Illinois Smart Energy Design Assistance Center

Feasibility Report

Energy Evaluation
and
Recommendations

.

Urbana Middle School

Urbana School District #116
1201 S. Vine Street
Urbana, IL 61801

4/6/2009

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

dceo
ILLINOIS DEPARTMENT OF COMMERCE AND ECONOMIC OPPORTUNITY

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Acknowledgements

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SEDAC Background

In order to enhance the economy the Illinois Department of Commerce and Economic Opportunity (DCEO) has implemented the Smart Energy Program for the commercial, municipal, and educational building sectors. The program is funded by DCEO and is managed by the School of Architecture at the University of Illinois at Urbana-Champaign. The Smart Energy Design Assistance Center's (SEDAC's) mission is to encourage communities, municipalities, school districts, business owners, design professionals, and building contractors to incorporate energy efficiency practices and renewable energy systems.

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 maximizing energy productivity. Improving energy performance helps to stabilize costs while increasing business profitability. Most commercial buildings use 10 to 30 percent more energy than necessary and have abundant opportunities to save.

As part of this program, the Smart Energy Design Assistance Center (SEDAC) conducted an energy audit of Urbana Middle School at 1201 S. Vine Street in Urbana, Illinois. The analysis focused on energy savings opportunities and life cycle cost estimates for various energy cost reduction measures (ECRM) with high potential for implementation. This report presents recommendations for energy saving investments resulting from the analysis, along with the methods and assumptions used.

Executive Summary

SEDAC has performed an energy audit of Urbana Middle School (UMS) in Urbana, Illinois. The SEDAC team has assembled a list of suggestions related to the building's envelope (roof, wall, windows); heating, ventilating, and air conditioning (HVAC); and lighting. Additionally, information on financial incentives is presented.

SEDAC has identified $130,133 in annual cost savings from an investment of about $1,036,026, representing a net present value of $607,178 and resulting in an 11 percent return on your energy efficiency investment. These savings amount to a 31 percent reduction in UMS's energy costs. This report details our findings.

This study evaluated eight Energy Cost Reduction Measures (ECRMs) and two ECRM packages for application to the building. The packages analyze the indicated ECRMs *together*, accounting for any interaction between them. Table 1 summarizes the ECRMs and their expected energy and cost impacts.

The primary strategies for savings are improving the building envelope to increase comfort and allow for setback of space conditioning; reducing heating ventilating and air conditioning during unoccupied times; turning down or off lighting during unoccupied periods, and replacing some of the lighting with more efficient models. We recommend implementing Package 2 to begin saving energy dollars. The package consists of:

Envelope:

- Roof Insulation - Insulate the roof of the facility to R-25.
- Window Wall Upgrade - Insulate metal window wall panels to R-25. Install double pane low-e windows in place of single pane windows in prefabricated widow walls.

Lighting:

- Probe to Pulse Start Metal Halide Lamps - Replace 250 W probe start metal halide (MH) lamps with 200 W pulse start MH lamps with pulse start ballasts in the cafetorium.
- CFL to LED exits - Retrofit 9 W CFL exit signs with 2.7 W LED lamps.
- Occupancy Sensor Light Control - Install occupancy sensor light control in classrooms, offices, restrooms, and other intermittently used areas.
- Lighting Turn Down/Off - Establish a practice of turning off half of the hallway lights and all of the gymnasium lights at the end of the school day.

HVAC:

- Scheduled Ventilation – Control outdoor air ventilation to reflect occupancy schedules. Program the building automation system to close outdoor air dampers and turn off circulating fans during unoccupied times.
- Thermostat Setback - Program space thermostats to reflect occupancy schedules. Aim for an 8°F setback for 12 hrs/day. Implement in well insulated areas immediately, and expand as insulation is increased.

Financial Incentive Guidelines:

- Utilize EEPS incentives from DCEO for efficiency projects.
- Utilize DCEO assistance for energy service contracting.

Most of the building's energy usage is due to heating and cooling loads dictated by the envelope. The envelope of the building is in good condition but does not have high levels of insulation.

For projects that focus on energy reduction, there is a natural order to building improvements. In projects where energy consumption is dominated by climate, i.e. envelope dominated buildings; initial efforts should focus on the building envelope to reduce loads. The envelope of the building represents the crux of the energy problem but can be very difficult and costly to retrofit. After feasible envelope improvements are implemented, HVAC controls should be fully utilized to exploit envelope improvements, building lighting should be scrutinized since lights affect heating and cooling loads and only thereafter mechanical systems should be addressed.

Implementing the recommended measures will reduce operating expenses, increase efficiency, reduce environmental impact, demonstrate leadership, function as an educational program for the community and demonstrate prudent use of taxpayer's monies.

The American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) has published a series of guides designed to provide recommendations for achieving energy savings for various building types. One of the guides is for K-12 facilities. The Advanced Energy Design Guidelines[1] (AEDG) can be found at the link to the website in the footnote below. These guides are primarily intended for new construction however many of the recommendations can also be applied to existing schools. These guides address everything from the building envelope to plumbing, mechanical, and electrical systems. SEDAC recommends that Urbana School District 116 consider the recommendations in these guidelines. Several of the ECRMs in this analysis follow the recommendations in the K-12 AEDG.

The first cost pricing used herein was developed only for budgeting purposes and strategic direction and will vary according to the final design of the retrofits. Our work does not replace engineering design which will be necessary for project implementation. Our suggestions do not override local building code requirements which should be consulted and may dictate prioritization of investments**.**

On site we noticed or were told of several energy efficiency measures already in place including vigilant facility maintenance; low-e windows; wall and roof insulation in the new sections; economizers, VFDs, and DDC on the HVAC; individual room temperature control; staged compression cooling; smaller staged capacity boilers for the summer season; efficient lighting sources (T8, T5, CFL, and LED); kitchen vent hoods turned off after hours; lighting turned off in some unoccupied spaces; and lighting turned down in the hallways after cleaning. We applaud your efforts.

[1] http://www.ashrae.org/publications/page/1604

Energy Cost Reduction Measure (ECRM)	First Cost Investment ($)	Electric savings (kWh/yr)	Electric Demand Savings (kW)	Natural Gas Savings (therms)	Annual Cost Savings ($/yr)	IRR (%)	NPV ($)
ECRM 1 - Roof insulation	$844,938	209,465	8.31	50,114	$66,891	6%	$108,593
ECRM 2 - Window Wall Upgrade	$163,856	32,016	1.27	7,660	$10,224	4%	($18,112)
ECRM 3 - Tstat Setback	$0	107,131	0	10,621	$19,861	Infinite	$156,042
ECRM 4 - Scheduled Ventilation	$0	3,441	0	8,233	$8,183	Infinite	$64,291
ECRM 5 - Pulse MH	$1,733	3,737	0.08	-25	$315	13%	$741
ECRM 6 - LED Exit	$1,500	5,519	0	0	$500	32%	$2,429
ECRM 7 - Motion Sensors	$24,000	405,311	0	-2,666	$34,173	142%	$244,490
ECRM 8 - Lighting Turn off - gym	$0	82,096	0	-540	$6,922	Infinite	$54,384
ECRM 9 - Lighting Turn Down - hallway a	$0	29,177	0	-192	$2,460	Infinite	$19,326
PKG1 - ECRMs1-3	$1,008,794	278,890	10	54,716	$77,581	6%	$97,124
PKG2 - All Projects, ECRMs1-9	**$1,036,026**	**808,171**	**9.7**	**59,527**	**130,133**	**11%**	**$607,178**

Table 1: Summary of ECRMs, Savings, LCC Analysis

Notes to Table 1:

(1) Discount Rate assumed to be 5% when calculating the NPV.
(2) Economic life of individual lighting and controls measures is 10 years; insulation and windows have a 25 year life. Package 1 has an assumed life of 25 years. Package 2 has an assumed life of 20 years
(3) When ECRMs are implemented as a package, results vary from application of individual ECRMs.
(4) Projects will show a negative NPV if the IRR is less than the discount rate (here 5%).
(5) "Inf." In the IRR column stands for infinite, and refers to projects that have little or no first cost.

Introduction

The Smart Energy Design Assistance Center (SEDAC) performed an energy savings life cycle cost analysis for various conservation technologies applied to the Urbana Middle School in Urbana, Illinois. A site visit was conducted on February 12, 2009. This report presents the results of the analysis along with the methods and assumptions used.

SEDAC has prepared guidance on envelope, HVAC, lighting, and financial considerations**.** Our goal is to identify promising Energy Cost Reduction Measures (ECRMs) for implementation at the facility and to provide perspective on the magnitude of investment and anticipated energy and cost impacts. Verification of site conditions and engineering design will be necessary to implement these recommendations.

Facility Description

The Urbana Middle School was built in 1950 and had an expansion/renovation in 2000-2002. The floor area of the facility is currently near 197,400 SF with one and two story sections. The school serves 6th through 8th grade, has 900 students and 150 staff and about 250 computers.

The kitchen prepares meals which are distributed to all the Urbana elementary schools (1,000 breakfast and 3,000 lunch meals per day during the weekdays). The kitchen operates 5am to 4pm M-F.

Figure 1: Aerial View UMS

The primary heating, ventilating, and air conditioning (HVAC) systems operate 24 hours/day, 7 days a week with a 72°F setpoint. Kitchen ventilation is manually turned off at the end of the kitchen work day. Classes run from 8:45 am to 3:45 pm Monday through Friday. Lighting in the classrooms, library, kitchen, and cafetorium is turned off primarily by the cleaning crew and remains off on average 6hrs/day during the week, and on weekend and school vacations except for special functions. Some hallway lighting remains on all the time, but is turned down to half capacity after cleaning in the evening. The gymnasium lighting and restroom lighting is on all the time. The annual teaching schedule is from the last week in August through the first week in June for 174 attendance days. There are approximately 12 weeks per year of vacation days or holidays. School facilities are utilized evenings and weekends for extracurricular activities and community meetings, approximately 20 hrs/wk. Administrators and instructors frequent the building during school breaks to prepare for teaching terms. The schedule of the cleaning crew is 10 pm to 6:30 am Monday through Thursday and Sunday.

Figure 2: Exterior Views of UMS

Wall construction is a combination of masonry walls with 8” concrete masonry units and brick façade (41%), prefabricated metal window wall units (29%), and insulated frame walls with metal siding or brick façade (30%). Masonry walls have single pane windows and glass block windows. Metal window walls have single pane windows. Insulated frame walls have double pane low-e windows. Older sections of the roof (74%) have metal decking with a tectum, layer, rubber membrane, and gravel surface. New sections of the roof (26%) have metal decking, 3” of PIR rigid insulation, tectum, and a rubber membrane. Roof decking is exposed on the interior of classrooms, gymnasium, and cafetorium.

Building envelope R-values are low for older sections of the building. See Table 2. The low insulative character of the majority of the walls and the roof prevents setback of heating or cooling temperatures during unoccupied hours. Several attempts to setback interior temperatures have led to comfort complaints.

The building is heated with steam and cooled with chilled water. During the winter, low pressure steam is generated by two natural gas fired 250HP (8.4MBtu/hr) Cleaver Brooks boilers. During the summer, two smaller (62kBtu/hr-330kBtu/hr) staged boilers service reheat coils for interior zone air handlers. Chilled water is generated by three 105 Ton York electric chillers, and two 105 Ton McQuay electric chillers. Chilled water is circulated at 45°F with variable frequency drives (VFDs) on the water pumps. All condensers are air cooled.

Assembly	Estimated R-Value
Masonry walls with 36% glass block and 16% single pane windows	R-1.8
Masonry walls with 3% single pane windows	R-2.3
Metal window walls with 20% single pane windows and 24% masonry sections	R-1.5
Insulated frame walls with 12% double pane, low-e windows	R-9.2
Roof Older Sections	R-2
Roof Newer Sections	R-20

Table 2: Estimated R-Values

McQuay through-the-wall or ceiling-mount unit ventilators are located in each classroom. The four pipe units have chilled water and steam coils with face and bypass damper control and economizers for free cooling. Six air handlers serve interior zones. They are equipped with variable speed fan drives and economizer control for free cooling. There is a supplemental rooftop unit for the computer laboratory.

The HVAC system has direct digital control (DDC) throughout and is networked to a Honeywell building automation system (BAS). Technical System Solutions manages the BAS with semiannual site visits and remote monitoring.

Lighting is primarily 32W T8 fluorescent with electronic ballasts. The cafetorium has 250 W probe start metal halides and the gymnasium has highly efficient 54W T5 fluorescents with electronic ballasts. Exit lighting is primarily 9W CFL. The overall lighting power density for the facility is 1.4 W/sf.

On site we noticed or were told of several energy efficiency measures already in place including vigilant facility maintenance; low-e windows; wall and roof insulation in the new sections; economizers, VFDs, and DDC on the HVAC; individual room temperature control; staged compression cooling; smaller staged capacity boilers for the summer season; efficient lighting sources (T8, T5, CFL, and LED); kitchen vent hoods turned off after hours; lighting turned off in some unoccupied spaces; and lighting turned down in the hallways after cleaning. We applaud your efforts.

Energy Profile

Electricity is provided by Ameren under its DS-3 service rate. Natural gas is provided by Peoples Gas. The annual gas and electric utility bills for July 2007 through June 2008 totaled $380,511 (69 percent electricity, 31 percent gas,) at an average cost of $0.09/kWh for electricity and $0.96/therm for natural gas. The facility's energy use intensity (EUI) is 113 kBtu/sf/yr. The energy cost intensity (ECI) is $1.93/sf/yr. A summary of this energy profile is provided in Table 3. Typical EUI for an air conditioned

school in this climate is 74.5 kBtu/sf/yr[2]. UMS is 52% higher than average in its energy consumption. The lighting power density (LPD) of the facility at 1.4W/sf is 17% above the 1.2 W/sf maximum recommended by the AEDG. These comparisons indicate ample opportunities for saving.

	Annual Consumption		Annual Costs		Average Unit Cost	
Electricity	2,884,046	kWh	$261,298	69%	$0.09	$/kWh
Natural Gas	124,690	therms	$119,213	31%	$0.96	$/therm
		Total	**$380,511**			
Floor Area	197,400	ft^2				
Energy Use Intensity	113	kBtu/ft^2/yr	**Energy Cost Intensity**	$1.93	$/$ft^2$/yr	

Table 3: Energy Profile

Figure shows the building's electric consumption over time along with cooling degree days (units indicative of outdoor temperature profiles). Electricity is used for lighting, cooling, refrigeration, cooking, office equipment, fans, and pumps. The electricity consumption shows an increase during the cooling season.

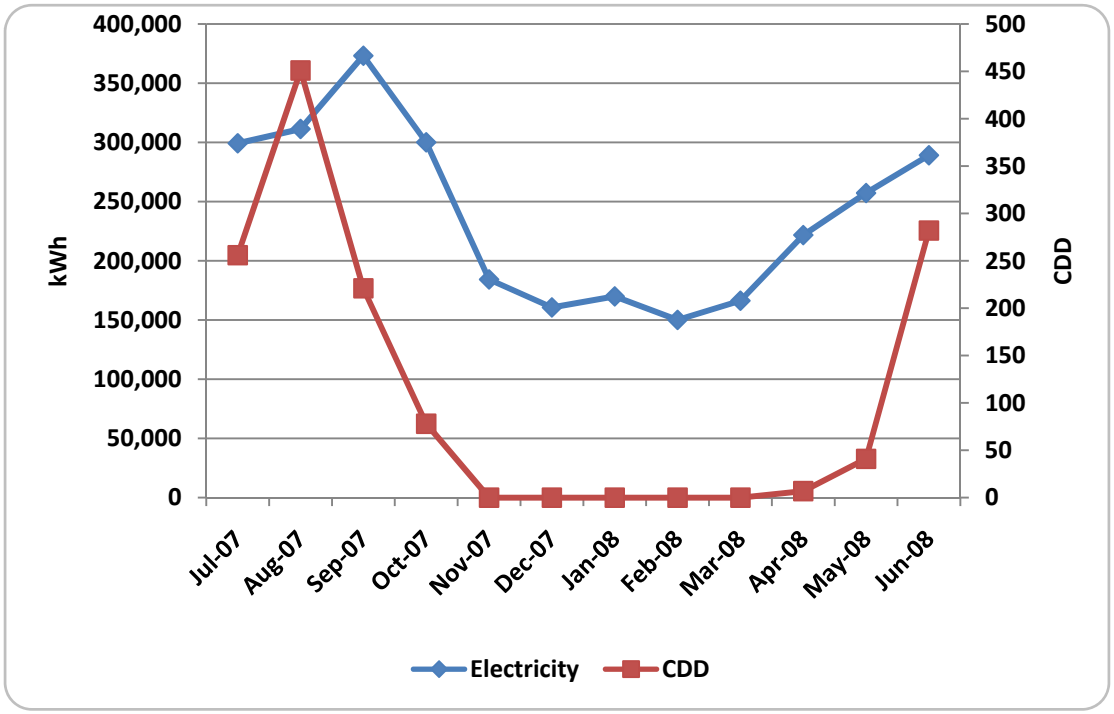

Figure 3: Electric Consumption vs. CDD

[2] Energy Star Target Finder output is included in the appendix.

Figure shows the building's natural gas consumption over time along with heating degree days. Natural gas is used for space heating, service hot water, and reheat of cooling air in the building core. The natural gas consumption tracks the heating degree days indicating that the heating requirements are strongly influenced by the building envelope.

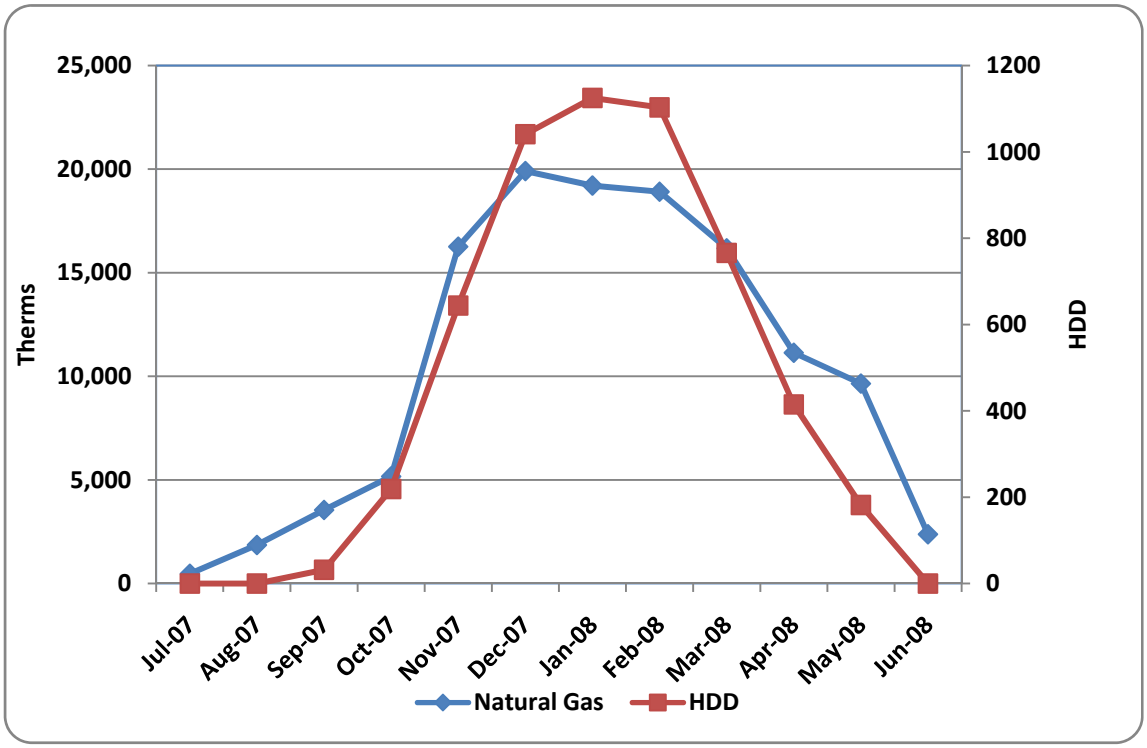

Figure 4: Natural Gas Consumption vs. HDD

Based on the Commercial Building Energy Consumption Survey[3], energy modeling, DOE Energy Star[4] and Food Service Technology Center[5] data on restaurant equipment, equipment inventories and usage schedules, our estimate of the utility cost breakout for UMS is shown in
Figure . Heating, cooling and lighting are prime targets for cost reductions. Heating and cooling is best addressed with envelope improvements.

[3] http://www.eia.doe.gov/emeu/cbecs/

[4] http://www.energystar.gov/index.cfm?c=commercial_food_service.commercial_food_service

[5] http://www.fishnick.com/

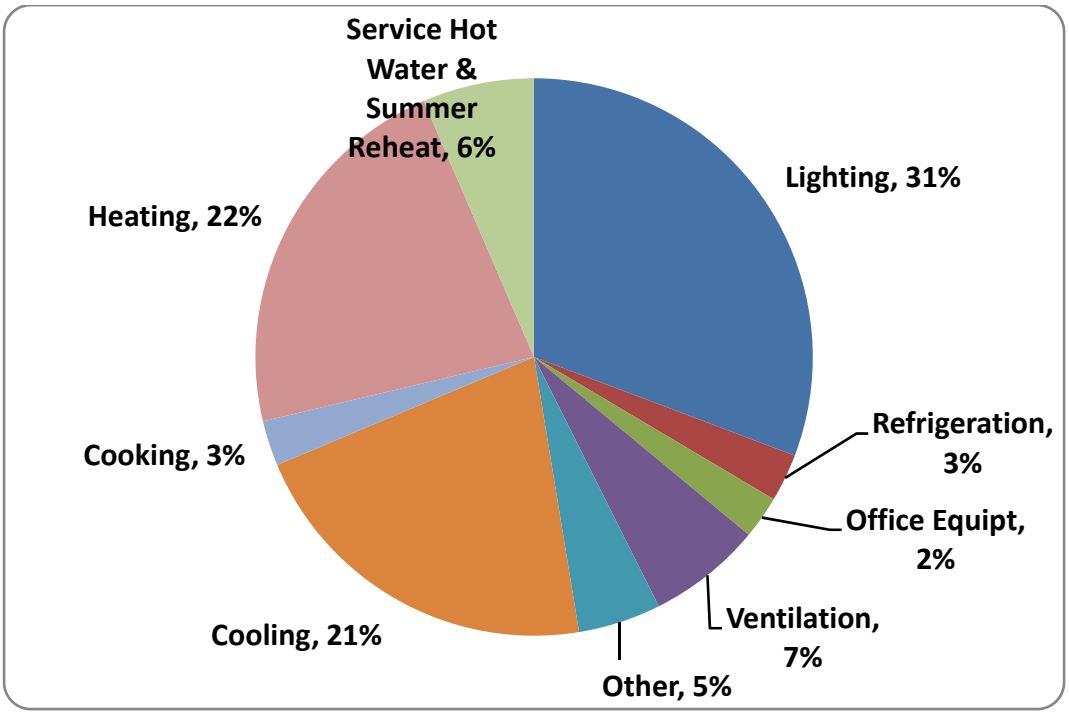

Figure 5: Estimated Utility Cost Breakout - UMS

ECRMs – Energy Cost Reduction Measures

ECRM 1 - Roof Insulation - Insulate the roof of the facility to R-25. Install a high reflectance roof membrane.

ECRM 2 - Window Wall Upgrade - Insulate metal window wall panels to R-25. Install double pane low-e windows with thermally broken window frames in place of single pane windows in widow walls.

ECRM 3 - Thermostat Setback - Program space thermostats to reflect occupancy schedules. Aim for an 8°F setback for 12 hrs/day. Implement in well insulated areas immediately, and expand as insulation is increased.

ECRM 4 - Scheduled Ventilation – Control outdoor air ventilation to reflect occupancy schedules. Program the building automation system to close outdoor air dampers and turn off circulating fans during unoccupied times.

ECRM 5 - Probe to Pulse Start Metal Halide Lamps - Replace 250 W probe start metal halide lamps with 200 W pulse start MH lamps[6] with pulse start ballasts in the cafetorium. These lamps have quicker start times, produce about 15% more mean lumens, and have up to a 50% longer lamp life.

ECRM 6 - CFL to LED exits - Retrofit 9 W CFL exit signs with 2.7 W LED lamps.

[6] http://ecom.mysylvania.com/miniapps/FileNet2/PIBs/%20HID045.pdf

ECRM 7 - Occupancy Sensor Light Control - Install occupancy sensor light control in classrooms, offices, restrooms, and other intermittently used areas.

ECRM 8 - Lighting Turn Off - Establish a practice of turning off all the gymnasium lights at the end of the school day.

ECRM 9- Lighting Turn Down - Establish a practice of turning off half of the hallway lights at the end of the school day. Consider and maybe experiment with delamping some of the fixtures in the hallway. On site measurements of lightings levels were 30-90fc with an average of 50fc. This is average for an office and much brighter than the 30fc recommended for a hallway for normal use or necessary for emergency hallway lighting.

PKG 1 combines the envelope improvements with thermostat setback, ECRMs 1-3. These are combined as current envelope conditions prevent thermostat setback.

PKG 2 combines all projects, ECRMs 1-9, and results in a building energy use intensity of 80 kBtu/sf/yr, or 8% above average.

Cost estimates of ECRMs were based on the following budget numbers:

Equipment	Initial Cost
Roof Insulation	$5.5/sf * 153,629sf
	$884,938
Window wall upgrade	$5/sf insulation * 9363sf+ $35/sf windows * 3344sf
	$163,856
Pulse Start Metal Halide lamps	($35.50/ lamp+$60 ballast +$20 labor) * 15 lamps
	$1,773
LED Retrofit kits for Exit signs	$15/each * 100 units
	$1,500
Motion Sensors	$150/each * 160 units
	$24,000

Table 4: ECRM Cost Estimates

ECRM Impact

Table 5 gives the energy and cost impact of the potential projects.

Energy Cost Reduction Measure (ECRM)	First Cost Investment ($)	Electric savings (kWh/yr)	Electric Demand Savings (kW)	Natural Gas Savings (therms)	Annual Cost Savings ($/yr)	IRR (%)	NPV ($)
ECRM 1 - Roof insulation	$844,938	209,465	8.31	50,114	$66,891	6%	$108,593
ECRM 2 - Window Wall Upgrade	$163,856	32,016	1.27	7,660	$10,224	4%	($18,112)
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PKG2 - All Projects, ECRMs1-9	**$1,036,026**	**808,171**	**9.7**	**59,527**	**130,133**	**11%**	**$607,178**

Table 5: ECRM Savings

Evaluating Options

Economic decisions can be assessed at SEDAC's energy project economic calculator at: http://www.ao.uiuc.edu/energy/Energy.cfm

From a strictly business perspective of maximizing profits, projects are typically considered attractive if their Internal Rate of Return (IRR), or annual yield, is greater than the investor's time value of money (their discount rate). In addition, the Net Present Value (NPV) at their desired rate of return is often required to be greater than zero, indicating that the project more than pays for itself. The discount rate is often set at what

an investor could expect to make on an alternate investment and is often assumed to be 5% for school districts.

The lifetime of energy investment projects vary. Typically a 5 year life is assumed for personal computers; 10 years for interior lighting, controls, commissioning, and kitchen equipment; and 20-25 years for HVAC equipment and envelope changes such as insulation or windows.

If the facility is expected to be utilized for the lifetime of a project, prioritizing projects based on highest NPV is a reasonable strategy. Additionally, recognition of non-quantifiable benefits such as comfort, productivity, and reduced environmental impact can raise decisions above apparent face value economics.

Illinois Energy Conservation Code

As of April 2006, the Illinois Energy Conservation Code for Commercial Buildings requires commercial construction to follow a comprehensive statewide energy conservation code to receive construction permits (where applicable). Renovations, alterations, additions, and repairs to most existing commercial buildings must follow the Illinois Energy Conservation Code. Local governments are also free to adopt stricter energy conservations Laws. The IECC 2006 version of the code went into effect on October 9, 2007.

EPAct 2005 Tax Deduction

Building designers[7] may be able to claim tax deductions for energy efficiency improvements put into service in 2006-2008. The 2005 Energy Policy Act (EPAct) provides tax deductions for buildings that are 50% more efficient than the 2001 ASHRAE Standard 90.1. Businesses may also receive deductions if individual components of the building (lighting, envelope, HVAC) meet the requirements. A summary of incentives is below. Additional information is included in the technical supplement.

Category	Energy Savings (vs. ASHRAE 90.1-2001)	Tax Deduction	Requires Energy Simulation?
Whole Building	50%	Up to $1.80/sq. ft.	Yes
Lighting, HVAC, or Envelope	16.7 % per system	Up to $0.60/sq. ft. per system	Yes
Lighting savings of at least 25%	25-40%	Sliding scale: $0.30/sq. ft. for 25% savings to $0.60/sq.ft. for ≥40%	No, just lighting power density calculation

Table 5: Summary of Federal Tax Deductions

Illinois Portfolio Standards – Energy Efficiency Rebates

New state legislation requires Illinois utilities to reduce their electric usage and increase their renewable energy sources. Rebates of utility tariffs may be available to customers that implement energy efficiency measures. DECO launched an incentive program for public buildings in June 2008.

SEDAC has created a Web page to post relevant documents and link to programs and services at www.IllinoisEEPS.org. Please bookmark this page and watch for further developments.

DECO's guidelines and application for the electric efficiency program (public sector) can be found from the following link. See for additional information.

http://www.illinoisbiz.biz/NR/rdonlyres/5190E007-6FCD-4E69-8F3A-A4444EAFFF72/0/Public_Sector_Electric_Efficiency_Guidelines_070808.pdf

[7] http://www.efficientbuildings.org/about_the_provision.html#6

Some incentives that may be applicable to UMS are listed in Table 6. These values are for the current program year which has already closed. A new program will start in June, and these values may change, but have not yet been announced. Further, incentives for natural gas savings are expected within the year.

Equipment Type	Incentive	Unit	Estimated # of units	Incentive Subtotal	Simple Payback
Exit Signs – LED Retrofit	$22	per sign	100 signs	$2,200	3yrs
Occupancy Sensors	$0.10	per W controlled	193,801W	$19,380	0.7yrs
Pulse Start Metal Halides	$35	per fixture	15 fixtures	$525	3.9yrs
Permanent Lamp Removal	$6	per lamp			
Custom Efficiency Measure, Payback 1 to <7yrs, >5yr life	$0.07	per kWh	Envelope Upgrade PKG1 263,550kWh	(18,449)	13yrs not applicable
Total				**$22,105**	

Table 6: Utility Rebates

Energy Performance Contracting

One method of financing that UMS might consider is Energy Performance Contracting (EPC). This financing method allows for designing, installing, and financing energy improvement projects where the energy and maintenance savings achieved by the project are guaranteed to help pay for the project over a period of time. Some energy efficiency strategies literally pay for themselves with energy savings. Some entities choose to also help finance longer pay-off strategies and maintenance items with the more lucrative strategies to create an overall improvement package for their buildings.

Because of Enabling Legislation in the State of Illinois, public K-12 schools and community colleges, state universities, municipalities, and state agencies can all enter into EPC contracts without the added step of voter approval. Businesses can also enter

into these contracts and take advantage of a financing mechanism set up to recognize the effect of energy efficiency on the bottom line as well as a guarantee of future energy savings from the contractor.

More information may be obtained by contacting the DCEO's Energy Performance Contracting Program (EPC). The EPC program has an expert in EPC available to provide technical assistance to public sector and not-for-profit entities to help them understand and navigate the EPC process, and has developed sample documents to assist you through the process. The EPC program has helped implement over $73 million in projects with annual utility savings of about $10 million. The contact for this program is Wayne Hartel at 217-785-3420, wayne.hartel@illinois.gov.

Conclusion and Recommendations

We applaud your efforts toward energy efficiency in your facility.

We recommend implementing Package 2 to begin saving 33% of your annual energy dollars. The package consists of:

Envelope:

- Roof Insulation - Insulate the roof of the facility to R-25.
- Window Wall Upgrade - Insulate metal window wall panels to R-25. Install double pane low-e windows in place of single pane windows in window walls.

Lighting:

- Probe to Pulse Start Metal Halide Lamps - Replace 250 W probe start metal halide lamps with 200 W pulse start MH lamps with pulse start ballasts in the cafetorium.
- CFL to LED exits - Retrofit 9 W CFL exit signs with 2.7 W LED lamps.
- Occupancy Sensor Light Control - Install occupancy sensor light control in classrooms, offices, restrooms, and other intermittently used areas.
- Lighting Turn Down/Off - Establish a practice of turning off half of the hallway lights and the all of the gymnasium lights at the end of the school day.

HVAC:

- Scheduled Ventilation – Control outdoor air ventilation to reflect occupancy schedules. Program the building automation system to close outdoor air dampers and turn off circulating fans during unoccupied times.
- Thermostat Setback - Program space thermostats to reflect occupancy schedules. Aim for an 8°F setback for 12 hrs/day. Implement in well insulated areas immediately, and expand as insulation is increased.

Financial Incentive Guidelines:

- Utilize EEPS incentives from DCEO for efficiency projects.
- Utilize DCEO assistance for energy service contracting.

Technical Supplement

Occupancy Sensors

Occupancy sensors turn on the lights when someone enters an area and turn off the lights when the space has been unoccupied for a set period of time (e.g. 5-30 minutes). Key areas to install these in are rooms that are not utilized all the time such as restrooms and the office. There are sensors available for many different applications. The sensing technology, positioning, and time delay can be selected to minimize unplanned shut-offs and false switch-ons. We recommend using manual on, automatic off switches in offices and places where the switches are readily accessible. An article describing these choices, *Occupancy Sensors 101*, is online at **http://ecmweb.com/lighting/electric_occupancy_sensors/.**

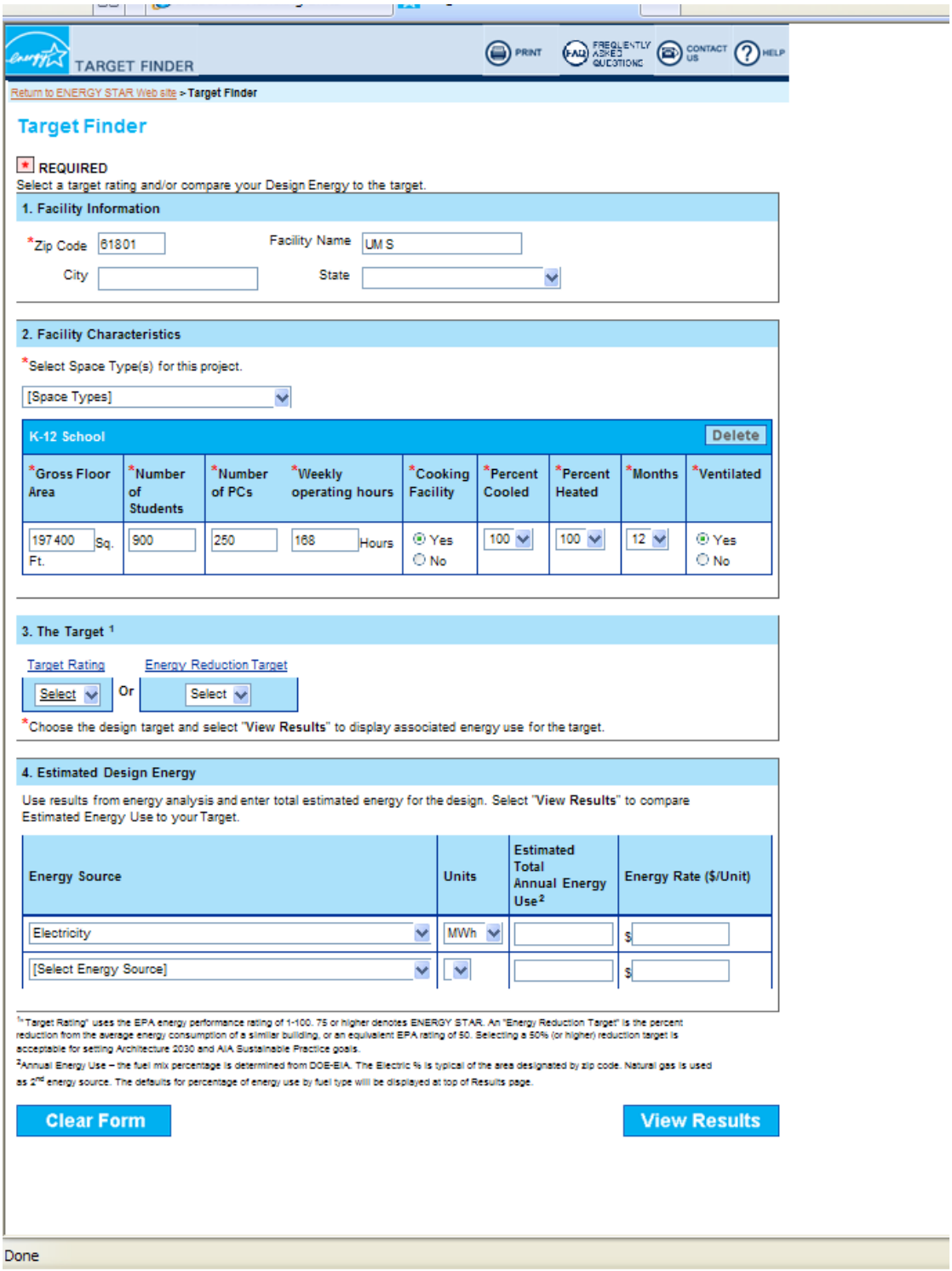
Illinois Portfolio Standard Details

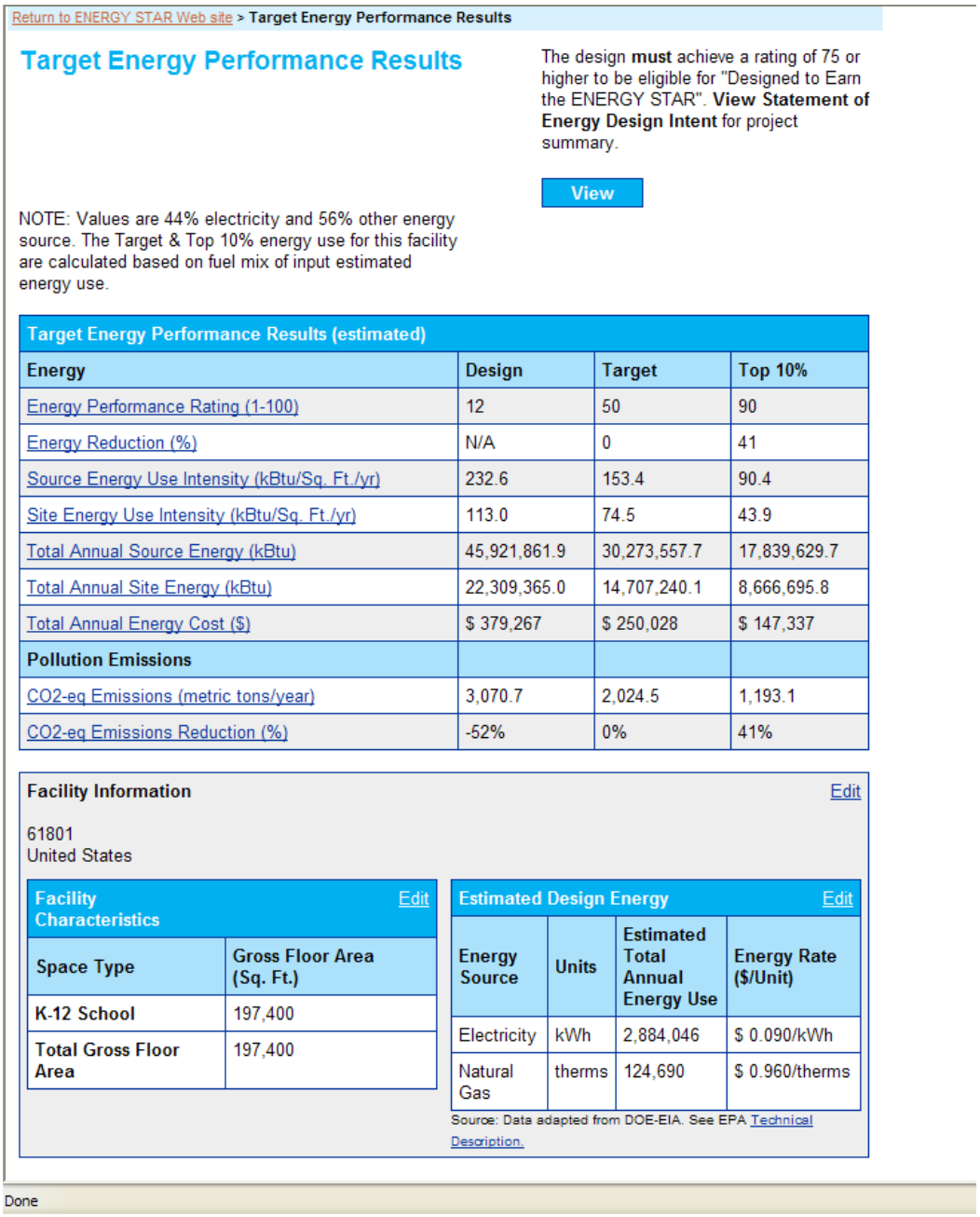
On August 28, 2007 Senate Bill 1592 was signed into law which includes an Energy Efficiency Portfolio Standard (EEPS) and a Renewable Portfolio Standard (RPS) that are among the most ambitious in the nation. The EEPS will require Illinois utilities to reduce overall electric usage by 0.2% of demand in 2008, escalating to 2.0% by 2015. The RPS will require utilities to supply 2% of their power from renewable energy sources by 2008 for certain "eligible customers," escalating to 25% by 2025.

This law creates a substantial budget for programs and incentives to reduce electrical energy usage and demand for customers of ComEd and Ameren. During the first year, there will be approximately $50 million devoted to various sectors of utility customers. ComEd and Ameren will focus approximately $38 million on residential, commercial, and industrial customers and the Illinois Department of Commerce and Economic Opportunity (DCEO) will utilize about $12 million on the low income and public sectors. During the second year these budgets will double and by year three will triple, by far the largest opportunity Illinois has had for funding energy efficiency and demand reduction efforts.

The implications of the EEPS and RPS for SEDAC clients is that sometime in the near future clients in the Ameren and ComEd service territories may be able to take advantage of rebates for energy cost reduction measures (ECRMs) which reduce electric energy consumption, either through conservation or use of renewables.

Energy Star Target Finder Results





Return to ENERGY STAR Web site > **Target Energy Performance Results**

Target Energy Performance Results

The design **must** achieve a rating of 75 or higher to be eligible for "Designed to Earn the ENERGY STAR". **View Statement of Energy Design Intent** for project summary.

View

NOTE: Values are 44% electricity and 56% other energy source. The Target & Top 10% energy use for this facility are calculated based on fuel mix of input estimated energy use.

Target Energy Performance Results (estimated)			
Energy	**Design**	**Target**	**Top 10%**
Energy Performance Rating (1-100)	12	50	90
Energy Reduction (%)	N/A	0	41
Source Energy Use Intensity (kBtu/Sq. Ft./yr)	232.6	153.4	90.4
Site Energy Use Intensity (kBtu/Sq. Ft./yr)	113.0	74.5	43.9
Total Annual Source Energy (kBtu)	45,921,861.9	30,273,557.7	17,839,629.7
Total Annual Site Energy (kBtu)	22,309,365.0	14,707,240.1	8,666,695.8
Total Annual Energy Cost ($)	$ 379,267	$ 250,028	$ 147,337
Pollution Emissions			
CO2-eq Emissions (metric tons/year)	3,070.7	2,024.5	1,193.1
CO2-eq Emissions Reduction (%)	-52%	0%	41%

Facility Information Edit

61801
United States

Facility Characteristics Edit	
Space Type	**Gross Floor Area (Sq. Ft.)**
K-12 School	197,400
Total Gross Floor Area	197,400

Estimated Design Energy Edit

Energy Source	Units	Estimated Total Annual Energy Use	Energy Rate ($/Unit)
Electricity	kWh	2,884,046	$ 0.090/kWh
Natural Gas	therms	124,690	$ 0.960/therms

Source: Data adapted from DOE-EIA. See EPA Technical Description.

Done

Appendix – Abbreviations

A/C – Air conditioning

ACH – Air Changes per Hour

AFUE - Annual fuel utilization efficiency

ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers

Btu – British thermal unit

CFM - Cubic feet per minute

CLG - Cooling

COP - Coefficient of performance

CRI – Color rendering index

DX - Direct expansion

DWH – Domestic Water Heater

ECRMs - Energy Cost Reduction Measures

Effic – Efficiency

EER - Energy Efficiency Ratio

ERV - Energy Recovery Ventilator

F - Fahrenheit

ft - Foot, or Feet

fc – foot candle

GSHP - Ground Source Heat Pump

HP – Horsepower

HRV – Heat recovery ventilator

HSPF – Heating Seasonal Performance Factor

Htg – Heating

HO – High Output

HVAC - Heating, Ventilating, and Air Conditioning

HW – Hot Water

HX - Heat Exchanger

IM – Injection Molding

IRR - Internal Rate of Return

kW - kilowatt, one thousand watts

kWh - kilowatt-hours, one thousand watt-hours

LCCA - Life Cycle Cost Analysis

Lm/W – lumens per watt

LPD – Lighting Power Density

MH – Metal Halide

NPW – Net Present Worth

OA - Outside Air

PSIG – Pounds per square inch, gauge

RTU - Roof Top Unit

R-Value – a measure of the resistance of building materials to heat transfer

SC – Shading Coefficient

SEER – Seasonal energy efficiency ratio

SF or sf – Square Feet

SHGC – Solar Heat Gain Coefficient

Svgs - Savings

T5 – A tubular fluorescent lamp 5/8” in diameter

T8 – A tubular fluorescent lamp one-inch in diameter

Therm – A unit of measure for natural gas. Equal to 100,000 BTUs or 100 Cubic Feet.

U-Value – A factor expressing the ability of a material to transfer heat.

V- volts

VFD – Variable frequency drive

yr - Year