A Report to the 93rd General Assembly on

ENERGY COSTS & ENERGY EFFICIENCY AT ILLINOIS' PUBLIC UNIVERSITIES

by the Illinois Department of Commerce & Economic Opportunity
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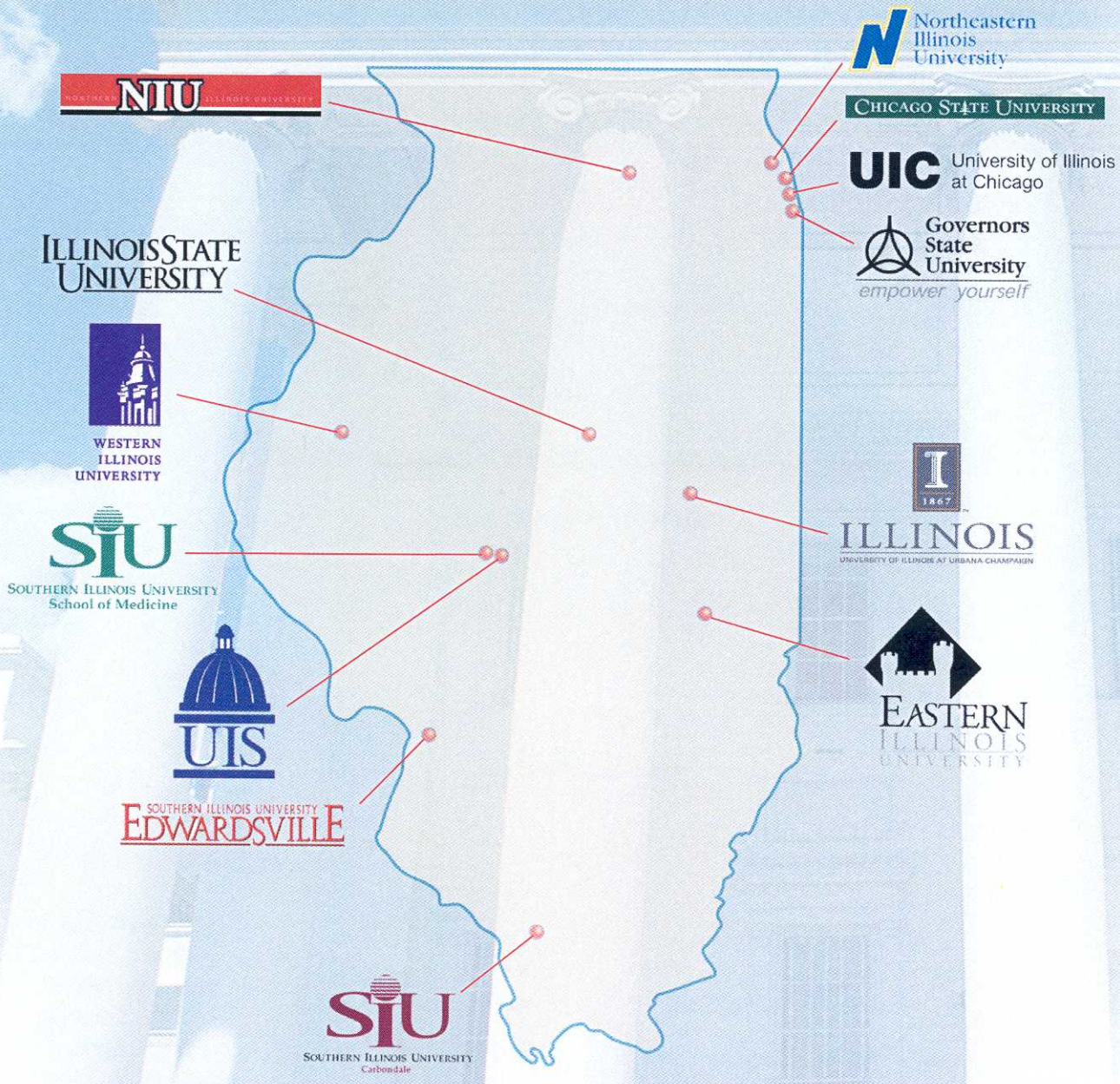

Rod R. Blagojevich, Governor

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STATE OF ILLINOIS

DEPARTMENT OF COMMERCE AND ECONOMIC OPPORTUNITY

A REPORT ON

ENERGY COSTS AND ENERGY EFFICIENCY

AT ILLINOIS' PUBLIC UNIVERSITIES

REPORTING TO THE

NINETY-THIRD GENERAL ASSEMBLY OF THE

STATE OF ILLINOIS

DECEMBER 2003

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I. Abstract

House Resolution 222, adopted on May 28, 2003 by the Ninety-third General Assembly, directs the Department of Commerce and Economic Opportunity (DCEO) to assess energy conservation measures taken at each of the State's public universities since 1995 and report its findings to the General Assembly.

This report highlights the overall findings of the assessment, which was conducted by surveys of and site visits to each of the nine universities and four "satellite" campuses. The report also provides recommendations to improve the energy efficiency of Illinois' public university facilities.

A primary task of the assessment, after the data gathering was complete, was to determine the energy costs per square foot at the different university facilities across the state. Such data would have enabled comparisons that are valuable for identifying efficiency improvement opportunities. However, a major finding of this report is that, given current university practices, data of sufficient detail is not available to allow for the identification of many efficiency targets. For example, many university facilities are not individually metered, rendering comparisons to similar facilities—commonplace in the commercial sector—impossible. Furthermore, each university is using a different management system for tracking their utility data, again rendering many of the most important similar-facility-comparisons impossible.

This report contains and analyzes information about energy usage at Illinois universities that could be collected, but perhaps more importantly, highlights what is not known. *The principal recommendation of the report is that public universities should adopt a shared uniform total utility management plan to reliably track energy information and enable quick analysis for continuous efficiency and purchasing improvements.* Implementation of such a plan would allow for easily identifiable improvements that would result in significant savings for the state.

The report also documents energy consumption and cost data for each university. University-specific reports are available at: **http://www.illinoisbiz.biz/efficientuniversities.html**

DCEO would like to offer special thanks to State Representative Robert Flider of Decatur for his efforts in sponsoring the resolution. DCEO would also like to thank Speaker of the House Michael J. Madigan, and Jack Unzicker of his office, for their assistance in the development of the Resolution.

II. Executive Summary

Illinois' public universities use more than one-half of the energy consumed by state government, spending over $93 million on energy in FY03. Energy efficiency and conservation efforts at public universities have the potential for significant overall savings. As the state is currently in a fiscal crisis, capturing all potential savings is essential. *Based upon the findings of the survey conducted for this report, upon comparisons to similar private-sector facilities, and upon the past experience of state-sponsored energy performance contracting projects, a comprehensive energy management strategy for the university system could, within several years, yield annual savings of $18-25 million.*

This report finds that state universities have implemented significant energy efficiency improvements since 1995. Very significantly, state universities used performance contracting to capture $63 million in energy savings over a 10-year period. This report also acknowledges that some buildings at many of the universities may well be among the most efficient of all state buildings. *Nevertheless, lessons learned from those efficiency improvement demonstrations have not been applied throughout the university system, leaving large savings untapped. These lost savings opportunities indicate a need for improved energy information management by universities.*

Energy efficiency improvements have benefits beyond reduced utility bills. Energy efficiency projects improve building comfort, improve lighting and indoor air quality, increase employee and student productivity, decrease unscheduled maintenance, create better preparation for changing needs in facilities management, and make a positive contribution to the environment through the reduction of unnecessary pollution.

Occupancy comfort is the traditional primary concern for university staff. Many of the universities were expanded during the 1970s and now have aging mechanical and electrical equipment that will need to be replaced in the near future. Energy efficiency improvements have multiple benefits, which should be understood as an opportunity to further improve, rather than conflict with occupancy comfort. In addition, while per unit costs for fuels has increasingly become market-driven, utility budgets have remained relatively constant. *A simultaneous evaluation of energy costs in light of potential efficiency improvements, changes in purchasing due to deregulation, and utility-bill management improvements would present a valuable framework for energy cost reductions for public universities.*

This report issues one principal recommendation as well as additional corollary recommendations.

1. Principal Recommendation

Each university should establish a total utility management plan, and each of those plans should be established in coordination, utilizing a uniform shared energy information system. Major steps to implement this plan should include:

a) Each university should convene all relevant senior management, including the university president and the senior-most operations, purchasing, finance, and property management officers, together with an outside professional energy advisor, to develop a campus energy plan. This team will conduct a two-hour diagnostic assessment of their university's energy management practices. This assessment will produce clear recommendations for improvements, in priority order.

b) The senior management energy plan will result in data system improvements, improved operations and maintenance policies, and in physical, investment-grade building-specific assessments. Data system improvements will eliminate billing errors and reduce associated personnel costs, and should include additional metering equipment acquisitions as necessary. Improved operations and maintenance policies will facilitate the capture of low-or-no-capital-cost savings. Investment-grade building assessments will identify further operations and maintenance savings as well as necessary major capital improvements (and financing methods for those improvements).

c) Operations and cost-effective capital improvements should be implemented with financing appropriate to the current state fiscal situation. To immediately note one key specific example, this report details that several state universities have conducted successful performance contracting projects, allowing those facilities to finance energy improvements on the basis of projected energy efficiency savings and thereby capture positive cash flows from the first day of a project. To facilitate these improvements, each university should adopt specific annual efficiency goals for a three-year period. University departments should have their own subsidiary goals and be held accountable to those goals.

2. Corollary Recommendations

Additional recommendations for resource efficiency, based on this report, are available in section VII. Key corollary recommendations include: Building Operator Certification ("BOC") training for all public university facility operations and maintenance staff, increased utilization of energy performance contracting, examination of additional Combined Heat and Power ("CHP") applications, aggregated purchasing, the adoption of LEED ("Leadership in Energy and Environmental Design") energy efficiency standards for new facilities and major rehabilitation projects, purchasing policy changes to allow for the higher incremental costs of choosing more efficient equipment versus standard equipment, establishing new procurement guidelines for ENERGY STAR® equipment, and analysis of renewable energy funding sources for university projects.

Energy efficiency is responsible policy of both sound fiscal practices and environmental stewardship. Illinois has the potential to serve as a model state for energy efficiency in its university facilities. Achieving greater energy efficiency at Illinois' public universities must be a joint venture. It will require collaboration, support and funding from university administrators and a variety of parties including the Legislature, the Capital Development Board (CDB), the Illinois Board of Higher Education (IBHE), Central Management Services (CMS), the Illinois Clean Energy Community Foundation (ICECF), and various energy service companies (ESCOs).

The state needs to establish, through collaboration, a uniform system to monitor energy use and costs at all universities in order to identify new improvements and problems.

3. Projected Savings

This report finds that universities should improve their energy information management. Consistent with that finding, adequate information is not available to definitively state the financial benefits of comprehensive energy improvements. With that caveat, however, DCEO staff has utilized three different methodologies to estimate savings.

a) A common assumption made in the energy efficiency industry, based on both public and private sector experience, is that typical facilities can save 20% in total annual energy costs following several years of efforts to adopt best practices. Using this methodology, savings by the university system would be $18.6 million per year.

b) The state of Illinois has significant prior experience with energy performance contracting. An initial performance-contracting pilot, begun in 1994, of seven facilities, resulted in 27% savings. Applying this methodology against total university energy costs indicates $25.1 million in annual savings. This method does not account for existing energy performance contracts recently implemented at the universities (amounting to approximately 20% of appropriate facilities), which would reduce the estimated savings, nor for savings resulting from aggregated purchasing or energy information management, which would increase the savings. This methodology assumes those unaccounted factors to be roughly offsetting.

c) A third methodology uses a "typical best practices" model to estimate costs. Using the average energy cost per square foot of the best three facilities (EIU, WIU, and SIU-E) and assuming that cost for the total square footage of all universities, the savings would be $23.4 million annually.

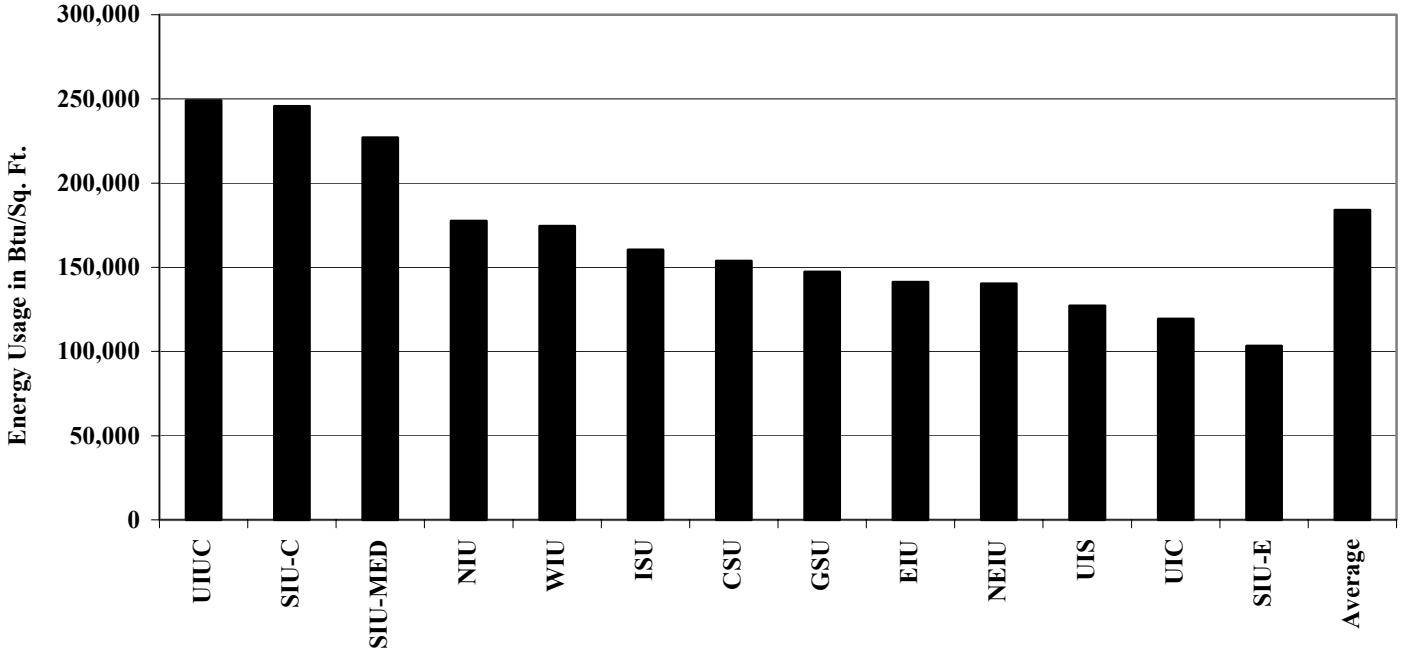
The range of annual savings identified by these three formulas is therefore $18 to $25 million.

III. Discussion

Illinois' public universities consume more than half of the energy of all state-owned facilities. In FY03 Illinois spent over $93 million to purchase electricity, natural gas, coal, steam, propane and fuel oil.[1] In order to make recommendations for energy efficiency and conservation in our public universities, it is imperative that we understand current usage patterns as well as the actions that have already been taken to reduce energy consumption. Future directions in energy efficiency improvements should be based on lessons learned from past and present energy conservation projects in Illinois and throughout the nation.

Charts one through four depict the FY03 energy usage per square foot, energy costs in dollars per square foot, total energy costs, and total unit energy costs, respectively, for each university.

Chart 1
FY03 Energy Usage at Illinois Public Universities



***UIUC and UIC campuses generate a significant portion of their electricity on campus.**

[1]**Tables A-1 and A-2, in the Appendix, show comparisons of energy costs and usage for the public universities for FY95 through FY03. Table A-3 documents data regarding the changes in average cost of energy (in $/MBtu) over the same time period.**

Chart 2
FY03 Energy Costs per Square Foot at Illinois Public Universities

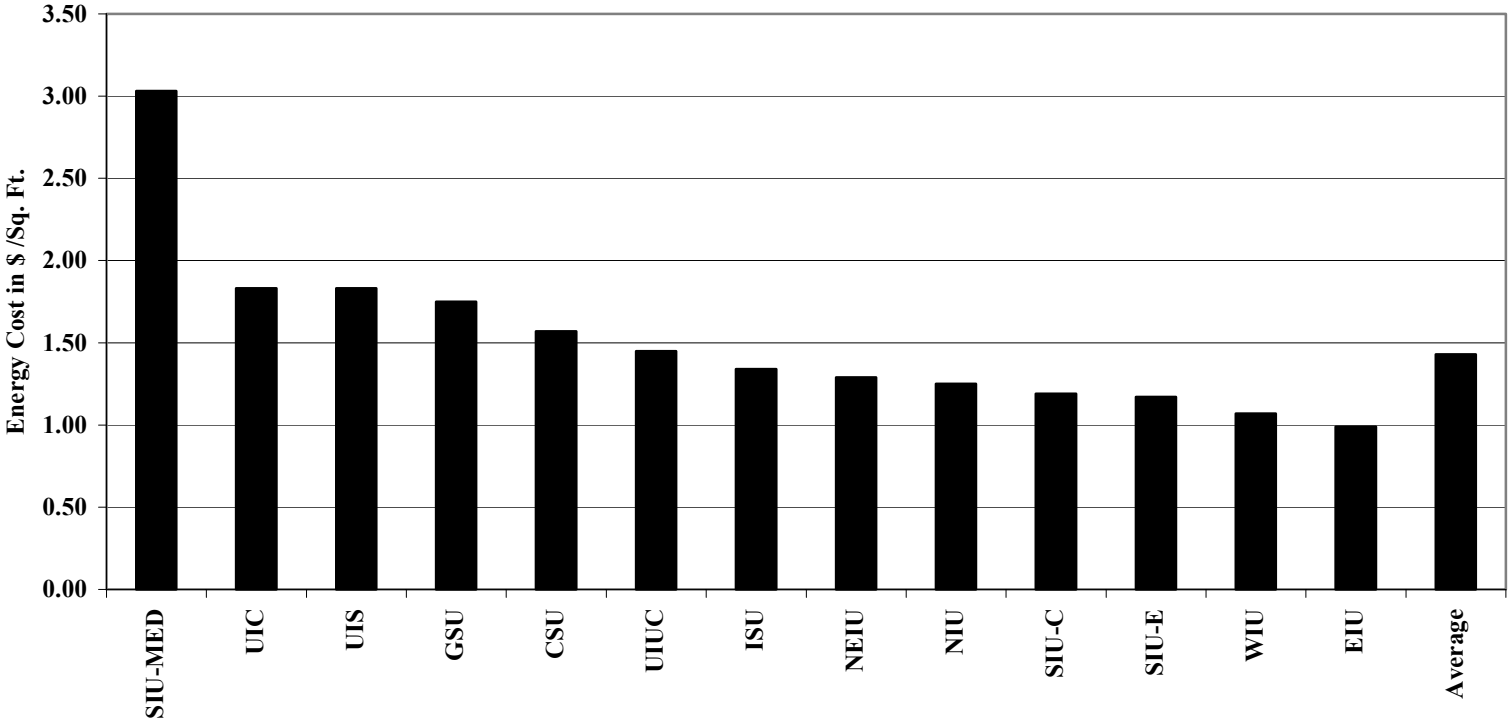


Chart 3
FY03 Energy Costs at Illinois Public Universities

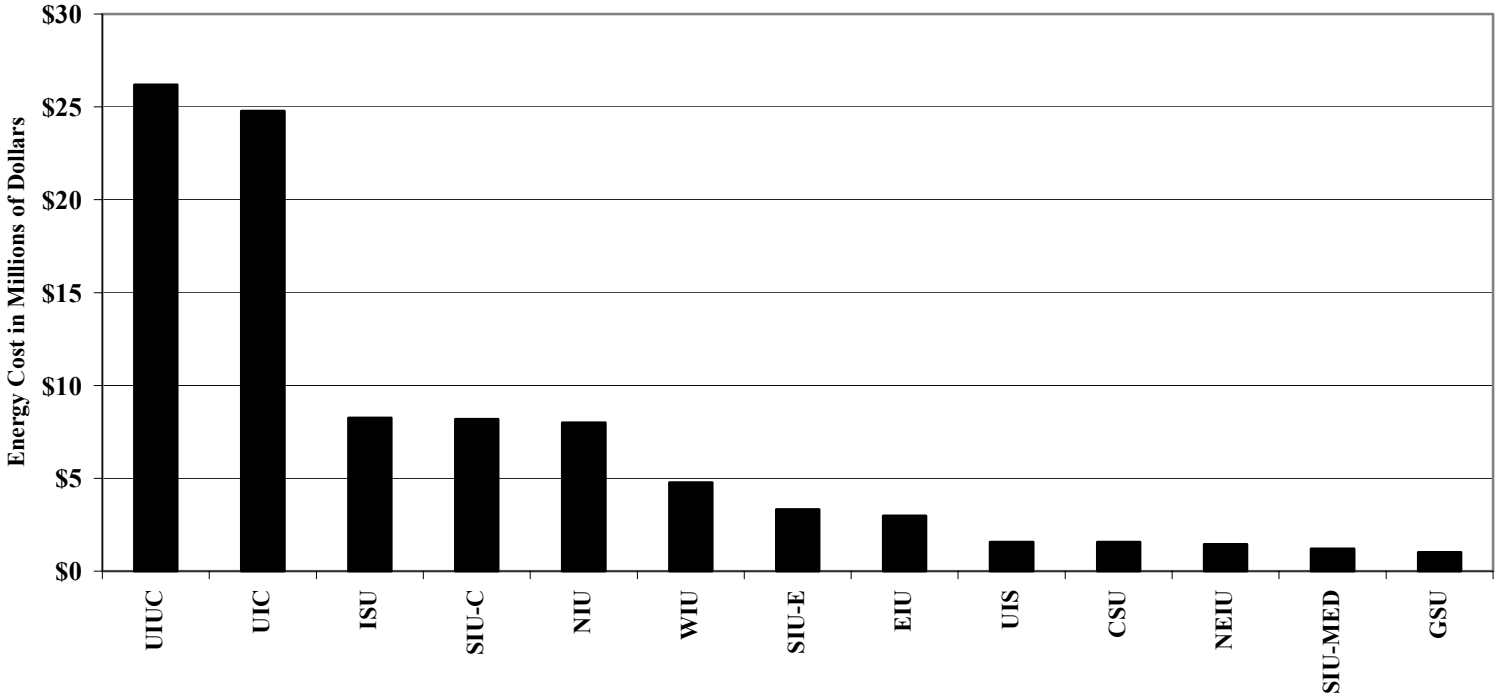
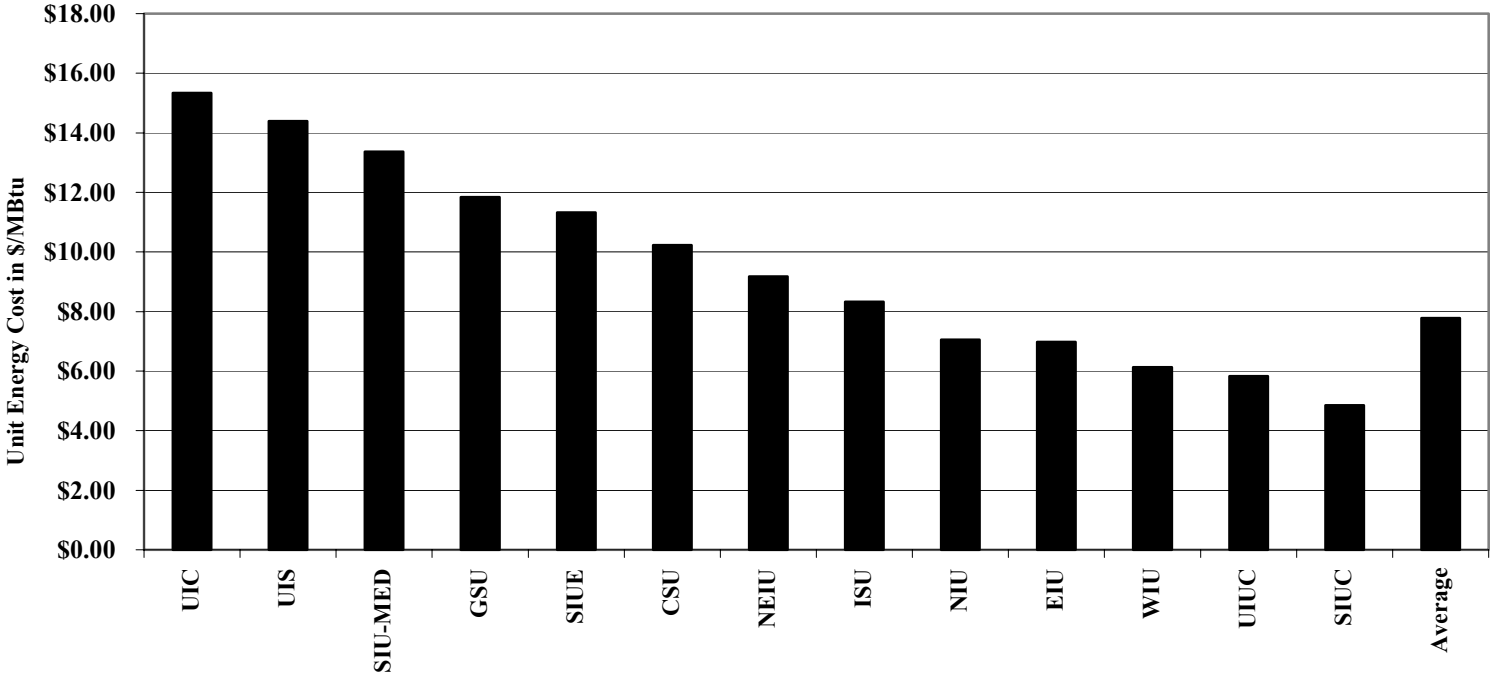


Chart 4
FY03 Average Unit Energy Costs at Illinois Public Universities



***UIUC and UIC campuses generate a significant portion of their electricity on campus.**

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).

Additional data regarding the energy use and cost for each of the campuses from FY95 through FY03 are available in the Appendix. 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.*

In order to assess energy conservation efforts at these universities, both current and past, site visits were conducted or contacts were made to each campus. Extensive interviews were held with the facility operations personnel to gather detailed information regarding projects with potential impacts on energy usage. Individual reports were generated, either by university personnel or DCEO engineers, for each of the campuses and are available for download at: **http://www.illinoisbiz.biz/efficientuniversities.html**. Each of the university reports includes a number of energy conservation or efficiency activities conducted at each campus with corresponding energy savings, where available, as well as (incomplete) lists of prospective

energy conservation measures that have not yet been, but should be, implemented. These lists are not exhaustive due to limits on currently available information. Motivation for the projects and funding mechanisms utilized varies from university to university; however, the desire to conserve energy and control energy costs is evident among personnel in all cases. Energy efficiency is a cost-effective means to reduce energy expenditures for university facilities while increasing building comfort.

IV. Energy Conservation Projects FY95 through FY03

Although all of the campuses have undertaken various energy conservation projects since 1995, there remain definite opportunities for improved energy efficiency and building comfort at each university. Some of the projects that have been completed targeted electricity savings while others focused on saving natural gas, coal, steam, fuel oil or water. Some projects did not result in energy savings at all, but achieved a reduction in facility operating costs.

Projects implemented over the past nine years can be grouped into five categories:

1) Performance Contracting Projects
2) Capital Development Board Projects
3) Institutional Conservation Program Projects
4) Operations and Maintenance Projects
5) Combined Heat and Power (CHP) Projects

1. Performance Contracting Projects

Performance contracting provides a practical means for improving the comfort level and productivity of a facility, without significant capital investment, by financing the cost of efficiency improvements through guaranteed energy savings. An Energy Service Company (ESCO), under a long-term contract, completes the renovations and guarantees projected savings based on the facility's past energy performance.

During the Edgar administration, five of the state's public universities entered into performance contracts, which paid for facility improvements with the savings generated from energy conservation measures implemented. Ten contracts with a total value of more than $38 million are currently in place. Eastern Illinois University and Northern Illinois University have capitalized on the performance contract method to fund energy conservation with $14.2 million and $11.9 million of contracts currently in place, respectively. Smaller performance contracts ($5.9 million, $4.2 million, $1.9 million) have been initiated at Chicago State University, Southern Illinois University-Edwardsville and Governors State University.

The combined savings from the contracts at these five universities will amount to almost $63 million over their ten-year terms. The projects that were implemented at SIUE and EIU were part of a pilot performance contract project that encompassed $20 million of projects at seven state facilities with guaranteed savings of more than $2.6 million annually. The pilot program was established in 1994 through the Department of Commerce and Community Affairs' Energy Division. University personnel at Northern Illinois University, Chicago State University and

Governors State University initiated their own performance projects after legislation was enacted in 1998 that allowed public universities to enter into ten-year term performance contracts. Table one lists information on costs and savings guarantees from these performance contracts.

Those projects, judged alone, were a tremendous success. That success, however, did not lead to the standardization of energy efficient practices in the rest of the university or state government system. Lost savings opportunities have cost the state tens of millions of dollars.

There remains great potential for savings through energy performance contract projects in universities. Performance contracting projects should be more heavily utilized to realize the greatest savings. Therefore, a system needs to be developed to continuously identify opportunities and inefficiencies for new performance contracts in state-owned facilities.

Table 1
Performance Contract Projects at Illinois Public Universities

University	Year	Cost ($)	Annual Savings ($)
Eastern Illinois University	1996	$3,416,222	$532,883
	2001	$10,800,000	$1,200,000
Southern Illinois University at Edwardsville	1996	$4,151,267	$585,371
Northern Illinois University	1999	$388,041	$45,422
	2001	$1,601,020	$236,396
	2002	$2,000,000	$587,545
	2002	$2,399,477	$589,321
	2003	$5,536,079	$1,372,896
Chicago State University	1999	$5,933,400	$836,200
Governors State University	1999	$1,900,000	$280,550
	Totals	**$38,125,506**	**$6,266,584**

Performance contract projects often integrate energy efficiency training for operation and maintenance staff and may require a maintenance component to ensure that equipment performs as efficiently as possible throughout the ten-year term of the contract. This is an attractive feature of the performance contract financing method. More detailed descriptions of the individual performance contracts and associated energy conservation strategies are detailed in the university-specific reports available online at:

http://www.illinoisbiz.biz/efficientuniversities.html.

In most cases, savings from energy conservation measures such as lighting retrofits were used to supplement energy efficiency upgrades with less attractive returns on investment. The Phase III performance contract at NIU was unique in that it used the savings from upgrading the design of the HVAC system of a new building to pay for the incremental cost increase for the more efficient systems. Other energy conservation measures that were funded through performance contracts at these universities included:

- Chiller replacement
- Boiler replacement
- Conversion to variable speed drives for pumps and motors
- HVAC conversions to variable air volume
- Pipe insulation
- Valve insulation
- Energy management systems
- Burner upgrades
- Steam trap repair
- Installation of cooling towers
- Installation of combined heat and power (CHP) equipment
- Conversion from incandescent to LED exit lights
- Pump and piping modifications

2. Capital Development Board Projects

The Illinois Board of Higher Education (IBHE) is mandated to make recommendations to the Governor and General Assembly regarding the budgetary needs of colleges and universities for operations and maintenance grants and capital improvements.

The FY04 recommendations for capital improvements total $341.8 million from requests totaling over $1.2 billion. Specific components include $30.0 million for Capital Renewal projects, including $20.0 million in Capital Development Funds and $10.0 million in Build Illinois Funds, and $311.8 million for Regular Capital projects, including $156.2 million for public universities, $152.6 million for community colleges, and $3.0 million for the Illinois Mathematics and Science Academy. The final capital appropriation approved by the Governor and the Ninety-third General Assembly for FY04 was $111.7 million.

Guidelines adopted by the Legislative Audit Commission prohibit the use of state-appropriated funds for auxiliary enterprises unless authorized by specific enabling legislation or by an appropriation specifically for the auxiliary enterprise. Auxiliary enterprise facilities include, but are not limited to dormitories, student unions, and athletic facilities. Proceeds from the sale of revenue bonds by the institutions, revenues from student and other user fees, private donations to the institutions, and federal grants support improvements to these facilities and their related operating and maintenance costs. State statutes require each state-supported higher education institution to submit its plans for such projects to the Illinois Board of Higher Education for approval prior to making any final commitments related to the project.

The Capital Renewal program funds infrastructure repair and maintenance requirements as well as upgrades for academic and instructional spaces for colleges and universities. Capital Renewal projects are generally of lesser size and scope than regular capital projects and generally will reduce the backlog of deferred maintenance on college and university campuses. Universities submit their annual capital requests to the IBHE. These requests include specific funding needs and a prioritized list of requested projects. The institutions each determine the criteria they will use in developing their respective priority lists.

There are many considerations that universities make when developing their priority lists. Concerns include:

- preventing disruption in daily operation;
- maintaining and protecting the state's investment in educational facilities;
- providing a safe work area and adequately controlled environment for occupants;
- providing accessibility improvements;
- providing equipment to complete state funded facilities; and
- providing funds to complete projects, where funds have been previously appropriated.

In addition to maintaining and improving existing facilities and completing ongoing projects, universities consider the need to construct new facilities and renovate existing space for instructional, public service, and research program activities. Requested projects may fund new facilities for new and expanding programs, or they may fund the renovation of existing facilities to provide necessary technology or specialized space for changing programs. Implementing energy efficiency improvements at all state universities, based on the results of site-specific, investment-grade energy assessments conducted by independent assessors, will reduce energy expenditures, thereby making funds available for additional improvements to facilities or to reduce deferred maintenance.

3. Institutional Conservation Program Projects

In the past, Illinois' universities have been able to take advantage of the Institutional Conservation Program (ICP) to assist in financing energy conservation projects. ICP, a federal program formerly administered by DCEO, helped schools (including universities) and hospitals reduce energy consumption by implementing energy efficiency improvements.

The University of Illinois at Chicago and the University of Illinois at Urbana/Champaign have had almost $10 million of energy conservation projects partially funded through ICP grants between 1990 and 1998. Eastern Illinois University and Southern Illinois University have also had projects partially financed through the ICP. These projects combined are saving more than $500,000 annually.

While ICP was a strong federal program, and produced clear benefits for public institutions, it has been discontinued, and funding under ICP is no longer available.

4. Operations and Maintenance Projects

Another method universities have used to fund energy conservation is through their operation and maintenance budgets (O&M). O&M efficiency improvements can include both equipment purchasing through O&M budgets as well as training improvements for facilities managers. Examples of O&M budgeted efficiency purchasing include acquisition of properly sized, efficient pumps and motors to replace failed units, testing and replacing faulty steam traps, or implementing other conservation strategies such as systematically controlling energy use.[2] *Simple implementation of proper maintenance practices and increased efficiency training, independent of any significant capital improvements, can save large commercial private sector facilities as much as 5% of total energy costs. This report finds no evidence to suggest that Illinois' public universities should anticipate any lesser savings.*

Individual instances of improper maintenance of equipment can cause that equipment to consume 200% or more energy than it was designed to use. For example, in May 2001, 71 steam traps on the GSU steam system were checked and faulty traps were identified. Repairing the failed traps resulted in over $25,000 in annual savings. Simple proper maintenance, without expensive capital improvements, can yield substantial annual savings on utility bills. Additionally, O&M funds are used to reduce the backlog of deferred maintenance items or to fund permanent improvements that may also affect energy consumption.

Whether the purchases of new, efficient equipment are implemented through performance contracts, CDB, the ICP or O&M budgets, the operation of this equipment has as significant an impact on energy consumption as the equipment design. If energy savings are to be achieved, as a result of new equipment, the equipment operators must receive training in the latest techniques and practices. At most universities this type of training has been supplied by equipment manufacturers or vendors but several universities send personnel for specific outside training. For instance, EIU recently sent 12 of its operations staff to a Building Operator Certification (BOC) training series sponsored by DCEO and the Midwest Energy Efficiency Alliance.

The goal of the BOC program is to train building operators to lower operations costs, reduce natural gas consumption, prolong the life of equipment, and protect the environment from unnecessary pollution. More than 90% of BOC participants and their supervisors say their training has improved comfort, saved energy, or saved money in their facilities.

BOC offers clear advantages, including increased employee productivity, decreased utility bills and unscheduled maintenance, and preparation for changing needs in facilities management. The program is available for both private business building operators and state building operators, allowing both entities to save on building energy costs.

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[2] In 2003 NIU closed one building during the summer months and operated most of the remainder of the campus only four days per week. This required the relocation of some offices and classes. NIU uses an Energy Management System to reduce electricity costs by shutting off non-essential equipment when electric demand reaches a preset maximum limit.

Due to the low-cost, high-return nature of operations and maintenance efficiency improvements, universities should include an aggressive O&M component in their overall energy cost reduction plans.

5. Combined Heat and Power (CHP) Projects

Combined Heat and Power (CHP) systems (also known as Cogeneration) generate electricity and useful thermal energy in a single, integrated system. CHP contrasts to the common practice of purchasing electricity (generated at a remote power plant) while using on-site heating and cooling equipment to meet non-electric energy requirements. The thermal energy recovered in a CHP system is used for the heating and cooling of buildings. Because CHP captures the heat that would otherwise be wasted in the traditional generation of electricity, the total efficiency of these integrated systems is much greater than the efficiency of traditional separate systems. Because the efficiencies of CHP systems are higher, fuel costs are lower and pollution is sharply reduced.

Currently four universities are applying CHP technology at their campuses (Table 2). NEIU's system, installed in 1995, is not currently in use as a result of a utility pricing strategy to price power below the cost of the CHP system (the utility reduced the cost of purchased power following CHP equipment installation). When requested by their utility, GSU, under a special utility rider, reduces their load by 500KW through usage of an emergency generator. CSU uses two generators to reduce their load during peak demand periods. However, since the generators at GSU and CSU do not have heat recovery equipment, they are not true CHP systems.

CHP projects at the University of Illinois Chicago and the University of Illinois Urbana Champaign are full CHP projects and were funded through mechanisms very similar to performance contracts without performance guarantees. Certificates of Participation (COPs) were sold to fund projects to build new CHP facilities at both universities. The savings achieved from operating these facilities versus purchasing the needed electricity and thermal load is used to make the payment on the COPs.

The East Side CHP facility at UIC was completed in two phases (Phase I in 1993 and phase II in 2000) at a total cost of $36.5 million. The total plant capacity is 20 megawatts and 30 MBtu/hr heating capacity with approximately $3 million in annual savings.

The West Side CHP facility was completed in 2001. Its total plant capacity is 37 megawatts with a fired capacity of 120,000 pounds per hour of steam. This $40 million project provides operating savings of approximately $5.5 million annually. The university will continue to realize $5.5 million in annual savings on their utility expenses over the life of the equipment.

An expansion of UIUC's Abbott power plant is scheduled for completion in FY04 at a cost of $60 million. Two 13-megawatt gas turbines with heat recovery steam generators, two 12.5-megawatt extraction/condensing steam turbines and one 7-megawatt extraction/back pressure turbine are being installed. UIUC anticipates savings of $6 million per year with the new system.

Table 2.
Combined Heat and Power Systems

Facility	Size	Date Installed	Cost	Savings
UIC East Campus	20 megawatts	Phase I 1993 Phase II 2000	$36.5 Mil	$3 Mil/Yr.
UIC West Campus	37 megawatts	2001	$40 Mil	$5.5 Mil/Yr.
UIUC	58 megawatts	Installation will be complete 2004	$60 Mil	$6 Mil/Yr.
NEIU	3.1 megawatts	1995		Currently not in use.

V. New Building Design Standards, LEED, and ENERGY STAR®

New construction and comprehensive reconstruction planning decisions are also key energy cost savings opportunities. Campus energy plans can ensure that new buildings are built to the highest standards, locking in energy savings both in the near term and for future generations. "Green Building" designs furthermore have a strong track record of overall building performance beyond reduced energy costs—improved ventilation, higher levels of occupant comfort, and, most relevant to the mission of Illinois' universities, superior student performance[3]

Energy efficient construction practices meeting ASHRAE Energy Code 90.1 are currently required by Illinois law for all projects financed by the Capital Development Board. This ensures, minimally, that no outright energy sieves are built with state financing. Construction practices far superior to the ASHRAE code are however widely available, commonly achieving 20% annual cost reductions over the ASHRAE code, and potentially achieving 50% cost reductions beyond the code.

Modestly higher first-costs are the primary barrier to sustainable design for public building projects. *Acceptance of this barrier, however, indicates an inappropriate failure to account for total near-term and long-term building costs.* A green building requiring 35% less energy, and with substantially reduced maintenance and personnel costs, may have a first-cost 5-10% higher than standard construction. Proper accounting, however, evaluating not only the building first-cost, but also the energy and maintenance costs and improved occupant comfort and performance, demonstrates the lower total lifecycle cost of efficient building design.

Seeking to develop a single, nationally recognized standard for high-performance and sustainable buildings, the U.S. Green Building Council established the Leadership in Energy and Environmental Design (LEED) Green Building Rating System. With the LEED system, building performance is evaluated on the basis of energy efficiency, water efficiency, site sustainability, materials sustainability, and indoor environmental quality. LEED is a scoring system, based on

[3] **http://www.innovativedesign.net/paper.htm#student**

improvements relative to the standard ASHRAE code, providing for certification at a minimal threshold and for silver, gold, and platinum designations for higher achievement.

The LEED standard is frequently updated, which allows for continuous building efficiency improvements. Consistent with the principal recommendation of this report- that universities continue to make energy efficiency improvements at their facilities- universities, the Capital Development Board, and the Illinois Board of Higher Education should adopt LEED certification as a minimum standard for new university buildings (and specifically require that new buildings be at least 25% more efficient than standard code), ensuring that new construction and reconstruction projects in future years will continue to aggressively pursue energy savings.

In Illinois, Cook County has adopted the LEED standard for county facilities.

For a transitionary period of three to five years, until the LEED standard becomes the norm for public buildings, the Illinois Clean Energy Community Foundation should provide funding for the higher incremental costs associated with LEED certification for all Illinois Board of Higher Education new construction and major rehabilitation projects.

Further information on LEED standards is available from the U.S. Green Building Council, **http://www.usgbc.org/.**

Similarly, new office equipment purchases are also a key decision for energy practices. The U.S. Environmental Protection Agency and U.S. Department of Energy have cooperatively developed the ENERGY STAR ratings process to label appliances—including computers, printers, and other common office equipment—that are significantly more energy efficient than standard models. Universities, the Capital Development Board, and the Illinois Board of Higher Education should also require that all equipment purchases carry the ENERGY STAR logo if available for the product line in question.

VI. Illinois Clean Energy Community Foundation

The Illinois Clean Energy Community Foundation (ICECF) was established in 1999 by the Illinois Legislature to encourage the development of energy efficiency and renewable energy technologies in Illinois. The foundation was established with $225 million from Commonwealth Edison and is governed by a group of trustees appointed by the Governor, the Illinois General Assembly, and Commonwealth Edison.

The ICECF can and should make additional funds available to support comprehensive new energy plans at state universities. Such funding should support:

- New uniform energy information management software,
- Audits and assessments of existing facilities to identify efficiency improvements,
- New metering equipment as necessary to enable basic comparisons between facilities of similar types,
- BOC training for university facility managers,
- Actual equipment and facility upgrade costs, and

- Design assistance for new facilities to reduce the higher incremental costs of building those facilities to high efficiency standards (such as to LEED standards).

VII. Recommendations

Energy efficiency is a cost-effective strategy to reduce energy costs for Illinois' public universities. In order to achieve the greatest efficiency in these facilities, universities must have the information and financial resources readily available. The following recommendations will assist Illinois' public universities in this endeavor.

1.Principal Recommendation

Each university should establish a total utility management plan, and each of those plans should be established in coordination, utilizing a uniform shared energy information system. Major steps to implement this plan should include:

a) Each university should convene all relevant senior management, including the university President and the senior-most operations, purchasing, finance, and property management officers, together with an outside professional energy assessor, to develop a campus energy plan. This team will conduct a two-hour diagnostic assessment of their university's energy management practices. This assessment will produce clear recommendations for improvements, in priority order.

b) The senior management energy plan will result in data system improvements, improved operations and maintenance policies, and in physical, investment-grade building-specific assessments. Data system improvements will eliminate billing errors and reduce associated personnel costs, and should include additional metering equipment acquisitions as necessary. Improved operations and maintenance policies will facilitate the capture of low-or-no-capital-cost savings. Investment-grade building assessments will identify further operations and maintenance savings as well as necessary major capital improvements (and financing methods for those improvements).

c) Operations and cost-effective capital improvements should be implemented with financing appropriate to the current state fiscal situation. To immediately note one key specific example, the report details that several state universities have conducted successful performance contracting projects, allowing those facilities to finance energy improvements on the basis of projected energy efficiency savings and thereby capture positive cash flows from the first day of a project. To facilitate these improvements, each university should adopt specific annual efficiency goals for a three-year period. University departments should have their own subsidiary goals and be held accountable to those goals

2. Corollary Recommendations

Consistent with the above principal recommendations, and through the process outlined above, universities will identify numerous corollary recommendations to improve the energy efficiency of their operations. The following recommendations are very likely to be identified in that process:

a) Building Operator Certification ("BOC") training for all public university facility managers;
b) Increased utilization of energy performance contracting as an effective financing method;
c) Examination of additional combined heat and power ("CHP") applications;
d) Evaluating the potential to reduce energy costs through aggregated or bundled energy purchasing;
e) Adoption of LEED ("Leadership in Energy and Environmental Design") energy efficiency standards for new facilities and major rehabilitation projects; LEED standards, with a specific requirement that new buildings exceed standard code efficiency by 25%, should be supported by both CDB and IBHE;
f) Purchasing policy changes to allow for the higher incremental costs of choosing more efficient equipment versus standard equipment;
g) Establishing new procurement guidelines for ENERGY STAR® equipment;
h) Encouraging the IBHE to include energy efficiency as a visible component of the objectives used by the IBHE when establishing capital budget priorities;
i) Evaluating the effectiveness of utilizing Illinois Clean Energy Community Foundation and DCEO renewable energy funds to generate heat and power on campuses.

3. Final Recommendation: Collaboration

Campus energy efficiency plans will require the collaboration of diverse groups to succeed. One very positive example of such collaboration—already occurring on an Illinois public university campus—is the UIUC Energy Efficiency Technology Fee program, enacted through a referendum by students (passing with overwhelming support) and by the UIUC Board of Trustees. Proceeds from this student fee are anticipated to be $140,000 per year and will be used for targeted clean energy improvements on campus.

Implementation of projects using the fee's funding will also give students a constructive voice in the campus energy management planning process. Student and faculty groups on other campuses should emulate this model of positive collaboration in their own campus energy plans. Achieving greater energy efficiency at Illinois' public universities will require the active and creative support of all university faculty, staff, and students.

Achieving greater energy efficiency at Illinois' public universities must be a joint venture beyond the campus grounds. It will require support and funding from a variety of parties including the Legislature, the Capitol Development Board (CDB), the Illinois Board of Higher Education (IBHE), Central Management Services (CMS), the Illinois Clean Energy Community Foundation (ICECF), and the private sector.

VIII. Acknowledgements

DCEO would like to thank State Representative Robert Flider of Decatur for his efforts in sponsoring House Resolution 222 and Speaker of the House Michael J. Madigan, and Jack Unzicker of his office, for their assistance in the development of the Resolution.

Equally, the generation of this report would not have been possible without the cooperation and assistance of the Board of Higher Education and staff at each of the public universities, including but not limited to those listed below.

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Appendix

The following tables provide data collected from each university regarding energy costs, energy usage, average unit cost, and building area. However, since many university facilities are not individually metered, it is impossible to make comparisons to similar facilities (even though each university can, for example, state the total aggregate costs per square foot for its facilities). Furthermore, each university is using a different management system for utility data, also rendering many of the most important similar-facility-comparisons impossible.

Table A-1 indicates total energy costs per square foot. Eastern Illinois University, with low energy consumption per square foot (per Table A-2), and relatively low costs per energy unit (Table A-5), boasts the lowest total energy costs among Illinois public universities—over 40% lower than the statewide average. EIU's strong track record of implementing energy performance contracts and energy conservation measures are extremely important factors in the university's lower costs.

Table A-1
Energy Costs at Illinois' Public Universities in Dollars per Square Foot

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
University of Illinois									
Urbana Champaign	$1.29	$1.34	$1.39	$1.53	$1.43	$1.41	$1.62	$1.40	$1.45
Chicago	$2.59	$2.60	$2.74	$2.56	$2.90	$2.28	$3.01	$2.25	$1.83
Springfield	$1.05	$1.20	$1.20	$1.29	$1.35	$1.36	$1.80	$1.68	$1.83
Southern Illinois University									
Carbondale	$1.24	$1.41	$1.36	$1.29	$1.15	$1.13	$1.27	$1.17	$1.19
Edwardsville	$1.39	$1.44	$1.45	$1.36	$1.34	$1.28	$1.61	$1.26	$1.17
School of Medicine	$2.30	$2.08	$2.10	$2.20	$1.83	$2.03	$3.35	$3.25	$3.03
Eastern Illinois University	$1.13	$1.35	$1.34	$1.40	$1.24	$1.28	$1.15	$1.03	$0.99
Western Illinois University	$0.80	$0.97	$1.06	$1.00	$0.99	$0.95	$1.23	$1.06	$1.07
Northern Illinois University	$1.13	$1.26	$1.41	$1.30	$1.29	$1.21	$1.53	$1.25	$1.25
Northeastern Illinois University	$1.23	$1.38	$1.51	$1.41	$1.63	$1.71	$1.99	$1.79	$1.29
Illinois State University	$1.03	$1.20	$1.26	$1.26	$1.24	$1.19	$1.48	$1.39	$1.34
Chicago State University	$1.41	$1.75	$1.79	$2.04	$1.51	$1.52	$1.59	$1.48	$1.57
Governors State University	$2.04	$2.39	$2.00	$2.01	$1.67	$1.48	$1.87	$1.46	$1.75
Universities average	$1.42	$1.55	$1.60	$1.59	$1.55	$1.47	$1.79	$1.51	$1.43

Table A-2
Energy Usage at Illinois' Public Universities in Btu's per Square Foot

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
University of Illinois									
Urbana Champaign	323,777	316,325	305,041	339,868	338,116	294,681	288,710	244,805	249,088
Chicago	187,665	189,913	184,683	176,480	196,145	155,097	157,038	119,126	119,503
Springfield	95,787	109,582	107,958	114,723	119,627	114,828	138,223	135,482	127,210
Southern Illinois University									
Carbondale	229,189	256,823	250,430	246,998	255,157	209,977	281,388	239,377	245,713
Edwardsville	190,618	160,292	164,897	156,018	160,178	136,892	144,925	106,087	103,230
School of Medicine	206,553	176,560	185,560	189,455	158,867	169,455	253,650	237,286	227,044
Eastern Illinois University	204,724	208,001	193,339	204,605	186,566	222,266	188,477	169,699	141,208
Western Illinois University	158,739	170,309	185,968	176,713	186,516	167,737	194,262	178,380	174,561
Northern Illinois University	173,821	176,899	178,429	160,328	164,085	148,349	172,721	160,630	177,592
Northeastern Illinois University	160,403	180,398	128,016	136,934	124,545	133,587	137,350	129,558	140,276
Illinois State University	162,204	177,565	191,360	174,782	170,286	156,870	168,117	160,147	160,353
Chicago State University	130,807	159,220	154,461	137,807	131,209	127,912	168,192	154,167	153,802
Governors State University	184,255	219,173	165,925	157,274	140,471	129,096	131,632	133,845	147,423
Universities average	222,683	227,097	222,876	226,862	228,636	200,510	213,252	181,259	184,073

Table A-3
Energy Costs by University

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
University of Illinois									
Urbana Champaign	$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
Chicago	$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
Springfield	$799,300	$908,600	$912,820	$980,280	$1,014,340	$1,078,100	$1,423,900	$1,430,000	$1,574,796
Southern Illinois University									
Carbondale	$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
Edwardsville	$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
School of Medicine	$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
Eastern Illinois University	$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
Western Illinois University	$3,457,700	$4,186,100	$4,568,900	$4,440,200	$4,416,000	$4,202,900	$5,519,000	$4,705,400	$4,765,642
Northern Illinois University	$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
Northeastern Illinois University	$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
Illinois State University	$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
Chicago State University	$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
Governors State University	$957,800	$1,124,200	$1,162,800	$1,166,600	$967,600	$861,000	$1,081,700	$845,300	$1,012,466
totals	$76,869,680	$87,981,710	$90,701,980	$90,784,530	$86,887,520	$89,743,630	$109,764,200	$97,175,100	$93,289,245

*Does not include costs for gasoline or diesel fuel

Table A-4
Energy Usage by University (MBtu's)*

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
University of Illinois									
Urbana Champaign	4,869,612	5,061,193	4,856,245	5,410,696	5,125,838	4,924,124	4,850,330	4,188,606	4,491,057
Chicago	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
Springfield	72,798	83,282	82,048	87,190	89,720	90,714	109,196	115,160	109,401
Southern Illinois University									
Carbondale	1,459,935	1,635,963	1,595,239	1,659,825	1,778,442	1,448,843	1,919,063	1,642,128	1,685,591
Edwardsville	461,297	387,906	397,401	376,004	389,233	353,182	376,804	301,287	293,174
School of Medicine	101,211	93,577	94,636	100,411	100,086	99,978	101,460	94,914	90,817
Eastern Illinois University	601,890	621,924	580,017	613,815	559,698	582,336	559,776	504,006	427,860
Western Illinois University	682,577	732,328	799,662	782,840	828,129	743,076	868,350	793,790	776,798
Northern Illinois University	935,156	994,175	1,002,773	901,042	933,646	940,535	1,098,505	1,026,425	1,134,811
Northeastern Illinois University	166,820	187,614	133,136	142,412	140,736	144,274	149,712	142,514	157,109
Illinois State University	877,521	960,629	1,056,308	971,788	946,789	942,789	1,023,830	989,709	990,981
Chicago State University	107,262	151,259	146,738	130,916	131,209	127,912	168,192	154,167	153,802
Governors State University	86,600	103,011	96,236	91,219	81,473	74,876	76,346	77,630	85,505
Total	12,051,612	12,908,196	12,628,167	12,976,485	12,803,612	12,253,150	13,104,361	11,631,391	12,012,590

*Does not include gasoline or diesel fuel

Table A-5
Average Unit Costs by University ($/MBtu)

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
University of Illinois									
Urbana Champaign	$3.97	$4.25	$4.55	$4.52	$4.22	$4.78	$5.59	$5.72	$5.83
Chicago	$13.81	$13.71	$14.82	$14.49	$14.78	$14.71	$19.14	$18.91	$15.34
Springfield	$10.98	$10.91	$11.13	$11.24	$11.31	$11.88	$13.04	$12.42	$14.39
Southern Illinois University									
Carbondale	$5.42	$5.49	$5.43	$5.22	$4.52	$5.40	$4.51	$4.88	$4.85
Edwardsville	$7.32	$9.01	$8.81	$8.72	$8.34	$9.35	$11.12	$11.83	$11.32
School of Medicine	$11.16	$11.79	$11.32	$11.63	$11.50	$11.97	$13.19	$13.70	$13.36
Eastern Illinois University	$5.51	$6.47	$6.95	$6.84	$6.65	$5.77	$6.12	$6.07	$6.98
Western Illinois University	$5.07	$5.72	$5.71	$5.67	$5.33	$5.66	$6.36	$5.93	$6.13
Northern Illinois University	$6.48	$7.10	$7.91	$8.09	$7.87	$8.19	$8.85	$7.77	$7.05
Northeastern Illinois University	$7.69	$7.67	$11.78	$10.26	$13.09	$12.80	$14.52	$13.81	$9.18
Illinois State University	$6.37	$6.77	$6.61	$7.22	$7.29	$7.58	$8.81	$8.67	$8.33
Chicago State University	$10.81	$10.98	$11.61	$14.78	$11.50	$11.89	$9.43	$9.60	$10.23
Governors State University	$11.06	$10.91	$12.08	$12.79	$11.88	$11.50	$14.17	$10.89	$11.84
Total	$6.38	$6.82	$7.18	$7.00	$6.79	$7.32	$8.38	$8.35	$7.78

Table A-6
Building Area by University (millions of square feet)

	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03
University of Illinois									
Urbana Champaign	15.04	16.00	15.92	15.92	15.16	16.71	16.80	17.11	18.03
Chicago	8.68	9.98	9.68	9.68	8.66	11.48	11.48	13.44	13.52
Springfield	0.76	0.76	0.76	0.76	0.75	0.79	0.79	0.85	0.86
Southern Illinois University									
Carbondale	6.37	6.37	6.37	6.72	6.97	6.90	6.82	6.86	6.86
Edwardsville	2.42	2.42	2.41	2.41	2.43	2.58	2.60	2.84	2.84
School of Medicine	0.49	0.53	0.51	0.53	0.63	0.59	0.40	0.40	0.40
Eastern Illinois University	2.94	2.99	3.00	3.00	3.00	2.62	2.97	2.97	3.03
Western Illinois University	4.30	4.30	4.30	4.43	4.44	4.43	4.47	4.45	4.45
Northern Illinois University	5.38	5.62	5.62	5.62	5.69	6.34	6.36	6.39	6.39
Northeastern Illinois University	1.04	1.04	1.04	1.04	1.13	1.08	1.09	1.10	1.12
Illinois State University	5.41	5.41	5.52	5.56	5.56	6.01	6.09	6.18	6.18
Chicago State University	0.82	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00
Governors State University	0.47	0.47	0.58	0.58	0.58	0.58	0.58	0.58	0.58
Total	54.12	56.84	56.66	57.20	56.00	61.11	61.45	64.17	65.26

Table A-7
State of Illinois Public University Energy Costs
FY95-FY03

	Natural Gas	Electricity	Coal	Steam	Fuel Oil	Propane	Total
FY95	$15,479,150	$53,154,520	$3,150,850	$4,963,760	$68,220	$53,180	$76,869,680
FY96	$19,690,680	$57,911,070	$3,787,270	$5,753,240	$779,020	$60,430	$87,981,710
FY97	$21,934,150	$57,535,580	$3,312,420	$7,206,050	$662,270	$51,510	$90,701,980
FY98	$21,653,250	$58,445,190	$4,041,590	$6,120,410	$495,910	$28,180	$90,784,530
FY99	$17,404,920	$60,010,800	$3,517,520	$5,507,410	$427,880	$18,990	$86,887,520
FY00	$17,632,430	$60,629,290	$4,058,900	$6,676,950	$726,940	$19,120	$89,743,630
FY01	$28,596,700	$67,005,100	$5,263,500	$7,287,800	$1,586,000	$25,100	$109,764,200
FY02	$19,486,700	$68,083,900	$3,132,200	$6,371,100	$72,600	$28,600	$97,175,100
FY03	$29,728,913	$59,434,524	$3,655,209	----------	$457,946	$12,653	$93,289,245

Table A-8
State of Illinois Public University Energy Usage (MBtu)
FY95-FY03

	Natural Gas	Electricity	Coal	Steam	Fuel Oil	Propane	Total
FY95	6,285,138	3,045,200	2,163,755	532,539	16,309	8,671	12,051,612
FY96	6,342,136	3,141,039	2,621,595	585,394	209,532	8,499	12,908,196
FY97	6,236,603	3,219,646	2,403,917	576,305	185,537	6,159	12,628,167
FY98	6,184,973	3,256,857	2,881,014	523,553	126,016	4,072	12,976,485
FY99	6,031,766	3,391,306	2,746,323	521,664	109,821	2,731	12,803,612
FY00	5,167,302	3,447,562	2,908,373	530,237	197,174	2,501	12,253,150
FY01	4,584,566	3,535,646	4,225,930	550,237	205,817	2,165	13,104,361
FY02	4,914,031	3,764,378	2,473,660	462,611	13,175	3,536	11,631,391
FY03	5,588,278	3,472,931	2,843,384	---------	106,600	1,397	12,012,590

Table A-9
State of Illinois Public University Energy Unit Costs ($/MBtu)
FY95-FY03

	Natural Gas	Electricity	Coal	Steam	Fuel Oil	Propane	Average
FY95	$2.46	$17.46	$1.46	$9.32	$4.18	$6.13	$6.38
FY96	$3.10	$18.44	$1.44	$9.83	$3.72	$7.11	$6.82
FY97	$3.52	$17.87	$1.38	$12.50	$3.57	$8.36	$7.18
FY98	$3.50	$17.95	$1.40	$11.69	$3.94	$6.92	$7.00
FY99	$2.89	$17.70	$1.28	$10.56	$3.90	$6.95	$6.79
FY00	$3.41	$17.59	$1.40	$12.59	$3.69	$7.64	$7.32
FY01	$6.24	$18.95	$1.25	$13.24	$7.71	$11.59	$8.38
FY02	$3.97	$18.09	$1.27	$13.77	$5.51	$8.09	$8.35
FY03	$5.32	$17.11	$1.29	-----	$4.30	$9.06	$7.78