composted for a year or two, then reused to top-dress topsoil around campus. Naturalization efforts to return grass-covered areas back to prairie grass and natural vegetation are also being implemented.

Naturalizing vegetation areas to their former condition results in reduced management costs, fuel and human capital cost are avoided and there is reduced pollution because the naturalized areas do not need to be mowed.²¹ The Tallgrass Prairie Center is involved with naturalization efforts and is currently conducting a study concerning amounts of biomass developed by different mixtures of plants that make the best biofuels. The information learned concerning biomass generated by different mixtures of switchgrass, native grasses, and wild flowers could be useful in developing the most effective biomass mixtures that produce the most effective fuel or the best cellulose ethanol.²² The documentary produced by Tallgrass Prairie Center director Daryl Smith and David O'Shields of New Light Media, called America's Lost Landscape: The Tallgrass Prairie recently was aired by Public Broadcasting Company and won the

International Documentary Association's Pare Lorentz Award in 2005 and the CINE Golden Eagle Award in 2006.²³

UNI Facilities Planning has implemented an office furniture re-use program in an effort to promote sustainability. When a department does not have need for a piece of office furniture, the interior design staff is notified that it is available for reallocation. If interior design staff does not have a place for the equipment, it goes to the excess inventory storage or to the campus store for resale. Higher value items are generally auctioned online (publicsurplus.com) to obtain better pricing due to reaching a broader audience. By auctioning items locally or on-line or by selling excess inventory through the campus store, more people have an opportunity to bid on and purchase surplus merchandise. The benefits include effectively utilizing existing warehouse space, avoiding landfill charges for unusable surplus property and waste creation is avoided in favor of finding a way to re-use equipment. Approximately \$18,000 per year on average is generated from sales and auctions and this money goes into the general fund for UNI.²⁴

The Interior Design staff also promotes sustainability in furnishings to campus departments. The use of carpet modules (tiles) allows specific sections of carpet that receive high traffic to be replaced instead of needing to replace the carpet in the entire room. Carpet is also recycled with cooperation from carpet makers. The Interior Design staff also uses carpet that has been recycled through using "green" production methods. Bamboo is being tried as a replacement for wood flooring. Bamboo is a grass and because it grows so much faster than trees, it is easier to replace than trees. One challenge faced by the interior designer is that budget constraints sometimes cause

departments to purchase the cheapest equipment available rather than to purchase products using life cycle costing.²⁵

The Buy Fresh/Buy Local campaign is a program directed from UNI that works to create a local food infrastructure. The program encourages institutional food buyers to purchase from nearby farms and processors. This process can save money and reduce fuel-generated pollutants by supporting reduced transportation costs. Buy Fresh/Buy Local also makes it easier to locate and acquire locally grown food for area residents.²⁶

The National Pollutant Discharge Elimination Program is a permit system monitored by the Environmental Protection Agency to regulate point sources such as storm drains to prevent polluting and silt contamination of waters from runoff and erosion.²⁷ A storm water hotline for reporting dumping violations or other problems has been implemented and is on the University's Safety website. A campus storm water management team has also been formed to monitor permit compliance as a component of the University's illicit discharge detection and elimination program.²⁸

UNI has many programs dealing with conservation and sustainability that reach out to the community. A project funded by the Iowa Energy Center encourages energy conservation and promotes awareness in the residence halls on campus by playing themed games, watching movies about conservation, and a door-to-door conservation evaluation and tip session with the highest scoring floor being awarded a pizza party.²⁹ The Center for Energy and Environment Education (CEEE) hosted a series of speakers called "Building for the Future: Energy Efficient Alternatives," where experts spoke about energy efficient building alternatives, passive solar systems, and straw bale and whole tree architecture.³⁰ The CEEE also promotes education of area children through

the Iowa Energy Poster Contest, Jr. Solar Sprint, the Iowa Electrathon, “Reduce, Reuse, Recycle” Beyond the Classroom and Waste Reduction: Addressing the Overlooked ‘R’. Teacher training workshops about Environmental Issues instruction are also offered by the CEEE.³¹ In January of 2008, UNI participated in a national teach-in about global warming solutions for America called Focus the Nation.³²

Future initiative trials and ideas are being studied at UNI. Experimenting with different renewable or more environmentally friendly fuels such as biomass and biodiesel for the power plant should continue. Petroleum coke is a step in the right direction, but more renewable sources would be desirable. With regard to biomass, the Tallgrass Prairie Center is conducting research over the next five years to find the highest biomass yielding mixture of switchgrass, native grasses, and native wild flowers.³³ Continued monitoring of costs associated with wind energy compared to current energy prices to see if conditions become more feasible should be implemented. The Iowa Power Fund created to promote energy projects could possibly be explored as a way to finance projects or studies, but there are only four years left of funding after which the legislation would have to be renewed. Increasing student participation in energy conservation and sustainability measure on campus through Green Project UNI or in other ways would be wise. Though perhaps difficult to mobilize, students could become a useful tool in promoting energy conservation on campus and are currently a mostly untapped resource. Working with Cedar Falls and other surrounding communities should continue as UNI looks toward a bright future remaining on the forefront of energy conservation and sustainability measures.

The research and interviews for this paper were conducted by Mathew A. Noble, a graduate student in the Public Policy program. Mathew was employed as an intern with the Facilities Services Department, University of Northern Iowa, during the spring semester, 2008.

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