STATE OF ILLINOIS

DEPARTMENT OF COMMERCE AND ECONOMIC OPPORTUNITY

A REPORT ON

ENERGY COSTS AND ENERGY EFFICIENCY

AT ILLINOIS' PUBLIC UNIVERSITIES

UNIVERSITY-SPECIFIC DATA

REPORTING TO

NINETY-THIRD GENERAL ASSEMBLY OF THE

STATE OF ILLINOIS

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University Reports

Introduction

The State of Illinois has nine public universities: Chicago State University (CSU), Eastern Illinois University (EIU), Governors State University (GSU), Illinois State University (ISU), Northeastern Illinois University (NEIU), Northern Illinois University (NIU), Southern Illinois University (SIU), the University of Illinois (U of I) and Western Illinois University (WIU). SIU has major campuses in Carbondale (SIUC), Edwardsville (SIUE) and Springfield (SIU School of Medicine). The U of I has major campuses in Urbana/Champaign (UIUC), Chicago (UIC) and Springfield (UIS).

In order to assess energy conservation efforts at these universities, both current and past, Department of Commerce and Economic Opportunity staff conducted site visits or made contacts to each campus. Extensive interviews were held with the facility operations personnel to gather detailed information regarding projects with potential impacts on energy usage. This data is very useful for evaluating energy usage for each university over time. Comparisons between universities, however, is difficult as campuses vary in age, utility rates, number and size of buildings, number of employees and number of students both on-campus and commuting. *Furthermore, as many university facilities lack physical metering equipment, it is not possible, for instance, to compare the energy consumption of 50,000 square foot classroom buildings of similar ages on multiple campuses. Such comparisons are a basic benchmarking tool for similar private sector facilities.*

While the university-specific lists of past improvements are relatively comprehensive, the university-specific lists of prospective improvements are very preliminary and minimal due to the limited data available (as reflected in the report's primary recommendation). Additional projects will be identified after each university has taken steps to improve upon the energy management systems at its facilities. While these lists of prospective projects are minimal, not exhaustive, they are included with the hope that they can serve as useful examples of the types of projects that could be undertaken consistent with a comprehensive plan.

Chicago State University

History

Chicago State University (CSU), located on 161 acres on Chicago's South Side, is the state's second oldest public university. It currently has eleven buildings with a total building area of about 1,000,000 square feet. Most of the campus buildings were built in the early 1970's. Five more buildings are either under construction or will be built in the near future and one of the oldest buildings, Robinson University Center, is in the process of being remodeled.

Most of the 7,000 plus students live off campus, but there is a residence hall that houses more than 300 on campus.

Two natural gas fired boilers located at the Power Plant produce high temperature hot water (400 degrees) for heating and domestic hot water use. Chilled water for cooling is generated by an absorption chiller and three electric chillers. Both hot and chilled water are distributed to most of the buildings through underground tunnels. The Power Plant also houses two natural gas, reciprocating engine driven, 825 kilowatt generators that are used to reduce the peak electrical load that is supplied by ComEd.

Chicago State University spends about $1.5 million dollars per year for natural gas and electricity to operate the campus. Table A-1 contains data on the energy consumption and costs by fuel type for Chicago State University for the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) and a percentage of normal year HDD and CDD. This information provides an indication of weather severity as compared with a normal year.

Table A-1
Chicago State University Energy Costs
FY95 – FY03

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
	Cost								
Natural Gas	$201,000	$367,100	$367,300	$366,100	$252,900	$293,800	$919,800	$706,300	$786,754
Electricity	$958,700	$1,293,100	$1,335,600	$1,568,800	$1,255,500	$1,227,000	$665,600	$773,200	$786,754
Total	$1,159,700	$1,660,200	$1,702,900	$1,934,900	$1,508,400	$1,520,800	$1,585,400	$1,479,500	$1,573,508
	Usage (MBtu's)								
Natural Gas	64,487	98,360	91,144	76,458	75,409	74,236	132,248	114,703	114,989
Electricity	42,775	52,899	55,594	54,459	55,800	53,677	35,944	39,464	38,813
Total	107,262	151,259	146,738	130,916	131,209	127,912	168,192	154,167	153,802
	Unit Costs ($/MBtu's)								
Natural Gas	3.12	3.73	4.03	4.79	3.35	3.96	6.96	6.16	6.84
Electricity	22.41	24.44	24.02	28.81	22.50	22.86	18.52	19.59	20.27
Total	10.81	10.98	11.61	14.78	11.50	11.89	9.43	9.60	10.23
	Weather Severity (% of Normal Year)								
HDD*	100.1%	118.0%	108.6%	88.2%	90.1%	98.1%	110.4%	97.4%	
CDD*	56.7%	104.1%	53.1%	77.8%	78.6%	77.7%	84.2%	105.6%	
Sq Ft (Millions)	0.82	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00

Normal Yr. HDD* 6,536

Normal Yr. CDD* 752

***Chicago weather data**

Energy Conservation Efforts

Table A-2 contains a list of energy conservation efforts that have taken place at Chicago State University since 1995. When available, data on the cost of the projects and savings is included. In addition to the energy conservation efforts listed in this table, CSU has undertaken projects that do not reduce energy usage but reduce energy costs. CSU has storage capacity for natural gas that allows them to purchase when prices are low. CSU also uses emergency generators to reduce peak electrical demand.

Table A-2
Energy Conservation Efforts at CSU
FY95 – FY03

Year	Project	Building Name	Savings ($ per year)	Cost
1998	CDB chiller replacement	H		
	CDB chiller replacement	K		
	CDB cooling tower rebuild	H		
	CDB cooling tower replacement	K		
1999	(Performance Contracting Project)			
	Lighting retrofit	All	$264,300	$1,423,200
	Chiller interface	H	$17,300	$14,200
	Chiller interface	K	$24,800	$7,500
	Upgrade temperature controls	Main Campus	$2,500	$64,100
	BAS expansion	All	$100,000	$715,300
	Repair temperature controls	A-C, F-H	$2,500	$81,00
	Interface to cooling tower	H	$5,000	$3,800
	Interface to cooling tower	K	$5,000	$3,800
	Replace burner in small boiler	K	$1,500	$26,500
	Repair Air Handling Units	Main Campus	$25,000	$505,400
	Install high efficiency motors	A-C, F-H	$15,300	$80,300
	Install 1,650 KW co-gen system	Main Campus	$332,300	$2,354,000
	Gas purchasing and electric metering	All	$27,700	$50,700
	Re-commission building HVAC system	A-C, F-H	$13,000	$684,600
			$836,200	$5,933,400
2003	Automatic flush valves in bathrooms			
	Push button faucets in bathrooms			

Remaining Potential Energy Conservation Opportunities

While university personnel have pursued a number of energy conservation projects, there are still significant opportunities for additional savings through improved energy efficiency. The following is a list of prospective projects that should be considered once a comprehensive energy management strategy is adopted.

1. Convert all exit lights to LED,
2. Install covers on three swimming pools in Building G,
3. Recover energy from generator exhaust and jacket water and use to preheat boiler feed water,
4. Install run-a-round heat recovery on building exhaust fan systems,
5. Install motion sensors on all classroom and office lights,
6. Install storm windows or replace windows on main campus buildings,
7. Weather-strip and caulk all exterior doors,
8. Install energy efficient fume hoods in labs in Building D,
9. Install heat recovery on boiler exhaust stacks,
10. Convert remaining pumps in chiller plant to variable speed drive, and
11. Enable control of all lights from the building automation system.

Eastern Illinois University

History

Eastern Illinois University is located in Charleston, a rural community of 20,000 that lies 50 miles south of Champaign and 125 miles east of St. Louis. Chartered as a teachers' college in 1895, the University has developed into a multi-purpose, public university offering undergraduate and graduate educational opportunities in liberal arts and professional studies. Of the 11,500 students who attend EIU each fall and spring semester, about 4,200 reside on campus. Approximately 3,500 students attend one of the four summer sessions. With more than 1,600 full-time employees and a payroll of nearly $50 million, the University is the largest employer in Coles County. The University campus is located on 320 acres and consists of 72 buildings, including 12 residence halls and 17 apartment buildings.

Table B-1 contains data on the energy consumption and costs by fuel type for Eastern Illinois University for the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) and a percentage of normal year HDD and CDD as an indication of weather severity.

Table B-1
Eastern Illinois University Energy Costs
FY95 – FY03

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
	Cost								
Natural Gas	$1,075,000	$1,667,000	$1,765,980	$1,745,900	$1,319,900	$1,327,700	$862,100	$637,800	$503,602
Electricity	$2,090,970	$2,323,100	$2,246,140	$2,434,500	$2,390,700	$1,948,000	$2,026,800	$2,062,200	$2,082,060
Coal	$151,070	$0	$0	$0	$0	$68,100	$493,200	$337,800	$401,696
Fuel Oil	$240	$34,300	$19,740	$20,000	$10,800	$14,300	$43,900	$23,700	$0
Total	$3,317,280	$4,024,400	$4,031,860	$4,200,400	$3,721,400	$3,358,100	$3,426,000	$3,061,500	$2,987,358
	Usage (MBtu's)								
Natural Gas	380,300	484,139	452,545	480,840	444,712	466,818	113,019	129,360	67,278
Electricity	137,282	129,427	123,327	132,975	114,986	111,444	114,980	115,346	134,093
Coal	84,266	0	0	0	0	4	324,826	255,171	226,489
Fuel Oil	42	8,358	4,145	0	0	4,070	6,950	4,129	0
Total	601,890	621,924	580,017	613,815	559,698	582,336	559,776	504,006	453,231
	Unit Costs ($/MBtu's)								
Natural Gas	2.83	3.44	3.90	3.63	2.97	2.84	7.63	4.93	7.49
Electricity	15.23	17.95	18.21	18.31	20.79	17.48	17.63	17.88	15.53
Coal	1.79	*	*	*	*	17025.00	1.52	1.32	1.77
Fuel Oil	5.76	4.10	4.76	*	*	3.51	6.32	5.74	*
Total	5.51	6.47	6.95	6.84	6.65	5.77	6.12	6.07	6.98
	Weather Severity (% of Normal Year)								
HDD*	104.7%	132.2%	127.5%	113.5%	110.7%	111.7%	133.1%	107.9%	
CDD*	55.1%	85.5%	59.0%	55.7%	75.7%	62.6%	64.0%	68.2%	
Sq Ft (Millions)	2.94	2.99	3.00	3.00	3.00	2.62	2.97	2.97	3.03

***St. Louis Weather Data Normal Year HDD 4,759 Normal Year CDD 1,534**

Since 1995 the Facilities, Planning and Management (FPM) staff at EIU have undertaken a number of initiatives that have served to conserve energy and reduce their operating costs while upgrading their energy using systems. These initiatives are discussed below.

Performance Contracting

Phase I

In 1994, Governor Jim Edgar initiated a performance contracting pilot program with several facilities selected to participate. These performance contracting projects allowed for the financing of energy efficiency and conservation improvements to be made at facilities with no upfront capital costs. Project costs were paid back over a ten-year period from guaranteed savings calculated prior to the installation of the energy efficiency measures. In a performance contract project, an energy services company (ESCO) guarantees savings sufficient to cover project costs, including debt service, for installed efficiency improvements. Eastern Illinois University, already considered relatively aggressive in its approach to energy conservation, was selected to be included as the higher education facility in the first round of projects.

Working with the support of the Department of Commerce and Community Affairs, now the Department of Commerce and Economic Opportunity, the University issued a Request for Proposal (RFP) in late 1993 requesting qualifications from interested ESCOs. Energy Masters, Inc. was selected in early 1994 as the ESCO for the EIU project. A detailed "investment grade" campus energy audit was performed, and completed by October 1994. The audit detailed recommended energy conservation measures (ECMS) for the campus. FPM staff reviewed the list of ECMS and selected the project scope. The project that emerged included scopes of work in 14 campus buildings covering 1.7 million square feet of space. Work included upgrades to lighting, HVAC, and building automation.

The project was competitively bid in early 1995 with awards going to local electrical and mechanical contractors. The construction cost for the project was $3,416,222, with guaranteed annual savings of $532,883. Project performance savings were estimated at $655,727 annually. Construction commenced in the spring of 1995 and was completed in December of that same year. The installed ECMS included 10,525 energy efficient lighting upgrades, 697 variable air volume conversions, 39 variable speed drive fans, 1,095 additional building automation points, an energy management system (EMS) upgrade and minimal steam and electrical metering. Since project completion, monthly performance calculations have confirmed that the energy measures are providing net savings in excess of the guarantee.

In recognition of the success and effectiveness of this project, EIU received a State of Illinois Energy Efficient Building award in 1997 from the Department of Commerce and Economic Opportunity.

Table B-2 lists the energy conservation measures installed in Phase I.

Table B-2
Energy Conservation Projects Installed In Phase I

Energy Conservation Projects	Location
Muti-zone to VAV Conversion	Andrews, Blair, Booth, Fine Arts, Lawson, Stevenson, University Union
Utility Metering	Andrews, Blair, Booth, Coleman, Fine Arts, Klehm, Lantz Rec., Lawson, Life Science, Life Science Annex, Old-Main, Physical Science, Stevenson, University Union
Specular Reflectors, New Ballasts and T-8 Lamps	Blair, Booth, Coleman, Fine Arts, Lantz, Life Science, Old-Main, University Union
Incandescent to Fluorescent Lamps	Blair, Booth, Coleman, Fine Arts, Klehm, Lantz, Lawson, Life Science, Life Science Annex, Physical Science, Stadium, Stevenson, University Union
Incandescent to Halogen Lamps	Blair, Booth, Klehm, Lantz, Stadium, Stevenson, Tarble Arts, University Union
Exit Lamp Retrofit	Blair, Booth, Fine Arts, Klehm, Lantz, Lawson, Old-Main, Physical Science, Stadium, Stevenson, Tarble Arts, University Union
New HVAC Equipment	Blair
Expand Energy Management System	Blair, Coleman, Fine Arts, Lantz, Life Science, Old-Main, Physical Sciences, Stevenson, Tarble Arts
New Fluorescent Fixtures for 8’ Fixtures	Booth, Klehm
Electronic Ballast and T-8 Lamps for 8’ Fixtures	Booth, Life Science, Life Science Annex, Tarble Arts
Constant Volume Reheat to VAV Reheat Conversion	Booth, Coleman, Fine Arts, Klehm, Physical Science, Stevenson, University Union
Return/Relief Damper	Booth Library
Variable Frequency Drives	Booth, Coleman, Lantz, Tarble Arts
Incandescent to Metal Halide Lamps	Fine Arts, Lantz,
Incandescent to Metal Halide Fixture	Lantz
Constant Volume to VAV Conversion	Lantz, Life Science Annex
Remote Ballast Study	Lawson, Stevenson
Electronic Ballasts and T-8 Lamps	Life Science Annex, Old-Main,
Mercury Vapor to High Pressure Sodium	Stadium
Specular Reflectors, New Ballasts and T-8 Lamps for 8’ Fixtures	Old-Main
Multi-zone to Single-Zone Conversion	Physical Science
Trim Pump Impeller	Stevenson
Electronic Ballast and T-8 Lamps	Tarble Arts

Phase II

Legislation was enacted during the 1998 session enabling colleges and universities to enter into ten-year paid from savings guaranteed performance contracts. Based upon the success of Phase I, an initiative to complete energy upgrades to the balance of the campus was started in the Fall of 2000. An RFP was issued, and an ESCO was selected in the Spring of 2001. Honeywell, Inc. completed a detailed energy audit for the Phase II project in July 2001. Project scopes of work included lighting retrofits, water conservation measures, variable speed pumping and fans, flue

gas economizer, chiller replacements and expansion of the campus gas transport services. See Table B-3 for more details on the Phase II project. The project scope was an estimated $10.8 million with associated annual savings of $1.2 million.

Table B-3
Energy Conservation Projects Installed In Phase II

Energy Conservation Projects	Type of Energy Conservation Project	Quantity
Lighting Retrofit	- Electronic Ballasts and T-8 Lamps - Incandescent to Fluorescent - Incandescent Exits to LED	18,335 Fixtures
Water Retrofit	- Commercial Toilets and Flush Valves - Gravity Tank & Bowl Toilets - Urinal Valves - Showerheads - Hand Washing Sinks - Clothes Washing Machines - Pool Conservation	770 Toilets 300 Toilets 146 Urinals 810 Showers 1448 Aerators 181 Machines 1 Filter
Steam Trap Repair	Mechanical Traps replaced with Barnes and Jones Steam Traps	---
Pipe Insulation	- ½ inch pipe - ¾ inch pipe - 1 inch pipe - 2 inch pipe - 6 inch pipe - Valves	22 feet 82 feet 123 feet 10 feet 40 feet 10
Chiller Modifications	- Replace absorption w/centrifugal - Extend chillers water loop - Replace pumps w/VFD pumps - Install 2-way control valves - High efficiency motors & VFD fans - DDC optimized control - Ultrasonic Flow Meters	4 chillers -- 8 pumps 5 buildings 7 fans --- ---
VAV Conversions	- DDC installed on air handlers - VFD installed on air handlers - Install High Efficiency Motors - Balance supply fans and registers	6 units 6 units 6 Motors 6 fans
AHU Controls	- Program occupancy schedules - Install additional DDC controls - Web interface provided - Convert Infinity software to Continuum - Install Infinet Devices	--- --- --- --- 16
Steam Pressure Reduction	Reduce Main Steam Supply Pressure	125 PSIG
Cooling Coil Replacements	Chilled Water Cooling Coils	15 Coils
North Loop Performance Monitoring	Chilled Water Flow Monitoring	---
Demand Control Ventilation	Measure CO2 Levels in the Return Air	26 Air Handlers

Water Conservation Initiatives
Facing a City of Charleston water rate increase of 20 percent during FY02, EIU increased its water budget by 10 percent. FPM was called upon to seek water conservation measures to offset the remaining 10 percent of the anticipated increase. After consulting with FPM plumbing staff, it was recognized that the showerheads in service in the residential buildings could possibly be a source of substantial savings. Flow tests were performed which confirmed that significant water could be saved. The most cost-effective locations were selected for showerhead replacement. Calculations, based upon conservation assumptions, suggested that annual savings of $112,000 could be realized from the project. If the calculated savings were realized, the installation costs of the upgrade would have a 200% return on investment. During the Christmas break in 1999, FPM plumbing staff replaced 510 showerheads. Since the first month of operation in January 2000, following the installation of low-flow showerheads, savings exceeding those calculated have been consistently realized. As a result of this improvement, EIU is realizing verified annual savings of approximately $200,000.

In FY02 a project to supply the baseball field irrigation system with water from the campus ponds was initiated. A well for pond make-up water from a deep aquifer was drilled and developed. The irrigation water is drawn from the ponds as needed for the baseball field and well pumps automatically start and refill the ponds as the level drops. This innovative system eliminates the use of potable city water for irrigation of the athletic fields, saving $6.59 for every 1,000 gallons pumped.

Fuels Management Initiative
With the support of grants from the DCEO Office of Coal Development and Marketing, a project was undertaken to return the coal burning facilities to operation. Major scopes of work included installation of a scrubber bypass duct, replacement of boiler controls, replacement of de-aerators, refurbishing of the particulate bag house, major upgrades to the coal dumping facility and upgrades to various scrubber systems. Completion of this project has allowed EIU to purchase and utilize lower cost high sulfur Illinois coal for its steam generating needs. Since February 2000, this effort represents a cost avoidance of over $1.4 million for the university.

Upgrade To Energy Efficient Lighting
Exterior lighting has been partially upgraded from 400-watt high-pressure sodium lamps to 175-watt metal halide lamps. The old lighting fixtures allowed most of the light to flare off into the atmosphere, providing little useful illumination where it is needed. The new fixtures possess optical control, which directs the new light below horizontal. This optical control, along with the whiter color of the new metal halide lamps, has combined to provide the campus with improved illumination and contrast for less than half of the energy input. A “Smartlights” grant from CIPS provided $20,000 in assistance for this project.

General lighting in the Facilities Planning Management office complex was upgraded from 4-tube T-12 fixtures to 2- tube T-8 fixtures with specular reflectors and electronic ballasts. An initiative to complete this upgrade in the maintenance shop areas and the central stores office is in progress. In addition, approximately 3,500 compact fluorescent lamps (CFLs) were installed in student dorm study desk lamps in the summer of 1999. These 20-watt energy efficient replacements were substitutes for 60-watt and 75-watt incandescent bulbs. With the project savings in energy alone, this improvement has a very high return on investment. In addition to

reduced energy consumption of the CFLs, savings will also be realized from the longer life of the fluorescent lamp.

Chilled Water Loop

In 1995, EIU initiated the design of a chilled water loop to connect the air-conditioning equipment of four academic buildings (Buzzard Hall, Booth Library, Life Science Building and the Fine Arts Complex). The goals of the project were to improve energy efficiency by using excess capacity in individual equipment, improve reliability by sharing equipment, permit the cooling of the buildings during seasonal shoulder periods, and avoid the simultaneous replacement of old equipment in the buildings. This project has been very successful.

A project in FY98-99 added four more buildings to the loop. Three residence halls (Stevenson Tower, Lincoln and Douglas Halls and Tower Food Service) and one academic building (Lantz Complex, which includes the Rec. Center) were connected.

During FY00 some funds were used to convert old steam-based chilled water equipment to electrical equipment in Taylor Hall, Lawson Hall and connecting Food Service. This equipment is more efficient and will permit the implementation of electrical peak-shaving techniques. These projects increased the reliability of cooling systems and allowed for more efficient use of energy throughout the year.

In FY01-02 EIU extended the existing chilled water loop to the Physical Science Building, McAfee Hall and the University Union Food Court. An additional chilled water loop was created on the south quad, which connected the following residence hall complexes: Taylor/Lawson and Thomas/Andrews, and the University Union ’72 addition, which also includes two food services. This smaller loop will probably be connected to the larger campus loop at a future time. Currently there are 18 buildings connected on the loop.

The University proposes to extend the chilled water loop south of Garfield Avenue, to Coleman and Klehm Halls, academic buildings, and the proposed Clinical Services Building at some time in the future.

Other Energy Conservation Projects

The Facilities Planning and Management staff at Eastern Illinois University have undertaken a number of other energy management projects in addition to what has been discussed. Table B-4 includes additional energy conservation projects that were evaluated with savings estimates.

Table B-4
Other Energy Conservation Projects
Eastern Illinois University

Energy Conservation Projects	Project Cost	Annual Savings	Payback	Project Completed
Classroom Occupancy Sensors (782 fixtures in 5 buildings)	$62,547	$28,059	2.23 Yrs	1997
Boiler Chem. Clean & Burner Upgrade	$62,000	$60,616	1.02 Yrs	1997
Boiler Forced Draft Fan (VSD drive installed)	$25,000	$10,393	2.41 Yrs	1998
Insulate Deaerator	$5,000	$4,003	1.25 Yrs	1998
Upgrade SSB Reheat Coils	$1,606	$2,487	7.7 Months	1997
Utilization of CIPS Rider 18	------	$3,808	----	1998
Booth Library Relief Damper	$1,585	$1,393	1.14 Yrs	1997
Field House Lights	$65,000	$8,400	7.7 Yrs*	1997
Vending Machine Occupancy Sensors	$12,800	$11,500	1.11 Yrs	2000
McAffree South Gym Lights	$11,500	$3,180	3.6 Yrs*	1998
Upgraded Exterior Lighting (300 fixtures convert 400 watt HPS to 175 watt metal halide)	$240,000	$14,600	16.4 Yrs*	2001
Conductivity Controlling	$4,000	$26,000	1.8 Month	1999
Replace Inc. Desk Lamps (3,456 lamps)	$30,378	$20,528	1.48 Yrs	1999
Office Lighting Upgrade to T-8	$6,514	$3,140	2.07 Yrs	2000
Eliminated Supply Water Booster	---	$5,424	---	2000
Low Flow Shower Heads (1054 installed)	$15,300	---	---	2000
Boiler Economizer and Warming	$109,971	$53,200	2.06 Yrs	1999
Renegotiated Utility Rate (went from CIPS 9B to flat rate)	---	$75,000	---	1999
Volunteer Curtailment Program	---	$2,500	---	1999
Totals	**$653,201**	**$334,231**	**1.95 Yrs**	

*Project improved lighting quality and safety.

Student and Faculty Involvement with Energy Conservation

Eastern Illinois University has asked the student population to assist in its energy conservation efforts. Students in the residence halls are making an effort to shave peak loads by limiting their energy usage during the daytime. They understand and are aware of the energy conservation efforts of the University, including compact fluorescent lighting and low flow showerheads.

FPM staff has begun working with the academic faculty to consolidate class locations and shut down areas that are not in use. During the Summer they incorporated a four-and-one-half-day work week and shut down buildings after 12:00 p.m. on Friday afternoons until Summer school was back in session.

FPM has hired a student to assist with identifying energy conservation opportunities at EIU. His salary is paid from energy savings achieved by the projects. Table B-5 highlights a list of recommendations and savings that have been developed by the student.

Table B-5
Staff Student Recommendations

Energy Conservation Projects	Project Savings	Project Completed
Research and generate improvement reports	---	08/02
Install 563 compact fluorescent bulbs	$6,911	01/03
Install 410 exit signs (LED)	$2,112	01/03
Install 286 exit sign retrofits (LED)	$3,358	01/03
Reduce Booth Library excess light levels	$7,726	In process
Install corridor occupancy sensors	$2,271	08/03
Reduce excess light on Garfield St.	$175	12/02
Install switch on steam plant lights	$548	02/03
Ballast inventory reduction	---	03/03
Relight McAffee stage	$3,374	04/03
Relight Rec. Center	$4,199	In process
Initiate Energy Star in computer labs	$438	05/03
Install Watt-Miser sensors	$604	In process
Relight Central Stores warehouse	$280	08/03
Install 191 Compact Fluorescent Lights in Student Union	$4,700	08/03
Upgrade lighting in Union vending lounge	$224	08/03
Upgrade lighting in paint shop	$512	08/03
Total	**$37,432**	

Miscellaneous Projects

Other energy conservation projects include:

- Continuously updating programming for the building automation controls (BAC),
- Using digital controls to incorporate the most energy efficient chillers as needed,
- Measuring CO2 and controlling the outside air dampers accordingly,
- Using the BAC to control pumping,
- Enhancing the BAC by upgrading to campus network global communication,
- Negotiating for transportation gas with an interruptible rate that they supplement with #2 fuel oil and coal as needed,
- Negotiating a discounted sewage charge for evaporation from the cooling towers,
- Completing a total upgrade on the cooling tower feed water system,
- Retrofitting exit signs to either fluorescent or LED lighting, and
- Contributing to and participating in Builder Operator Certification program sponsored by DCEO.
- The University has also participated in DCEO's Institutional Conservation Program (ICP) throughout the years and received $15,500 in funding to offset the cost of the energy audit in the performance contracting project.

Several other opportunities for energy conservation have been identified and are listed along with the estimated costs in table B-6.

Table B-6
PROPOSED FUTURE ENERGY PROJECTS

Regular Capital	**Amount**
Rehabilitate Life Science HVAC and Plumbing	$1,600,000
Rehabilitate Coleman HVAC and Plumbing	$1,290,000
Rehabilitate Steam Production Facilities	$11,000,000
Upgrade Utilities Infrastructure	$16,500,000
Rehabilitate Klehm Hall HVAC and Plumbing	$1,600,000
Campus Chilled Water Loop	$1,588,000
Capital Renewal	**Amount**
Rehabilitate Chiller, Klehm Hall	$370,000
Replace Reheat Coils, Physical Science and Klehm Hall	$161,700
Replace Compressed Air Distribution Piping	$164,000
Physical Science Emergency Generators	$250,000
Totals	**$34,523,700**

HVAC and Plumbing Rehabilitation in Life Science Complex, Coleman and Klehm Halls
These projects will replace the ventilation units, air handling units and cooling and heating coils throughout the structure. Temperature control instrumentation will be updated to deliver precise control at optimum energy efficiency. The hot and cold domestic water distribution piping will be replaced to eliminate further system leaks.

Rehabilitate Steam Production Facilities
The University is requesting funding to address known serious deferred maintenance needs in the steam generating plant and in the scrubber systems. Failing to address these needs will result in eventual loss of the ability to supply essential campus steam services, and possible injury to students, faculty, staff or the visiting public.

Upgrade Utilities Infrastructure
The utilities infrastructure upgrade plan will consider all current system conditions, future additional loads expected, location of underground utilities and operations plans that will impact utilities systems. Installation of prioritized upgrades will be based upon a comprehensive plan.

Campus Chilled Water Loop
The University proposes to extend the central chilled water loop south from Booth Library, under Garfield Avenue via the recently completed steam tunnel, connecting to the south quad loop. In addition, an extension to the north to provide hookups for the four campus buildings around the north quad is proposed. This project will join the existing north, central and west loops with the south quad and north quad users. This project would bring the total number of buildings piped into the loop to twenty-one, and completes the planned campus chilled water loop development.

Rehabilitate Klehm Hall Chiller
This project will replace the existing chiller with a newer and more efficient absorption machine. The chiller, which is presently located in the Fine Arts building, is being removed under the current Fine Arts renovation project. It is sized appropriately for the needs at Klehm Hall, and will be relocated there. This proposal recognizes the importance of connecting this chiller with the campus south quad chilled water loop, and its strategic location for supplying air conditioning to the proposed new Clinical Services building.

Replace Physical Science Building and Klehm Hall Reheat Coils
The existing reheat coils in the Physical Science Building and Klehm Hall are original to the buildings. Existing duct-mounted heating coils are inefficient, noisy during operation, exhibit numerous leaks, and are ineffective during heating season and will be replaced. Replacing these coils will decrease maintenance costs, increase building efficiency, and enhance building occupant comfort with better climate control. There are approximately 250 of these coils in the buildings.

Replace Campus Compressed Air Distribution Piping
The campus compressed air is produced at the central steam plant and is piped throughout campus in tunnels and in direct buried pipes. The air is used for control of all space temperature regulating systems, as well as critical functions in various academic labs and preparation areas.

A study performed by DCEO indicated that the distribution lines are undersized, causing loss of temperature control during periods of high air demand. This, in addition to the poor condition of portions of the underground system, dictates that a properly sized replacement piping system is required.

Emergency Generator for Physical Science Building
Presently, the Physical Science complex has no back-up power, which leaves critical services vulnerable to utility outages. These essential loads need to be analyzed and a new properly sized diesel-driven emergency generator set should be installed. Loads determined to be essential will need to be repowered from the new or revised distribution panels (emergency panels) that would then be backed up by the new generator. Location of the new generator will need to be sensitive to campus traffic and pedestrian needs.

Remaining Potential Energy Conservation Opportunities

Eastern Illinois University is currently researching the possibility of creating a new Combined Heat and Power (CHP) plant. The plant would use clean coal technology and utilize a fluidized bed boiler to generate steam for electricity production in addition to supplying some of the university's thermal load. Eleven million dollars in deferred maintenance savings have been identified and the University has applied for a Clean Coal Technology grant through DCEO to partially fund the project. The new plant has a high priority with the University with $21 million of internal funds identified. The project is currently a five year plan waiting for the first dollars to be committed and may be compressed to four years after all funding is identified.

The University would also like to research a photovoltaic project on the campus, possibly as an academic activity or a Facilities Planning and Management project.

The University would like to survey their buildings with a thermal imaging device in order to determine high heat loss areas.

Eastern Illinois University is a major contributor to the Building Operator Certification program sponsored by DCEO and feels that a similar Preventive Maintenance Training Series program would be beneficial. A Preventive Maintenance Training Series would assist facility managers with staff training in proper preventive maintenance procedures.

Governors State University

History

Governors State University is the only university in Illinois serving juniors, seniors and graduate students exclusively. It is the fastest growing public university in Illinois with a 22 percent increase in enrollment in the past four years.

The university complex occupies 760 acres. With the opening of the Family Development Center and the Faculty Office Building in 2003, the building area increased from 580,000 to 676,000 square feet. The main building consists of six wings that provide space for 57 classrooms, four computer labs and 67 laboratories and special purpose rooms. There is also a Conference Center, an Information Technology Building, Central Receiving and several residential type buildings providing various support functions. Approximately 7,000 students, all of whom commute, attend Governors State University. Governors State University therefore has no regular student dormitories.

Table C-1 contains data on the energy consumption and costs by fuel type for Governors State University for the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) as a percentage of normal year HDD and CDD which provides an indication of weather severity.

Table C-2 contains a list of the buildings on campus, the years they were built and their sizes.

Table C-1
Governors State University Energy Costs
FY95 – FY 03

	FY95	FY96	FY97	FY 8	FY99	FY00	FY01	FY02	FY03
	Cost								
Natural Gas	$124,800	$177,200	$148,000	$167,300	$131,100	$132,200	$362,800	$141,300	$274,162
Electricity	$827,200	$938,700	$1,008,800	$997,700	$834,100	$725,500	$717,300	$702,500	$738,304
Fuel Oil	$400	$200	$0	$200	$400	$500	$0	$0	$0
Propane	$5,400	$8,100	$6,000	$1,400	$2,000	$2,800	$1,600	$1,500	$0
Total	$957,800	$1,124,200	$1,162,800	$1,166,600	$967,600	$861,000	$1,081,700	$845,300	$1,012,466
	Usage (MBtu's)								
Natural Gas	44,933	57,484	52,073	47,341	44,354	42,042	44,333	45,011	51,850
Electricity	41,001	44,735	44,093	43,706	37,017	32,697	31,900	32,421	33,655
Fuel Oil	63	24	32	0	0	0	0	0	0
Propane	603	768	38	172	103	137	113	198	0
Total	86,600	103,011	96,236	91,219	81,473	74,876	76,346	77,630	85,505
	Unit Costs ($/MBtu's)								
Natural Gas	2.78	3.08	2.84	3.53	2.96	3.14	8.18	3.14	5.29
Electricity	20.18	20.98	22.88	22.83	22.53	22.19	22.49	21.67	21.94
Fuel Oil	6.38	8.18	0.00	*	*	*	*	*	*
Propane	8.95	10.55	157.65	8.14	19.49	20.40	14.12	7.59	*
Total	11.06	10.91	12.08	12.79	11.88	11.50	14.17	10.89	11.84
	Weather Severity (% of Normal Year)								
HDD*	100.1%	118.0%	108.6%	88.2%	90.1%	98.1%	110.4%	97.4%	
CDD*	56.7%	104.1%	53.1%	77.8%	78.6%	77.7%	84.2%	105.6%	
Sq Ft (Millions)	0.47	0.47	0.58	0.58	0.58	0.58	0.58	0.58	0.64

*Chicago weather data

Normal Yr. HDD* 6,536

Normal Yr. CDD* 752

Table C-2
Governors State University Buildings

Building	Year Completed	Square Footage
Barn-Hantack	1880/1920	5,256
Central Receiving	1969	9,700
Environmental Field Station Marek	1965	2,500
Family Development Center	2003	67,000
Hantack House	1954	2,500
Storage	1943	2,844
Outreach Technology Services (OTS)	1991	19,000
Physical Plant Operations Center	1988	7,500
Presidents Conference Center	1954	3,100
Pump House 1	1974	109
Pump House 2	1943	443
Tunnel	1974	12,414
Wagner House	1954	1,770
Main Building A Wing	1974	55,567
Main Building B Wing	1974/1994/1995	65,883
Main Building C Wing	1974	63,214
Main Building D Wing	1974/1994	140,831
Main Building E Wing	1974	55,657
Main Building F Wing	1974	58,501
Main Building G Wing	2003	61,690
Totals		635,479

Energy Conservation Efforts

A number of energy conservation efforts have been undertaken at Governors State University since 1995. A list of the major projects is presented in Table C-3.

The most significant energy conservation project was a $1.9 million performance contract entered into in September 1998, which saves more than $280,000 per year in natural gas, electricity, water and maintenance costs. Table C-4 contains more detailed information on the savings realized from this performance contract project.

Table C-3
Energy Conservation Projects at GSU

Year	Project location and scope	Savings
1996	Campus wide-began use of emergency generators to reduce electric demand by 500 KW as required by ComEd to qualify for Rider 32 rate reductions.	$12,000 /year
1997	Classrooms-occupancy sensors were installed in 50% of the classrooms as part of classroom renovation project.	
1998	G.E. Lighting computer was upgraded.	
1998-1999	(Performance contract project) Chiller replaced with energy efficient unit performance contract project. Lights in buildings A through F were converted to T-8 with electronic ballasts. 50 Variable frequency drives were installed on HVAC units. 75 motors on HVAC circulation pumps were replaced with energy efficient units. 750 HP boiler was re-tubed and an efficient burner was installed. Chilled water leaks were repaired. Condenser fans were staged to reduce KW. Single pass AC units were converted to Direct expansion.	$280,550 /year
1999	#2 boiler was re-tubed and an energy efficient burner was installed.	$7,372 /year
2001	New water saving water treatment system was installed on cooling tower. Insulation was added to the roof of the Planning Building.	$25,000 /year

Table C-4
GSU Performance Contract Energy Conservation Measure Summary

ECM Description	Annual Savings (kW)	Annual Savings (kWh)	Annual Savings (Therms)	Annual Water Savings (Gallons)	Electric Savings (Dollars)	Gas Savings (Dollars)	Water Savings (Dollars)	O & M Savings (Dollars)*	All Utility Savings (Dollars)	Total Savings (Dollars)
Lighting Modifications All Buildings	421	1,957,884	-947		$124,349	($292)		$9,549	$124,057	$133,606
Replace Chiller					$51,000				$51,000	$51,000
Convert to VAV	146	950,399	8,617		$51,944	$2,585		$2,350	$54,529	$56,879
High Efficiency Pump Motors	11.9	40,417			$2,153			$1,510	$2,153	$3,663
Convert Single Pass Units to DX				652,800			$16,904		$16,904	$16,904
Water Conservation Measures				1,797,075			$8,554		$8,554	$8,554
Repair Chilled Water Leak				150,000			$852		$852	$852
Stage Condenser Fans								$1,720		$1,720
Retube Boilers			3,678			$1,640		$5,732	$1,640	$7,372
TOTALS	578.9	2,948,700	11,348	2,599,875	$229,446	$3,933	$26,310	$20,861	$259,689	$280,550

*O & M savings averaged over ten year period.

In addition to the projects listed in Table C-3, there are several additional energy conservation efforts that have been initiated, including replacing existing exit lights with LED units that use only 3 watts of electricity; replacing inefficient motors with high efficiency motors when they fail, annual testing of boiler efficiency and steam trap operation; and sending staff to training in the efficient operation and maintenance of equipment.

Remaining Potential Energy Conservation Opportunities

Although University personnel have been diligent in their pursuit of energy conservation, there are still a number of opportunities for additional savings through energy efficiency improvements. The following list contains potential projects that should be considered once a comprehensive energy management strategy is adopted.

1. Convert the remaining T-12 fluorescent light fixtures (about 10percent) to T-8s with electronic ballasts.
2. Convert the remaining exit lights (about 25percent) to LEDs.
3. Control the remaining lights (about 30percent) with the GE Lighting computer.
4. Install occupancy sensors on remaining classrooms and offices.
5. Insulate all steam valves.
6. Install an air curtain on the entrance to C-wing of the main building.
7. Apply window tinting film on south and west facing windows.
8. Purchase a cover for the swimming pool.
9. Install heat recovery on the boiler blow-down.
10. Recover heat from boiler stacks to pre-heat feed water.
11. Five residential style buildings need to be rehabbed with new windows, doors, insulation and heating and cooling systems.
12. Investigate the potential for co-generation of electricity.
13. Investigate the possibility of using solar energy to heat the swimming pool and to heat domestic hot water for the reverse osmosis water treatment system in the boiler room.
14. Consider using a photovoltaic system to supplement the electrical needs of the Family Development Center.
15. Look into converting power plant boilers to use fuel oil.
16. Evaluate the potential for using wind energy to produce electricity on campus.
17. Rewire unit ventilators in 288 offices in the Faculty Office Center to allow unoccupied setback.

Illinois State University

History

Illinois State University (ISU), the state of Illinois' first public university, was founded in 1857. Over 21,000 students, of which 3,000 are graduate students, attend ISU each year. In a typical year, ISU will spend more than $8 million for natural gas and electricity to provide services to the campus. The ISU campus is comprised of 970 acres located in the Central Illinois community of Normal-Bloomington, which has a population of 110,000. The University maintains 168 buildings totaling about six million square feet. This includes 13 residence halls and two apartment complexes, which house more than 7,500 students. There are also two university-owned farms with about 590 acres of land that house an aquaculture center and other agricultural research facilities.

Table D-1 contains data on the energy consumption and costs by fuel type for ISU for the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) and a percentage of normal year HDD and CDD as an indication of weather severity compared to a normal year.

Table D-1
Illinois State University Energy Costs
FY95 – FY03

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
	Cost								
Natural Gas	$1,308,600	$1,767,500	$2,273,300	$1,943,700	$1,880,200	$2,003,200	$3,904,900	$2,983,800	$2,980,287
Electricity	$4,284,900	$4,735,900	$4,706,700	$5,074,000	$5,026,500	$5,143,800	$5,112,000	$5,600,900	$5,278,608
Total	$5,593,500	$6,503,400	$6,980,000	$7,017,700	$6,906,700	$7,147,000	$9,016,900	$8,584,700	$8,258,895
	Usage (MBtu's)								
Natural Gas	621,891	703,204	726,557	674,417	643,564	632,590	705,429	668,403	672,049
Electricity	255,630	257,425	329,751	297,370	303,224	310,199	318,401	321,306	318,932
Total	877,521	960,629	1,056,308	971,788	946,789	942,789	1,023,830	989,709	990,981
	Unit Costs ($/MBtu's)								
Natural Gas	2.10	2.51	3.13	2.88	2.92	3.17	5.54	4.46	4.43
Electricity	16.76	18.40	14.27	17.06	16.58	16.58	16.06	17.43	16.55
Total	6.37	6.77	6.61	7.22	7.29	7.58	8.81	8.67	8.33
	Weather Severity (% of Normal Year)								
HDD*	90.3%	106.3%	103.7%	87.9%	86.4%	84.4%	102.6%	86.2%	
CDD*	63.3%	111.8%	75.1%	98.4%	109.7%	92.8%	101.1%	101.8%	
Sq Ft (Millions)	5.41	5.41	5.52	5.56	5.56	6.01	6.09	6.18	6.18

Normal Yr. HDD* 6,148
Normal Yr. CDD* 982
*Peoria weather data

Table D-2
ISU Building List

Table D-2 contains a list of building names, abbreviations, year built and sizes for all the buildings on campus.

BLDG ABBR	BUILDING NAME	YEAR BUILT	GROSS SQ FEET (GSF)
HUA	211 N. University	1960	12,546
HNM	711 N. Main (Nite Ride)	1955	1,622
STV	Adlai E. Stevenson Hall	1966	162,180
ASB	Art Studio Bldg	1993	10,972
ATK	Atkin Hall	1962	80,173
BAR	Barton Hall	1952	36,272
BPB	Baseball Press Box	1989	280
PSB	Bill Waller Parking Services Bldg	1960	1,560
BON	Bone Student Center	1973	118,669
BBC	Bowling & Billiards Center	1973	22,709
BRA	Braden Auditorium	1973	140,000
CR	Campus Rec Bldg (220 N. Main)	1960	5,100
GRO	Campus Services Bldg	1964	3,480
GCR	Campus Services Chemical Rinsate Bldg	1997	3,418
GEB	Campus Services Equip. Bldg	1987	2,400
PPG	Campus Services Greenhouse	1964	1,144
GRE	Campus Services Greenhouse Annex-North	1964	1,125
GRA	Campus Services Greenhouse Annex-South	1969	1,080
GS1	Campus Services Storage Bldg #1	1964	2,580
GS2	Campus Services Storage Bldg #2	1964	2,580
GS3	Campus Services Storage Bldg #3	1987	2,560
CCI	Cardinal Court 1st add. Bldg I	1965	6,201
CCJ	Cardinal Court 1st add. Bldg J	1965	6,197
CCK	Cardinal Court 1st add. Bldg K	1965	6,197
CCL	Cardinal Court 1st add. Bldg L	1965	6,197
CCM	Cardinal Court 1st add. Bldg M	1965	6,197
CCN	Cardinal Court 1st add. Bldg N	1965	6,197
CCO	Cardinal Court 1st add. Bldg O	1965	6,197
CCP	Cardinal Court 1st add. Bldg P	1965	6,197
CCQ	Cardinal Court 1st add. Bldg Q	1965	6,197
CCS	Cardinal Court 1st add. Bldg S	1965	6,197
CCA	Cardinal Court Bldg A	1958	6,579
CCB	Cardinal Court Bldg B	1958	6,577
CCC	Cardinal Court Bldg C	1958	6,577
CCD	Cardinal Court Bldg D	1958	6,577
CCE	Cardinal Court Bldg E	1958	6,577
CCF	Cardinal Court Bldg F	1958	6,577
CCG	Cardinal Court Bldg G	1958	6,577
CCH	Cardinal Court Bldg H	1958	6,577

BLDG ABBR	BUILDING NAME	YEAR BUILT	GROSS SQ FEET (GSF)
CLR	Cardinal Ct Laundry Room	1963	3,680
CW	Centennial West	1959	30,182
CVA	Center for The Visual Arts	1973	132,916
CRP	Central Refrigeration	1970	1,274
CIR	Circus Barn (Grove Street)	1962	13,498
RAB	Clarence R Ropp Agriculture Bldg	1982	30,738
COL	Colby Hall	1962	80,173
ACC	Connecting Facilities Btwn Atk/Col	1962	29,675
CNS	Connecting North & South Tower	1969	32,463
CH	Cook Hall	1896	34,611
DVB	Daily Vidette Bldg	1994	3,910
DEG	DeGarmo Hall	1973	115,376
DEB	Driver Education Bldg (Gregory St.)	1972	2,593
DBC	Dunn Barton Connecting	1952	7,788
DUN	Dunn Hall	1952	36,313
EAB	Educational Admin (300 North Street)	1967	2,206
EDW	Edwards Hall	1909	40,169
ENH	Energy House	1988	2,960
ES	Eyestone School Museum	1930	993
FPB	Facilities Planning Bldg	1969	2,850
FOB	Faculty Office Bldg	1989	2,355
FH	Fairchild Hall	1952	80,903
FEN	Feeney Food Center	1960	43,894
FEL	Fell Hall	1918	94,856
FHS	Felmley Hall of Science	1930	53,096
FSA	Felmley Science Annex	1964	81,969
PPF	Fleet Vehicle Bldg	1990	2,550
GCCR	Golf Course Chemical Rinsate Bldg	1998	875
GCG	Golf Course Garage	1971	2,692
GCM	Golf Course Maintenance Shed	1983	3,150
GC	Golf Course Pro Shop	1963	3,886
GST	Golf Science Bldg #2	1971	3,660
GRS	Gregory Street Recreation Storage	1969	443
HAM	Hamilton Hall	1960	80,173
HWC	Hamilton Whitten Connecting	1960	29,675
HRR	Hancock Restroom/Concession	1976	1,461
HAY	Haynie Hall	1964	97,750
HWB	Hazardous Waste Bldg	1988	2,560
HPT	Heating Plant	1915	22,101
HEW	Hewett Hall	1966	161,268
HTN	Horton Field House	1963	198,391
HMS	Horton Maintenance/Storage	1990	2,000
HNN	House 302 N. Normal	1940	3,334
HWW	House 411 W. Willow	1970	4,465

BLDG ABBR	BUILDING NAME	YEAR BUILT	GROSS SQ FEET (GSF)
HOV	Hovey Hall	1951	67,807
HUD	Hudelson Bldg (English Lang Inst)	1960	3,000
ITD	Instructional Tech. & Dev. Center	1957	16,716
SCS	J. Green/North Storage Shed	1988	2,520
GFS	John Green Bldg	1967	51,195
JH	Julian Hall	1970	57,170
KFB	Kaufman Football Bldg	2000	16,000
LIN	Linkins Center	1964	44,134
MAN	Manchester Hall	1966	161,268
MCH	McCormick Hall	1926	63,440
MTB	McCormick Tennis Court Bldg	1976	153
MLB	Milner Library	1976	230,710
MLT	Moulton Hall	1912	50,408
PDN	N. University St. Parking Garage	1992	129,725
NSB	Nelson Smith Bldg	1970	65,898
ORL	Office of Residential Life Bldg	1989	16,500
OU	Old Union Bldg	1956	50,553
RLB	ORL Laundry Bldg	1989	4,262
PES	P E Storage	1985	1,800
PPO	Physical Plant Office	1964	4,818
PPS	Physical Plant Shop	1964	16,850
PPT	Physical Plant Trailer	1989	840
PDB	Prof Development Bldg	1964	12,336
PDA	Professional Develop. Bldg Annex	1970	2,754
RC	Rachel Cooper	1952	24,046
RAM	Rambo House	1939	9,116
RBA	Redbird Arena	1989	163,075
RSV	Research Services Bldg	1966	10,055
PDS	S. University St. Parking Garage	1999	166,320
PDS	School St. Parking Garage	1992	217,316
SHA	Schroeder Annex	1965	46,348
SH	Schroeder Hall	1957	58,060
SLB	Science Laboratory Bldg	1997	112,000
MSA	Shelbourne Apt. A	1971	6,348
MSB	Shelbourne Apt. B	1971	4,782
MSC	Shelbourne Apt. C	1971	4,782
MSD	Shelbourne Apt. D	1971	3,359
MSE	Shelbourne Apt. E	1971	3,359
MSF	Shelbourne Apt. F	1971	4,479
MSG	Shelbourne Apt. G	1971	4,782
MSH	Shelbourne Apt. H	1971	6,348
MSI	Shelbourne Apt. I	1971	6,348
MSJ	Shelbourne Apt. J	1971	4,479

BLDG ABBR	BUILDING NAME	YEAR BUILT	GROSS SQ FEET (GSF)
MSK	Shelbourne Apt. K	1971	4,479
MSL	Shelbourne Apt. L	1971	4,479
MSM	Shelbourne Apt. M	1971	3,359
MSN	Shelbourne Apt. N	1971	6,347
SDU	Shelbourne Apts. Maintenance	1971	1,647
SP	Softball Press box	1997	256
SAB	Student Accounts Bldg	1957	7,820
SRB	Student Rec Bldg (Beech Street)	1982	36,857
SSB	Student Services Bldg	1992	67,631
MLS	Thomas Metcalf School	1957	119,500
DWT	Tunnel Btwn Dunn-Barton/Walker	1955	1,224
TUR	Turner Hall	1963	97,118
UHSS	U-High Soccer Shed	1998	288
UH	University High School	1965	134,600
UMC	University Multi-culture Ct	1950	4,542
UR	University Residence	1971	7,615
VIT	Vitro Center (Glass House)	1949	4,705
VCA	Vitro Center Annex	1997	540
VRO	Vrooman Food Center	1966	65,000
WAL	Walker Hall	1955	85,960
WRC1	Warehouse Road Complex 1	1984	68,000
WRC2	Warehouse Road Complex 2	1980	7,200
WD	Watterson Dining	1969	75,639
WTN	Watterson Towers, North	1969	18,378
JFF	Watterson Towers, North (Jefferson)	1969	48,345
MDN	Watterson Towers, North (Madison)	1969	48,345
MRL	Watterson Towers, North (Marshall)	1969	48,212
PKG	Watterson Towers, North (Pickering)	1969	48,297
RPH	Watterson Towers, North (Randolph)	1969	48,345
WTS	Watterson Towers. South	1969	16,678
ADM	Watterson Towers. South (Adams)	1969	47,475
CLA	Watterson Towers. South (Clay)	1969	54,056
MRO	Watterson Towers. South (Monroe)	1969	47,305
SMH	Watterson Towers. South (Smith)	1969	47,278
VBR	Watterson Towers. South (Van Buren)	1969	47,338
WHT	Whitten Hall	1960	80,173
WIL	Wilkins Hall	1964	97,720
WHA	Williams Annex (Telecom)	1940	3,693
WIH	Williams Hall	1940	97,153
WRT	Wright Hall	1964	97,750
			5,997,523

Energy Conservation Efforts

Although ISU has pursued energy conservation for many years, data on projects that occurred before FY97 is not available. Table D-3 lists efforts undertaken since FY97.

Table D-3
Illinois State University Energy Conservation Projects

Year	Building	Project	Cost
FY97	HP	Emergency Generator	$349,204
	CFC	Chiller @BSC	CDB
	--	(CFC Chiller @SLB 11/07/97)	CDB
	STV	Cooling Towers	$109,736
	FH	Cooling Tower	$111,132
	BSC	CHW Pump	$25,223
	BSC	Condensate System	$12,359
	BSC	Variable Frequency Drives	$14,707
	HP	New Boiler (#8)	CDB
	ATK/COL	Water System	$519,862
		South Elevators, Phase #2	$1,014,973
	East Quad	Tunnel	$2,318,076
	?	Re-Tube Boiler #5	
FY98	HP	Install Apogee System	$80,741
	ORL	Upgrade Powers 600	$47,075
	Golf ProShop	HVAC	$12,930
	HEW	Heating & Air Conditioning	$1,547,269
	BSC	DDC Controls S-8 & S-9	$18,415
	BSC	DDC Controls S-6 & S-7	$12,219
	FEN	Re-pipe CHW System	$35,285
	RSV	Air Condensing Unit	$39,674
	HTN	Utility Tunnel	$231,446
	MLB	CHW Lines	$238,494
	South Tunnel	Expansion Joints	$73,965
FY99	BSC	Zone Dampers S-3 & S-4	$15,519
	CDB	Chiller & Loop	CDB
	ATK/COL	Chiller Replacement	$49,210
	BSC	CHW In-Line Filter	$23,923
		Boiler Controls	CDB
		Boiler # 5	
		Boiler # 6	
		Boiler # 7	
	BSC	Refrigeration Cooling Tower	$35,878
		Chemical Feed Water System	$83,857
	RBA	Building Automation	$45,867
	NSB	CHW Piping	$67,270

Year	Building	Project	Cost
FY00	BSC	Zone Dampers S-6 & S-7	$11,954
	CVA	Re-Tube Absorption Chiller	$52,538
	CC	Replace Water Heaters	$39,898
	CC	Replace Roofs	$103,883
	HEW	Replace Lights: 96 Rooms	$18,540
	South Quad	Electrical Radial	CDB
	JH	EM Generator Upgrade	CDB
	East Quad	Tunnel – Phase 2	CDB
	RAM	Remove Boiler, Connect Steam	$28,931
	BSC	CHW Piping Efficiency	$20,203
	NSB	Cool Tower Installation	$26,056
	BSC	Hot Water System	$22,749
	FEN	Refrigeration Cooling Tower	$21,958
		Chemical Treatment & Blow-Down	$10,540
FY01	BSC	Zone Dampers S-1 & S-5	$12,569
	WAT	Upgrade Electrical System	$731,344
	LIN	Chiller Overhaul	$35,216
	CDB DEG/NSB	Absorption Chiller @HP Manual Transfer Switch: Portable Gen	CDB $35,015
	BSC	DDC Controls	$30,281
	LNK	Refrigeration Condenser	$31,419
	NSB	Chiller Replacement	$153,645
	UH	Re-tube Chiller	$11,114
	EDW	CHW Loop	$49,459
	CE	Hot Water Heater	$20,972
	EAST	Replace Electric Dryers with Steam Dryers NJP	$12,261
	FH	Chilled Water System	$290,376
	FHS	Electrical Upgrade, Ph2	CDB
FY02	HTN	Re-insulate	$20,000
	HTN	Temp A/C	$43,315
	Ropp	Shade Cooling	---
	South Campus	Ceiling Lights	$5,260
	MLB	Elevator Motor	$59,956
	LIN	Soffit & Insulation	$104,170
	FEN	Replace CHW Header	$21,186
	HP	Boiler Water Meters	$37,693
	BSC	Damper Actuators	$31,191
	HOV	CHW Loop Connection	$335,930

Year	Building	Project	Cost
FY02	BRA	S-1 CHW Coils	$18,320
	GFS	Cooler #3	$21,425
	HTN	Pool Condensate Pump	$16,291
	South Quad	Tunnel	CDB
	BSC	Water Treatment	$16,109
		Water Meters for Cooling Towers	$54,281
		Air Curtains @ Various	$26,812
		Occupancy Sensors (Conservation)	$4,117
	LIN	Cooling Tower Pipes	$17,743
	WD	Refrigeration Cooling Tower	$44,844
		Lighting Replacement (Conservation)	$87,144
		Trunk line Upgrade (Conservation)	$145,959
		Steam Trap Replacement (Conservation)	$38,326
FY03	CVA	CHW Loop Pipe	$66,024
	ATK-COL	AC Valves	$98,229
	Shelbourne	Ceiling Fans	$16,800
	FEN	Chiller Starter	$17,746
	BSC	Ballroom Pump	$11,210
		Replace 5 Cooling Towers	$101,298
	UH	Unit Ventilators	$69,752
	EDW-CH	Utility Bridges	$57,523
		Replace Expansion Joint EJ25	$30,959
	OEM	Insulation [Conservation]	--
	OEM	Lighting [Conservation]	$216,149

Table D-4
Remaining Potential Energy Conservation Opportunities

Location	Project Description
UHS	Upgrade Generators
HPT	Re-tube Boiler # 7
WAT	Upgrade Elevators
CAM	Replace Remaining Exit Lights with LED Lights (approximately 10%)
CAM	Add Corrosion Coupons for Remaining HW & CHW Systems
CAM	Upgrade Tunnel Lighting for Energy Conservation (Incandescent to compact fluorescent)
HPT	Upgrade Lighting in Shops, Locker Room, and Boiler Room
HPT	Use Reverse Osmosis Water for Boiler Feed-water
HPT	Replace Six Feed-water Pumps
EDW	Replace Leaking Condensate Return Piping
EDW	Replace Fans S-3, S-5, & S-6
CAM	Repair Air Leaks in Various Air Handling Units
CAM	Connect Central Refrigeration Plant to Quad CHW Loop
DEG	Connect CHW System to Southwest CHW Loop
DEG	Upgrade Steam Station & Condensate Pumps
DEG	Convert Pneumatic Controls to DDC; Remove Air Compressors
HOV	Replace Heating Coils & Zone Dampers in S-1, S-3, S-4
CAM	Reconfigure Main Street Condensate Return Line
CAM	Use Motion Detectors to Control Restroom Lighting
CAM	Extend Utility Tunnel System to West Quad Buildings
CRP	Replace Chiller #1 with Chiller from SH Renovation Project
PPO	Replace Fresh Air Intake
CAM	Connect Additional Loads to Emergency Generators
OU	Replace Air Handlers S-4 & S-5
OU	Replace Window Air Conditioning Units
CVA	Replace CHW Coils and Distribution Lines
STV	Replace 4 Air Handling Units
FEN	Replace Heating Hot Water Tanks
HTN	Replace Heating Hot Water Tanks
GFS	Shift Steam & Condensate Lines to Utility Tunnel
WD	Replace Air-Stream Scrubber Unit in Kitchen
LIN	Replace Air-Stream Scrubber Unit in Kitchen
CAM	Connect Lighting Circuits in Decks to Photo-Cell
UH	Replace Chiller and Cooling Tower
UH	Replace Remaining Unit Ventilators in Classrooms
WIH	Connect CHW Lines to Quad Loop
NSB	Replace Fans, Coils, and Dampers: S-1, S-2 & S-6
CCA	Roof Replacement
CCB	Roof Replacement
CCC	Roof Replacement
HWC	Roof Replacement
HEW	HVAC Replacements
MAN	HVAC Replacements
MSA	Roof Replacement

Location	Project Description
MSB	Roof Replacement
WT	Exterior caulking, replace hot water heaters
WIL	Roof Replacement
CAM	Upgrade electric distribution
CE & CW	Upgrade Chilled water piping and condensate return
CH	Roof Replacement
CVA	Re-lamp and Chilled water loop connection
DEG	Replace 28 windows, replace roof
HTN	Reinsulate
ITDC	Replace roof
GFS	New condensate lines to S-5 and PRV's, new pump
PDB	Replace two ten-ton AC units
UH	Replace chiller tubes, air handler dampers and controls
WIH	Replace roof
CDA	CHW bridge
FHS	Mechanical and electrical upgrades
VRO	Emergency generator upgrade to allow peak shaving

Northeastern Illinois University

History

Northeastern Illinois University (NEIU) is a comprehensive state university serving more than 11,600 commuter students. It is located on 67 acres in a residential area on the northwest side of Chicago and offers more than 80 undergraduate and graduate majors. Before being taken over by the state in 1960, it was known as Chicago Teachers College. NEIU owns 19 buildings with nearly one million square feet of area and leases two other buildings totaling more than 28,500 square feet. Table E-1 lists the buildings, their ages and sizes.

Table E-1
NEIU Building Age and Size

Building Number	Building Name	Date Constructed	Date Major Re-Hab	Building Area (GSF)
1	A	1961		33,014
2	B	1961	2002	35,590
3	C	1961		40,664
4	D	1961		53,360
5	E	1961	2002	84,826
6	F	1961		16,698
7	Fine Arts Center	1999		104,930
8	H	1961	1971	21,284
9	Classroom Building	1973		148,662
10	Student Union	1975	1999	58,362
11	Science Building	1972		143,670
12	Library	1977		141,232
15	Public Safety	1989		1,440
31	Cottage*	1901*		5120*
33	Facilities Maintenance	1992		7,200
35	Grounds Maintenance	1994		5,400
36	Physical Education	1988		117,360
37	Child Care Center	1988		4,385
64	5555 North Benard	1955	2001	6,408
61	Center for Inner City Studies	1904	1972	65,070
EC	El Centro	Leased		11,566
TC	Chicago Teacher's Center	Leased		17,029
			Total	1,118,150

- Demolished in 2002

High temperature hot water for heating and domestic hot water production, and chilled water for cooling are generated at the power plant and distributed through tunnels to the buildings on the main campus.

It costs approximately $1.4 million per year to provide natural gas and electricity to the campus. Table E-2 contains data on the energy consumption and costs by fuel type for NEIU for the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) as a percentage of normal year HDD and CDD as an indication of weather severity compared to a normal year.

Table E-2
Northeastern Illinois University Energy Costs
FY95 – FY03

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
	Cost								
Natural Gas	$355,720	$430,850	$376,090	$271,400	$278,100	$273,400	$610,900	$457,000	$491,017
Electricity	$927,200	$1,008,040	$1,192,010	$1,189,800	$1,564,100	$1,572,800	$1,562,900	$1,510,500	$951,853
Total	$1,282,920	$1,438,890	$1,568,100	$1,461,200	$1,842,200	$1,846,200	$2,173,800	$1,967,500	$1,442,870
	Usage (MBtu's)								
Natural Gas	115,595	133,397	75,010	77,675	74,395	77,558	83,475	77,732	92,183
Electricity	51,225	54,217	58,126	64,736	66,341	66,716	66,237	64,782	64,926
Total	166,820	187,614	133,136	142,412	140,736	144,274	149,712	142,514	157,109
	Unit Costs ($/MBtu's)								
Natural Gas	3.08	3.23	5.01	3.49	3.74	3.53	7.32	5.88	5.33
Electricity	18.10	18.59	20.51	18.38	23.58	23.57	23.60	23.32	14.80
Total	7.69	7.67	11.78	10.26	13.09	12.80	14.52	13.81	9.18
	Weather Severity (% of Normal Year)								
HDD*	100.1%	118.0%	108.6%	88.2%	90.1%	98.1%	110.4%	97.4%	
CDD*	56.7%	104.1%	53.1%	77.8%	78.6%	77.7%	84.2%	105.6%	
Sq Ft (Millions)	1.04	1.04	1.04	1.04	1.13	1.08	1.09	1.10	1.12

*Chicago weather data
Normal Yr. HDD* 6,536
Normal Yr. CDD* 752

Energy Conservation Efforts
Four 775-kilowatt natural gas fired reciprocating engine generator sets were installed in 1995. Waste heat from the engines is recovered and used by the boilers. Currently, the engines are only fired three times per week due to an arrangement with ComEd that essentially pays NEIU not to generate electricity.

In 1995 fifty-three air handler motors larger than 15 horsepower were replaced by high efficiency units.

In1997 two new high temperature hot water generators were installed to replace the existing inefficient units.

In 1999 the Student Union building was remodeled with many upgrades to energy using systems. Variable frequency drives were installed on many of the air handlers and some systems were converted to variable air volume. Lighting was changed to T-8 fluorescent fixtures with electronic ballasts in both the Student Union and the Classroom Building that same year.

The lights in the Science Building were converted from T-12 fluorescent to T-8 with electronic ballasts in 2001. The two 1,200-ton chillers were converted to use 134a refrigerant and the cooling tower which used three 60 HP motors was replaced by a unit with two 60 HP motors with variable speed drives. Two elevators were upgraded to higher efficiency systems.

In 2002, Buildings B and E were the subjects of major remodeling projects that included replacing single pane window-walls with insulated low-e glass. Insulation was also added to the areas above the window-walls at that time. Lighting was changed to T-8 with electronic ballasts. Variable frequency drives were installed on air handlers and some supply boxes were converted to variable air volume.

In 2003, three additional elevators were equipped with higher efficiency systems

Remaining Potential Energy Conservation Opportunities
The following is a brief list of prospective energy efficiency improvements that should be made once a comprehensive energy management strategy is adopted.

1. Buildings A, C, and F need gut-rehab
2. Remainder of campus (about 80 percent) needs Energy Management System upgrades
3. Several buildings need window-walls replaced

Northern Illinois University

History

Chartered in 1895, Northern Illinois University (NIU) is a comprehensive teaching and research institution with a student enrollment of nearly 25,000. In terms of student enrollment, it is the second largest public university in Illinois. About 5,500 students live on campus in the five residence halls and university apartments.

Located in one of the most dynamic regions of the country, with its main campus in the City of DeKalb, NIU also operates regional sites in Rockford, Hoffman Estates, Oregon, and Naperville. The main campus has 81 buildings and 755 acres of land. Table F-1 lists the buildings, the year they were constructed and their sizes.

NIU spends nearly eight million dollars per year to provide electricity and natural gas to the campus for heating, cooling, cooking and other energy using purposes. Table F-2 contains data on the energy consumption and costs by fuel type for NIUfor the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) and a percentage of normal year HDD and CDD as an indication of weather severity compared to a normal year..

Table F-1
Northern Illinois University

Building Name	Year Constructed	GSF
Altgeld Hall	1897	132,907
Adams Hall	1948	41,141
Still Hall	1928	30,727
Still Gym	1928	32,131
McMurry Hall	1911	31883
Davis Hall	1942	71274
Barsema Hall	2002	140,000
Williston Hall	1915	75,704
Morton 48x81	1974	4,698
Morton 42x63	1976	2,602
Morton 54x72	1976	5,778
Greenhouse	1977	3,047
W. Campus Shed	1956	2,353
Ground Office Shop	1977	3,888
Grounds Salt Shed	1987	519
Swen Parson Hall	1952/62/65	164,939
Gilbert Hall	1952	77,903
Kishwaukee Hall	1900-30/48	5,781
Neptune Central	1958	70,870
Neptune East	1958	86,798
Neptune North	1955	77,903

Building Name	Year Constructed	GSF
Neptune West	1958	84,408
Evans Field House	1957	103,038
Reavis Hall	1957	49,908
Gabel Hall	1958	127,427
Speech & Hearing	1959	6,312
Stevens Building	1959	66,573
Physical Plant	1959	35,947
Physical Plant Storage	1966	1,292
Storage Building	1987	1,700
University Apartments	1960	44,822
Holmes Student Center	1962/68	329,684
Lincoln Hall	1962	252,320
Watson Hall	1962	55,975
Dorland Building	1962	80,066
Dorland Warehouse	1969	3,730
Douglas Hall	1963	255,381
Anderson Hall	1964	111,367
Faraday Hall	1964	100,574
Faraday West	1995	119,700
Graham Hall	1964	88,109
Telephone & Security	1964	15,813
Wirtz Hall	1964	89,217
Lowden Hall	1965	38,286
Grant Towers	1965/66	519,148
Grant North	1966	0
Grant South	1965	0
Huskie Stadium	1965	148,148
West Heating Plant	1962	27,430
Stevenson Towers	1967/68	519,148
Stevenson North	1968	0
Stevenson South	1967	0
Health Center	1967	50,343
Visual Arts	1970	104,104
Psychology/Computer	1973	98,113
Music Building	1974	128,328
Television Center	1972	5,415
Founders Library	1975	327,273
Parking Booth	1979	40
Motorcycle Building	1979	494
Recreation Building	1984	95,063
Rec. Ctr. Annex	1995	28,650
Concession Stand	1984	746
Radio Tower Shed	1987	899
Weather Station	1986	0

Building Name	Year Constructed	GSF
Nursing School	1981	23,072
Dusable Hall	1968	112,234
Montgomery Hall	1967	114,381
Zulauf Hall	1968	54,892
Fay-Cooper Cole	1968	34,584
Broadcast Center	1992	16,719
Human Resources	1993	25,000
Social Sciences RC	1994	36,708
Ctr. Black Studies	1993	4,200
Parking Garage	1994	371,910
Campus Life	1994	56,400
Engineering Building	1995	121,500
Burch House	1971	2,872
Culbertson House	1969	3,116
Jacobs House	1970	2,717
Knetsch House	1970	4,376
President’s House	1968	6,785
Pottenger House	1971	3,018
Oderkirk Carriage	1900	1,232
Oderkirk House	1900	3,251
Parking Services	1992	1,474
University Res. Women	1992	5,176

Table F-2
Northern Illinois University Energy Costs
FY95 – FY03

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
	Cost								
Natural Gas	$1,581,300	$1,671,700	$2,221,100	$1,951,200	$1,679,700	$1,947,100	$3,691,500	$2,245,600	$4,084,828
Electricity	$4,474,800	$5,385,000	$5,713,200	$5,336,200	$5,672,000	$5,753,300	$6,030,200	$5,724,600	$3,912,852
Total	$6,056,100	$7,056,700	$7,934,300	$7,287,400	$7,351,700	$7,700,400	$9,721,700	$7,970,200	$7,997,680
	Usage (MBtu's)								
Natural Gas	669,699	706,515	713,740	604,090	624,515	626,280	750,911	686,975	800,947
Electricity	265,457	287,661	289,033	296,952	309,131	314,256	347,593	339,450	333,864
Total	935,156	994,175	1,002,773	901,042	933,646	940,535	1,098,505	1,026,425	1,134,811
	Unit Costs ($/MBtu's)								
Natural Gas	2.36	2.37	3.11	3.23	2.69	3.11	4.92	3.27	5.10
Electricity	16.86	18.72	19.77	17.97	18.35	18.31	17.35	16.86	11.72
Total	6.48	7.10	7.91	8.09	7.87	8.19	8.85	7.77	7.05
	Weather Severity (% of Normal Year)								
HDD*	99.3%	118.7%	113.3%	88.3%	87.0%	87.5%	121.1%	101.3%	
CDD*	56.7%	105.9%	51.3%	92.2%	102.7%	98.2%	72.3%	100.1%	
Sq Ft (Millions)	5.38	5.62	5.62	5.62	5.69	6.34	6.36	6.39	6.39

Normal Yr. HDD* 6,536
Normal Yr. CDD* 752
*Chicago weather data

Energy Conservation Efforts

Since the mid-1980s, NIU has been relatively creative and proactive in efforts to conserve energy. Internally, energy conservation efforts have been devised and put into place through routine maintenance projects and specific energy-saving general revenue projects. Publicly, NIU has entered into performance contracts specifically designed and guaranteed to yield energy savings. Table F-3 lists the performance contracts, their scopes, costs and annual savings.

Beginning in the summer of 2003, NIU initiated a program to save energy by operating on a four-day work week during June, July and August. To accomplish this some offices and classes had to be relocated; however, by doing so, they are able to close one large building (DuSable Hall) for the summer months and realize significant energy and financial savings.

Table F-3
Northern Illinois University Performance Contract Projects

Year	Scope	Location	Cost	Annual Savings
1999	New lighting fixtures, lamps and ballasts; new ceiling systems; three-way switching of classroom lighting; new variable frequency drives and controls for chilled water pump motors; new outdoor air damper assemblies for air handling units.	DuSable Hall	$388,041	$45,422
2001	Lighting conversions & LED exit signs.	20 Buildings	$1,601,020	$236,396
2002	HVAC system upgraded to increase energy efficiency above normal design specs. for new building.	Convocation Center	$2,000,000	$587,545
2002	Lighting conversions.	40 Buildings	$2,399,477	$589,321
2003	Install two 1,200 ton chillers and 1,400 ton cooling tower; Convert 14 AHU's to use chilled water; Install chilled water pumps and heat exchangers.	West Heating Plant Recreation Center Stevenson Towers	$5,536,079	$1,372,896
	Totals		$11,924,617	$2,831,580

Remaining Potential Energy Conservation Opportunities

NIU is very interested in opportunities to reduce their energy usage and associated costs, using performance contracts to finance projects. The following five projects have been identified as having potential to succeed as future performance contract projects. Additional projects could be identified once a comprehensive energy management strategy is adopted.

1. Installation of variable frequency drives on large motors in five campus buildings to improve energy efficiency and motor life.
2. Purchase of flat screen LCD computer monitors versus the traditional CRT monitors across campus.
3. Construction of a thermal energy storage system to operate with the West Heating Plant.
4. Replacement of single pane windows in three or more buildings on campus.
5. Replacement of current water closets, urinals, sinks, faucets and showerheads in nine buildings on campus.

Southern Illinois University at Carbondale

History

Southern Illinois University (SIU) is a multi-campus university that is comprised of two major institutions, SIU at Carbondale (SIUC) and SIU School of Medicine (SIU-MED), in Springfield. SIU also has campuses in Niigata, Japan and Edwardsville (SIUE), a School of Dental Medicine in Alton and a center in East St. Louis. The University, with an annual operating budget of over $618 million, enrolls over 34,000 students. SIU was chartered in 1869 and has undergone significant academic and geographic expansion over the years.

Student enrollment has remained fairly steady at around 22,000 since 1995. In 2003, approximately 4,900 students lived on campus.

Overview of Heating and Cooling Systems

SIU uses approximately 70,000 tons of Illinois coal per year and generates an average of 120,000 lbs/hr of steam, which is distributed through approximately four miles of tunnel system and direct buried steam lines. The steam is used for heating and air conditioning with the peak normally occurring in the summer. SIU has one circulating fluidized bed combustor rated at 105,000 lbs/hr and two very old stoker units rated at 80,000 lbs/hr. A gas-fired boiler rated at 120,000 lbs/hr is used as an emergency back up. Sixty percent of the campus air conditioning load is met by a central chilled water system consisting of two 3,500-ton steam driven chillers that provide chiller water to 19 buildings. Six buildings utilize stand-alone chillers, which are either absorbers or centrifugal units.

Nighthawk Coal Company of Ava, Illinois, provides coal with a sulfur content of three to three and one-half percent to the university.

SIUC spends about $8 million per year to provide electricity, natural gas, coal, fuel oil and propane for heating, cooling, cooking and other energy using purposes. Table G-1 contains data on the energy consumption and costs by fuel type for Southern Illinois University at Carbondale for the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) and a percentage of normal year HDD and CDD as an indication of weather severity compared to a normal year..

Table G-1
Southern Illinois University at Carbondale Energy Costs
FY95 – FY'03

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
					Cost				
Natural Gas	$1,059,100	$1,834,800	$1,354,000	$985,400	$593,000	$638,300	$1,058,000	$879,700	$843,831
Electricity	$5,882,200	$6,219,100	$6,247,500	$6,678,400	$6,232,800	$6,279,200	$6,130,200	$5,967,900	$6,034,229
Coal	$914,700	$895,200	$1,039,100	$977,200	$1,196,900	$895,400	$1,440,300	$1,155,800	$1,285,314
Fuel Oil	$27,000	$2,400	$2,400	$4,100	$4,200	$6,600	$5,600	$9,300	$5,396
Propane	$28,000	$32,700	$20,200	$15,200	$6,800	$4,300	$14,100	$8,800	$10,448
Total	$7,911,000	$8,984,200	$8,663,200	$8,660,300	$8,033,700	$7,823,800	$8,648,200	$8,021,500	$8,179,218
					Usage (MBtu's)				
Natural Gas	316,699	490,457	308,082	219,993	128,518	114,725	120,713	152,899	152,899
Electricity	385,336	400,008	401,273	423,824	445,175	446,622	449,536	436,071	436,071
Coal	747,858	740,165	883,143	1,012,804	1,202,679	885,849	1,347,034	1,051,146	1,051,146
Fuel Oil	5,133	382	354	877	813	814	589	1,050	1,050
Propane	4,909	4,951	2,387	2,327	1,256	833	1,190	962	962
Total	1,459,935	1,635,963	1,595,239	1,659,825	1,778,442	1,448,843	1,919,063	1,642,128	1,642,128
					Unit Costs ($/MBtu's)				
Natural Gas	3.34	3.74	4.39	4.48	4.61	5.56	8.76	5.75	5.52
Electricity	15.27	15.55	15.57	15.76	14.00	14.06	13.64	13.69	13.84
Coal	1.22	1.21	1.18	0.96	1.00	1.01	1.07	1.10	1.22
Fuel Oil	5.26	6.29	6.78	4.67	5.16	8.11	9.50	8.86	5.14
Propane	5.70	6.61	8.46	6.53	5.42	5.16	11.84	9.14	10.86
Total	5.42	5.49	5.43	5.22	4.52	5.40	4.51	4.88	4.98
					Weather Severity (% of Normal Year)				
HDD*	109.2%	129.1%	115.2%	103.1%	96.7%	99.3%	117.0%	98.3%	
CDD*	52.3%	92.0%	65.0%	92.3%	90.8%	82.8%	90.9%	89.8%	
Sq Ft (Millions)	6.37	6.37	6.37	6.72	6.97	6.90	6.82	6.86	6.86

	Normal Yr.		**Normal Yr.**	
***Paducah weather**	**HDD***	4,279	**CDD***	1,475

Table G-2 lists projects that have reduced energy consumption at SIUC since 1995. Also included in the table, when available, are the costs of the energy conservation measures (ECMs).

Table G-2
SIUC Energy Conservation Related Projects

Year	Project	Buildings	Total Project Cost	ECM Related Cost
1995	Roof replacement, new insulation. CDB project 825-020-095	Morris Library, Anthony Hall	$546,499	$163,950
1995	Replaced the cooling tower as part of a phased chiller system replacement project resulting in an efficient, environmentally friendly system that will provide reliable cooling for the 25 to 30 years. CDB project 825-020-099	Neckers	$398,243	$398,243
1996	Reroofing project that included new insulation. Renovation remodeled spaces and lighting 21,500 SF. CDB project 825-020-104.	Neckers	$1,690,000	$743,600
1998	Reroofing project of single-ply EPDM fully adhered membrane roofing and flashing system that included new insulation. CDB project 825-020-113.	Agriculture Building "B" wing	$175,319	$52,500
1998 1999 2000	CFC Remediation. Demolition and renovation of piping, electrical and mechanical equipment. CDB project 825-020-801.	Arena, Davies, Student Center, Faner A, Parkinson, Anthony, Student Recreation Center, and Neckers	$2,112,355	$422,471
1999	Reroofing project that included new insulation. Installation of a fully adhered EPDM roof system, insulation and roof edge. CDB project 825-020-110.	Woody Hall, Quigley Hall, and Pulliam Hall	$389,354	$116,806
1999	Reroofing project that included new insulation. CDB project 825-020-117.	Coal Research	$26,556	$7,967

Year	Project	Buildings	Total Project Cost	ECM Related Cost
2001	Replace Roofs-Various Campus. Reroofing project that included new insulation. Installed single ply EPDM membrane systems, clay tile roofing, standing seam color coated metal roofing on wood trusses, and metal siding with aluminum window and door system. CDB project 825-020-122	Shryock, Material Tech Lab, Life Science II	$976,363	$292,909
2001	Upgrade HVAC & fire alarm – Complete replacement of existing heating, lighting and power distribution systems. Heating work included complete replacement of existing heating systems with a new four-pipe heating system feeding fan coil units and several air-handling units. Ventilating work included replacement of existing ventilating systems with multiple air-handling units ducted throughout the building. Electrical work included replacement of the lighting systems and upgrading power distribution system to handle dual primary voltage. CDB project 825-020-112.	Anthony	$2,838,837	$1,419,418
2001 2002	High Efficiency Motors. A motor survey was performed to identify motors which if replaced would generate a 3 year or less pay back in electrical savings. Ten motors were replaced for an annual savings of $2,193. ICP/DCEO.	Neckers		
	Converted approximately 15,000 fluorescent fixtures from 40 watt with magnetic ballast to		$80,000	$80,000
2001 2002 2003	T-12 to T-8 Conversion. This conversion not only equates to immediate electrical savings, it also means a reduction in the A/C load. Electronic ballasts generate 10-15% less heat. ICP Matching ICP/DCCA grant.		80,000	80,000

Year	Project	Buildings	Total Project Cost	ECM Related Cost
2002	Replace electrical feeders. Repair and maintain current 5kV rated equipment by using 15kV rated equipment. Over time the majority of equipment will be rated for 15kV, and then remaining 5kV equipment will be replaced. This allows higher voltage electric distribution that reduces line losses resulting in overall energy conservation. Power quality meters provided. CDB project 825-020-11.	feeders 8, 17, & 18	$872,052	$87,205
2002	Replacement of theater stage lighting controls and distribution. Installed new three phase distribution, new dimmer racks, extension of existing stage lighting circuits, new stage lighting distribution and new stage rigging. CDB project 825-020-124	McLeod Theater	$614,145	$61,414
2002	Reroofing project that included new insulation. Installed fully adhered membrane roof system and metal roof edge. CDB project 825-020-127.	Lesar Law	$229,483	$68,844
2002	Reroofing project that included new insulation. Installed base sheet, insulation, roofing felts, and coal tar pitch roof system. CDB project 825-020-131.	Engineering "C"	$364,550	$109,365
2002	Reroofing project that included new insulation. Replace existing roof with EDPM. New metal roof over 2335 sq ft penthouse. Installed new fully adhered EPDM roof system and tapered rigid insulation. CDB project 825-020-132	Lindegren Hall	$285,532	$85,659
2002	Emergency Upgrade of Cooling Tower. CDB project 825-020-133	Communication	$700,000	$700,000

Year	Project	Buildings	Total Project Cost	ECM Related Cost
2002	Incandescent to CFL Conversion. Replaced approximately 8300 incandescent lamps in the 60 to 150 watt range with 28-watt compact fluorescent lamps. This conversion equates to electrical and A/C savings, there is also a significant savings in labor due to the longer life of the compact fluorescent lamps.			
2002	Replaced incandescent lamps in most exit light fixtures with light emitting diodes (LED's). This conversion saves electricity and labor.			
2003	Renovation of existing buildings and construction of an addition to existing building. New HVAC system and T-8 lighting. CDB project 825-020-103.	Altgeld Hall	$12,750,000	$2,550,000
2003	Major renovation included replacing old mechanical systems. CDB project 825-020-129.	Morris Library	$27,609,000	$5,521,800
2003	A survey of the main steam distribution system was conducted to identify faulty or needed steam traps. Traps were repaired, replaced or added as needed.			
2003 2004	Repaired and replaced damaged or missing insulation on the Campus steam distribution system in various mechanical areas.			
2004 2005	Campus wide energy conservation project (see Proposed Energy Conservation Measures).	Campus-wide	$4.2 million	$4.2 million

Proposed Energy Conservation Projects - SIUC

Project Scope

SIUC has developed a $4.2 million project to design and construct several energy conservation measures (ECMs) in the academic and administrative facilities on the main campus. The proposed ECMs involve replacement and/or conversion of existing lighting fixtures to high efficiency fixtures, replacement of electric motors, vending machine miser units and installation of "conserve-a-cap" plumbing fixtures as well as installation of other miscellaneous ECMs such as occupancy sensors, additional energy management equipment and updated metering capabilities.

The preliminary plans for the project include the conversion of approximately 33,000 T-12 light fixtures to high efficiency T-8 lighting. In addition, due to the higher light output of the T-8 fixtures, it is estimated that another 8,000 T-12 fixtures can be removed completely. Approximately 265 electric motors fall into the parameters set for this project and would be eligible for replacement, along with the installation of around 100 "vending miser" units which will improve the efficiency of the vending machines across campus. The preliminary plans also include the installation of over 1,000 "conserve-a-cap" units that will greatly increase the efficiency of various plumbing fixtures in campus facilities.

In addition to the above ECMs, the comprehensive energy conservation project would pay for the upgrading of energy management equipment (including the installation of several new metering devices), various HVAC upgrades, and occupancy sensors in certain areas such as restrooms, etc.

Several new meters will be installed to establish a baseline for the present energy consumed. After the energy conservation measures are installed, the savings can be shown and return on investment calculated from actual data, not estimates. This metering effort will coincide with long-range plans at SIUC for the complete retrofit of all the metering on campus, complete with automated meter reading capabilities, including web-based access.

The project would begin around January 2004 and be completed over a period of two to three years. To maximize efficiency and minimize the disruption to classroom activities and office personnel, in-house staff will perform the installations.

Project Rationale

State-allocated operation and maintenance funds for utilities have lagged behind actual utility costs for several years. Given the current fiscal crisis in Illinois and throughout the country, it is imperative that state-supported universities maximize their efforts to conserve energy and thereby lower costs.

SIU has completed a pilot project in the Neckers building with very positive results. Annual electrical cost savings in the pilot building are approximately 16 percent. The proposed project will perform similar ECMs in the majority of the academic and administrative buildings on the main campus. It is estimated that using the resulting energy savings, the overall investment returns will exceed initial capital outlays in approximately seven years.

SIUC has several hundred electric accounts on premises adjacent to the main campus. At this time, they are considering the possibility of aggregating only the larger of these accounts. The costs of upgrading the metering often make the conversion of smaller accounts prohibitive. Consideration must also be given to the impact of aggregation on the overall load profile when negotiating bulk electricity purchases.

Table G-3 lists other identified projects that could save energy.

Table G-3
SIUC Deferred Maintenance Capital Renewal Projects

Project Rank	Project	Building Name	Cost Estimate
Funded	Bldg Renovations	Altgeld Hall	1,534,770
Funded	Bldg Renovation	Morris Library	25,294,650
Funded	Upgrade ten auditoriums	Lawson Hall	600,0000
Funded	Upgrade lighting	Foundry	3,000
Funded	Primary Electrical Distribution Upgrade - phase C	Campus	700,000
1	Window Replacement	Lindegren Hall	300,000
2	Bldg Renovation	Agricultural Building	12,875,000
3	HVAC Renovations	Neckers	3,495,400
4	Bldg Renovation	Studio Arts	900,000
5	Primary Electrical Distribution Upgrade - phase B	Electric	3,000,000
6	General Repair Phase 2	Steam Tunnels System	500,000
7	Classroom/Lab Improvements Phase II	Campus	920,000
8	Building Renovation	Allyn	2,500,000
9	Mechanical Renovation	Lindegren Hall	500,000
10	Mechanical/plumbing/HVAC	Pulliam Ind. Ed.	1,500,000
11	Electrical distribution Upgrade Phase 2	Woody Hall	300,000
12	Electrical distribution Upgrade Phase I	Woody Hall	300,000

Project Rank	Project	Building Name	Cost Estimate
13	Window Replacement	Woody Hall	1,172,000
14	Mechanical Improvements	Woody Hall	1,600,000
15	Bldg Renovation	Life Science II	30,000,000
NA	Additional Chiller	Neckers	1,500,000
16	HVAC Renovation - A, B, D	Engineering A	3,000,000
17	Window Replacement - A, B, C	Faner Hall	4,000,000
18	Utility Distribution Study	Campus	100,000
19	Facilities condition audit	Campus	500,000
20	Lighting Upgrades - by Energy Act	Campus	9,700,000
21	Mechanical Renovation	Quigley Hall	1,000,000
22	HVAC Temperature Controls	Lesar Law	350,000
23	Bldg Renovation	Communications	30,000,000
24	HVAC - Construction Phase 2	Faner Hall	3,000,000
25	Mechanical Renovation	Blue barracks – Main 1	350,000
26	Steam Distribution Upgrade	Campus	1,000,000
27	Chilled Water Pumps – Variable Speed Drives	Campus	1,400,000
28	Chilled Water Systems Upgrade	Campus	7,000,000
29	Replace Exterior Windows (Storm Window)	Parkinson	35,000
30	Insulate and Vent “Hot” Mechanical Rooms	Shryock Auditorium	25,000
31	Electric Upgrade	Service Shop II	260,000
32	Mechanical Renovation	Lawson Hall	3,000,000
33	Primary Electrical Distribution Upgrade	Electric	12,000,000
	Total		166,214,820

Table G-4 lists the buildings on campus and their sizes.

Table G-4
Building List – SIUC

Building/Structure/ Grounds	Sq. Ft.	Building/Structure/ Grounds	Sq. Ft.	Building/Structure/ Grounds	Sq. Ft.
Altgeld Hall	36229	SIU Arena	109422	Crawford Hall	13477
Allyn Building	24893	Quigley Hall	98555	Miles Hall	16567
Parkinson Lab	56136	Pulliam-Wham Ctwr	1729	Salter Hall	15469
Anthony Hall	30532	Wham Education	109934	Colyer Hall	16705
Shryock Auditorium	39079	Student Center	344652	Kesnar Hall	15469
Dorothy Davies Hall	53018	Rehn Hall	68793	Wakeland Hall	12758
Wheeler Hall	17832	Lawson Hall	53476	Kaplan Hall	12924
Storage Bldg	144	Lesar Law Building	97699	Beimfohr Hall	15937
Pump House	316	Admissions Reception	0	Shuman Hall	15469
Mcandrew Stadium E	17474	Communications Bld	229053	Southern Hills	13844
Power Plant	16858	Life Science Ii	217285	Southern Hills	6534
Mcandrew Stadium W	25136	Life Science Iii	101946	Southern Hills	9251
Service Building 1	52979	Int Micro & Graph Exp	5200	Southern Hills	7043
Service Building 2	13689	Laundry-Appl Science	19504	Southern Hills	14614
Physical Plant Annex	3030	Boat Dock Storage	396	Southern Hills	11909
Lindegren Hall	64216	Neckers Building	180878	Southern Hills	11285
Matrials Tech Center	5789	Public Pol Institute	17582	Southern Hills	8569
Botany Greenhouse	8637	Vehicle Storage	9912	Southern Hills	17305
Electric Substation	758	Dunn-Richm Econdev	54732	Southern Hills	8569
Pulliam Indust Ed	26375	Handball Courts	0	Southern Hills	11639
Pulliam Phys Ed	17807	Engineering A	72515	Southern Hills	15880
Pulliam Hall	106186	Engineering B	32125	Southern Hills	10813
Woody Hall	103661	Appl Sci & Arts Bld	93311	Southern Hills	15135
Morris Library	272673	Engineering D	54440	Southern Hills	6534
Agriculture	83455	Engineering E	94350	Southern Hills	10652
Lentz Hall	54906	Boat House	510	Southern Hills	6534
Bailey Hall	28575	Beach House	1886	Campus Chill Plant E	0
Pierce Hall	28575	Chlorine Pump House	100	Rainbows End	11000
Pump House	136	Stone Center	14018	Trueblood Hall	74579
Bowyer Hall	28575	Coal Res Cntr-Grand	3978	Neely Hall	196248
Steagall Hall	28575	Tennis Court Bld	635	Allen Hall	84399
Brown Hall	28575	Parking Garage	0	Boomer Hall	84399
Felts Hall	28575	Faner Hall	235673	Wright Hall	84399
Kellogg Hall	29063	Thalman Hall	12924	Schneider Hall	193480
Warren Hall	29063	Fulkerson Hall	12924	Mae Smith Hall	194166
Smith Hall	29063	Barber Hall	12758	Grinnell Hall	67664
Abbott Hall	29063	Stein Hall	12924	Recreation Bldg	238923
Baldwin Hall	29063	Caldwell Hall	12758	Evergreen Terrace	3521
Lingle Hall	33184	Scott Hall	12924	Evergreen Terrace	8143

Building/Structure/ Grounds	Sq. Ft.	Building/Structure/ Grounds	Sq. Ft.	Building/Structure/ Grounds	Sq. Ft.
Evergreen Terrace	7310	Washington Sq C	8130	Tree Centr E Greenhse	1867
Evergreen Terrace	8143	Washington Sq D	8130	Tree Centr W Greenhse	1867
Evergreen Terrace	8143	Art School	3279	Tree Center - Pole Barn	2022
Evergreen Terrace	7310	Art School - Rear	1929	Pump House	120
Evergreen Terrace	7310	Eval & Devel Ctr-C	29584	Coal Research-Adm	25748
Evergreen Terrace	7310	Eval & Devel Ctr-D	7820	Coal Research-Hgh Bay	12955
Evergreen Terrace	8143	Radiological Center	1504	Coal Research Storage	1680
Evergreen Terrace	8143	Casa Storage 1	4571	Coaltec Energy Usa Inc	3509
Evergreen Terrace	7310	Casa Storage 2	3248	Bus Stop	400
Evergreen Terrace	7310	Main Replacement I	19414	Alchol Fuel Plant	2400
Evergreen Terrace	7310	Main Replacement Ii	9814	Telephone Equip @ Vti	0
Evergreen Terrace	7310	Photographic Service	6137	Physical Plant 1	1200
Evergreen Terrace	8143	Highway Safety Trning	3111	Physical Plant 2	920
Evergreen Terrace	8143	Hort Greenhouse	946	Automotive Lab 1	10677
Evergreen Terrace	7310	Horticulture Storage 1	2080	Automotive Lab 2	10677
Evergreen Terrace	7310	Lathhouse	805	Automotive Lab 3	10677
Evergreen Terrace	7310	Horticulture Storage 2	1040	Construction Lab 2	12392
Evergreen Terrace	7310	Cadet House	954	Adm Bldg-Carterville	11370
Evergreen Terrace	8143	Barracks T-29	4254	Man Power	7720
Evergreen Terrace	7310	Barracks T-48	3890	Welding Lab	6495
Evergreen Terrace	7310	Salt Dome	1617	Power Plant Coal Stor	6701
Evergreen Terrace	7310	Fisheries Boat Stor	2505	Automotive Tech	5475
Evergreen Terrace	7310	Law School House	2037	Construction Lab 3	2726
Evergreen Terrace	8143	Wildlife Annex	7695	Wood Kiln	684
Evergreen Terrace	8143	Housing Storage	2184	A-Frame Building	1200
Evergreen Terrace	7310	Farm Manager House	2323	Ton-Admin Building	3104
Evergreen Terrace	7310	Farm Manager Storage	89	Ton-Admin Annex	1036
Evergreen Terrace	7310	Wildlife Storage	1320	Ton-Pink House	1170
Evergreen Terrace	7310	Wildlife House	2772	Ton-Storage Shed	196
Evergreen Terrace	7310	Wildlife Kennels	906	Ton-Storage Building 1	780
Evergreen Terrace	7310	Univ Photo Communic	4470	Ton-Storage Building 2	780
Evergreen Terrace	7310	Work Force Ed	2500	Ton-Pole Bldg Storage	2970
Evergreen Terrace	7310	Vp Budget	4536	Ton-Red House	3028
Evergreen Terrace	7310	Physical Plant Storage	1296	Ton-Nature Center	854
Evergreen Terrace	8143	Vp University Services	3693	Ton-Privy 1	120
Evergreen Terrace	7310	Art Foundry 1	4056	Ton-Service Area	3840
Radio Transmitter	1452	Art Foundry 3	4080	Ton-Service Area-Stor 1	2200
Vivarium Annex	7160	Quonset Storage	4196	Ton-Cabin #5-Geronimo	907
Library Storage	32035	Poult Cntr-Form House	2004	Ton-Wash House 1	910
University Press	20593	Poult Cntr-Res&Svchq	1664	Ton-Cabin #1-Osceola	1080
Museum Storage	17679	Dairycntr-Res & Tch Hq	4048	Ton-Cabin #2-Cochise	439
Boat Storage	3291	Drycntr-Nutr Res Barn	3961	Ton-Cabin #4-Crzy Horse	442
Hazardous Waste	4456	Dairycntr-Cow Lfg Brn	4826	Ton-Wash House 2	1078
Fisheries Res Lab	9855	Dairycntr-Yng Stk Brn	3711	Ton-Cabin #7-Lone Wolf	328
Center Env Hlth & Sfty	13400	Darycntr-Dar Calf Brn	556	Ton-Cabin #10-Sky Chief	232
Bb Field Restroom	602	Dairycntr-Hrrds House	2038	Ton-Cabin #11	233
Baseball Lockerroom	3172	Cattle Work Shelter	285	Ton-Restroom Building	500

Building/Structure/ Grounds	Sq. Ft.	Building/Structure/ Grounds	Sq. Ft.	Building/Structure/ Grounds	Sq. Ft.
Mcma-Broadcasting	2423	Dairycntr-Calf Barn	4803	Ton-Dining Hall	3915
Music House	1954	Pump House	51	Ton-Restroom	274
903 W Whitney	992	Agrmy Coop- Mach Stor	1382	Ton-Lois Goldman Pavil	821
Art Studio	1411	Agrnmy Coop- Herb Lab	301	Ton-Storage Building 3	448
Art Studios	1868	Agrnmy Coop- Field Lab	2603	Ton-Cabn #13-Howl Wlf	287
Solar House	2088	Agronomy Coop	4832	Ton-Wsh Hse 3 Hnt Hrs	961
Hr - Employ Services	3260	Agrnmy Coop-Equip Sto	4902	Ton-Lrn Cent Clssroom	1274
Hr - Employ Benefits	2876	College Of Ag Pavilion	2068	Ton-Cabin #20	804
Nw Annex A	17235	Swine Cntr- Res& Tch Hq	2524	Ton-Wash House 4	910
Nw Annex B	25645	Swine Cntr- Frrw Unit 1	2928	Ton-Little Grassy Ldge	9337
Nw Annex C	27688	Sw Cntr- Bed&Equip Str	2753	Ton-Indian Building	1930
Hr - Insurance Services	2216	Sw Cntr- Farrwng Unt 2	1288	Tn-Cbn #3-J Inkslinger	349
Hr - Labor Relations	3140	Sw Waste Trtmnt Cent	684	Ton-Wash House 5-Girls	418
Hr - Employ Records	2248	Sw Cntr- Gestatn Nutr	7392	Ton-Wash House 6-Boys	418
Hr - Data Control	1675	Sw Cntr- Exp Cnfne Feed	2114	Ton-Cabin #5-J Magarac	349
Elizabeth St Apartms	8184	Swine Center- Storage	940	Ton-Cabin #7-Pacos Bill	349
1007 W Mill	2015	Sw Cntr- Hrdsman's Hse	2637	Ton-Lion's Club Pavil	401
1009 W Mill	2252	Farm Serv Cntr - Class	4527	Ton-Freeberg Hall	9638
SIU Easter Seal Soc	2152	Farm Serv Cntr - Wrksp	7380	Ton-Food Storage	448
Broadcasting Service	1804	Feed Mill - Feed Center	5086	Ton-Shawnee Lodge	2877
Art Studio/Metal	2748	Swine Center - Breeding	4120	Ton-Cabin #9-Febold Feboldson	821
Dewey Studies	2844	Swine Center - Finishing	4201	Ton-Cabin #10-Davy Crockett	765
Sm-Behavioral & Soci	2407	Beef Cntr - Res& Tch Hq	9861	Ton-Cabin #13-Brny Beal	828
Central Research Shop	2970	Hay Barn - Hay Storage	6760	Ton-Wash House 7-Men's	1072
University Relations	2503	Bf Cntr - Bull Mgt & Tst	2400	Ton-Morris Lodge	2885
Child Study Coop Nur	2856	Pump House	24	Ton-L.B. Sharp Lodge	3392
Faculty House	2672	Beef Cntr- Scale House	521	Ton-Wash Hse 8-Women's	1086
Univ Elect Communic	3564	Beef Cntr- Hrdmn's Hse	2133	Ton-Cbn #15-M Humphrey	760
Univ Publications	1838	Beef Center- Calf Barn	9489	Ton-Cbn #18-J Appleseed	826
Univ Print Communic	2885	Sheep Center- Shed	2354	Ton-Cabin #19-J Darling	912
Univ News Service	2600	Pump House	32	Ton-Activity Pavilion 2	1248
Women's Studies	2205	Sheep Cntr- Res& Tch Hq	9790	Friends Gazebo	158
Wildlife Co-Op	1919	Test Farm-Hrse Hmn Hse	1659	Ton-Arboretum House	816
1004 W. Chautauqua	1816	Hog-Strfrm-Swfrw&Fee	4474	Ton-Upper 40 Log Cabin	1469
1002 W. Chautauqua	1435	Hog-Strfrm-Mach Stor	1379	Ton-Stable House	1280
Glendale School	15942	Pump House	20	Ton-Oikos Equip Bldg	3931
Glendale Office	960	Dairy Farm - Milk Parlr	748	Ton-Oikos Cabin #1	859
Industrial Park East	23569	Dairy Farm	1984	Ton-Oikos Cabin #2	859
Industrial Park West	8994	Dairy Farm - Opr's Hse	2013	Ton-Oikos Cabin #4	859
Glendale Off Mod Add	2304	Fruit Coop - Field Lab	8220	Ton-Oikos Cabin #5	859
Marion St Sto-Library	10006	Beef Eval - Stor House	925	Ton-Oikos Cabin #6	859
Marion St Sto-Phys Plnt	6083	Beef Evalhay&Machstr	2421	Ton-Aq Trailer	911
Marion St Sto-Cehs	4870	Pump House	179	Ton-Aquacult Shelter	1949
Marion St Sto Bldg F	3825	Pump House	142	Tamaroa Tv Xmiter	2672

Building/Structure/ Grounds	Sq. Ft.	Building/Structure/ Grounds	Sq. Ft.	Building/Structure/ Grounds	Sq. Ft.
Marion St Sto Bldg G	1679	Pump House	128	Olney Tv Xmiter	5124
Marion St Sto Bldg H	2025	Fruit Coop-Grnhouse-4	12323	Aviation Tech	61625
Air Force ROTC	3391	Hort Res Ctr Shop 1	1577	Sw Exp Farms Res Ctr	1885
Air Force ROTC - Rear	1240	Beef Eval-Statn House	1446	Mach Stor-Belleville	6400
University Courts	12740	Beef Eval-Station Eval	6842	Fac & Hangar #1	12757
Studio Arts	49922	Multi Purpose Barn	4071	Air Terminal	3715
Barracks T-42	3750	Horticlt Res Ctr Shop 2	753	Hangar #6	32032
Barracks T-41	3750	Pump House	288	O B Yng Bldg-Flt Trng	5760
Barracks T-40	3750	Hort-Apartment Bldg	687	Helicopter Lab Facility	9830
Old Baptist Foundation	24121	Horticulture-House	1512	Mrphysboro Headstart	2016
Family Practice Center	11776	Hre Cntr-Brdbrn & Shp	1690	Johnstn City Headstart	3000
Washington Sq A2	4065	Horse Cntr-Pump House	38		
Washington Sq A1	8130	Horse Center-Office	11535	**Total**	**6,960,953**

Southern Illinois University at Edwardsville

History

Southern Illinois University at Edwardsville (SIUE) is located in Edwardsville on 2,660 acres of rolling land and woods. The campus contains 28 buildings and hosts an enrollment of over 13,000 students. About 2,800 of the students live on campus. SIUE serves traditional college-aged undergraduate students, with many commuting from the surrounding areas, as well as older, part-time, and minority students. SIUE also administers the School of Dental Medicine at Alton and operates a center in East St. Louis.

SIUE spends $3.3 million per year on electricity and natural gas. Table H-1 contains data on the energy consumption and costs by fuel type for SIUE for the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) and a percentage of normal year HDD and CDD as an indication of weather severity compared to a normal year.

Table H-1
Southern Illinois University at Edwardsville Energy Costs
FY95 – FY03

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY 02	FY 03
	Cost								
Natural Gas	$614,000	$721,400	$805,900	$695,400	$636,700	$685,700	$1,437,800	$799,400	$799,419
Electricity	$2,757,700	$2,767,600	$2,685,700	$2,582,900	$2,605,900	$2,616,900	$2,747,400	$2,763,400	$2,520,473
Fuel Oil	$0	$5,400	$7,900	$0	$0	$0	$0	$0	$0
Propane	$4,000	$1,700	$2,400	$2,000	$2,200	$1,400	$4,900	$1,800	$0
Total	$3,375,700	$3,496,100	$3,501,900	$3,280,300	$3,244,800	$3,304,000	$4,190,100	$3,564,600	$3,319,892
	Usage (MBtu's)								
Natural Gas	295,422	229,774	239,378	219,608	228,295	188,429	206,518	141,423	131,649
Electricity	165,223	156,718	156,316	156,088	160,697	164,590	169,901	159,665	161,525
Fuel Oil	0	1,112	1,390	0	0	0	0	0	0
Propane	652	302	318	308	241	163	386	200	0
Total	461,297	387,906	397,401	376,004	389,233	353,182	376,804	301,287	293,174
	Unit Costs ($/MBtu's)								
Natural Gas	2.08	3.14	3.37	3.17	2.79	3.64	6.96	5.65	6.07
Electricity	16.69	17.66	17.18	16.55	16.22	15.90	16.17	17.31	15.60
Fuel Oil	*	4.86	5.68	*	*	*	*	*	*
Propane	6.13	5.63	7.56	6.48	9.13	8.57	12.71	9.01	*
Total	7.32	9.01	8.81	8.72	8.34	9.35	11.12	11.83	11.32
	Weather Severity (% of Normal Year)								
HDD*	90.7%	112.8%	107.0%	96.6%	80.3%	80.9%	114.6%	94.8%	
CDD*	54.3%	84.0%	57.7%	89.3%	92.5%	82.3%	90.8%	75.4%	
Sq Ft (Millions)	2.42	2.42	2.41	2.41	2.43	2.58	2.60	2.84	2.84

*St. Louis weather

Normal Yr. HDD* 4,759
Normal Yr. CDD* 1,534

Energy Conservation Efforts

Energy conservation measures were implemented in FY95 and FY96 as a result of SIUE's participation in the DCEO performance contracting pilot initiative. The measures and total cost and savings are presented in Table H-2.

Table H-2
SIUE Performance Contract Projects

Year	Scope	Location	Cost	Annual Savings[1]
1996	Expansion of facility management system 5,000 points added Fan coil units controlled.	Science Supporting Services		$13,901
1996	Soffit insulation upgrade.	Science		$6,830
1996	Economizer controls and mechanicals added to allow for the central chiller plant to be shutdown in the winter.	Campus-wide		$64,555
1996	Lighting retrofit and upgrade.	Campus-wide		$284,723
1996	Constant volume conversion to variable air volume (VAV) to control flow of air and water.	University Center Vadalabene		$42,996
1996	Boiler control upgrade.	Central Plant		$23,536
1996	Chiller control upgrade	Central Plant		$1,768
1996	Chiller optimization to allow for demand limiting during summer months.	Central Plant		$147,062
		Totals	$4,151,267	$585,371

[1] Annual Savings figures are annual guaranteed savings. Actual savings attributed to the performance contract are higher. After 5 years of tracking energy savings, $2.9 million of guaranteed savings accumulated, but actual savings was $3.6 million according to Year 5 Final Savings Report.

SIUE performs annual operations and maintenance activities on the boiler controls and water treatment to ensure that the boilers are running at optimum efficiency. Other energy conservation measures are listed in Table H-3.

Table H-3
SIUE Energy Conservation Projects

Year	Scope	Location	Cost
2003	Lighting retrofit and upgrade, appr. 100,000sf.	Alton	
2003	Exit sign upgrade.		
2003	Thermal storage system operational. CDB Project.		$2.8 million

Remaining Potential Energy Conservation Opportunities
SIUE is planning to replace the central boiler plant with distributed boilers in the campus core. The central boiler plant is nearing the end of its useful life and the parts and labor involved to keep it operational outweigh the benefits of maintaining a central plant. The cost for this project is estimated at $3.24 million. It is expected to save about $100,000 in operational costs and $150,000 in energy (primarily gas) costs. This boiler project is recommended as a maintenance project to improve reliability and avoid a $10,000,000 distribution project that would be needed within 10 - 15 years.

A large percentage of the variable air volume boxes also need to be upgraded since they are no longer operational. The primary reason for repairing the boxes is to improve conditions in the classroom, although a significant amount of heating and cooling savings will be achieved as well.

Most of the campus windows are single pane glass. At a minimum, windows need to be caulked and have window film applied. Ideally, old windows would be replaced with new windows containing two layers of glazing and a low-e (low-emittance) coating.

Table H-4 lists the buildings and building sizes for SIUE

Table H-4
SIUE Building List

BUILDING/STRUCTURE/ GROUNDS	SQ. FT.	BUILDING/STRUCTURE /GROUNDS	SQ. FT.
Alton Campus	108,860	James F Metcalf Student Experimental Theater	5,050
Alumni Hall	77,760	John Mason Peck Hall	78,300
Art and Design building	33,880	John S Rendleman Hall	63,970
Bluff Residence Hall	63,740	Katherine Dunham Hall	69,620
Cougar Village	401,410	Springfield Complex	4,948
Delyte W Morris University	146,670	Prairie Residence Hall	61,240
Early Childhood Center	4,670	Ralph F Korte Stadium/Bob Guelker Field	10,390
East St Louis Center	88,730	Sam M Vadalabene Center	101,400
Elijah P Lovejoy Library	118,950	Science Building	85,730
Engineering Building	46,467	Student Fitness Center	46,395
Environmental Resources Training Center	21,691	Supporting Services Complex	71,079
Founders Hall	74,780	University Park	34,023
Greenhouse	1.250	Woodland Residence Hall	63,740
Heating, Refrigeration & Waste Treatment	1,220	Miscellaneous Tract Houses	15,433

Southern Illinois University School of Medicine

History

The Southern Illinois University (SIU) School of Medicine was established in 1969 with a mission of meeting the healthcare needs of Central and Southern Illinois. The first year of the curriculum, which centers on studies in the basic sciences, takes place on the Carbondale campus. The remainder of the curriculum and 14 residency training programs take place on the Springfield campus. The School of Medicine at Springfield has 288 students, 258 residents and fellowships, and 69 graduate students in Pharmacology and in Medical Microbiology and Immunology. All students reside off campus. The school has 301full-time faculty and 875 staff.

Table I-1 contains data on the energy consumption and costs by fuel type for SIU School of Medicine for the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) and a percentage of normal year HDD and CDD as an indication of weather severity compared to a normal year.

Table I-1
SIU School of Medicine Energy Costs
FY95 – FY03

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
	Cost								
Natural Gas	$155,300	$167,390	$193,720	$194,630	$181,830	$206,340	$378,000	$241,900	$311,188
Electricity	$942,730	$907,420	$848,110	$944,320	$942,230	$949,140	$950,000	$1,054,100	$902,262
Steam	$30,750	$27,230	$26,980	$28,930	$26,710	$41,100	$10,000	$3,900	$0
Fuel Oil	$350	$1,030	$2,000	$0	$0	$440	$0	$0	$0
Total	$1,129,130	$1,103,070	$1,070,810	$1,167,880	$1,150,770	$1,197,020	$1,338,000	$1,299,900	$1,213,450
	Usage (MBtu's)								
Natural Gas	43,997	40,686	44,147	46,276	44,719	44,796	50,665	47,270	48,655
Electricity	52,589	48,816	46,197	49,831	51,165	49,273	49,245	46,744	42,162
Steam	4,587	3,913	3,962	4,305	4,203	5,796	1,550	900	0
Fuel Oil	37	162	329	0	0	113	0	0	0
Total	101,211	93,577	94,636	100,411	100,086	99,978	101,460	94,914	90,817
	Unit Costs ($/MBtu's)								
Natural Gas	3.53	4.11	4.39	4.21	4.07	4.61	7.46	5.12	6.40
Electricity	17.93	18.59	18.36	18.95	18.42	19.26	19.29	22.55	21.40
Steam	6.70	6.96	6.81	6.72	6.35	7.09	6.45	4.33	*
Fuel Oil	9.39	6.37	6.08	*	*	3.89	*	*	*
Total	11.16	11.79	11.32	11.63	11.50	11.97	13.19	13.70	13.36
	Weather Severity (% of Normal Year)								
HDD*	87.6%	106.8%	102.7%	92.3%	83.8%	82.0%	103.1%	84.6%	
CDD*	74.1%	112.5%	78.0%	102.4%	113.8%	103.4%	105.3%	109.7%	
Sq Ft (Millions)	.49	.53	.51	.53	.63	.59	.40	.40	.40

*Springfield weather data

Normal Yr. HDD* 5,688

Normal Yr. CDD* 1,141

Energy Conservation Efforts

SIU School of Medicine utilizes a maintenance contract for building maintenance. Energy conservation measures previously completed are listed in Table I-2.

Table I-2
SIU School of Medicine Energy Conservation Projects

Year	Scope	Location
1996	Changed 6 foot wide overhead roll-up door at dock to double-swing doors with closers to minimize air infiltration.	Medical Instructional Facility
1996	Installed new, more efficient 300-ton chiller when replacement was required.	Medical Instructional Facility
1996	Replaced cooling towers with more efficient towers.	Medical Instructional Facility Springfield Combined Laboratory Facility
1997	Maintenance contract requires replacement of all burned-out motors with high efficiency motors.	Medical Instructional Springfield Combined Laboratory Facility SIU Clinics Building Research Facility Departmental Office Complex
1997	Installed automatic toilet flush valves.	Medical Instructional Facility
1997	Installed timers on electric steam generator and hot water bundle that reduced run-time from 24 hours a day, 7 day a week to 8 hours a day, 5 days a week.	Springfield Combined Laboratory Facility
1998	Rebuilt 800-ton chillers using high efficiency motor/tubes.	Medical Instructional Facility
1998	Maintenance contract requires replacement of all burned-out motors with high efficiency motors.	Medical Instructional Springfield Combined Laboratory Facility SIU Clinics Building Research Facility Departmental Office Complex

Year	Scope	Location
1999	Replace T12 light tubes with T8 tubes throughout the buildings. Installed electronic ballasts.	Medical Instructional Springfield Combined Laboratory Facility SIU Clinics Building Research Facility Departmental Office Complex
1999	Maintenance contract requires replacement of all burned-out motors with high efficiency motors.	Medical Instructional Springfield Combined Laboratory Facility SIU Clinics Building Research Facility Departmental Office Complex
2000	Rebalanced supply air in building.	Medical Instructional Facility
2000	Maintenance contract requires replacement of all burned-out motors with high efficiency motors.	Medical Instructional Springfield Combined Laboratory Facility SIU Clinics Building Research Facility Departmental Office Complex
2001	Installed LED exit lights throughout building.	Medical Instructional Facility Springfield Combined Laboratory Facility SIU Clinics Building
2001	Maintenance contract requires replacement of all burned-out motors with high efficiency motors.	Medical Instructional Springfield Combined Laboratory Facility SIU Clinics Building Research Facility Departmental Office Complex
2002	Reduced run time on supply and exhaust fans by 20%.	Medical Instructional Facility Springfield Combined Laboratory Facility SIU Clinics Building
2002	Replaced all duct insulation.	Departmental Office Complex

Year	Scope	Location
2002	Maintenance contract requires replacement of all burned-out motors with high efficiency motors.	Medical Instructional Springfield Combined Laboratory Facility SIU Clinics Building Research Facility Departmental Office Complex
2003	Summer shutdown of backup boiler.	Medical Instructional Facility
2003	Replaced deteriorated rooftop duct insulation.	Medical Instructional Facility
2003	Reduced run time on supply and exhaust fans by 20%.	Springfield Combined Laboratory Facility Addition
2003	Maintenance contract requires replacement of all burned-out motors with high efficiency motors.	Medical Instructional Springfield Combined Laboratory Facility Calhoun Complex SIU Clinics Building Research Facility Departmental Office Complex
	Installed VFD on 4 exhaust fans.	Medical Instructional Facility, 801 North Rutledge
	Installed setback stats throughout the building	Departmental Office Complex, 913 North Rutledge
	Maintenance contract requires replacement with high efficiency motors	Departmental Office Complex, 913 North Rutledge
	Re-ballasted all fluorescent lights with electronic ballasts	Departmental Office Complex, 913 North Rutledge

Remaining Potential Energy Conservation Opportunities

At this time, the SIU School of Medicine is in the final stages of issuing a Request for Proposal (RFP) for an Energy Performance Contract for the Medical Instructional Facility, Springfield Combined Laboratory Facility, SIU Clinics Building, Research Facility, and Departmental Office Complex. Additional opportunities for energy conservation projects will be easier to identify once a comprehensive energy management strategy is adopted.

Table I-3 lists the six buildings at SIU School of Medicine and their sizes.

Table I-3
SIU School of Medicine Building List

BUILDING/STRUCTURE/GROUNDS	**SQ. FT.**
Medical Instructional Facility	160,305
Springfield Combined Laboratory Facility	73,123
Calhoun Complex	64,596
SIU Clinics Building	106,918
Research Facility	22,952
Departmental Office Complex	146,670

University of Illinois at Chicago

History

The University of Illinois at Chicago (UIC) was formed in 1982 by consolidating two university campuses, the medical center campus, which dated back to the 19th century and the Chicago Circle campus, a comprehensive university that in 1965 replaced the two-year undergraduate division at Navy Pier, founded in 1946 to educate returning veterans.

The Chicago campus has approximately 101 buildings and offers approximately 10 courses related to energy. Enrollment remained relatively constant at about 25,500 students from 1995 through 2002. In 2003, the enrollment increased to about 26,700. Approximately 3,100 students live on campus.

Table J-1 contains data on the energy consumption and costs by fuel type for the University of Illinois at Chicago for the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) and a percentage of normal year HDD and CDD as an indication of weather severity compared to a normal year.

Table J-1
University of Illinois at Chicago Energy Costs
FY95 – FY03

	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
	Cost								
Natural Gas	$937,580	$1,405,610	$934,920	$857,080	$908,930	$1,466,900	$2,999,200	$1,071,800	$4,697,887
Electricity	$16,631,580	$18,680,790	$17,817,740	$17,370,920	$18,540,740	$18,087,050	$23,593,100	$22,838,900	$20,081,643
Steam	$4,933,010	$5,726,010	$7,179,070	$6,091,480	$5,480,700	$6,635,850	$7,277,800	$6,367,200	$0
Fuel Oil	$0	$166,560	$558,040	$438,400	$174,480	$0	$636,200	$500	$500
Total	$22,502,170	$25,978,970	$26,489,770	$24,757,880	$25,104,850	$26,189,800	$34,506,300	$30,278,400	$24,780,030
	Usage (MBtu's)								
Natural Gas	317,271	413,466	235,113	242,609	271,058	417,856	411,550	310,803	795,518
Electricity	783,711	838,691	820,608	829,895	854,584	838,213	816,942	828,439	820,067
Steam	527,952	581,481	572,343	519,248	517,461	524,441	548,687	461,711	0
Fuel Oil	0	61,698	159,663	116,575	55,511	0	25,618	103	94
Total	1,628,934	1,895,336	1,787,727	1,708,328	1,698,613	1,780,509	1,802,796	1,601,055	1,615,679
	Unit Costs ($/MBtu's)								
Natural Gas	2.96	3.40	3.98	3.53	3.35	3.51	7.29	3.45	5.91
Electricity	21.22	22.27	21.71	20.93	21.70	21.58	28.88	27.57	24.49
Steam	9.34	9.85	12.54	11.73	10.59	12.65	13.26	13.79	*
Fuel Oil	*	2.70	3.50	3.76	3.14	*	24.83	4.84	5.31
Total	13.81	13.71	14.82	14.49	14.78	14.71	19.14	18.91	15.34
	Weather Severity (% of Normal Year)								
HDD*	100.1%	118.0%	108.6%	88.2%	90.1%	98.1%	110.4%	97.4%	
CDD*	56.7%	104.1%	53.1%	77.8%	78.6%	77.7%	84.2%	105.6%	
Sq Ft (Millions)	8.68	9.98	9.68	9.68	8.66	11.48	11.48	13.44	13.52

*Chicago weather data Normal Year HDD 6536 Normal Year CDD 752

Energy Conservation Projects

For over a decade, UIC, in concert with the Institutional Conservation Program (ICP), a U.S. Department of Energy (DOE) program designed to aid service institutions (colleges, universities, hospitals, etc.) has been actively pursuing efforts to conserve energy. Federal grants were awarded to UIC on an annual basis that provided up to 50 percent of the cost for energy conservation measures. From 1990 to 1997, UIC received and implemented $4,410,060 in federal and matching state funds (50/50 match), for more than 29 energy conservation projects. The implementation of these conservation projects resulted in UIC reducing its energy costs by an average of $315,000 annually.

UIC has understood the importance of energy conservation for quite some time. The University sees it not only as a way to save money, but also as an effective way to reduce air pollution, improve indoor air quality, and fundamental in mitigating global warming. There has been a continued commitment to energy conservation projects. From 1997 to 2001, eight in-house energy conservation projects with a capital expenditure of $773,090 were completed and have reduced the annual energy costs by $65,000.

Tables J-2 and J-3 contain lists of energy conservation projects completed at UIC since 1993.

Table J-2
University of Illinois at Chicago Energy Conservation Projects

ECM Project and Building Name	Project Cost	Project Completed
HTHW Pipe Insulation Utilities Tunnel	$127,442	12/1993
Building Automation System College of Pharmacy	$152,280	11/1993
Revise General Exhaust Systems Sciences & Engineering Lab	$281,248	7/1994
Reverse Osmosis Deionization Systems Sciences & Engineering South	$224,980	12/1994
Fans Modifications Neuropsychiatric Institute	$158,000	11/1994
Night Setback Control Personnel Services Building	$159,868	7/1994
Bldg. Automation Systems Eye & ear Infirmary Bldg.	$143,458	7/1994
Steam Trap Replacement College of Medicine West	$50,800	7/1994
Lighting Retrofit - Phase I College of Dentistry Bldg.	$90,452	9/1994
Lighting Retrofit College of Medicine - West	$186,692	12/1994
Lighting Retrofit Associated Health Professions	$160,118	12/1994
Lighting Retrofit & Night Setback Control	$313,574	12/1994
Lighting Retrofit Biologic Resources Lab	$35,970	12/1994

ECM Project and Building Name	Project Cost	Project Completed
Lighting Retrofit Personnel Services Bldg.	$84,660	12/1994
Bldg. Automation Systems Clinical Sciences Bldg.	$208,000	12/1994
Lighting Retrofit College of Pharmacy Bldg.	$153,032	12/1994
Lighting Retrofit Medical Sciences Bldg.	$140,197	12/1994
Lighting Retrofit - Phase II College of Dentistry Bldg.	$159,880	12/1994
Building Automation & Lighting Retrofit Sciences & Engineering Lab	$361,024	12/1994
Lighting Retrofit Sciences & Engineering South	$233,015	12/1994
Lighting Retrofit Architectural & Art Lab	$47,022	12/1995
Lighting Retrofit Chemical Engineering	$13,236	10/1995
Lighting Retrofit - Phase III College of Dentistry	$267,085	10/1995
Condensed Water Filter Systems Utilities Bldg.	$158,440	12/1995
Lighting Retrofit - Phase II Biologic Resources Lab	$84,342	12/1996
Lighting Retrofit - Phase II Medical Sciences Bldg.	$139,908	10/1996
Lighting Retrofit Associated Health Professions	$106,478	10/1996
Lighting Retrofit - Phase II Clinical Sciences Bldg.	$110,755	2/1997
Lighting Retrofit Nuero-psychiatric Institute	$68,104	2/1997
TOTAL 29 ECM Projects Funded by Federal Funding	**$4,420,060**	

Table J-3
In-House Energy Conservation Projects
1997-2001

ECM Project and Building Name	Project Cost	Project Completed
Lighting Redesign Sciences & Engineering Lab	$357,331	10/1997
Lighting Redesign - Exit Signs East Campus	$25,853	10/1997
Lighting Redesign Utilities Tunnel	$19,947	2/1997
Lighting Redesign Steam Plant Tunnel	$19,796	8/1998
Lighting Redesign - Exit Signs West Campus	$28,013	10/1998
Lighting Redesign - Mechanical Rooms East Campus	$76,540	11/1998
Lighting Redesign Services Building	$162,610	5/2000
Lighting Redesign Engineering Research Facility	$83,000	1/2001
TOTAL: 8 ECM PROJECTS	**$773,090**	

In addition to the energy conservation projects discussed above, UIC has constructed two combined heat and power (CHP) plants and two chilled water plants that have significantly reduced operating costs.

East Side Combined Heat and Power Facility
Combined heat and power is defined as the sequential generation of electricity and heat. The UIC East Side CHP Facility does so by generating electricity, using four gas-fired reciprocating engines and recovering the heat from the exhaust to manufacture cooling water and heating water for space cooling and heating. The local utility has a plant efficiency of about 30 percent while the overall efficiency of the East Side CHP Facility is over 56 percent. Phase I of the plant was completed in 1993, and Phase II in 2000, for a total project cost of $36.5 million. The total plant electrical capacity is 20 megawatts and about 30 MBtu/hr heating capacity. As part of the above project, three high temperature hot water (HTHW) generators were installed to replace four old inefficient units. These dual-fuel, high efficiency, high temperature, hot water generators operate only when the campus heating load exceeds the heat recovered from the cogeneration process. This project will achieve approximately $3 million in annual savings.

West Side Combined Heat and Power Facility
The West Side CHP Facility was completed in 2001. The plant consists of three gas-fired combustion turbines and three gas-fired reciprocating engines. Total plant capacity is 37 megawatts. The three turbine generators have heat recovery steam generators with supplemental gas firing. Each has an unfired capacity of 30,000 pounds per hour and a fired capacity of 120,000 pounds per hour of steam. This facility has replaced four of the original (1949) steam boilers in the old steam plant. Last winter it was necessary to run only one of the remaining boilers for less than 30 days, and at that, only a portion of the day. This $40 million project, in addition to replacing worn out inefficient equipment, provides operating savings of approximately $5.5 million annually.

East Side Chiller Plant and Distribution
A $4.5 million project, completed in 1998, replaced the four original chillers in the East Side Chiller Plant with three 2,000-ton York high efficiency chillers. These three chillers, along with converting the distribution system to a primary pumped variable flow system, allowed the campus to reduce energy use for chilled water from 1.2 kilowatts/ton to 0.7 kilowatts/ton, a reduction in campus demand of approximately 2 megawatts. In addition, a 1,000-ton dual effect absorption chiller has been added, to make use of the waste heat from the CHP plant in the summer. This absorber, in addition to the other three absorption chillers located on the east side of the UIC campus, make yearlong full use of the waste heat stream from the CHP facility. Not only has this project improved the chilled water production, but it has also reduced the cost for distribution by lowering the pumping costs. In addition, the project has facilitated the removal of about 500 horsepower worth of chilled water pumps in the buildings. Total cost savings in 2003 was approximately $386,000 and is being used to repay the debt on the project.

West Side Chiller Plant and Distribution
This $12 million project, scheduled to be complete for the 2004 cooling season, includes the construction of a 10,000-ton high efficiency centrifugal chiller plant, with ultimate chiller capacity of about 16,000 tons, and a campus chilled water distribution system. A part of the project is the conversion of the connected buildings to a high delta T (temperature difference between supply and return water) system. This system will emulate the east side plant in its operation and expected energy savings. A further savings will be realized in operations and maintenance (O&M) costs, by not having to maintain or replace the old low efficiency chillers in the buildings. Estimated cost savings when completed are $650,000 annually after debt repayment.

Although a great deal has been done to reduce energy costs at UIC, many deferred maintenance projects remain that could affect energy usage. They are listed in Table J-4.

Table J-4

	UIC Deferred Maintenance Project List	
Building	**Description**	**Cost**
Addams Hall	Replace HVAC Circulation Pump with High Efficiency Unit	$8,445
	Replace HVAC Rooftop Exhausters with High Efficiency Units	$17,305
	Replace, Repair, & Weather-strip Exterior Doors & Windows	$468,334
	Replace Lighting with High Efficiency Systems	$778,331
Administration Office Bldg.	Replace Chiller with High Efficiency System	$373,978
	Replace HVAC with High Efficiency Unit	$2,152,509
	Replace Lighting with High Efficiency Systems	$373,579
Art & Architecture	Replace HVAC Rooftop Exhausters with High Efficiency Units	$15,378
	Replace Exterior Doors & Weather-strip	$17,623
	Replace Lighting with High Efficiency Systems	$911,511

Building	Description	Cost
Behavioral Sciences Bldg.	Replace HVAC with High Efficiency Unit	$387,710
	Replace Domestic Hot Water Heater with High Efficiency Unit	$10,803
	Replace & Weather-strip Exterior Doors & Windows	$259,652
	Replace Air Handlers	$1,402,121
	Replace Lighting with High Efficiency Systems	$102,613
Benjamin Goldberg	Replace HVAC with High Efficiency Unit	$202,330
Research Center	Replace & Weather-strip Exterior Doors & Windows	$1,701,385
	Replace Lighting with High Efficiency Systems	$311,716
Biological Resources Lab	Replace HVAC Chilled Water Circulation Pumps with High Efficiency System	$48,124
	Replace & Weather-strip Exterior Doors & Windows	$14,366
	Replace Air Handlers	$141,282
	Replace HVAC Air Intake Dampers with High Efficiency System	$30,205
Burnham Hall	Replace HVAC Rooftop Units with High Efficiency Systems	$41,242
	Replace & Weather-strip Exterior Doors & Windows	$563,972
	Replace Lighting with High Efficiency Systems	$256,321
Chemical Engineering Bldg.	Repair, Replace, & Weather-strip Exterior Doors & Windows	$136,562
	Replace HVAC with High Efficiency Unit	$1,228,626
	Replace Domestic Hot Water Heater with High Efficiency Unit	$11,888
Clinical Scienc Bldg.	Replace Lighting with High Efficiency Systems	$1,426,282
	Replace & Weather-strip Exterior Doors & Windows	$117,204
	Replace HVAC Steam Systems with High Efficiency Systems	$54,420
Clinical Sciences North	Replace Lighting with High Efficiency Systems	$1,279,300
	Replace & Weather-strip Exterior Doors & Windows	$1,314,803
CMS Police Bldg.	Replace & Weather-strip Exterior Doors & Windows	$200,288
	Replace HVAC with High Efficiency Unit	$709,170
Co-Generation Bldg.	Replace Lighting with High Efficiency Systems	$1,897
College of Dentistry	Replace Air Handlers	$704,723
College of Medicine	Renovate HVAC with High Efficiency System	$4,252,549
East Tower	Replace HVAC Air Handlers with High Efficiency System	$704,723
	Replace & Weather-strip Exterior Doors & Windows	$1,333,024
College of Medicine West	Replace Lighting with High Efficiency Systems	$353,704
	Renovate HVAC with High Efficiency Systems	$4,398,983

Building	Description	Cost
College of Nursing	Replace Cooling Towers	$268,776
	Replace Air Handlers	$776,394
	Replace Lighting with High Efficiency Systems	$1,204,996
	Replace & Weather-strip Exterior Windows	$79,011
College of Pharmacy	Replace Air Handlers	$247,754
	Renovate Chiller	$27,801
	Replace Domestic Hot Water Converter with High Efficiency Unit	$84,585
	Replace Lighting with High Efficiency Systems	$104,485
College of Urban Planning &	Replace Chiller with High Efficiency Unit	$322,388
Public Administration	Replace, Repair, & Weather-strip Exterior Doors & Windows	$114,347
	Replace Lighting with High Efficiency Systems	$84,787
Douglas Hall	Replace HVAC Rooftop Exhausters with High Efficiency Unit	$17,305
	Replace Domestic Hot Water Heater with High Efficiency System	$7,425
	Replace Lighting with High Efficiency Systems	$174,549
Easter Seal Bldg.	Replace Domestic Water Piping	$18,156
	Replace Lighting with High Efficiency Systems	$103,987
	Repair, Replace, & Weather-strip Exterior Doors, Walls & Windows	$309,191
Education, Commerce &	Replace Domestic Hot Water Heater with High Efficiency System	$31,684
Social Science	Renovate HVAC	$3,123,461
	Repair, Replace, & Weather-strip Exterior Doors	$16,082
Engineering Research Facility	Renovate HVAC	$107,245
	Insulate Ductwork	$18,696
	Replace Lighting with High Efficiency System	$28,292
Grant Hall	Replace Circulation Pumps	$25,336
	Replace Rooftop Exhausters	$20,725
	Replace Unit Ventilators	$194,601
	Replace Lighting with High Efficiency Systems	$72,183
	Replace & Weather-strip Exterior Doors & Windows	$221,770
Health & Human	Replace HVAC with High Efficiency Unit	$4,361,604
Developmental Sciences	Replace and Weather-strip Exterior Doors & Windows	$207,747
Henry Hall	Replace Rooftop Exhausters	$12,636.00
	Replace & Weather-strip Exterior Doors & Windows	$218,259
	Replace Lighting with High Efficiency Systems	$59,647

Building	Description	Cost
Human Resources Bldg.	Replace Air Handlers	$27,498
	Replace Domestic Hot Water Converter with High Efficiency Unit	$43,419
	Replace & Weather-strip Exterior Windows	$143,507
	Replace Lighting with High Efficiency Systems	$421,007
Jane Addam's Hull House	Replace Chillers	$523,787
	Replace Air Handlers	$1,279,367
	Replace Domestic Hot Water Converter with High Efficiency Unit	$116,226
	Replace & Weather-strip Exterior Doors & Windows	$66,549
	Replace Lighting with High Efficiency Systems	$1,369,642
	Replace Domestic Hot Water Heater	$11,888
	Replace HVAC Pumps	$378,721
	Insulate HVAC Piping	$116,168
	Replace HVAC Steam Valves	$14,338
	Renovate HVAC	$484,022
	Replace & Weather-strip Exterior Doors & Windows	$95,103
Jane Addams Hull House	Renovate HVAC	$151,534
Jefferson Hall	Replace Domestic Hot Water Heater with High Efficiency System	$14,851
	Replace Lighting with High Efficiency System	$143,779
	Replace Rooftop Exhausters	$10,466
	Replace & Weather-strip Exterior Doors & Windows	$207,813
	Replace HVAC Unit Ventilators	$180,676
Lecture Hall	Replace HVAC Circulation Pump	$8,445
	Replace Air Handlers	$282,154
	Replace & Weather-strip Exterior Doors & Windows	$1,899,310
	Replace Lighting with High Efficiency Systems	$183,901
Library of the Health Sciences	Replace Lighting with High Efficiency Systems	$3,573
	Replace HVAC Condensing Unit	$19,604
	Replace & Weather-strip Exterior Doors & Windows	$71,897
	Replace HVAC Rooftop Exhausters	$24,145
	Replace Domestic Hot Water Heater with High Efficiency Unit	$14,851
	Replace Lighting with High Efficiency Systems	$368,566

Building	Description	Cost
Lincoln Hall	Replace HVAC Unit Ventilators	$318,266
	Replace & Weather-strip Exterior Doors & Windows	$279,241
	Replace HVAC Rooftop Exhausters	$24,145
	Replace Domestic Hot Water Heater with High Efficiency Unit	$14,851
	Replace Lighting with High Efficiency Systems	$134,497
Lions of Illinois	Replace Lighting with High Efficiency Systems	$311,329
Eye Research Institute		
Magnetic Resonance	Renovate HVAC	$627,471
Imaging Center		
Marshfield Avenue Bldg.	Replace Chiller	$445,822
	Replace Domestic Hot Water Converter	$62,250
	Renovate HVAC	$2,893,640
	Replace & Weather-strip Exterior Windows	$67,964
	Replace Lighting with High Efficiency Systems	$739,329
Medical Center	Replace Lighting with High Efficiency Systems	$236,189
Administration	Replace Steam Radiators	$29,043
	Replace HVAC Steam and Condensate Pipe	$15,104
	Replace & Weather-strip Exterior Windows	$212,063
Medical Sciences Bldg.	Replace Cooling Towers	$110,781
	Replace Chiller	$193,177
	Replace Domestic Hot Water Converter	$84,585
	Renovate HVAC	$42,778
	Replace Condensate Return Unit	$19,985
	Replace Lighting with High Efficiency Systems	$74,456
Molecular Biology	Replace & Weather-strip Exterior Doors & Windows	$19,190
Research Bldg.		
Neuropsychiatric Institute	Replace & Weather-strip Exterior Doors & Windows	$23,536
	Replace Lighting with High Efficiency Systems	$74,456
	Replace HVAC Chiller Piping	$627,149
	Replace HVAC Receiver	$99,511
Paulina Street	Replace Circulation Pumps	$40,994
	Replace Cooling Tower	$34,870
	Replace & Weather-strip Exterior Windows	$99,569
	Replace Chiller	$134,217

Building	Description	Cost
Physical Education Bldg.	Replace Air Handlers	$1,628,099
	Replace Domestic Hot Water Converter with High Efficiency Unit	$370,180
	Replace HVAC Piping	$1,598,792
	Replace Heat Exchangers	$247,274
	Replace HVAC Ventilation Systems	$140,373
	Replace & Weather-strip Exterior Doors & Windows	$1,203,492
Physical Plant Bldg.	Replace HVAC Rooftop Exhausters	$34,689
	Replace Domestic Hot Water Heater with High Efficiency Unit	$8,896
	Replace HVAC Unit Heater	$2,645
	Replace & Weather-strip Exterior Doors & Windows	$519,117
Richard Dailey Library	Replace Heat Exchangers	$372,833
	Replace & Weather-strip Exterior Doors & Windows	$2,539,263
	Replace Air Handlers	$1,306,068
	Replace Domestic Hot Water Converter with High Efficiency Unit	$128,202
	Replace Chilled Water Circulation Pumps	$73,223
Roosevelt Road Bldg.	Replace HVAC Boiler	$326,886
	Replace HVAC System with High Efficiency Unit	$730,795
	Replace & Weather-strip Exterior Doors & Windows	$168,772
	Replace Lighting with High Efficiency Systems	$844,629
School of Public	Repair Cooling Towers	$35,233
Health & Psychiatry	Replace HVAC Insulation	$41,006
	Replace HVAC Unit Heater with High Efficiency Unit	$3,896
	Replace & Weather-strip Exterior Windows	$1,082,668
	Replace Lighting with High Efficiency Systems	$1,246,026
Science & Engineering Offices	Replace Domestic Water Piping	$340,701
	Renovate HVAC	$7,285,609
	Replace & Weather-strip Exterior Doors & Windows	$152,024
	Replace Lighting with High Efficiency Systems	$1,272,024
Science & Engineering	Replace HVAC S4 Air Conditioning Unit with High Efficiency Unit	$49,844
Laboratory East	Replace & Weather-strip Exterior Doors & Windows	$1,988,516
Science & Engineering	Replace HVAC HW Heating Converter	$54,502
Laboratory West	Replace & Weather-strip Exterior Doors & Windows	$1,310,218

Building	Description	Cost
Science & Engineering South	Replace HVAC Circulation Pumps	$204,665
	Replace Air Handlers	$2,213,174
	Replace Domestic Hot Water Converter	$212,887
	Replace HVAC Steam Traps	$90,673
	Replace Condensate Return Units	$49,767
	Replace HVAC Steam Generators	$243,870
	Replace Electric Heat Curtains	$12,290
	Replace Lighting with High Efficiency Systems	$1,770,402
	Replace & Weather-strip Exterior Door & Windows	$667,772
	Replace HVAC Piping	$1,598,792
Stevenson Hall	Replace Lighting with High Efficiency Systems	$228,774
	Replace HVAC Unit Ventilators	$279,244
	Replace HVAC Rooftop Exhausters	$20,725
	Replace Exterior Walls & Windows	$277,642
Student Services Bldg.	Replace Air Handlers	$585,500
	Replace & Weather-strip Exterior Doors & Windows	$33,729
Taft Hall	Replace Lighting with High Efficiency Systems	$235,909
	Replace HVAC Rooftop Exhausters	$20,725
	Replace HVAC Unit Ventilators	$325,418
	Replace Exterior Walls & Windows	$279,083
Taylor Street Bldg.	Replace Lighting with High Efficiency Systems	$81,646
Transportation Facility	Install Occupancy Sensors	$5,365
Tunnels & Underground	Replace HVAC Piping	$39,601
	Replace Lighting with High Efficiency Systems	$15,769
UIC Theater	Renovate HVAC	$575,930
	Replace Exterior Doors	$41,295
University Hall	Replace Air Compressor	$9,188
	Replace & Weather-strip Exterior Doors & Windows	$1,450,930
Utilities Bldg.	Replace Domestic Hot Water Heater with High Efficiency Unit	$3,768
	Replace Lighting with High Efficiency Systems	$92,967
	UIC Campus Total	**$96,017,439**

University of Illinois at Springfield

History

The University of Illinois at Springfield (UIS) campus has approximately 28 buildings and offers several courses related to energy. Student enrollment has remained relatively steady at 4,000 to 4,700 since 1995. In 2003, 700 students lived in campus housing.

In a typical year, UIS will spend more than $1.5 million for natural gas, electricity, fuel oil and propane to provide services to the campus. Table K-1 contains data on the energy consumption and costs by fuel type for UIS for the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) and a percentage of normal year HDD and CDD as an indication of weather severity compared to a normal year.

Table K-1
University of Illinois at Springfield Energy Costs
FY95 – FY03

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
	Cost								
Natural Gas	$111,900	$152,400	$175,420	$167,600	$177,110	$187,460	$430,000	$247,100	$394,584
Electricity	$684,500	$754,300	$732,920	$810,820	$837,230	$890,640	$993,900	$1,182,900	$1,180,212
Fuel Oil	$0	$0	$1,090	$0	$0	$0	$0	$0	$0
Propane	$2,900	$1,900	$3,390	$1,860	$0	$0	$0	$0	$0
Total	$799,300	$908,600	$912,820	$980,280	$1,014,340	$1,078,100	$1,423,900	$1,430,000	$1,574,796
	Usage (MBtu's)								
Natural Gas	34,867	40,841	40,747	40,537	42,073	40,292	54,165	57,294	59,377
Electricity	37,423	42,128	40,749	46,422	47,648	50,422	55,031	57,865	50,024
Fuel Oil	0	0	160	0	0	0	0	0	0
Propane	508	313	392	231	0	0	0	0	0
Total	72,798	83,282	82,048	87,190	89,720	90,714	109,196	115,160	109,401
	Unit Costs ($/MBtu's)								
Natural Gas	3.21	3.73	4.31	4.13	4.21	4.65	7.94	4.31	6.65
Electricity	18.29	17.90	17.99	17.47	17.57	17.66	18.06	20.44	23.59
Fuel Oil	*	*	6.81	*	*	*	*	*	*
Propane	5.71	6.06	8.65	8.04	*	*	*	*	*
Total	10.98	10.91	11.13	11.24	11.31	11.88	13.04	12.42	14.39
	Weather Severity (% of Normal Year)								
HDD*	87.6%	106.8%	102.7%	92.3%	83.8%	82.0%	103.1%	84.6%	
CDD*	74.1%	112.5%	78.0%	102.4%	113.8%	103.4%	105.3%	109.7%	
Sq Ft (Millions)	0.76	0.76	0.76	0.76	0.75	0.79	0.79	0.85	0.86

*Springfield weather data	Normal Yr. HDD*	5,688
	Normal Yr. CDD*	1,141

Table K-2 lists energy conservation projects undertaken at UIS from FY 95-FY00. Annual energy cost savings for these projects is about $15,000.

Table K-2
Energy Conservation Projects FY95-FY00
at the University of Illinois at Springfield

Year	Project Name	Project Cost	Completion
1994	Lighting Retrofit Brookens Library	$6,207	3/1994
1995	Chiller Replacement Brookens Library	$17,000	5/1996
1995	Exterior Lights Lots A & B	$23,580	5/1996
1995	EMS	n/a	5/1996
1995	Exit Lights Brookens Library & Metal Buildings	$4,796	2/1996
1995	Lighting Retrofit Brookens Library & HRB	$9,971	2/1996
1995	Occupancy Sensors Classrooms	$3,383	2/1996
1996	Lighting Retrofit PAC	$3,519	1/1997
1996	Occupancy Sensors Classrooms	$1,153	1/1997
1996	PAC Plaza Lighting	$1,242	12/1996
1996	PAC Exit Lights	$2,653	12/1996
1996	PAC Outside Air Resets	$2,697	12/1996
1996	PAC - Variable Frequency Drives	$17,620	12/1996
1997	Exterior Lights Lots C & D	$2,903	10/1997
1999	Chillers HSB	$6,000	11/1997
2000	Domestic Hot Water Heaters Brookens Library	$3,173	10/2000
	Total Project Cost:	**$105,897**	

In addition to the projects listed in Table K-2, there have been two major chiller projects completed at UIS.

Brookens Library Chiller Replacement

This project consisted of three parts. The first part was the retrofitting of one 700-ton Trane chiller and replacing a second 700-ton chiller with a new centrifugal chiller. Both chillers serve the cooling needs of Brookens Library and the Public Affairs Center. In addition, this project retrofitted the exterior lighting in Parking Lots A & B with high efficient lamps on 26 poles. This project also included the upgrade of the existing Honeywell energy management system to a new Barber Coleman DDS system. Annual cost savings for this project is $40,580.

Health & Sciences Building Chiller Project

The Health and Sciences Building chiller project consisted of replacing two 280-ton Dunham Bush air cooled screw chillers (R-22 refrigerant) with two new chillers, one a 350 ton and the other a 280-ton chiller. Both are Carrier air-cooled screw chillers using R-134A refrigerant. Annual cost savings for this project is $85,700. Several other opportunities to save energy have been identified but have not yet been funded. They are listed along with estimated costs in Table K-3.

Table K-3
UIS Differed Maintenance Project List

Building	Description	Cost
Brookens Library	Replace Cooling Towers	$ 132,851
	Replace Chillers	$ 389,704
	Replace Air Handlers	$ 484,678
	Replace Duct Reheat Coils	$ 181,392
	Replace Lighting with High Efficiency Systems	$ 35,317
	Repair, Replace, & Weather-strip Exterior Doors & Windows	$ 7,752
	Replace Lighting with High Efficiency Systems	$ 509,952
Business Services Bldg.	Replace Lighting with High Efficiency Systems	$ 61,534
Child Care Center	Replace HVAC Rooftop Units with High Efficiency Units	$ 19,638
Communications	Replace Domestic Hot Water Heater with High Efficiency Unit	$ 3,674
Visual Arts & Psychology	Replace HVAC Rooftop Units with High Efficiency Units	$ 156,259
	Replace Lighting with High Efficiency Systems	$ 92,514
Health & Sciences Bldg.	Insulate Ductwork	$ 8,423
	Replace Ventilation Heat Recovery Systems	$ 95,398
	Repair, Replace, & Weather-strip Exterior Doors	$ 10,829
	Replace Lighting with High Efficiency Systems	$ 128,374
Human Resources Bldg.	Replace Domestic Water Heater with High Efficiency System	$ 3,095
	Replace HVAC Rooftop Units with High Efficiency System	$ 116,133
Maintenance Bldg.	Replace Domestic Hot Water Heater with High Efficiency Unit	$ 3,537
Public Affairs Center	Replace Air Handlers	$ 103,550
	Replace Domestic Hot Water Converter with High Efficiency Unit	$ 52,752
	Replace Lighting with High Efficiency Systems	$ 320,403

Building	Description	Cost
Student Affairs Bldg.	Replace Domestic Hot Water Heater with High Efficiency Unit	$ 2,432
	Repair & Replace Exterior Walls & Windows	$ 45,171
	Replace Exterior Walls & Windows	$ 203,973
	Repair HVAC Rooftop Units	$ 132,723
	Replace Lighting with High Efficiency Systems	$ 57,715
Student Life Bldg.	Repair Exterior Walls & Windows	$ 69,521
	Replace Exterior Walls & Windows	$ 350,874
	Replace HVAC Rooftop Units with High Efficiency Units	$ 56,733
	Replace Lighting with High Efficiency Systems	$ 46,257
Total		$ 3,883,158

University of Illinois at Urbana/Champaign

History

The University of Illinois at Urbana/Champaign (UIUC) was one of the original 37 public land-grant institutions created within 10 years of the signing of the Morrill Act by Abraham Lincoln in 1862. Chartered in 1867 as the Illinois Industrial University, the campus opened in 1868.

The Urbana campus has approximately 335 buildings. From 1995 through 2002, 36,200 to 36,900 students were enrolled each year. In 2003, 38,300 students enrolled at UIUC. About 9,400 of these students live on campus.

In a typical year, UIUC will spend more than $26 million for natural gas, electricity, coal, fuel oil and propane to provide services to the campus. Table L-1 contains data on the energy consumption and costs by fuel type for UIUC for the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) and a percentage of normal year HDD and CDD as an indication of weather severity compared to a normal year.

Table L-1
University of Illinois at Urbana/Champaign Energy Costs
FY95 – FY03

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
	Cost								
Natural Gas	$7,285,250	$7,948,730	$9,295,920	$10,655,140	$7,622,150	$7,154,230	$9,602,800	$7,515,400	$12,349,270
Electricity	$10,355,840	$10,430,920	$10,650,360	$10,903,930	$11,583,200	$12,892,660	$13,760,300	$15,204,500	$12,110,485
Coal	$1,658,980	$2,580,170	$2,142,220	$2,858,490	$2,200,320	$2,755,800	$2,913,200	$1,233,600	$1,435,498
Fuel Oil	$15,330	$541,930	$7,900	$5,210	$212,200	$701,500	$853,700	$500	$288,188
Propane	$11,980	$15,130	$18,220	$6,720	$7,190	$10,320	$3,200	$12,600	$0
Total	$19,327,380	$21,516,880	$22,114,620	$24,429,490	$21,625,060	$23,514,510	$27,133,200	$23,966,600	$26,183,441
	Usage (MBtu's)								
Natural Gas	3,160,210	2,628,099	2,735,639	3,004,023	2,856,172	2,125,930	1,543,690	2,168,031	2,437,291
Electricity	666,671	659,009	693,394	691,061	771,670	828,946	888,213	1,132,976	849,190
Coal	1,037,715	1,641,885	1,423,254	1,713,558	1,451,667	1,776,558	2,253,804	885,759	1,124,315
Fuel Oil	3,141	130,153	1,063	1,136	45,305	191,351	164,257	69	80,262
Propane	1,875	2,048	2,894	918	1,024	1,339	366	1,772	0
Total	4,869,612	5,061,193	4,856,245	5,410,696	5,125,838	4,924,124	4,850,330	4,188,606	4,491,058
	Unit Costs ($/MBtu's)								
Natural Gas	2.31	3.02	3.40	3.55	2.67	3.37	6.22	3.47	5.07
Electricity	15.53	15.83	15.36	15.78	15.01	15.55	15.49	13.42	14.26
Coal	1.60	1.57	1.51	1.67	1.52	1.55	1.29	1.39	1.28
Fuel Oil	4.88	4.16	7.43	4.59	4.68	3.67	5.20	7.28	3.59
Propane	6.39	7.39	6.29	7.32	7.02	7.71	8.74	7.11	*
Total	3.97	4.25	4.55	4.52	4.22	4.78	5.59	5.72	5.83
	Weather Severity (% of Normal Year)								
HDD*	87.6%	110.6%	106.6%	94.9%	92.6%	93.5%	111.4%	90.3%	
CDD*	74.1%	114.9%	79.4%	74.9%	101.8%	84.1%	86.0%	91.6%	
Sq Ft (Millions)	15.04	16.00	15.92	15.92	15.16	16.71	16.80	17.11	18.03

	Normal Yr.		Normal Yr.	
*Springfield weather data	HDD*	5,688	CDD*	1,141

Energy Conservation Projects

A number of energy management projects were completed during FY94 through FY98 as part of a program with the Department of Energy (DOE) – The National Energy Conservation Policy Act (NECPA) of 1978 (amended 1989) was the first step in providing federal matching funds for energy conservation projects. The UIUC began participating in the program in 1982. Total matching funds (50/50) amount to $4.8 million for 34 projects impacting 41 buildings. Table L-2 shows the projects completed during FY94 to FY00 with a brief description and building location. The total amount of DOE funds for the five years was $5,508,000 and the average cost savings per year for the campus was approximately $249,000.

Table L-2
University of Illinois at Urbana/Champaign Energy Conservation Projects
FY94-FY00

FY94 Energy Conservation Projects	Project Cost	Project Completed
Pump Modifications J.B. Turner Hall	$32,497	9/1993
Fan Controls and Fume Hood Improvement	$62,084	7/1993
Steam Trap Monitoring and Repair - Various Locations	$132,023	7/1993
Equipment Replacement	$13,685	7/1993
Fan Motor Speed Controls - FY94 Installation Foellinger Auditorium, Ag Engineering Sciences Bldg., Gregory Hall, Henry Admin. Bldg., Undergraduate Library, Burnsides Research Lab., Foreign Languages Bldg., Speech & Hearing Clinic, University Press Bldg., Plant Sciences Bldg., Plant Sciences Lab, Vet. Med. Surgery & OB Lab, Natural Resources Studies Annex, Morrill Hall	$703,538	8/1993
Temperature Controls	$1,744	3/1994
Fan Motor Speed Controls (Design for FY95 Projects) Beckman Institute, Vet. Med. Basic Sciences, Advanced Computation Bldg., Art & Design, Levis Faculty Center, Krannert Art Museum, Commerce West, Education Bldg.		Completed
	$945,571	

FY95 Energy Conservation Projects	Project Cost	Project Completed
Motor Speed Controls, FY95 Installation Beckman Institute, Civil Engineering, Harker Hall, Digital Computer Laboratory, Roger Adams Laboratory, Vet. Med. Teaching Hospital, Plant Sciences Laboratory, Plant & Animal Biotechnology Lab, Vet. Med. Basic Sciences	$139,431	Completed
Steam Trap Monitoring and Repair - Various Locations	$159,924	Completed
FY95 Fan Motor Speed Controls - Design & Installation Beckman Institute, Vet. Med. Basic Sciences, Advanced Computation, Art & Design, Levis Faculty Center, Krannert Art Museum, Commerce West, Education Bldg.	$640,176	Completed

FY96 Fan Motor Speed - Control Design by A/E's KCPA, Armory, Student/Staff Air Conditioner Center -CT, Student Services Bldg., Swanlund Administration Bldg., Digital Computer Laboratory, Library, Mechanical Engineering Lab, Library Air Conditioner Center-CT	$44,215	Completed
	$983,746	

FY96 Steam Trap Monitoring and Repair - Various Locations	$195,474	Completed
FY96 Fan Motor Speed Control Installation (USDOE Cycle #14) Krannert Center for the Performing Arts, Armory	$175,247	Completed
FY96 Fan Motor Speed Control Installation Vet. Med. Basic Sciences, Library A/C Center, Mechanical Engineering Laboratory	$249,962	Completed
FY96 Equipment Replacement Animal Sciences, J.B. Turner Hall, Madigan Lab.	$20,760	Completed
FY97 Motor Speed Control Design by A/E's (Fans and Pumps) - Coordinated Science Research Lab., Swanlund Administration Bldg., Digital Computer Lab., KCPA (pumps), Microelectronics Lab. (pumps)	$77,500	Completed
FY96 Fan Motor Speed Control Design by A/E KCPA, Armory, Vet. Med. Basic Sciences, Library A/C Center, Mechanical Engineering Lab.	$37,125	Completed
FY96 Pump Motor Speed Control Digital Computer Lab.	$17,767	Completed
	$773,835	

FY97 Energy Conservation Projects	Project Cost	Project Completed
FY97 Steam Trap Monitoring & Repair - Various Locations	$114,865	6/1997
FY97 Fan Motor Speed Controls Madigan Lab., Art & Design	$63,372	6/1997
FY97 Motor Speed Control Installation by Contractor (Fans & Pumps) Digital Computer Lab., KCPA - Pumps, Microelectronics Lab - Pump	$185,663	6/1997
FY97 Fan & Motor Speed Control Installation by Contractor CSRL, Swanlund	$132,204	6/1997
FY97 Fan Pump Motor Speed Control Installations by O&M Music Bldg., Ag. Engr. Science Bldg., Civil Engineering Bldg., Harker Hall, Hazardous Material	$82,956	6/1997
FY97 Temperature Controls and Duct Damper Replacement Burrill Hall, Loomis Lab., Morrill Hall, Swanlund	$205,084	6/1997

FY97 Lighting Replacement Quad Lighting	$6,691	6/1997
FY98 Fan Motor Speed Control Design by O&M Beckman Institute, Madigan Lab., Animal Sciences, Vet. Med. Basic Sciences	$315	6/1997
	$791,150	

FY98-FY00 Energy Conservation Projects	Project Cost	Project Completed
FY98 Steam Trap Monitoring & Repair - Various Locations	$50,742	6/1998
FY98 Fan/Pump Motor Speed Controls Installed by O & M		
Madigan Lab.	102,904	5/1998
Animal Sciences Lab.	$158,094	6/1998
Beckman Institute	$145,461	10/1998
Swanlund	$13,049	6/1998
Illini Union Bookstore	$6,353	6/1998
Animal Sciences Lab.	$59,551	6/1998
Abbott Power Plant	$121,063	6/1998
FY98 Temperature Controls & Duct Damper Replacement		
Bevier Hall	$93,434	6/1998
KCPA	$1,067	6/1998
FY98 Temperature Control Air Supply - Bevier Hall	$5,836	12/1997
	$757,554	

Other energy conservation projects included campus-wide projects to reduce utility costs on a broad scope. They are multi-year projects and are still in process. It is anticipated that the UIUC will see approximately $7 million in annual savings. These projects are the Abbott Power Plant Expansion and Rehabilitation and the Chilled Water Project.

Chilled Water Project

The basic configuration of the chilled water system serving the campus consists of a large coal/gas-fired electric power generation plant with extensive steam distribution tunnels that serve a fleet of low-pressure steam-fired absorption chillers. This infrastructure began in the early 1940s and has evolved throughout the intervening years to serve the ever-expanding academic programs. Most of the chillers were installed in the 1960s and are reaching the end of their service life; indeed, at the beginning of this project, fully 15,000 tons of refrigeration was on the brink of collapse. This situation, plus steadily rising maintenance and fuel costs and the need to create a strategy for dealing with changing fuel markets, led the University to authorize a complete, long-range study and plan for upgrading the chilled water utility.

A management team was formed consisting of representatives from the Operations and Maintenance Division, the Office for Planning and Budgeting, and the consulting firms involved. Extensive reviews were conducted in three stages to reach consensus on the database for decision-making. It was determined that the campus refrigeration load would increase from 31,495 tons currently to 51,495 tons at the end of the planning timeframe of 20 years. In order to continue to support the operation of the power plant and allow for flexibility in dealing with the volatile fuel market, a mix of steam- and electric-driven chillers was decided upon. To reduce

pumping costs and minimize the initial investment in underground pipe, it was decided to convert the distribution system to direct primary.

Given these parameters, three strategies were conceived as solutions to the chilled water infrastructure upgrade requirements; to be benchmarked against a fourth strategy representing continued operation with no changes. These strategies were investigated in detail, ranked and evaluated in light of the goals, objectives, and resource considerations developed at the beginning of the process.

Evaluation of the three strategies led to a final hybrid that utilizes a direct buried main chilled water loop connecting three central plants in the service area. Two of the plants, North Campus Chiller Facility and Animal Science, were to be refurbished and expanded. The third is currently under construction, a new main plant of 24,000 tons of capacity. Existing buildings will be connected to the new chilled water loop as their chillers fail, or as it is deemed necessary. New buildings will not be constructed with their own chillers; they will be connected to the central facility.

This hybrid strategy was compared with the do-nothing-different strategy in a detailed economic model constructed in a set of linked spreadsheets so that the management team could easily evaluate the effect of changes to input variables.

The economic model incorporated many input variables for each of the two strategies into energy and cost calculation algorithms, and then summarized the results in a life cycle analysis as net present total values, so that comparisons could be made; the hybrid strategy for a new chilled water distribution system demonstrated a net present value advantage of approximately $29.9 million over the do-nothing-different strategy that represents continuing on with the existing, aging chiller fleet. This advantage is comprised of $8.3 million in capital cost and $21.6 million in operating costs.

A sensitivity analysis was performed for all input variables to test the effect of changes on the net present value difference between strategies. Three input variables caused a change in the net present value difference of between five percent and 12 percent; cost of capital, new absorption steam consumption rate and new building plant cost.

Abbott Power Plant Expansion and Rehabilitation

The campus began exploring options for the rehabilitation and expansion of Abbott during FY00. The primary goal of the project is to install combined heat and power equipment to produce all of the electric power and steam requirements for the University in a cost-effective fashion. Plant rehabilitation also includes a number of smaller projects to improve the operation and efficiency of the existing facility.

Abbott is now required to produce all utilities for the new chiller water production facility, which is currently under construction and slated to be completed in FY04, with a cost of $60 million and an estimated payback rate of approximately 10 years. The University worked to determine the best overall prime mover selection, based on the combined operating costs at Abbott and the new chiller facility.

The proposed integrated solution led the University to install two 13-megawatt gas turbines with heat recovery steam generators, two 12.5-megawatt extraction/condensing steam turbines and one seven-megawatt extraction/back pressure turbine at the Abbott plant.

Abbott Power Plant currently produces superheated steam at both 320 pounds per square inch gauge (psig) and 840 psig. Three dual- fuel, natural gas and No. 2 oil-fired boilers produce steam at 320 psig and are each rated at 175 thousand pounds per hour. The 840-psig steam is produced in three coal-fired boilers and the new 13-megawatt gas turbines. The average demand for electricity at the University after the completion of the projects will be approximately 30 megawatts to 60 megawatts depending on the time of day and season. Similarly, the average total campus steam demand would remain between 300,000 lbs/hr and 510,000 lbs/hr.

It is forecast that this project, in conjunction with the chilled water initiative, will reduce the overall campus demand by approximately five megawatts.

Table L-3 (Deferred Maintenance Project List) contains descriptions and estimated costs for other projects that could be undertaken once a comprehensive energy management strategy is adopted.

Table L-3
UIUC Deferred Maintenance Project List

Building	Description	Cost
1207 W. Oregon, Urbana	Domestic Water Piping	$107,059
	Renovate HVAC	$455,246
	Replace & Weather-strip Exterior Windows	$190,651
	Replace Lighting with High Efficiency Systems	$104,269
805 W. Pennsylvania, Urbana	Replace HVAC Perimeter Heating	$190,677
	Replace & Weather-strip Exterior Doors & Windows	$52,563
	Replace Domestic Water Piping	$44,693
909 W. Oregon, Urbana	Replace Furnace	$55,453
	Replace & Weather-strip Exterior Windows	$66,716
	Replace Lighting with High Efficiency Systems	$16,434
Abbott Power Plant	Replace Lighting with High Efficiency Systems	$215,061
	Replace Boilers	$1,242,912
	Replace & Weather-strip Exterior Doors & Windows	$479,817
Administration Information	Replace Air Handlers	$109,096
Technology Services	Replace Lighting with High Efficiency Systems	$165,443
Admissions & Records Bldg.	Repair & Weather-strip Exterior Doors & Windows	$3,254
Advanced Computation Bldg.	Replace Condenser Unit	$127,040
	Renovate HVAC	$486,713
	Replace Lighting with High Efficiency Systems	$75,939
Aeronautical Laboratory A	Replace Exterior Doors & Windows	$172,861
	Renovate HVAC	$304,490
	Replace Lighting with High Efficiency Systems	$4,219
Agricultural Bioprocess Lab.	Replace Chiller	$25,633
	Replace Domestic Hot Water Heater	$40,027
	Renovate HVAC	$582,085
Agricultural Engineering	Replace Chilled Water Pumps	$62,255
Science Bldg.	Replace HVAC Piping Insulation	$2,463
	Replace Lighting with High Efficiency Systems	$552,468
	Repair & Weather-strip Exterior Doors	$4,973

Building	Description	Cost
Agronomy Seed House	Replace Boiler	$81,295
	Replace HVAC Piping Insulation	$3,280
	Replace Window Air Conditioner	$13,812
	Replace Lighting with High Efficiency Systems	$17,071
Altgeld Hall	Replace Domestic Water Piping	$117,022
	Replace Condensate Receiver	$15,685
	Renovate HVAC	$1,547,303
	Renovate HVAC Balance System	$10,737
	Repair & Weather-strip Exterior Windows	$801,630
Animal Husbandry	Replace Lighting with High Efficiency Systems	$7,920
Cattle Feeding Plant		
Animal Husbandry	Replace Furnace	$3,154
Sheep Barns	Replace Window Air Conditioner	$1,359
	Replace Lighting with High Efficiency Systems	$10,614
Animal Science AC Center	Repair Cooling Towers	$78,379
	Replace HVAC Piping Insulation	$8,882
	Replace Lighting with High Efficiency Systems	$11,909
Animal Science K40 Facility	Replace HVAC Piping Insulation	$1,538
	Replace Lighting with High Efficiency Systems	$23,021
Architecture Building	Replace Domestic Water Piping	$436,126
	Replace Domestic Hot Water Converter	$78,439
	Repair HVAC Piping	$1,113,285
	Replace Condensate Return Unit	$20,726
	Repair, Replace, & Weather-strip Exterior Windows	$242,906
	Replace Steam System	$384,327
Armory	Replace Domestic Water Piping	$436,126
	Replace Domestic Hot Water Converter	$78,439
	Replace Condensate Return Unit	$23,165
	Replace HVAC Piping Insulation	$15,696
	Replace Window Air Conditioners	$15,246
	Replace Air Compressor	$53,893
	Replace & Weather-strip Exterior Windows	$2,206,311
	Replace Air Handlers	$629,376
	Replace Lighting with High Efficiency Systems	$1,346,562

Building	Description	Cost
Art and Design Bldg.	Replace Air Handlers	$492,943
	Replace Domestic Hot Water Converter	$76,189
	Replace Air Compressor	$26,216
	Replace Lighting with High Efficiency Systems	$531,081
Art Studio	Replace Furnace	$12,122
	Replace Domestic Hot Water Heater	$1,654
	Replace Window Air Conditioner	$56,167
	Repair, Replace, & Weather-strip Exterior Doors & Windows	$12,596
	Replace Lighting with High Efficiency Systems	$13,144
Art-East Annex, Studio 1	Replace HVAC Systems	$534,592
	Replace Air Compressor	$16,027
	Repair, Replace, & Weather-strip Exterior Windows	$193,298
	Replace Lighting with High Efficiency Systems	$295,678
Art-East Annex, Studio 2	Replace Window Air Conditioner	$121,968
	Repair, Replace, & Weather-strip Exterior Doors & Windows	$71,977
	Replace Lighting with High Efficiency Systems	$21,203
Astronomy Bldg.	Replace Boilers	$51,149
	Replace Lighting with High Efficiency Systems	$88,020
Atmospheric Sciences Bldg.	Replace Domestic Hot Water Heater	$7,977
	Replace Lighting with High Efficiency Systems	$61,183
Bevier Hall	Replace Cooling Towers	$166,114
	Replace Domestic Water Piping	$219,873
	Replace Condensate Receiver	$31,201
	Renovate HVAC	$2,355,303
	Replace & Weather-strip Exterior Windows	$350,707
	Replace Lighting with High Efficiency Systems	$7,909
Burnsides Research Lab.	Replace Chiller	$39,648
	Renovate HVAC	$484,452
	Replace & Weather-strip Exterior Windows	$170,936
	Replace Lighting with High Efficiency Systems	$116,555
	Replace Domestic Hot Water Converter	$40,027
	Replace Cooling Towers	$41,935

Building	Description	Cost
Burrill Hall	Replace Air Handlers	$713,833
	Replace Condensate Return Unit	$20,726
	Replace Domestic Water Piping	$574,987
	Replace Domestic Hot Water Converter	$78,037
	Repair Steam System	$419,791
	Replace HVAC Piping	$1,972,697
	Repair & Weather-strip Exterior Doors	$10,806
Central Receiving Bldg.	Replace Lighting with High Efficiency Systems	$206,353
	Replace & Weather-strip Exterior Doors	$10,494
Central Trash Depot	Replace Lighting with High Efficiency Systems	$1,432
Ceramics Bldg.	Replace Air Handlers	$731,977
	Replace Air Compressor	$19,293
	Replace Lighting with High Efficiency Systems	$322,141
Ceramics Facility	Replace Lighting with High Efficiency Systems	$11,802
Ceramics Kiln House	Replace Lighting with High Efficiency Systems	$14,162
Chemical & Life Sciences Bldg.	Repair Ductwork	$21,547
	Repair & Weather-strip Exterior Doors	$5,719
Chemistry Annex	Replace Make-Up Air Units	$231,404
	Replace HVAC Lecture Hall Unit	$48,463
	Replace Window Air Conditioners	$3,128
	Replace Lighting with High Efficiency Systems	$224,261
Child Development Lab	Retrofit HVAC	$572,181
	Replace Domestic Hot Water Converter	$40,027
	Replace & Weather-strip Exterior Windows	$133,832
Children's Research Center	Replace Boilers	$72,179
	Replace Chilled Water Circulation Pumps	$34,021
	Replace Domestic Hot Water Heater	$7,656
	Replace Heat Exchanger	$60,595
	Renovate HVAC	$810,815
	Replace Lighting with High Efficiency Systems	$50,932
Civil Engineering	Replace Domestic Hot Water Heater	$40,027
Hydrosystems Lab.	Replace Condensate Return Unit	$18,774
	Renovate HVAC	$900,184
	Replace & Weather-strip Exterior Windows	$108,998
	Replace Lighting with High Efficiency Systems	$106,868

Building	Description	Cost
Coble Hall	Retrofit HVAC	$490,100
	Replace Domestic Hot Water Converter	$40,027
	Replace Condensate Receiver	$15,844
	Repair, Replace, & Weather-strip Exterior Windows	$6,650
	Replace Lighting with High Efficiency Systems	$112,691
Colonel Wolfe School	Replace Boilers	$47,767
	Retrofit HVAC	$390,408
	Replace Domestic Hot Water Heater	$9,535
	Replace Condensate Return Unit	$15,655
	Repair, Replace, & Weather-strip Exterior Windows	$95,582
	Replace Lighting with High Efficiency Systems	$97,860
Computer & Systems	Replace & Weather-strip Exterior Windows	$17,602
Research Lab.		
Computer Applications Bldg.	Replace Circulation Pumps	$17,652
	Replace Hot Water Converters	$159,147
	Replace HVAC Piping	$636,769
	Replace Condensate Return Unit	$20,726
	Replace & Weather-strip Exterior Windows	$283,478
Dairy Experimental	Replace Domestic Water Piping	$12,738
Round Barn 1	Replace & Weather-strip Exterior Doors & Windows	$67,314
Dairy Experimental	Replace & Weather-strip Exterior Doors & Windows	$71,380
Round Barn 2	Replace Domestic Water Piping	$12,738
Dairy Experimental	Replace & Weather-strip Exterior Doors & Windows	$110,910
Round Barn 3	Replace Domestic Water Piping	$12,738
Davenport Hall	Replace Condensate Return Unit	$52,915
	Replace Lighting with High Efficiency Systems	$609,568
	Renovate HVAC	$1,668,039
	Replace & Weather-strip Exterior Windows	$1,517,899
	Install Insulation in Attic	$42,268
David Kinley Hall	Replace Circulation Pumps	$8,920
	Replace Domestic Water Piping	$459,552
	Replace Hot Water Converters	$78,439
	Replace Condensate Return Unit	$20,726
	Replace HVAC Piping	$1,164,532
	Replace & Weather-strip Exterior Doors	$7,066

Building	Description	Cost
Digital Computer Lab.	Replace Air Handlers	$540,670
	Replace Domestic Hot Water Converter	$32,134
	Replace HVAC Steam Valves	$13,431
	Replace Lighting with High Efficiency Systems	$1,261,043
Education Bldg.	Replace Air Handlers	$1,028,410
	Replace Unit Heater	$7,534
	Repair & Weather-strip Exterior Windows	$23,031
	Replace Lighting with High Efficiency Systems	$618,957
Engineering Sciences Bldg.	Replace Circulations Pumps	$38,301
	Renovate HVAC	$2,496,776
	Repair, Replace, & Weather-strip Exterior Doors & Windows	$307,827
English Bldg.	Replace Domestic Hot Water Converter	$28,077
	Replace HVAC Steam Valves	$10,073
	Repair & Weather-strip Exterior Windows	$38,150
	Replace Air Compressor	$26,946
	Replace Lighting with High Efficiency Systems	$694,872
Environmental Health	Replace Lighting with High Efficiency Systems	$9,113
& Safety Bldg.		
Everitt Electrical	Replace Air Handlers	$769,602
	Replace HVAC Steam Valves	$2,889
	Replace Domestic Hot Water Converter	$18,967
	Repair Exterior Windows	$120,299
	Replace Air Compressor	$26,946
	Replace Lighting with High Efficiency Systems	$722,338
Feed Storage Plant	Replace Boiler	$21,518
	Replace Air Compressor	$26,946
	Replace Lighting with High Efficiency Systems	$24,659
Flagg Hall	Retrofit HVAC	$970,805
	Replace Condensate Receiver	$31,688
	Replace Domestic Hot Water Piping	$69,329
	Replace & Weather-strip Exterior Windows	$368,229
Foellinger Auditorium	Repair Exterior Windows	$291,314
	Replace Lighting with High Efficiency Systems	$22,895

Building	Description	Cost
Foreign Languages Bldg.	Replace HVAC Circulation Pumps	$214,305
	Replace HVAC Air Handlers	$433,052
	Replace Air Compressors	$31,606
	Repair & Weather-strip Exterior Windows	$120,096
	Replace Lighting with High Efficiency Systems	$675,225
	Replace Domestic Hot Water Converter	$34,543
	Replace HVAC Steam Valves	$12,675
Freer Hall	Replace Domestic Hot Water Converter	$64,019
	Replace HVAC Steam Valves	$6,715
	Replace HVAC Piping	$7,180
	Repair Exterior Windows	$95,888
	Replace Lighting with High Efficiency Systems	$585,663
Garage & Car Pool	Repair, Replace, & Weather-strip Exterior Doors & Windows	$2,480
	Replace Lighting with High Efficiency Systems	$129,473
General Arts Bldg.	Repair, Replace, & Weather-strip Exterior Doors & Windows	$3,687
	Replace Lighting with High Efficiency Systems	$11,802
Geological Survey Lab.	Repair, Replace, & Weather-strip Exterior Windows	$164,396
	Replace Lighting with High Efficiency Systems	$44,906
Glass Sculpture Bldg.	Replace Furnace	$10,607
	Replace Lighting with High Efficiency Systems	$8,282
	Replace Domestic Hot Water Heater	$1,447
Graduate Painting Facility	Repair, Replace, & Weather-strip Exterior Doors & Windows	$9,262
Graduate Photography Studio	Replace Lighting with High Efficiency Systems	$9,704
	Repair, Replace, & Weather-strip Exterior Doors & Windows	$7,159
Gregory Hall	Replace FES Chiller Condenser	$5,556
	Replace HVAC Reheat Valves	$18,107
	Replace Condensate Receiver	$31,107
	Renovate HVAC	$1,773,795
	Repair, Replace, & Weather-strip Exterior Doors & Windows	$956,403
	Replace Lighting with High Efficiency Systems	$464,157
Gym Annex	Replace HVAC Steam Valves	$6,715
	Repair, Replace, & Weather-strip Exterior Windows	$74,147
	Replace Domestic Hot Water Converter	$18,717

Building	Description	Cost
Harding Band Bldg.	Replace HVAC Condensing Unit	$68,962
	Replace Domestic Hot Water Converter	$40,027
	Replace Condensate Receiver	$15,844
	Replace Air Compressor	$20,347
	Renovate HVAC	$519,749
	Repair & Weather-strip Exterior Windows	$97,625
	Replace Lighting with High Efficiency Systems	$172,774
Henry Administration Bldg.	Renovate HVAC	$3,296,405
	Repair, Replace, & Weather-strip Exterior Windows	$577,246
Horticulture Field Lab.	Replace Domestic Hot Water Converter	$40,027
	Replace Condensate Receiver	$16,023
	Renovate HVAC	$1,045,070
	Repair, Replace, & Weather-strip Exterior Windows	$273,445
	Replace Lighting with High Efficiency Systems	$87,191
	Add Occupancy Sensors	$3,983
	Replace HVAC Steam Valves	$6,715
	Replace, Repair, & Weather-strip Exterior Windows	$207,066
	Replace Lighting with High Efficiency Systems	$742,138
Huff Hall	Replace Lighting with High Efficiency Systems	$742,138
Illini Hall	Replace Condensate Return Unit	$19,018
	Renovate HVAC	$1,065,329
	Replace & Weather-strip Exterior Windows	$282,600
	Replace Lighting with High Efficiency Systems	$245,602
Imported Swine Research Lab.	Replace HVAC Piping Insulation	$27,767
	Replace Boiler	$813,585
	Replace Lighting with High Efficiency Systems	$65,016
Institute of Government &	Upgrade HVAC	$81,746
Public Affairs Bldg.		
Institute of Labor &	Replace Condensate Return Unit	$17,704
Industrial Relations	Renovate HVAC	$895,918
	Replace & Weather-strip Exterior Windows	$181,824
	Replace Lighting with High Efficiency Units	$186,459
International Studies Bldg.	Replace Boiler	$42,765
	Replace Lighting with High Efficiency Systems	$116,192

Building	Description	Cost
Kenney Gymnasium	Replace Domestic Hot Water Converter	$18,191
	Replace HVAC Steam Valves	$13,431
	Replace & Weather-strip Exterior Windows	$194,889
	Replace Lighting with High Efficiency Systems	$320,698
Krannert Art Museum	Renovate HVAC	$1,354,966
	Repair Exterior Windows	$9,184
	Replace Lighting with High Efficiency Systems	$5,218
Krannert Center for the	Replace Domestic Hot Water Converter	$58,724
Performing Arts	Renovate HVAC	$2,950,933
Law Bldg.	Replace Air Handlers	$452,091
	Replace HHW Converter	$82,444
Levis Faculty Center	Replace Condensate Return Unit	$15,491
	Renovate HVAC	$872,615
	Replace Lighting with High Efficiency Systems	$46,116
Library	Replace Air Handlers	$527,049
	Replace HVAC Ductwork	$216,379
	Replace HVAC Steam Valves	$10,073
	Replace Air Compressor	$19,131
	Replace & Weather-strip Exterior Windows	$1,741,680
	Replace HVAC Piping	$9,717
Library AC Center	Replace Cooling Towers	$501,018
	Replace Condensate Receiver	$13,179
	Replace HVAC Steam Valves	$13,431
	Replace HVAC Pumps	$211,054
	Replace Lighting with High Efficiency Systems	$7,122
Lincoln Hall	Renovate HVAC	$2,874,034
	Replace & Weather-strip Exterior Windows	$1,262,196
	Replace Lighting with High Efficiency Systems	$648,343
	Add Insulation to Attic	$65,197
Loomis Laboratory of Physics	Replace Condensate Receiver	$31,107
	Renovate HVAC	$2,539,684
	Replace Domestic Hot Water Converter	$86,328
Meat Science Lab.	Replace Domestic Hot Water Converter	$74,572
	Replace Refrigeration Insulation	$9,366
	Renovate HVAC	$517,420
	Replace & Weather-strip Exterior Windows	$72,911

Building	Description	Cost
Mechanical Engineering Bldg.	Replace Circulation Pumps	$17,652
	Replace Condensate Return Unit	$20,726
	Replace Steam System	$580,505
	Replace & Weather-strip Exterior Windows	$226,455
Mechanical Engineering Lab.	Replace Condensate Return Unit	$18,782
	Replace & Weather-strip Exterior Windows	$472,310
	Replace Lighting with High Efficiency Systems	$796,477
Medical Sciences Bldg.	Replace Condensate Return Unit	$348,240
	Replace Lighting with High Efficiency Systems	$410,127
	Add Occupancy Sensors	$49,021
Metallurgy & Mining Bldg.	Replace Circulation Pump	$20,132
	Replace Steam System	$626,687
	Replace Condensate Return Unit	$20,726
	Replace Wall Radiation	$385,574
	Replace Domestic Hot Water Converters	$161,116
	Replace HVAC Piping	$1,363,430
	Replace & Weather-strip Exterior Windows	$263,417
Morrill Hall	Replace Domestic Hot Water Converter	$64,019
	Replace & Weather-strip Exterior Windows	$445,871
	Replace Lighting with High Efficiency Systems	$714,423
	Add Occupancy Sensors	$94,120
Mumford Hall	Replace HVAC Steam Valves	$6,715
	Replace Window Air Conditioners	$19,559
	Replace & Weather-strip Exterior Windows	$159,740
	Replace Lighting with High Efficiency Systems	$654,506
Mumford House	Replace Circulation Pumps	$11,793
	Replace Condensate Return Unit	$20,726
	Replace & Weather-strip Exterior Windows	$22,101
Music Bldg.	Replace Condensate Receiver	$13,864
	Replace Air Handlers	$166,162
	Replace Lighting with High Efficiency Systems	$618,499
National Soybean	Replace Air Handlers	$377,741

Building	Description	Cost
Research Center	Replace HVAC Ductwork	$16,483
	Replace Condensate Return Unit	$17,948
	Replace HVAC Steam Valves	$6,715
	Replace HVAC Piping Insulation	$7,743
	Replace Window Air Conditioners	$12,149
	Replace Lighting with High Efficiency Systems	$636,856
	Replace Air Compressor	$27,696
	Repair & Weather-strip Exterior Doors	$32,255
Natural History Bldg.	Replace Domestic Water Piping	$279,029
	Replace Air Compressor	$26,946
	Repair & Weather-strip Exterior Windows	$306,307
	Replace Lighting with High Efficiency Systems	$589,926
Natural History	Replace Domestic Hot Water Heater	$4,977
Survey Greenhouse	Replace HVAC Steam Valves	$3,358
	Replace HVAC Piping Insulation	$7,459
	Replace Air Compressor	$17,160
	Replace & Weather-strip Exterior Windows	$20,521
Natural Resource	Replace Boiler	$84,144
Studies Annex	Replace Chiller	$240,237
	Replace HVAC Piping Insulation	$5,821
	Replace HVAC Pumps	$69,383
	Replace HVAC Steam Valves	$5,876
	Repair Exterior Windows	$20,286
	Replace Wall Radiation	$210,885
	Replace Domestic Hot Water Converter	$34,794
Natural Resources Bldg.	Replace Condensate Return	$41,581
	Replace HVAC Steam Valves	$13,431
	Replace Window Air Conditioners	$2,583,489
	Repair & Weather-strip Exterior Windows	$146,569
	Replace Lighting with High Efficiency Systems	$768,143
Natural Resources Garage	Replace Domestic Hot Water Heater	$1,430
	Replace HVAC Steam Valves	$3,358
	Replace & Weather-strip Exterior Windows	$40,579
	Replace Lighting with High Efficiency Systems	$17,106
Newmark Civil	Replace Cooling Towers	$150,138
Engineering Bldg.	Replace Condensate Receiver	$31,107
	Renovate HVAC	$2,767,757

Building	Description	Cost
Noble Hall	Retrofit HVAC	$495,117
	Replace Exterior Windows	$374,880
	Replace Lighting with High Efficiency Systems	$122,880
North Barn &	Replace Temperature Control	$1,728
Milk House - LAD	Replace & Weather-strip Exterior Windows	$66,472
	Replace Lighting with High Efficiency Systems	$17,177
North Campus	Replace Cooling Towers	$859,956
Chilled Water Plant	Replace Domestic Hot Water Heater	$2,894
	Replace HVAC Piping Insulation	$6,313
	Replace Heater	$394
	Replace Lighting with High Efficiency Systems	$7,693
Noyes Lab.	Replace HVAC Steam Valves	$6,715
	Replace Ventilation Systems	$320,764
	Replace Lighting with High Efficiency Systems	$1,050,688
Nuclear Engineering Lab.	Renovate HVAC	$511,797
	Replace & Weather-strip Exterior Windows	$96,142
	Replace Lighting with High Efficiency Systems	$104,701
Nuclear Physics Lab.	Replace Domestic Hot Water Converter	$51,887
	Replace Condensate Return Unit	$18,774
	Renovate HVAC	$981,210
	Replace & Weather-strip Exterior Windows	$137,090
Nuclear Radiation Lab.	Replace Domestic Hot Water Heater	$6,367
	Renovate HVAC	$266,821
	Replace & Weather-strip Exterior Windows	$52,907
	Replace Lighting with High Efficiency Systems	$76,714
Nuclear Reactor Lab.	Replace Air Handlers	$115,031
	Replace Domestic Hot Water Heater	$34,541
	Replace Air Compressor	$20,265
	Replace Lighting with High Efficiency Systems	$11,803
Observatory	Replace HVAC Piping	$16,277
	Replace Window Air Conditioners	$85,375
	Replace Exterior Windows	$70,329
	Replace Lighting with High Efficiency Systems	$35,173
Optical Physics &	Replace Domestic Hot Water Heater	$9,390

Building	Description	Cost
Engineering Bldg.	Replace Condensate Return Unit	$18,782
	Replace Ventilation Systems	$47,156
	Renovate HVAC	$358,407
	Replace Exterior Windows	$55,827
	Replace Lighting with High Efficiency Systems	$34,242
Paleobotanical Bldg.	Replace & Weather-strip Exterior Windows	$4,524
Personnel Services Bldg.	Replace Condensate Return Unit	$18,774
	Replace Perimeter Heating	$232,159
	Replace Air Compressor	$26,946
	Repair, Replace, & Weather-strip Exterior Doors & Windows	$70,830
	Replace Lighting with High Efficiency Systems	$106,715
Physical Plant Service Bldg.	Replace Domestic Hot Water Converter	$50,759
	Replace Condensate Return Unit	$23,193
	Replace HVAC Steam Valves	$13,431
	Replace Window Air Conditioner	$52,495
	Replace Temperature Controls	$606,872
	Repair, Replace, & Weather-strip Exterior Windows	$164,597
	Replace Lighting with High Efficiency Systems	$1,021,501
	Add Air Curtains to Ventilation Systems	$263,961
Plant Sciences Lab.	Replace Refrigeration Compressors	$37,630
	Replace Piping Insulation	$20,465
Police Training Institute	HVAC Piping Insulation: Poor Condition	$1,849
	Replace Lighting with High Efficiency Systems	$186,426
Police Training Institute	Replace Classroom HVAC	$63,116
Tactical	Replace Lighting with High Efficiency Systems	$20,859
President's House	Replace Boiler	$63,411
	Replace Chillers	$170,686
	Replace Air Handlers	$132,121
	Replace & Weather-strip Exterior Doors & Windows	$131,815
Printing & Photographic	Replace Air Handlers	$488,582
Services	Replace Domestic Hot Water Converter	$31,150
	Replace Condensate Return Unit	$18,774
	Replace HVAC Piping	$2,741
	Replace Lighting with High Efficiency Systems	$356,013

Building	Description	Cost
Printing Services South Bldg.	Replace HVAC Ductwork	$6,410
	Replace Lighting with High Efficiency Systems	$39,157
Psychology Bldg.	Replace Chilled Water Circulation Pumps	$61,140
	Replace Cooling Towers	$149,132
	Replace Air Handlers	$912,053
	Replace Condensate Return Unit	$18,774
	Replace HVAC Piping Insulation	$13,128
	Replace HVAC Steam Valves	$6,715
	Replace Temperature Control	$94,262
	Replace Lighting with High Efficiency Systems	$984,470
Rehabilitation Education Center	Replace Chilled Water Circulation Pumps	$13,815
	Replace Domestic Hot Water Converter	$40,027
	Renovate HVAC	$639,129
	Replace & Weather-strip Exterior Windows	$112,217
	Replace Lighting with High Efficiency Systems	$109,361
Roger Adams Lab.	Replace HVAC Coils	$2,366,163
	Replace Domestic Hot Water Converter	$39,733
	Replace Condenser Water Pumps	$8,914
	Replace Condensate Return Unit	$17,560
	Replace HVAC Chilled Water Pumps	$47,237
	Replace Hydronic Heating Converter	$66,763
	Replace Window Air Conditioners	$16,678
	Windows: Replace Wood Double Hung Windows	$188,620
	Windows: Replace Aluminum Windows	$377,747
	Replace Steam Pressure Regulator Valves	$31,564
	Replace Occupancy Sensors	$130,722
	Replace & Weather-strip Exterior Windows	$565,967
Sculpture Bldg.	Replace Furnace	$12,122
	Replace Window Air Conditioners	$56,167
	Repair, Replace, & Weather-strip Exterior Doors & Windows	$11,114
	Replace Lighting with High Efficiency Systems	$9,700

Building	Description	Cost
Seitz Materials Research Lab.	Replace Chilled Water Circulation Pumps	$37,926
	Replace Cooling Towers	$98,809
	Renovate HVAC	$2,551,938
	Replace Lighting with High Efficiency Systems	$542,405
	Add Occupancy Sensors	$10,458
	Repair, Replace & Weather-strip Exterior Doors	$12,306
Shelford Vivarium	Replace HVAC Piping	$15,879
	Replace HVAC Steam Valves	$3,358
	Replace Window Air Conditioner	$167,379
	Replace Temperature Controls	$29,396
	Repair & Weather-strip Exterior Windows	$74,029
Smith Memorial Hall	Replace Domestic Hot Water Converter	$69,938
	Renovate HVAC	$1,528,736
	Repair, Replace, & Weather-strip Exterior Windows	$449,824
	Replace Lighting with High Efficiency Systems	$17,747
South Barn &	Replace Temperature Controls	$1,728
Calf House - LAD	Replace Heater	$8,571
	Replace Heater	$53,221
	Repair, Replace, & Weather-strip Exterior Windows	$16,587
Sow Feeding Bldg.	Replace HVAC Piping & Insulation	$62,426
Swine Research Center	Replace Lighting with High Efficiency Systems	$41,756
Speech & Hearing Clinic	Replace Air Compressor	$23,578
	Renovate HVAC	$766,187
	Replace Lighting with High Efficiency Systems	$153,719
Stock Pavilion	Replace Domestic Hot Water Heater Converter	$20,507
	Replace HVAC Piping	$16,996
	Replace HVAC Steam Valves	$6,715
	Replace Window Air Conditioners	$13,256
	Replace Thermostats	$19,514
	Replace Air Compressor	$26,946
	Repair, Replace, & Weather-strip Exterior Doors & Windows	$69,000
	Replace Lighting with High Efficiency Systems	$130,775
Student Staff AC Center	Replace Cooling Towers	$351,214
	Replace HVAC Chilled Water Pumps	$76,848
	Replace HVAC Piping Insulation	$24,300
	Replace Air Compressor	$26,965
	Replace Lighting with High Efficiency Systems	$7,250

Building	Description	Cost
Surveying Bldg.	Replace Condensate Return	$20,726
	Replace HVAC Piping	$200,755
	Repair, Replace, & Weather-strip Exterior Doors & Windows	$70,685
Swanlund Administration Bldg.	Replace Boiler	$59,381
	Replace Air Conditioning Unit	$25,461
	Replace Domestic Hot Water Heater	$13,608
	Repair & Weather-strip Exterior Windows	$10,236
Talbot Lab.	Renovate HVAC	$2,713,487
	Replace Exterior Windows	$666,537
	Replace Lighting with High Efficiency Systems	$632,235
Transportation Bldg.	Replace Condensate Receiver	$22,354
	Replace Window Air Conditioners	$18,992
	Repair, Replace, & Weather-strip Exterior Doors & Windows	$119,743
	Replace Lighting with High Efficiency Systems	$375,760
Turner Hall	Replace Chillers	$261,671
	Replace Air Handlers	$1,489,392
	Replace Condensate Unit	$34,767
	Replace HVAC Pumps	$69,044
	Replace Hydronic Heating Converter	$58,963
	Replace HVAC Insulation	$36,802
	Replace Temperature Controls	$418,886
	Repair & Weather-strip Exterior Windows	$98,724
	Replace Lighting with High Efficiency Systems	$975,105
Turner Hall Greenhouses	Replace Air Handlers	$213,193
	Replace Domestic Hot Water Converter	$65,285
	Replace Condensate Return Unit	$18,774
	Repair & Weather-strip Exterior Windows	$2,426
	Replace Lighting with High Efficiency Systems	$23,966
Undergraduate Library	Replace Air Handlers	$389,495
	Replace Temperature Controls	$373,213
	Replace Lighting with High Efficiency Systems	$600,637
University High School	Replace Air Handlers	$653,797
	Replace Domestic Hot Water Heater	$15,646
	Replace HVAC Steam Valves	$3,358
	Repair & Weather-strip Exterior Windows	$126,983
	Replace Lighting with High Efficiency Systems	$220,989

Building	Description	Cost
University High School	Replace HVAC Steam Valves	$3,358
Gymnasium	Replace Temperature Controls	$9,291
	Repair & Weather-strip Exterior Windows	$40,968
University Press	Replace Air Handlers	$306,320
	Replace Condensate Receiver	$16,881
	Replace HVAC Piping	$7,729
	Replace HVAC Steam Valves	$6,715
	Replace Lighting with High Efficiency Systems	$213,648
Veterinary Medicine	Replace Condensate Receiver	$27,727
Basic Sciences Bldg.	Renovate HVAC	$1,815,962
Veterinary Medicine	Replace Domestic Hot Water Heater	$65,251
Surgery & Obstetrics Lab.	Renovate HVAC	$187,463
Veterinary Medicine	Renovate HVAC in Large Animal Clinic	$1,105,945
Teaching Hospital	Renovate HVAC in Wards	$750,366
	Renovate HVAC in Small Animal Clinic	$1,007,204
	Replace Condensate Receiver	$25,052
Veterinary Medicine	Replace HVAC Chilled Water Pumps	$129,842
Chiller Plant	Replace HVAC Insulation	$17,409
	Replace Lighting with High Efficiency Systems	$27,965
	Replace Cooling Towers	$224,109
Waste Management &	Replace Lighting with High Efficiency Systems	$299,289
Research Lab.		
Water Survey Research Center	Replace Chilled Water Circulation Pumps	$15,095
Number 1	Replace Air Handler	$119,667
	Repair, Replace, & Weather-strip Exterior Windows	$52,853
Water Survey Research Center	Replace Boilers	$409,275
Number 2	Replace Chilled Water Circulation Pumps	$15,095
	Replace Chiller	$323,359
	Replace Air Handler	$119,667
	Repair, Replace, & Weather-strip Exterior Windows	$4,793
Water Survey Research Center	Replace Chilled Water Circulation Pumps	$15,095
Number 3	Replace Air Handler	$119,667
	Replace Domestic Hot Water Heater	$20,790
	Repair, Replace, & Weather-strip Exterior Windows	$42,954

Building	Description	Cost
Water Survey Research Center	Replace Chilled Water Circulation Pumps	$15,095
Number 4	Replace Air Handler	$119,667
	Replace Domestic Hot Water Heater	$20,790
	Repair, Replace, & Weather-strip Exterior Windows	$42,954
Water Survey Research Center	Replace Chilled Water Circulation Pumps	$15,095
Number 5	Replace Air Handler	$119,667
	Replace Domestic Hot Water Heater	$20,790
	Repair, Replace, & Weather-strip Exterior Windows	$45,967
Water Survey Research Center	Replace Chilled Water Circulation Pumps	$15,095
Number 6	Replace Air Handler	$119,667
	Replace Domestic Hot Water Heater	$20,790
	Repair, Replace, & Weather-strip Exterior Windows	$45,271
Wohlers Hall (Commerce West)	Replace Domestic Hot Water Converter	$86,507
Wood Engineering Lab	Replace Temperature Controls	$102,848
	Replace Window Air Conditioners	$3,260
	Repair & Weather-strip Exterior Windows	$46,281
	Replace Lighting with High Efficiency Systems	$32,645
	Total for UIUC Campus:	**$149,991,499**

Western Illinois University

History

Western Illinois University (WIU) is located in Macomb, Illinois and enrolls over 13,000 students including enrollment at WIU-Quad Cities and the Extension Center. About 5,170 students reside on campus.

The campus is situated on 1,000 acres that supports 52 buildings and 10 residence halls. In addition, the University operates the Alice L. Kibbe Life Sciences Station on the Mississippi River, the Frank J. Horn Field Campus, and the University Farm. The University also operates a branch campus, the Western Illinois University Regional Center in Moline.

In a typical year, WIU will spend more than $4.6 million for natural gas, electricity, coal, fuel oil and propane to provide services to the campus. Table M-1 contains data on the energy consumption and costs by fuel type for WIU for the past nine fiscal years. Also included in this table are annual heating degree days (HDD) and cooling degree days (CDD) and a percentage of normal year HDD and CDD as an indication of weather severity compared to a normal year.

Table M-1
Western Illinois University Energy Costs
FY95 –FY03

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
	Cost								
Natural Gas	$669,600	$1,379,000	$2,022,500	$1,652,400	$1,743,300	$1,316,100	$2,338,900	$1,559,600	$1,212,085
Electricity	$2,336,200	$2,467,100	$2,350,800	$2,552,900	$2,525,800	$2,543,300	$2,715,400	$2,698,300	$2,854,790
Coal	$426,100	$311,900	$131,100	$205,900	$120,300	$339,600	$416,800	$405,000	$532,701
Fuel Oil	$24,900	$27,200	$63,200	$28,000	$25,800	$3,600	$46,600	$38,600	$38,600
Propane	$900	$900	$1,300	$1,000	$800	$300	$1,300	$3,900	$3,900
Total	$3,457,700	$4,186,100	$4,568,900	$4,440,200	$4,416,000	$4,202,900	$5,519,000	$4,705,400	$4,642,076
	Usage (MBtu's)								
Natural Gas	219,769	315,716	522,428	451,108	553,983	315,753	367,850	314,127	211,746
Electricity	160,876	169,306	161,184	169,538	173,869	180,507	191,722	189,850	191,086
Coal	293,917	239,545	97,520	154,652	91,977	245,962	300,265	281,584	386,929
Fuel Oil	7,893	7,643	18,401	7,427	8,192	825	8,403	7,824	16,248
Propane	123	118	129	116	108	29	110	404	330
Total	682,577	732,328	799,662	782,840	828,129	743,076	868,350	793,790	806,338
	Unit Costs ($/MBtu's)								
Natural Gas	3.05	4.37	3.87	3.66	3.15	4.17	6.36	4.96	5.72
Electricity	14.52	14.57	14.58	15.06	14.53	14.09	14.16	14.21	14.94
Coal	1.45	1.30	1.34	1.33	1.31	1.38	1.39	1.44	1.38
Fuel Oil	3.15	3.56	3.43	3.77	3.15	4.36	5.55	4.93	2.38
Propane	7.34	7.65	10.06	8.64	7.44	10.46	11.83	9.65	11.81
Total	5.07	5.72	5.71	5.67	5.33	5.66	6.36	5.93	5.76
	Weather Severity (% of Normal Year)								
HDD*	90.3%	106.3%	103.7%	87.9%	86.4%	84.4%	102.6%	86.2%	
CDD*	63.3%	111.8%	75.1%	98.4%	109.7%	92.8%	101.1%	101.8%	
Sq Ft (Millions)	4.30	4.30	4.30	4.43	4.44	4.43	4.47	4.45	4.45

HDD*	5550	6535	6374	5406	5315	5191	6307	5303
CDD*	621	1098	737	967	1077	911	993	1000

Peoria weather Normal Yr. HDD 6,148 Normal Yr. CDD* 982

Overview of Heating and Cooling Systems
Two coal-fired boilers and three natural gas/fuel oil boilers produce steam that is distributed through steam tunnels for building hot water and heat. Central steam absorbers are used for air conditioning along with electric chillers located in buildings. A combination of unit ventilators and forced air handling units are utilized for heating and cooling distribution. Most systems are controlled with pneumatic controls and monitored through an electronic facility management system that continues to be expanded.

Utility Providers
The main campus is considered a large electric user and qualifies for electric rate incentives with Ameren Energy. The campus negotiates natural gas costs through Tylex, utilizing Ameren CIPS for natural gas distribution. The University purchases Illinois high-sulfur coal from Freeman United Industry. Previously, Industry Coal Mine, 9 miles south of Macomb, supplied coal but the available coal supply there has been depleted.

Energy Conservation Related Projects 1995 to 2003
WIU continually tracks utility costs and prepares analysis reports that compare electricity, natural gas, coal, fuel oil, liquid propane gas, water and sewer costs and consumption as well as percentage change from year-to-year. Recently, WIU has completed two major projects; coal systems upgrade and campus steam line replacement. Additionally, WIU has commissioned a comprehensive engineering analysis on the campus chilled water system and a heating plant assessment. WIU will use these assessments to prioritize projects. Table M-2, Energy Conservation Measures with Estimated Savings, provides a summary of these major projects and estimated energy savings.

Coal Systems Upgrade
A $6 million coal systems upgrade was implemented in FY00 that included boiler re-tubing, economizers, stoker replacement, bag house addition, and controls to allow for more reliable steam production using coal in place of natural gas. After the upgrade was completed, natural gas consumption decreased an average of 59 percent while coal consumption increased an average of 260 percent. This was planned to allow WIU the flexibility of utilizing other coal or natural gas, depending on which has the better price.

The cost savings achieved by avoiding the purchase of natural gas demonstrates the benefit of the coal systems upgrade. At WIU the natural gas costs per MBtu increased 32 percent from FY99 to FY00 and 53 percent from FY00 to FY01. From FY01to FY02, the costs for natural gas decreased by 22 percent, only to increase by 34 percent during FY02-FY03.

Coal has experienced only small increases in unit cost. From FY99 to FY00, FY00 to FY01, FY01 to FY02 and FY02 to FY03, the coal cost per ton increased 5.6 percent, 0.5 percent, 3.6 percent and 2.0 percent, respectively.

Before the coal systems upgrade, during FY97 through FY99, the average consumption of natural gas was 509,173 MBtu. After the upgrade, from FY00 to FY03, the average

consumption of natural gas was 301,983 MBtu. The average difference, or savings, in gas consumption is 207,190 Mbtu that, at FY03 natural gas prices of $6.90 per Mbtut, amounts to $1,381,473.

Consequently, before the upgrade, during FY97 through FY99, the average consumption of coal was 4,988 tons. After the upgrade, from FY00 to FY03, the average consumption of coal was 12,959 tons. The average difference, or increase, in coal consumption is 7,972 tons that, at FY03 coal costs of $33.73 per ton, indicates an increased coal cost of $268,896.

Overall, the benefit of the $6 million coal systems upgrade can be measured by the difference between what WIU would have paid using natural gas, $1,381,473 versus coal, $268,896 or $1,112,557 in savings.

Steam Line Replacement
A $9.5 million project that replaced steam lines and added steam tunnels was recently completed on approximately 50 percent of the campus. Original steam lines were buried directly and many were leaking significant amounts of steam. Underground steam tunnels were installed to house steam lines that are now insulated and utilize steam traps. Significant savings occurred by reducing the steam load on the boiler and reducing the boiler makeup water, and associated water treatment costs, from 70 percent to 25 percent.

Chilled Water Master Planning Study
During the 1960s and 1970s WIU experienced an increase in students and subsequently, many new buildings were added. Many of these buildings still contain the original mechanical systems for heating and cooling and the individual chillers are nearing or past their useful equipment life. A Chilled Water Master Planning Study was recently commissioned. It recommends utilizing a central chilling plant to save 30 percent on total campus capacity requirements. There would be a $14 million net present cost advantage over simple chiller replacement in buildings. Savings would accrue from O&M as well as energy, owing to higher efficiency equipment and the centralized location of the chilled water plant to the existing steam production plant.

Heating Plant Assessment Study and Plant Capital Development Plan
A Heating Plant Assessment Study and a Plant Capital Development Plan were recently completed, containing an analysis of the efficiency and life expectancy of the gas-fired steam boilers as well as a capital development plan for the Heating Plant. The study contains an energy management analysis of Heating Plant operations; a total cost comparison between coal and natural gas; an evaluation of data acquisition; and control system opportunities in the plant.

Establishment of Team to Manage Mechanical Systems
WIU has begun planning and necessary training to establish a multi-disciplined team within the Physical Plant to develop and implement building control system strategies and oversee standards for design and operation of HVAC and building automation system (BAS) controls.

Table M-2 lists recent energy conservation measures implemented at WIU and estimated annual savings.

Table M-2
Energy Conservation Measures with Estimated Savings

Year	Project	Buildings	Total Project Cost	Savings
FY00	Coal systems upgrade. Included boiler re-tubing, economizers, stoker replacement, bag house addition, and controls to allow for more reliable steam production using coal in place of natural gas.	Heating Plant and steam distribution system	$6,000,000	$1,112,595
FY02	Campus steam line replacement	Heating Plant and steam distribution system	$9,500,000	$35,000
FY03	Chilled Water Master Planning Study. Recommends a central chilling plant saving 30% on total campus capacity requirements with a $14 million net present cost advantage over simple chiller replacement in buildings. Savings would accrue from O&M as well as energy, owing to higher efficiency equipment and the centralized location of the chilled water plant to the existing steam production plant.	Campus-wide		
Present	Heating Plant Assessment Study and Plant Capital Plan Development. Analysis of gas-fired steam boilers efficiency and life expectancy as well as capital development plan for the Heating Plant. Energy management analysis of Heating Plant operations and a total cost comparison between coal and natural gas. Evaluate data acquisition and control system opportunities in the plant.	Heating Plant and steam distribution system		

Table M-3, Energy Conservation Measures and O&M Measures without Estimated Savings, presents additional energy conservation measures WIU has implemented since FY95.

Table M-3
Energy Conservation Measures and O&M Measures without Estimated Savings

Year	Project	Year	Project
FY95	Replace current lighting with more efficient lighting	FY98	Install high efficiency motors
FY95	Utilize photocell controls	FY98	Steam trap maintenance
FY95	Facility Management System (FMS)	FY98	Motormaster utilization
FY95	Reduce ventilation	FY98	Boiler testing
FY95	Thermostat setback/setup	FY98	Water treatment
FY95	Install high efficiency motors	FY98	Staff training
FY95	Steam trap maintenance	FY99	Replace current lighting with more efficient lighting
FY95	Motormaster utilization	FY99	Utilize photocell controls
FY95	Boiler testing	FY99	Utilize destratification fans
FY95	Water treatment	FY99	Optimize boiler controls
FY95	Staff training	FY99	Install high efficiency motors
FY96	Replace current lighting with more efficient lighting	FY99	Steam trap maintenance
FY96	Retrofit current lighting with more efficient lighting	FY99	Motormaster utilization
FY96	Install time clock controls	FY99	Boiler testing
FY96	Install high efficiency motors	FY99	Water treatment
FY96	Steam trap maintenance	FY99	Staff training
FY96	Motormaster utilization	FY99	CDB capital projects
FY96	Boiler testing	FY00	Replace current lighting with more efficient lighting
FY96	Water treatment	FY00	Install time clock controls
FY96	Staff training	FY00	Optimize steam valves
FY97	Replace current lighting with more efficient lighting	FY00	Reduce ventilation
FY97	Utilize photocell controls	FY00	Optimize boiler controls
FY97	Reduce ventilation	FY00	Install high efficiency motors
FY97	Utilize destratification fans	FY00	Steam trap maintenance
FY97	Install high efficiency motors	FY00	Motormaster utilization
FY97	Steam trap maintenance	FY00	Boiler testing
FY97	Motormaster utilization	FY00	Water treatment
FY97	Boiler testing	FY00	Staff training
FY97	Water treatment	FY00	CDB capital projects
FY97	Staff training	FY01	Replace current lighting with more efficient lighting
FY98	Replace current lighting with more efficient lighting	FY01	Utilize photocell controls
FY98	Retrofit current lighting with more efficient lighting	FY01	Facility Management System (FMS)
FY98	Facility Management System (FMS)	FY01	Optimize steam valves
FY98	Reduce ventilation	FY01	Reduce ventilation

Year	Project	Year	Project
FY98	Utilize destratification fans	FY01	Utilize destratification fans
FY98	Install high efficiency motors	FY01	Upgrade FMS controls
FY98	Steam trap maintenance	FY01	Motormaster utilization
FY98	Motormaster utilization	FY01	Boiler testing
FY98	Boiler testing	FY01	Water treatment
FY98	Water treatment	FY01	Staff training
FY98	Staff training	FY01	CDB capital projects
FY99	Replace current lighting with more efficient lighting	FY02	Replace current lighting with more efficient lighting
FY99	Utilize photocell controls	FY02	Optimize steam valves
FY99	Utilize destratification fans	FY02	Reduce ventilation
FY99	Optimize boiler controls	FY02	Utilize destratification fans
FY99	Install high efficiency motors	FY02	Upgrade FMS controls
FY99	Steam trap maintenance	FY02	Install high efficiency motors
FY99	Motormaster utilization	FY02	Steam trap maintenance
FY99	Boiler testing	FY02	Motormaster utilization
FY99	Water treatment	FY02	Boiler testing
FY99	Staff training	FY02	Water treatment
FY99	CDB capital projects	FY02	Staff training
FY00	Replace current lighting with more efficient lighting	FY02	CDB capital projects
FY00	Install time clock controls	FY03	Replace current lighting with more efficient lighting
FY00	Optimize steam valves	FY03	Utilize photocell controls
FY00	Reduce ventilation	FY03	Optimize steam valves
FY00	Optimize boiler controls	FY03	Reduce ventilation
FY00	Install high efficiency motors	FY03	Utilize destratification fans
FY00	Steam trap maintenance	FY03	Commission chiller study
FY00	Motormaster utilization	FY03	Install high efficiency motors
FY00	Boiler testing	FY03	Steam trap maintenance
FY00	Water treatment	FY03	Motormaster utilization
FY00	Staff training	FY03	Boiler testing
FY00	CDB capital projects	FY03	Water treatment
FY01	Replace current lighting with more efficient lighting	FY03	Staff training
FY01	Utilize photocell controls	FY03	CDB capital projects
FY01	Facility Management System (FMS)		
FY01	Optimize steam valves		
FY01	Reduce ventilation		
FY01	Utilize destratification fans		
FY01	Upgrade FMS controls		
FY01	Install high efficiency motors		
FY01	Steam trap maintenance		

Table M-4, Deferred Maintenance Capital Renewal Projects, contains the prioritized list of deferred maintenance capital renewal projects, cost estimates, and potential for energy and operations and maintenance savings at WIU.

Table M-4
Deferred Maintenance Capital Renewal Projects

Project Rank		Cost Estimate	Saves Energy	O&M
1	Knoblauch, Currens, Waggoner, & Browne Elevators	$ 400,000	X	X
2	Steam Line Segment #3	$ 625,000	X	X
3	Waggoner Absorption Chiller & CT Replacement	$ 815,125	X	X
4	Stipes Roof Replacement	$ 400,000	X	X
5	Horrabin Hall Absorption Chiller Replacement	$ 594,000	X	X
6	Steam Line Segment #1	$ 625,000	X	X
7	Waggoner Hall Elevator	$ -		
8	Browne Hall Absorption Chiller & CT Replacement	$ 403,875	X	X
9	Simpkins Absorption Chiller	$ 168,750	X	X
10	Steam Line Segment #2	$ 625,000	X	X
11	Chilled Water Study	$ 100,000	X	X
12	Browne Hall Freight Elevator	$ -		
13	Western Hall & Horriban Generator	$ 150,000		
14	Horrabin Roof Replacement	$ 1,300,000		
15	Heating Plant Improvements - Phase I	$ 308,000		X
NA	Heating Plant Facility Assessment	$ -	X	X
16	Heating Plant Switchgear	$ 1,500,000		
17	Steam Line Segment #5	$ 625,000	X	X
18	Retube Boiler #5 - Heating Plant	$ 1,000,000	X	
19	Western Hall South Roof Replacement	$ 225,000		
20	Heating Plant Improvements PH II	$ 500,000	X	X
21	Brophy Chiller & CT Replacement	$ 765,000	X	X
22	Simpkins Roof Replacement	$ 250,000		
23	Library Chiller & CT Replacement	$ 1,462,500	X	X
24	Stipes Chiller Replacement	$ 365,625	X	X
25	Currens Chiller Replacement	$ 365,625	X	X
26	Domestic Water Upgrades - Phase I	$ 500,000		
27	Low Voltage Electrical Distribution Improvements - Phase I	$ 500,000		
28	Art Gallery Exterior	$ 500,000		
29	Sherman Hall Fascia & Exterior Work	$ 400,000		
	Subtotal: Extent of Five Year Plan	$ 15,473,500		

Table M-5, Deferred Maintenance & Capital Renewal Project Backlog, contains the outstanding prioritized list of deferred maintenance capital renewal projects, cost estimates, and potential for energy and operations and maintenance savings at WIU.

M-5
Deferred Maintenance & Capital Renewal Project Backlog

Project Rank	Project	Cost Estimate	Energy	O&M
30	Steam Line Segment #4	$ -	X	X
31	Steam Line Segment #6	$ -	X	X
32	Steam Line Segment #7	$ 2,600,000	X	X
33	Retube Boiler #6 - Heating Plant	$ 1,000,000	X	
34	Low Voltage Electrical Distribution Improvements - Phase II	$ 500,000		X
35	Heating Plant Improvements - Phase II	$ 500,000		
36	Domestic Water Upgrades - Phase II	$ 1,500,000		
37	Two Portable Electrical Generators (Optional)	$ 150,000		
38	Two Portable Chiller Systems (Optional)	$ 200,000		
39	Heating Plant Condensate Line	$ 25,000	X	X
40	Sherman Hall Condensate Line	$ 25,000	X	X
41	Library Tie Switch	$ 50,000		
42	Retube Boiler #7 Heating Plant	$ 1,000,000	X	
43	Western Hall Insulate Duct Work	$ 35,000	X	
44	Horrabin Water Line Replacement to Bldg.	$ 35,000		
45	Replace Switchgear at Switchyard	$ 1,000,000		
46	Exterior Cleaning & Restoration Sherman	$ 1,000,000		
47	Exterior Cleaning & Restoration Simpkins	$ 1,000,000		
48	Waterproofing & Tuck pointing Library	$ 300,000		
49	Retube Boiler #8 Heating Plant	$ -		
50	Tillman HVAC	$ 800,000	X	X
51	Stipes Obsolete Flush Valves	$ 25,000		
52	Upgrade Campus Classrooms (per VPs & Academic VP)	$ 5,000,000		
53	Waterproofing & Tuck pointing Waggoner Hall	$ 400,000		
54	Tillman Hall Freight Elevator	$ 250,000		
55	Waterproofing & Tuck pointing Brophy Hall	$ 300,000		
56	Tillman Hall Window Replacements	$ 350,000	X	
57	Browne Hall Window Replacements	$ 600,000	X	
58	Replace Campus Link Boxes with Switches	$ -		
59	Western Hall Remove Tile & Seal Floor	$ 75,000		
60	Auxiliary Services Roof	$ -		
61	Garwood Window Replacement	$ 350,000	X	
62	Stipes Replace HVAC - Air Side	$ 800,000	X	X
63	Sherman Auditorium Renovation	$ 1,500,000		
64	Morgan Replace HVAC - Air Side	$ 800,000	X	X
65	Building Automation Systems	$ 1,800,000	X	
66	Install Redundant Fiber Optic Backbone	$ 275,000		
67	Waggoner/Currens HVAC	$ 2,500,000	X	X
68	Tillman Floor Tile Replacement	$ 350,000		
69	Garwood Floor Tile Replacement	$ 350,000		
70	Stadium Bleachers	$ 3,400,000		
71	Baseball Field Dugouts	$ -		
	Total	$ 30,845,000		

Table M-6 lists the buildings at WIU, years they were built and their sizes.

Table M-6
Building List – WIU

Building	Year Built	Size (GSF)
Alumni House	1900	5,700
Annex	1934	30,400
Auxiliary Enterprises	1948	9,700
Bayliss	1966	116,800
Beu Health Center	1963	15,300
Brophy	1973	107,500
Browne	1959	70,200
Cinema	1971	8,736
Commissary	1967	7,538
Corbin	1962	135,200
Currens	1970	142,200
East Village	1966	41,538
Farm Field Lab (All Buildings)	NA	74,290
Garwood	1914	25,900
Godfather's Lease Space	1973	2,728
Golf Course (All Buildings)	NA	7,832
Greenhouse	1964	5,000
Henninger	1966	116,800
Higgins	1967	310,248
Horn Field Campus	NA	4,100
Horribin	1967	148,700
Kerr Farm (All Buildings)	NA	8,052
Kibbe Station	NA	11,200
Knoblauch	1964	93,500
Lamoine Village	1970	154,240
Lincoln	1963	98,150
Malpass Library	1978	222,300
Memorial	1962	83,500
Morgan	1967	118,300
Mowbray	1973	9,600
Physical Plant	1969	43,200
Physical Plant East	1972	2,535
Olson	1965	135,200
Regional Center	1971	58,500
Salee	1964	53,000
Seal	1955	35,500
Sherman	1902	107,100
Simpkins	1937	110,600
Bennett Hursh Lounge	1957	38,900
Stipes	1970	142,600
Storage (All Areas)	NA	17,300
Student Recreation Center	1997	51,380
Tanner	1968	228,083
Thompson	1969	300,097

Building	Year Built	Size (GSF)
Thompson Dining Hall	2001	26,000
Tillman	1953	88,400
University Art Gallery	1902	7,100
University Residence	1973	7,400
University Service Building	1977	26,000
University Union	1956	183,683
University Village	1956	14,508
Utility Plant	1924	18,200
Waggoner	1968	131,900
Washington	1963	98,150
Western	1964	102,090
Wetzel	1970	208,900
	Total	4,421,578