

MEMORANDUM

To: Board of Regents
From: Board Office
Subject: Annual Report on Energy Conservation
Date: September 5, 2000

Recommended Actions:

1. Receive the Annual Report on Energy Conservation.
2. Encourage the institutions to continue to pursue actively energy conservation measures and other methods to control energy costs.

Executive Summary:

Annually, the Board receives a report on energy conservation efforts at the Regent institutions. The report includes information on energy usage and energy costs for the past fiscal year and a status report on the completion of energy conservation measures. The report also provides a means of assessing the efficiency and effectiveness of the operations of the Regent institutions consistent with Action Step 4.2.1.2. of the Board's Strategic Plan.

Under Iowa Code §473.12, the Board was required to undertake by June 30, 1989, comprehensive engineering analyses of its facilities and implement energy conservation measures which were economically feasible and practical. The section also requires the Board to report by October 1 of each year to the Department of Natural Resources on both the results of energy usage analyses of the Board's facilities, and the status of energy conservation measures identified in the comprehensive engineering analyses.

The Regent institutions have significantly reduced their energy consumption on a BTU (British Thermal Unit) per gross square foot basis since FY 1979, the peak consumption year. Consumption has declined from 1979 by approximately 21.5 percent at the University of Iowa, 24.2 percent at Iowa State University, and 16.4 percent at the University of Northern Iowa. The reductions since 1979 are more impressive than the data indicate considering the growth in the installation of energy-consuming research and diagnostic equipment, personal computers and air conditioning equipment.

With the exception of Iowa State University, the institutions report decreases in energy consumption per gross square foot from FY 1999 to FY 2000. The decreases partially reflect the mild winter weather during the 1999-2000 heating season. The 16.7 percent increase in energy consumption at Iowa State University can be attributed to the occupancy of new facilities during FY 2000, particularly Howe Hall, the College of Design Auditorium, the Palmer Human Development and Family Studies Building, and the Communications Building Addition. These facilities utilize current technologies and therefore are more energy intensive than other campus buildings.

The institutions report little or no increases in energy costs per gross square foot from FY 1999 to FY 2000, with the exception of Iowa State University; energy costs per gross square foot increased 14.7 percent due to the addition of new energy-intensive space, while the University's energy costs per million BTU decreased by 1.1 percent.

Background:

In accordance with Iowa Code §473.12, the institutions undertook engineering analyses of their facilities in 1989 to identify energy conservation measures in an effort to reduce energy consumption and control energy costs. The analyses identified a total of \$73.8 million (2000 dollars) in energy conservation measures, which were to be implemented if economically feasible and practical and if they did not require a simple payback period of more than six years.

Of this amount, projects totaling \$41.0 million had individual payback periods of six years or less and were identified as the projects most likely to be implemented, although a number of these projects were later determined not to be feasible. It was estimated that the identified projects would save approximately \$10.2 million annually for a simple payback of 4.03 years.

There are wide differences among the institutions in the cost of energy because of the mix of fuels used, the amount of electricity generated versus purchased, and local utility rate structures. To control energy costs, the institutions contract for fuel at the lowest cost, use the least costly fuel if there is a choice, and schedule air handling units around class schedules.

Deregulation legislation was considered by the Iowa legislature during the 2000 session but was not passed. One concern was the potential impact on energy rates, which could increase in a deregulated market in a state such as Iowa where energy costs are currently relatively low.

Several states have enacted deregulation legislation, including those with large populations and relatively high electrical rates. In California, the deregulation of the electrical industry has resulted in significant increases in consumer electrical bills, shortages in electrical power to meet demand which has resulted in electrical blackouts, and power cut-offs necessary to preserve the state's power supply network. These deficiencies have been partially attributed to an inadequate electrical generation and transmission capacity to serve the state's deregulated market.

Analysis:

The following is a summary of current and historical energy usage and costs, and a status report on the implementation of energy conservation measures at the Regent institutions. Also included is an update on the pending deregulation of the electrical utility industry and the institutions' preparation efforts. Additional detail is available in the institutions' reports in the Exhibit Book.

Energy Usage

Energy consumption on a BTU per gross square foot basis has declined significantly since FY 1979, the peak consumption year. The following table summarizes energy consumption by institution.

	<u>Energy Consumption (BTUs/GSF)</u>					<u>%</u>	<u>%</u>
						<u>Change</u>	<u>Change</u>
	<u>FY 1979</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 79 to</u>	<u>FY 99 to</u>
						<u>FY 00</u>	<u>FY 00</u>
SUI	523,030	428,226	432,386	439,154	410,786	(21.5)	(6.5)
ISU	635,606	393,390	396,950	413,126	482,011	(24.2)	16.7
UNI	409,364	351,986	334,220	342,379	340,194	(16.9)	(0.6)
ISD	N/A	146,424	139,600	131,450	N/A *	-----	-----
IBSSS	N/A	144,360	125,605	119,508	110,992	-----	(7.1)

* Comparable data not available due to corrections in electrical demand meter.

New facilities on the Iowa State University campus have contributed to the 16.7 percent increase in energy consumption from FY 1999 to FY 2000. While the buildings feature energy efficient designs, they are more energy intensive than the low-technology, unconditioned buildings which were razed from the campus in FY 2000 (Engineering Research Institute Building, Engineering Annex, and Exhibit Hall). No other campus facilities were taken off-line with occupancy of the new buildings.

While the decreases in energy consumption at the remaining institutions are due primarily to mild winter weather, the 6.5 percent decrease at the University of Iowa may also be attributed to improvements in chilled water service. Energy usage at the University of Northern Iowa, Iowa School for the Deaf and Iowa Braille and Sight Saving School is more dependent upon weather conditions than is usage at the two larger institutions, as a smaller percentage of total campus space has sophisticated heating, ventilating and air conditioning and environmental control systems.

In addition, purchased electricity decisions will affect the total BTUs reported by the universities; the universities buy power when economically feasible and cogenerate when that is the most cost-effective option. There are different formulas for calculating BTUs for purchased versus generated electricity.

Energy Costs

Energy costs per gross square feet are a function of usage (BTUs/GSF) and the cost of energy (\$/MILLION BTUs). Changes in energy costs by institution by year represent fluctuations in the mix of fuels, fluctuations in coal, natural gas and purchased electricity prices and the availability of economy power.

The following tables summarize changes in energy costs per gross square foot and per million BTUs over the last three fiscal years.

Energy Costs (\$/GSF)

	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	% Change FY 1998 – <u>FY 2000</u>	% Change FY 1999 – <u>FY 2000</u>
SUI	\$1.02	\$1.01	\$1.01	(1.0)	----
ISU	.72	.75	.86	19.4	14.7
UNI	.62	.62	.62	----	----
ISD	.55	.55	.54	(1.8)	(1.8)
IBSSS	.52	.46	.47	(9.6)	2.2

Energy Costs (\$/Million BTUs)

	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>% Change FY 1998 – FY 2000</u>	<u>% Change FY 1999 – FY 2000</u>
SUI	\$2.36	\$2.29	\$2.46	4.2	7.4
ISU	1.83	1.81	1.79	(2.2)	(1.1)
UNI	1.87	1.80	1.81	(3.2)	0.6
ISD	4.00	4.08	N/A*	----	----
IBSSS	4.11	3.83	4.27	3.9	11.5

* Comparable data not available due to corrections in electrical demand meter.

The following table summarizes institutional reports of total energy costs from FY 1994 through FY 2000. It does not include water, sewer or personnel costs.

Total Energy Costs

	<u>FY 1994</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>FY 1997</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>
SUI	\$13,301,158	\$13,007,388	\$13,880,224	\$12,712,118	\$13,248,367	\$13,272,715	\$13,798,666
ISU	6,886,181	6,668,818	6,923,392	7,056,472	7,195,315	7,516,343	7,562,904
UNI	2,295,643	2,166,114	2,504,404	2,460,272	2,279,672	2,263,235	2,309,343
ISD	141,709	134,730	154,531	190,727	172,155	166,353	168,151
IBSSS	<u>126,468</u>	<u>119,852</u>	<u>111,797</u>	<u>122,645</u>	<u>98,245</u>	<u>87,080</u>	<u>90,221</u>
TOTAL	<u>\$22,751,159</u>	<u>\$22,096,902</u>	<u>\$23,574,348</u>	<u>\$22,542,234</u>	<u>\$22,993,754</u>	<u>\$23,305,726</u>	<u>\$23,929,285</u>

Since FY 1994, energy costs at the three universities have remained relatively stable, while the total gross square footage of campus facilities has steadily increased during the period. Total gross square footage has increased by 8.8 percent at the University of Iowa, 1.5 percent at Iowa State University, and 14.5 percent at the University of Northern Iowa.

When compared to FY 1994, the increase in energy costs at the Iowa School for the Deaf can be attributed to increased space usage resulting from additional students, the leasing of space on campus, and summer school programs. A portion of the decrease in energy costs at the Iowa Braille and Sight Saving School can be attributed to the savings resulting from the installation of new boilers in FY 1999 and their improved efficiencies.

While Iowa State University has reported significant increases in energy consumption from FY 1999 to FY 2000 (as previously outlined), the decrease in energy costs per million BTU has resulted in relatively small increases in total energy costs for the same period (0.6 percent).

Energy Conservation Measures

The 1989 engineering analyses identified a total of \$73.8 million (2000 dollars) in energy conservation measures at the institutions; it was estimated that these projects would save approximately \$13.2 million (2000 dollars) annually for a simple payback period of 5.59 years. The simple payback formula was used in all 1989 analyses to determine the estimated amount of time needed to realize energy savings equal to the project cost. The formula is derived by dividing the total project cost by the estimated annual savings; it does not include the cost of money in the calculations. The simple payback for individual projects identified in the 1989 study ranged from less than one month to more than 25 years. Many of the projects identified in the technical assistance studies have not been completed because the payback period is greater than six years, the project was not feasible when further analyzed, or it was determined that installation costs were excessive due to unusual construction circumstances.

To date, approximately \$24.7 million have been spent on identified energy conservation measures, saving approximately \$5.8 million annually for a simple payback of 4.29 years. The costs and savings associated with the identified energy conservation projects are measured in 2000 dollars and are summarized by institution in Table 1 of this report (page 9).

Approximately 70 percent of the identified energy conservation measures with payback periods of six years or less have been implemented in the 11 years since the engineering analyses were undertaken. The majority of the energy conservation measures implemented at the institutions have been complete for a number of years. The institutions report that they will work to address the remaining measures to the extent that funding is available. Further engineering analyses to identify additional energy conservation measures may be justified should energy prices increase in the future.

In addition to the projects identified in the 1989 analyses, the institutions also undertake other energy conservation projects and incorporate energy conservation measures into new construction and remodeling projects. Additional energy conservation projects, including those in the residence systems, should be undertaken and incorporated into major renovation projects if they are cost effective and feasible. Installation of energy efficient boilers and improvements to campus steam distribution systems can significantly reduce energy consumption on a BTU per gross square foot basis and can reduce operating costs.

Further institutional details on energy conservation measures are included in Appendix A.

Potential Deregulation of Electrical Utility Industry

In response to California's experience with deregulation, utility providers and organizations in the state of Iowa have responded with caution regarding the potential impact of electrical deregulation in the state. Included is the issue of whether adequate electrical generation and transmission capacity exists at this time to support a deregulated electrical market in Iowa. There are differing opinions on this and other issues related to deregulation. As a result, there is uncertainty regarding whether deregulation legislation will be introduced or pursued in the 2001 legislative session.

In preparation for the possibility of a restructured electrical utility industry, major energy consumers are engaging in contract negotiations with utilities to ensure the availability of a sufficient supply of purchased electricity at the most economical price. The University of Iowa is currently operating under an agreement with its local utility (MidAmerican Energy) which allows the University the flexibility to use its generation assets to produce electrical energy in response to the prevailing market as well as purchase required generation capacity at market prices. The University reports that the agreement reduced its cost of purchased electricity by approximately \$1.3 million in FY 1999, the first year of operation under the five-year agreement.

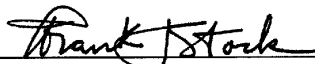
Iowa State University has purchased a portion of its electrical power under an agreement with the City of Ames which makes the University a participant in the electrical transmission facilities in the Ames area. In addition, the University's transmission facility rights under the agreement have allowed it to purchase power from another Iowa supplier.

The University of Northern Iowa operates under an existing interconnection agreement with the local utility for the purchase of a portion of its electrical power. The University reports that it is reviewing strategies to optimize its existing cogeneration system in anticipation of potential changes in the cost of purchased electricity.

If energy costs do increase, the life cycle cost analysis associated with potential energy conservation measures would have to be reevaluated as additional energy conservation efforts may become cost effective. Conversely, any potential reductions in energy costs are not likely to be significant enough to negate the positive impact of implementing well-planned conservation efforts. As utility restructuring progresses, the institutions will continue to monitor the potential impact on their energy programs.


Sheila Lodge

Approved:


Frank J. Stork

**TABLE 1
SUMMARY
ENERGY CONSERVATION MEASURES - IDENTIFIED AND COMPLETED**

	Projects Identified in 1989 Engineering Analyses				Identified Projects with Payback Periods of Less than 6 Years				Identified Projects Completed to Date			
	# of Proj.	Identified Capital Costs (2000\$)	Projected Annual Energy Savings (2000\$)	Est. Pay-back Prd. (Yrs)	# of Proj.	Identified Capital Costs (2000\$)	Projected Annual Energy Savings (2000\$)	Est. Pay-back Prd. (Yrs)	# of Proj.	Actual Capital Costs (2000\$)	Annual Energy Savings (2000\$)	Est. Pay-back Prd. (Yrs)
University of Iowa												
General Fund - Main Campus	659	#####	\$2,917,851	5.32	453	\$7,221,066	\$1,837,873	3.93	393	\$9,165,297	#####	5.13
General Fund - Oakdale	67	402,723	69,354	5.81	45	132,828	33,010	4.02	29	275,808	48,982	5.63
Athletics	14	139,310	27,595	5.05	10	89,274	21,255	4.20	9	98,047	20,037	4.89
Hospital	17	14,557,511	3,035,237	4.80	12	10,863,256	2,695,061	4.03	12	7,009,555	1,732,424	4.05
Hospital School	7	633,898	126,640	5.01	4	513,279	116,215	4.42	2	495,008	92,801	5.33
Iowa Memorial Union	11	276,227	53,430	5.17	8	192,453	42,987	4.48	5	61,012	10,678	5.71
Residence Halls	100	1,210,704	260,912	4.64	62	740,455	201,608	3.67	27	279,567	65,393	4.28
Utility Enterprise	9	19,129,237	3,969,897	4.82	8	18,145,390	3,821,938	4.75	2	5,663,582	1,407,835	4.02
Subtotal	884	#####	#####	4.96	602	#####	\$8,769,946	4.32	479	#####	#####	4.46
Iowa State University												
General Fund Buildings	507	\$10,816,399	\$1,068,729	####	180	\$929,103	\$638,898	1.45	108	\$421,207	\$204,982	2.05
Subtotal	507	\$10,816,399	\$1,068,729	####	180	\$929,103	\$638,898	1.45	108	\$421,207	\$204,982	2.05
University of Northern Iowa												
General Fund Buildings	228	\$9,821,740	\$1,382,301	7.11	63	\$1,269,127	\$516,604	2.46	49	\$577,530	\$318,643	1.81
Residence Halls	90	1,037,808	235,167	4.41	80	760,080	219,875	3.46	25	504,742	40,081	####
Subtotal	318	#####	\$1,617,468	6.71	143	\$2,029,207	\$736,479	2.76	74	\$1,082,272	\$358,724	3.02
Iowa School for the Deaf	16	\$139,262	\$26,566	5.24	11	\$54,765	\$16,647	3.29	11	\$61,397	\$10,971	5.60
Iowa Braille & Sight Saving	21	\$104,525	\$20,542	5.09	11	\$55,754	\$16,115	3.46	12	\$65,477	\$16,806	3.90
TOTAL	####	#####	#####	5.59	947	#####	#####	4.03	684	#####	#####	4.29

Appendix A

Highlights—Energy Conservation Activities

University of Iowa

Annual savings are estimated at approximately \$5.2 million from 479 projects identified in the 1989 studies and implemented to date. In FY 2000, the University completed four additional projects which provided for the retrofitting of UIHC mechanical systems. The projects are estimated to provide additional savings of approximately \$131,000 per year (2000 dollars). The University is continuing with two UIHC projects to install more energy efficient lighting systems and implement off-hour lighting conservation measures. The renovation portion of the Biological Sciences Renovation/Replacement project, which will begin this fall, will incorporate five additional energy conservation measures.

In addition to the energy conservation measures identified in the 1989 audit, the University undertook other projects with energy conservation components during FY 2000. Included were the completion of space for the Department of Otolaryngology in the Pomerantz Pavilion, which incorporated mechanical and electrical systems with numerous energy-efficient features. The University also replaced obsolete steam absorption chillers at the Museum of Art and Hancher Auditorium, and completed connection of the Lindquist Center to the east campus central chilled water system.

In 1997, the University retained an energy consultant to analyze the campus energy production and utilization systems. The purpose of the analysis was to determine potential energy savings through a comprehensive program of repairs, replacement and optimization of all energy production and utilization equipment. The analysis was completed in 1998 and the results are under review by a University committee which has commissioned a more detailed study to verify the potential economic advantages of the proposed improvements.

Since July 2000, the University has been participating in the new Energy Efficient Commercial New Constructions program sponsored by MidAmerican Energy. The utility provides an independent building energy performance consultant which recommends energy conservation strategies for various building systems in new construction and major remodeling projects. The program also provides construction incentives to the University, in varying amounts, depending on the size of the project.

The University continues to identify and evaluate opportunities to incorporate energy efficient components in new construction and remodeling projects.

Iowa State University

Annual savings are estimated at \$204,982 from 108 projects identified in the 1989 studies and implemented to date; these projects have been complete for a number of years. For the general university, the energy conservation measures identified in the comprehensive engineering analyses with payback periods of less than six years have been completed, incorporated into renovations, or determined not to be feasible. Additional energy conservation efforts undertaken in general university facilities include the operation of an off-hour activity center program which continues to be very successful in controlling energy consumption and costs.

The University completed during FY 2000 energy conservation improvements in the campus steam distribution system which were not identified in the 1989 analyses. Included were the repair, conversion and decommissioning of several sections of steam tunnel to minimize the amount of lost energy, and the removal of asbestos from more than 350 feet of steam piping and installation of safer, more efficient insulation.

The University reports that it will continue to review opportunities for energy conservation improvements in its general university facilities. For the Department of Residence, energy conservation measures continue to be prioritized and implemented on the basis of available funding, and are reviewed for incorporation into renovation projects.

The renovation of the heating, ventilating, and air conditioning system at the College of Veterinary Medicine was completed in 1996. The last payment on the master lease financing for the project will be made in November 2000. Future savings will be applied toward additional energy conservation measures at the College of Veterinary Medicine beginning in FY 2002.

University of Northern Iowa

Annual savings are estimated at \$358,724 from 74 projects identified in the 1989 studies and implemented to date; the majority of these projects have been complete for a number of years. The University completed six additional projects in FY 2000 estimated to provide additional savings of approximately \$9,100 per year (2000 dollars); included were four projects in the residence hall facilities which provided lighting modifications and window replacements.

The University has targeted additional energy conservation measures with an estimated cost of \$654,556 for residence system buildings; the estimated payback period is 4.0 years. Included are improvements to the lighting and heating, ventilating and air conditioning systems for the Redeker Dining Center; this work has been incorporated into the renovation project for the facility which is currently underway. In addition, the University is planning to incorporate energy conservation improvements for the Towers Dining Center into a future project.

Iowa School for the Deaf

Annual savings are estimated at \$10,971 from 11 projects identified in the 1989 studies and implemented to date; these projects have been complete for a number of years and represent all of the energy conservation measures identified for implementation.

The School continues to pursue additional means to reduce purchased utilities without restricting academic programming. Projects completed during FY 2000 include the installation of new steam mains and returns with thermal pipe insulation; caulking and sealing; exterior door and window replacements; and improved operating and maintenance procedures.

Iowa Braille and Sight Saving School

Annual savings are estimated at \$16,806 from 12 projects identified in the 1989 studies and implemented to date; these projects have been complete for a number of years and represent all of the energy conservation measures identified for implementation. The school has completed all practical energy conservation measures with a payback period of six years or less.

The School has undertaken additional energy conservation measures which include the assignment of on-campus students to one dormitory to reduce heating and cooling requirements, replacement of the roof and tuckpointing of the Main Building, insulation of hot water tanks, and optimization of the energy management system for improved temperature control of heating and cooling systems.

Further information on energy management plans and projects completed during FY 2000 and those planned for FY 2001 and future years are included in the institutional reports in the Exhibit Book.