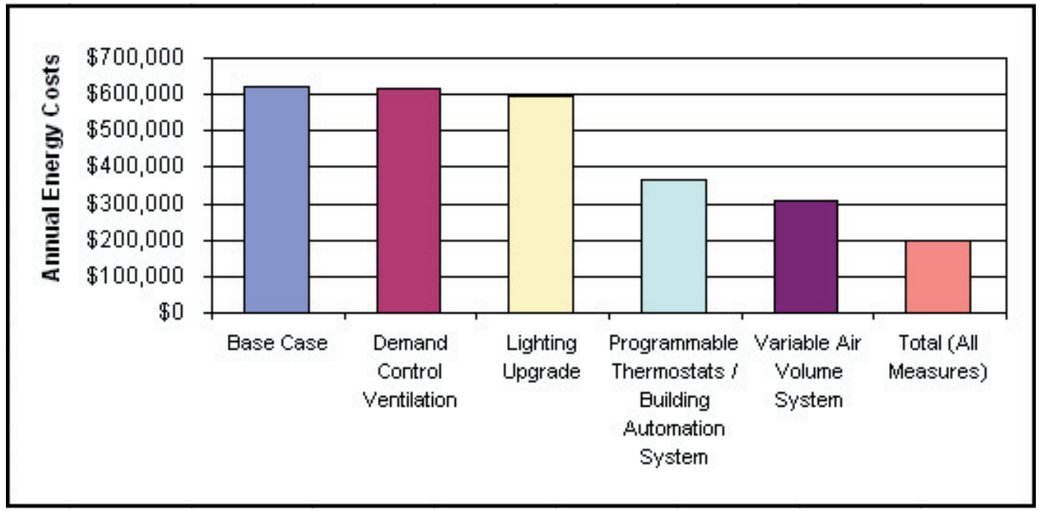
Looking Forward

Implementing energy efficiency measures is a proven method of controlling costs. Organizations that take a systematic and strategic approach to energy management enjoy a broad array of tangible and intangible benefits. We have entered an increasingly complex and volatile energy marketplace requiring a new emphasis on measuring and maximizing energy productivity.

The results of the audit show a significant opportunity to reduce the Illini Union's energy consumption. Implementing these recommendations at this prestigious and highly frequented building would showcase the University's commitment to energy efficiency and serve as a model for the entire University. Chancellor Richard Herman has recently stressed the importance of energy conservation on campus. An energy task force has been created, classes have performed audits on additional buildings, and several other steps have been taken to reduce energy consumption. If measures similar to those found in the Union were employed on other campus buildings, a multiplication of these considerable savings could be attained.



Estimated annual energy costs after implementation of efficiency measures

Efficiency Measure	Implementation Cost	Energy Saved (Million Btu/yr)	Annual Cost Savings	GHG Emissions Reduction (Tons)	Annual Return
Demand Control Ventilation	$25,000	1,056	$8,465	61	32%
Lighting Upgrade	$90,503	3,477	$28,968	469	30%
Programmable Thermostats/ Building Automation System	$602,500	24,638	$256,910	2,542	42%
Variable Air Volume System	$2,299,398	30,007	$313,004	3,570	12%
Total (All Measures)	$3,017,401	40,755	$423,391	4,817	13%

Results from energy analysis for different efficiency measures



Smart Energy Design Assistance Center

SEDAC SUMMARY REPORT, August 2007

About SEDAC

The Smart Energy Design Assistance Center (SEDAC) provides advice and analyses, enabling small businesses in the State of Illinois to increase their profitability through the efficient use of energy resources. SEDAC is sponsored by the Illinois Department of Commerce and Economic Opportunity's *Small Business $mart Energy Program (SB$E)* and provides its valuable services at no cost to small businesses. SEDAC is managed by the University of Illinois at Urbana-Champaign.

Building Data
Location: Urbana, Illinois
Floor Space: 283,150 sf
Energy Use Intensity: 201 kBtu/sf/yr
Annual Energy Cost: $623,349
Energy Cost Intensity: $2.20/sf/yr

Unit Cost of Utilities:
$0.05/kWh electricity
$8.49/kLb steam
$8.55/MBtu chilled water

Impact from Recommended Energy Efficiency Measures:
Cost of Measures: $3,017,401
Annual Savings:
- Total: $423,391
- Electric: 885,638 kWh
- Steam: 24,833 kLb
- Chilled Water: 13,639 MBtu
- Greenhouse Gases: 4,817 tons

Summary of Recommendations:
- Lighting Upgrades
- Variable Air Volume System
- Programmable Thermostats
- Thermostat Settings
- Demand Control Ventilation
- Building Automation System

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Illini Union Energy Renovation

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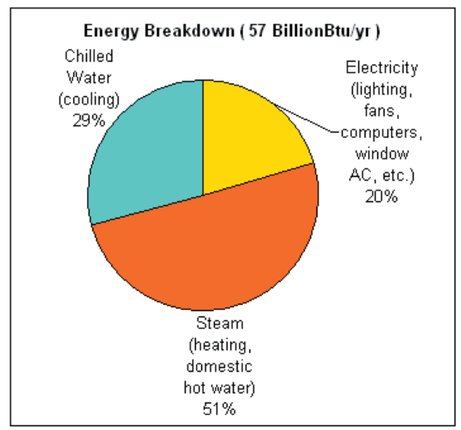
Since the spring of 2003, students at UIUC demonstrated leadership in environmental stewardship through a self imposed $2 per semester fee to jump start clean energy and energy efficiency projects on campus. The Student Clean Energy Committee allocated $50,000 from this fund towards an energy audit of the university's landmark Illini Union. In the summer of 2006, student volunteers gathered building data, which the Smart Energy Design Assistance Center (SEDAC) subsequently analyzed. Funds remaining after the audit were made available for recommended efficiency measures. The energy and cost impacts of several energy efficiency measures were evaluated by SEDAC. Recommendations for an impressive $423,391 per year cost savings (68% of current costs) and 71% energy savings were compiled.

The Illini Union serves as a community center for students, faculty, staff, and guests by offering diverse university and community programs, entertainment, services, study lounges, hotel facilities, and assorted food service options.

Current Energy Consumption

The Union's energy consumption is high because of its antiquated lighting and outdated heating, ventilating, and air conditioning system (HVAC) which employs control schemes that were developed before energy efficiency was a concern. The Union spends about $623,349 each year on utilities. Modern, more efficient technologies could provide the required lighting and space conditioning while using only a third of the present energy total, cutting utility costs by 68%, and reducing emissions of green house gases by 4,817 tons.



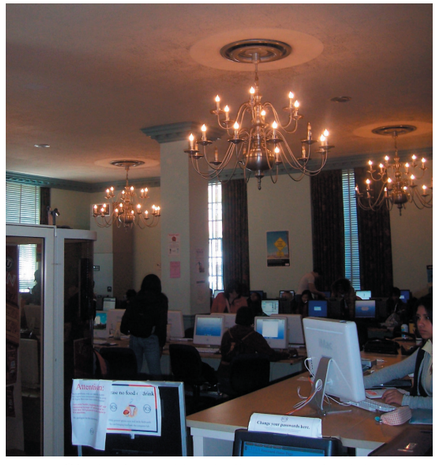
Recommendations

SEDAC recommends the following Building Modifications:

- Lighting Upgrade
- Variable Air Volume HVAC System
- Programmable Thermostats and Building Automation System
- Demand Control Ventilation

Lighting Upgrade

SEDAC recommends replacing existing lamps and lighting controllers (ballasts) with more efficient, longer lasting models. Incandescent lamps should be replaced with fluorescents. Older fluorescents should be switched out for newer more efficient fluorescents. Magnetic ballasts should be retrofitted with high efficiency electronic ballasts. A wide variety of lamp shapes and color temperatures are available to ensure that room atmosphere is maintained.



Students working in the computer lab

Variable Air Volume (VAV) HVAC System

The existing HVAC system (constant volume terminal reheat) wastes considerable amounts of energy by first cooling and then heating the same air. SEDAC recommends retrofitting the current system to a less energy intensive VAV system with variable speed fan motors. Outdoor air reset, which adjusts the temperature of the supply air based on outdoor temperatures, should be specified. Additionally, all controls for the VAV system should be upgraded to direct digital controls which have vastly increased reliability over existing pneumatic controls saving energy and increasing comfort. Furthermore, since VAV systems reduce the amount of air flow, make sure that the air flow at minimum conditions can provide adequate ventilation to maintain indoor air quality.

Programmable Thermostats

The building is currently cooled and heated to 74 °F, regardless of the season. SEDAC recommends installing programmable thermostats that automatically adjust temperature settings based on the season of the year and time of the day so that temperature settings are seasonally appropriate and spaces are less conditioned when unoccupied. During the summer, SEDAC recommends cooling to 76 °F when occupied and 80 °F when vacant. During the winter, recommended settings for heating are 68 °F when occupied and 62 °F when vacant.

South view of Illini Union

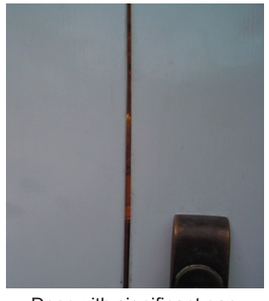
Building Automation System (BAS)

A Building Automation System is a central computer system that monitors and controls HVAC and potentially lighting systems throughout the building. BAS systems can provide a central point for metering energy flows, monitoring interior temperature profiles, and adjusting control schemes based on occupancy, weather conditions, enabling alarms when equipment is malfunctioning, etc. They reduce energy and maintenance costs, allow verification that system are operating as intended, and enhance troubleshooting when maintenance issues arise. The energy savings attributed to a BAS is much of the same energy that could also be saved through programmable thermostats and so is combined as a single measure in the summary table. Additionally the labor cost savings from a BAS can be significant but was not estimated.

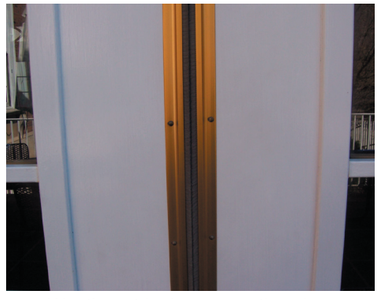
Recommendations

Demand Control Ventilation (DCV)

Fresh air from outdoors is introduced into buildings to maintain comfortable and healthy air quality. This outside air is heated or cooled to bring it to interior comfort conditions, which requires energy. Spaces with many people require more outside air than lightly populated spaces. The Union currently ventilates around the clock at the flow rate required for maximum occupancy, even when spaces are unoccupied. A demand control ventilation scheme adjusts the ventilation rates depending on building occupancy. Carbon dioxide sensors can be used to adjust the air flow while maintaining needed air quality during periods of low or no occupancy. SEDAC recommends adding DCV to the ventilation system to reduce energy consumption.



Door with significant gap



Weather stripping on another door

Additional Options for Efficiency

Additional recommendations include lowering domestic hot water settings, installing occupancy sensors to control lighting in certain spaces, engaging in hotel and kitchen management strategies, installing variable frequency motors on pumps and fan, and reducing air leaks with weather stripping.

Summary

SEDAC recommends making the following energy saving renovations to the Illini Union:

- Upgrade lighting and controls
- Convert HVAC to variable air volume
- Install new thermostats
- Install a building energy monitoring and control system (Building Automation System)
- Add demand controls to the ventilation system

Implementing the recommended measures will:

- Improve building comfort
- Lower operational costs
- Reduce energy consumption
- Reduce vulnerability to fuel price fluctuations
- Reduce environmental impacts
- Free up funds for other purposes
- Show leadership in sustainability
- Support campus energy efficiency initiatives

The combined measures will result in an estimated annual savings of $423,391 for an investment of approximately $3,017,401. These measures produce robust energy and cost reductions.

A full report of the energy audit and recommendations is available from SEDAC.

Students entering and leaving Union between classes