

**The University of Iowa
Energy Conservation and Management Strategic Plan
February 2007**

I. INTRODUCTION

During the past two years, the University has faced rising costs of natural gas and coal and increasing demands by new and renovated facilities that increased energy costs by 26%. The continued growth in the campus' demand for energy and the University's need for an affordable, reliable supply of energy presents the opportunity for Facilities Management¹ to develop an integrated energy plan that will systematically help offset the rising costs and increasing campus demand by focusing on reductions in energy consumption per square foot and gains in system-wide operational efficiencies.

The plan sets forth energy objectives, strategies for accomplishing the objectives and a proposed funding model for investments in staffing, centralized building controls systems, and conservation and efficiency projects that are necessary if the University is to contain its energy costs. The plan also includes investments in capacity, efficiency and renewal of plant assets that will ensure an uninterrupted supply of energy to meet campus demands. At the same time, innovative approaches to plant operations and utilizing alternative fuel sources will help lower costs and advance the UI's reputation for environmental stewardship. Through the synergies generated by integrated improvements in energy conservation, reliability and sustainability, the UI will be able to make significant improvements by 2013.

II. ENERGY OBJECTIVES: Reliability - Conservation - Sustainability

Facilities Management believes that The University of Iowa can offset rising costs of fossil fuels and increasing campus demand by simultaneously focusing on objectives that will reduce consumption and increase operational efficiencies – and accomplish this in an environmentally responsible manner.

Reliability: Robust & Redundant Energy Systems

¹ Facilities Management is responsible for the maintenance and operation of general fund-supported academic and administrative support buildings, most campus grounds, and all utility systems. It is also responsible for the design and construction of non-hospital campus buildings, utility systems, and landscape improvements.

Facilities Management will pursue strategies to reach firm capacity² by 2013. Having the capacity to reliably meet the current and the foreseeable future demand for steam, electric power, chilled water and other utilities is critical to ensuring continued business operations and the avoidance of costly interruptions. Meeting the current demand and the growth anticipated from the development of new facilities supporting the University's academic mission entails investing in plant capacity, plant renewal, redundancy and system integrity.

Conservation: Ten Percent Energy Reduction by 2013

Using Fiscal Year 2003 as a baseline, The University of Iowa will reduce energy consumption by 10% per square foot per degree-day by July 1, 2013 for all owned, major, conditioned facilities. Understanding that energy consumption varies by the type of activity that occurs in the building, targeted reductions for individual buildings will range from 7.5% to 15%. To reduce energy consumption by 10%, Facilities Management will need to invest in energy management staffing, centralized building controls systems, and conservation and efficiency projects.

Sustainability: Fifteen Percent Renewable Energy by 2013

By July 1, 2013, 15% of all energy (combination of purchased and self generated) consumed by the UI campus will be produced from renewable sources. Renewable energy sources include solar, wind, waste management, resource recovery, refuse-derived fuel, biomass, wood burning, small hydro, and other carbon neutral sources.

Facilities Management is partnering with the College of Engineering on wind and hydro projects, working with the city of Iowa City to determine the viability of capturing and burning landfill methane gas, and is exploring the feasibility of utilizing additional biofuels. At present, the University's overall energy portfolio is approximately 10.96% renewable, including purchased electricity, and produced electric power and steam.

III. STRATEGIES FOR REACHING ENERGY OBJECTIVES

In 2004, the General Education Fund (GEF) Task Force challenged the campus to reduce GEF energy expenditures by \$1.5 million over three years. Facilities Management responded by specifically identifying energy management as one of its five over-arching organizational goals and developing strategies to reduce energy costs through conservation, system dependability and environmental sustainability. The strategies employed by Facilities Management that contributed to successfully meeting the challenge included:

- Creating a campus-wide Energy Conservation Advisory Council³ to encourage energy conservation and raise the visibility
- Reducing projected GEF expenditures for energy through conservation initiatives

² Firm capacity is the ability to meet peak demand for a particular utility when the largest unit within the system is not in service.

- Becoming a U.S. Environmental Protection Agency Energy Star Partner in 2005 to increase visibility and institutionally commit to reducing energy demand
- Burning renewable energy (such as oat hulls) to reduce fuel costs, CO2 emissions and reliance on coal
- Becoming “greener” – joining the Chicago Climate Exchange in 2004 as one of only four university members
- Developing a campus Energy Policy that will drive campus decisions and action
- Developing a funding strategy for energy conservation projects
- Determining a utilities plant investment plan to ensure future reliability, looking at how and when to expand, and ensuring diversified energy sources
- Developing a centralized building controls strategy to optimize building systems performance
- Developing a commissioning program to ensure properly designed and installed, and optimally operated building mechanical systems

Facilities Management expanded the responsibility of the Utilities & Energy Management organization, from the traditional role of supplying power to one that includes energy management, specifically to provide accountability and management of energy ranging from the procurement of fuels to the control of the room thermostat, and incorporates the purchase of energy-conserving equipment. Within this framework, the Facilities Management organization evaluates all aspects of the energy supply chain for efficient and cost-effective use of energy and identifies conservation and operational opportunities. Using a comprehensive systems approach, Facilities Management optimizes fuel mixes based on market conditions and campus demand, continuously monitors and fine-tunes plant equipment for efficient operation, inspects distribution systems for losses, and routinely audits buildings for operational efficiencies.

In the past two years, Facilities Management and the Energy Conservation Advisory Council led the University of Iowa to a cost avoidance of \$1.85 million (6.5%) for the General Education Fund through energy conservation and energy management. Enhanced energy awareness and increased building efficiencies have accumulated a savings of \$1.1 million in energy costs to the General Education Fund. During this same period, the Utilities Enterprise⁴ reduced costs by achieving full capacity for the 2004 biomass fuel project and implementing a fuel/energy strategy that yields the maximum cost savings through real-time optimization of coal, gas, oat hulls and purchased electricity. This avoided approximately \$750,000 in costs to the GEF – bringing the total costs avoided by the GEF during this period to approximately \$1.85 million.

With this basic energy management framework in place, Facilities Management has positioned itself to address (a) Utilities Enterprise Supply and Demand Management, (b)

⁴ The Utilities Enterprise is a recharge cost center that sells energy and services to the campus to fund its zero-profit budget.

General Education Fund Energy Management, and (c) Campus Consumption and Conservation Management. The next steps can build on this to promote energy conservation; deliver building systems that are optimized via commissioning, improve customer satisfaction with enhanced building controls, extend equipment life and reduce maintenance costs, and continue to reduce energy consumption. The resulting plan is designed to increase campus energy efficiency, support UI-wide energy conservation efforts, reduce the consumption of energy in existing facilities, and partner with utilities, consumers, service providers and energy conservation advocates.

(a) Utilities Enterprise Supply and Demand Management

Strategy #1: Utilities Capacity and Infrastructure Growth Funding. Capital project budgets requiring Board of Regents approval on or after March 1, 2007 will include contributions to a utilities infrastructure growth fund for central plants. A project's contribution will be in an amount no more than the estimated cost to install gas-fired boilers and electric-powered chillers in the building, sized to meet building capacity, including 50% redundancies, which is the minimum redundancy for a stand-alone system.

The policy will be phased-in during calendar year 2007. From March 1, 2007 through July 31, 2007, project budgets will reflect no less than 50% of the estimated inclusive boiler and chiller costs. Budgets approved between August 1, 2007 and December 31, 2007 will be assessed 75% of the estimated capacity costs. Project budgets approved after January 1, 2008 will be assessed the full amount.

The purpose of this contribution is to cover the cost of increased capacity in the central plants to meet the demand created by new and renovated facilities on campus. Central plants provide the most cost efficient production of utilities due to economies of scale. In the past, the predominant model for funding increased plant capacity was to shift 100% of the project cost for utility capacity expansion and infrastructure growth into the utilities rates. This spread the cost of the equipment for generating and distributing heating and cooling to a new building or major renovation across the entire consumer base, and understated the cost of a new or significantly renovated building. Having the project contribute to a plant expansion fund, similar to a utilities-imposed demand charge, would properly align capital and operating costs. Other universities have adopted similar costing methods.

Strategy #2: Campus-wide Demand Side Management and Systems Optimization. The Utilities Enterprise will require two FTE to provide professional services to campus utilities consumers, enabling them to identify and pursue conservation measures and investments.

Successful efforts to reduce user demand allow the Utilities Enterprise to avoid or delay incurring debt for plant capacity growth, which avoids debt-driven rate increases for all energy and utilities consumers. While conservation has been encouraged, promoted and

facilitated to yield gains in efficiency from operational improvements, the Utilities Enterprise has not traditionally focused its efforts on lowering the demand for energy within individual buildings; the ratepayers have undertaken recent energy conservation initiatives for the General Education Fund and the UIHC buildings. Enterprise-based resources to lead and complement the focus of individual units on lowering user demand would be in the best interest of all consumers. Thus, Facilities Management will adopt strategies similar to those employed by MidAmerican Energy and other utilities providers to balance its focus on production and reliability with increased efforts on conservation and efficiency. The financial support of these outreach and consultative services will be embedded within the utilities rates.

Strategy #3: Investment in Capacity. The Utilities Enterprise has been facilitating energy efficiency and renewable fuels through (a) replacement of aged equipment with high efficiency equipment, (b) use of oat hulls in Boiler 11 and (c) a new fuel mix strategy that offsets rising gas prices through use of the fixed electric power contract. Now, the University of Iowa is developing a comprehensive utilities master plan. Driven by concerns over aging equipment and the additional energy demands created by modern medical, research and academic facilities, the plan will provide a framework for the expansion, improvement and configuration of the utility infrastructure on the central and Oakdale campuses. The plan will address the cost, reliability and capacity of power, steam, chilled water and potable water production and distribution to meet the current and future needs of the University.

Engineering studies will be incorporated into the utilities plan to prioritize capital renewal and plant growth. A comprehensive engineering and economic analysis of chilled water production and distribution was completed by Stanley Consultants in early 2005 and provided the basis for the Chilled Water Master Plan. A study analyzing power and steam demand and capacity, by RMF Engineering, Inc., was completed in 2006. The results of the RMF study will form the basis of a master plan and long term planning for increasing steam and power capacity, and efficiency.

Strategy #4: Capital Renewal. A comprehensive condition assessment of existing plant infrastructure is nearing completion by ISES Corporation, a consulting firm specializing in facilities condition assessments. The resulting detailed database of information enables the University to optimize its maintenance and operational efforts, and more clearly define deferred maintenance backlog, plant adaption deficiencies, and projected capital renewal funding levels necessary to maintain the utilities infrastructure over the next ten years.

(b) General Education Funded Energy Management

Strategy #5: Central GEF Building Control & Monitoring. The University will pursue a course of action to invest in a centralized building controls system with the goal of

achieving control and monitoring of the space inventory representing 90% of the GEF energy expense by July 1, 2013. The Energy Control Center will facilitate efforts, as in monitoring and determining trends in energy usage and system efficiencies. The investment in central control and monitoring will have the additional major advantages of improving occupant comfort and monitoring security. Additional savings will be realized through equipment scheduling during non-occupied periods. The anticipated \$3 million investment in systems, equipment and technology by 2013 will be funded through the reinvestment of utilities savings and the energy provider rebate, reimbursement and incentive programs.⁵

Strategy #6: GEF Building Controls Design, Engineering & Installation. The University will become increasingly proficient on building control systems engineering and installations. The current Facilities Management buildings controls central shop and the Utilities & Energy Management meters and controls groups will partner to provide controls integration and coordination through the entire energy supply chain, and set the stage for the development of an Energy Control Center. Future work for the controls technicians will include extensive participation in building commissioning, test and balance HVAC systems, and Direct Digital Control (DDC) installation for new projects.

Controls staff will be added to provide specific skills. In Fiscal Year 2007, one controls technician will be added to work specifically on energy consumption reduction initiatives and development of the energy control center. In Fiscal Year 2008, additional staff will be needed to manage new controls installations, and conduct system test and balance. Initial discussions indicate approximately three additional controls technicians will be required to complete this shift in providing energy system monitoring and control. Funding for increased staff will be supported by a combination of utilities budget savings, the energy rebate program, and charges against project budgets in lieu of outside controls vendor charges.

Strategy #7: Energy Management Staffing. A second energy engineer position (1 FTE) will be used to conduct building audits, review commissioning plans, track energy performance, and review engineering designs for compliance with Campus Design Standards, energy codes and campus energy policies. The additional duty of overseeing administration of the energy rebate program will be managed by the energy engineer. Accelerated progress in reaching targeted savings is the objective. The funding support for these positions will be through savings in the energy budget and the energy rebate program.

⁵ MidAmerican Energy Company offers rebates are available for energy-efficient equipment installations, incentives to help offset the initial cost of design and installation for energy-efficient options in new commercial buildings, and reimbursements for 50% of the cost an energy audit, with the remaining 50% paid upon completion of the recommended energy efficiency measures. Alliant Energy also offers a set of energy efficiency programs, including shared up-front investments, rebates, and design assistance.

(c) Campus Consumption and Conservation Management

Strategy #8: Life Cycle Cost Investments. All new construction and major renovations of facilities that are heated or cooled by a mechanical or electrical system will implement the recommendations of a life cycle cost analysis. Project budgets for new construction and major renovations must support meeting the best overall life cycle investment. Minor renovation projects must invest in conservation improvements up to no less than a seven-year payback level. The provisions may only be appealed through, and waived by, the Capital Projects Review Committee.

Strategy #9: Reinvestment of Rebates. Projects must comply with Campus Design Standards that reflect the benchmarks used in the energy rebate program and the latest ASHRAE standard adopted. By meeting these institutional and energy rebate program standards, project designs are complying with minimum requirements that reflect sound life cycle investment decision making.

The rebates will be invested in other campus conservation efforts to help offset the demand created by the new project. For non-GEF facilities, rebates shall remain under the control of the auxiliary, but must be used to invest in conservation opportunities.

Strategy #10: Commissioning. All new facilities and major renovations will be commissioned. Project budgets shall support the cost for commissioning. Where practicable, efforts shall be made to re-commission and retro-commission existing facilities. Funding for retro-commissioning may be supported through savings in the energy budget and the utility rebate program.

Strategy #11: Partnerships. The University will seek, develop and leverage relationships with business partners, governmental agencies, academia, students, professional associations and entrepreneurs to pursue the Energy Policy objectives of reliability, conservation and sustainability. The University will take the lead in providing and facilitating an environment that promotes innovation, discovery and exploration of solutions to energy challenges.

Strategy #12: Energy Star Purchases. As an Energy Star partner and an institution that seeks to lower its energy costs, University equipment purchases should be Energy Star-rated. Purchasing Energy Star-rated equipment will improve the University's energy and financial performance while distinguishing our institution as an environmental leader. Energy Star is a program helping businesses and individuals protect the environment through superior energy efficiency. The Purchasing Department will assist in raising awareness of Energy Star products, providing resources for learning about Energy Star, seeking Energy Star-rated equipment specifications, and including Energy Star criteria in blanket/volume purchase agreements.

Strategy #13: Measuring Progress. Facilities Management will develop and utilize a system of metrics to gauge progress and success towards achieving energy objectives. Actual returns on investment in energy conservation improvements will be measured against projected returns to assess the effectiveness of planning assumptions and principles and to validate success.

Strategy #14: Reporting. Facilities Management will develop a communications strategy that will be structured to increase campus, community and State of Iowa awareness of UI's energy initiatives and progress meeting its goals and executing its strategies. The communications strategy will include an annual report, progress reports, web-based resources and information, press releases and internal reports related to the effectiveness of energy conservation investments. The internal reports will help University financial planners understand how energy projects are determined and evaluated, provide a list of specific energy conservation projects and the rate of return/payback period, and identify possible means of financing the projects; and will facilitate justification for future continued investments in pursuing objectives.

IV. REINVESTMENT STRATEGY

Strategic investments in innovative technological solutions and infrastructure are required if the UI is to reduce its energy consumption and realize an on-going financial return. To pursue the aggressive goals of the Energy Conservation and Management Strategic Plan, Facilities Management proposes a two-tier funding strategy that will reinvest energy rebates and savings into energy conservation.

Facilities Management currently works in coordination with energy-provider rebate programs to identify and fund energy savings opportunities for the UI. Rebate programs reward the University for utilizing the latest technologies, systems and materials when building new facilities or renovating existing facilities on the UI campus. Included in this collection of programs are the following: Commercial New Construction Program Rebates, Nonresidential Custom Systems Program Rebates, Prescriptive Rebates, and the Efficiency Partners Programs. Investments of these rebates and reimbursements will provide funds to invest in staffing, technologies and projects to pursue additional savings through conservation reductions and the goals outlined in the preceding proposals. Upon the implementation and payback of the projects, the reinvestment of these funds would result in additional annual incremental savings for the University, which would then be programmed for reinvestment into energy conservation. Conceptually, the reinvestment of the energy rebates is occurring. However, in order to make the program more robust, responsive and effective, the funding needs to be "programmed" in an allocated budget that allows funds to be strategically planned into many initiatives over both immediate and long term horizons. The current mode does not facilitate taking maximum advantage of conservation opportunities.

Facilities Management proposes a two-tiered approach to budgeting the reinvestment of utility budget savings and energy rebates. The first tier would be a fixed allocation for funding portions of the staffing identified in Strategies 5 through 7. This allocation would

also cover relatively modest opportunity investments discovered in the course of Facilities Management's work throughout the year. The funding for this tier would be relatively constant year over year.

The second tier would represent investments in capital projects; prepared by the Facilities Management engineering staff and evaluated by the Capital Projects Review Committee. The funding for this tier could be more variable than the first tier and would be driven by the attractiveness of the investment and availability of funding.

The details of this funding plan will be developed in collaboration with the University Budget Office.

V. SUMMARY

Facilities Management believes that executing the energy conservation and management plan will have a significant impact on reducing campus energy consumption, meeting ongoing campus energy demands, lowering operational costs, and expanding our sustainable energy portfolio by the end of 2013. However, Facilities Management recognizes that its current organizational capacity is not sufficient to realize those goals. To pursue energy saving projects and technologies, the funding mechanisms and policies need to be put in place. The plan can then interconnect the various efforts and capitalize on the heightened energy awareness and positive outcomes that the UI has realized.