The Greenest Little Schools in the Midwest

And what we can do to get there…
What are ‘Green Schools’

- Facts
  - Economically efficient
  - Promotes occupant well being
  - Responsive to the environment
  - Pedagogical opportunities
  - Energy efficient schools do not take away from safety, health, security, or comfort
It’s all about Reducing Energy Waste!

- As much as 25% of building energy use is wasted!
- The least expensive energy today is energy saved through energy efficiency
- It is cheaper to invest in energy efficiency than pay utilities for their energy over the long term
- Who should get your money? The utilities or your education funds
Why save energy?

- If total district gas and electric costs in 2005 were $1.6M
- 10% energy savings = $160,000
- Green is a no-brainer. If green schools saved $160,000 per year in operational costs, that's roughly enough to hire three new teachers, buy 300 new computers or purchase 7,000 new textbooks.
- With today's economics this is money we can't afford to leave on the table (or in the utility's coffers)!
Why is energy wasted?

- Some problems are invisible
- Users are not aware of the significance
- People don’t know what to do
- There is conflicting information
- Sometimes it’s not easy or convenient
- We don’t always remember that many little steps add up to big savings
Understanding Energy Use in Schools

- How much does your school spend each year on energy?
  - Elementary Schools: $70,000 to $150,000
  - Middle Schools: $100,000 to $200,000
  - High Schools: $200,000 to $650,000

The chart shows the percentage distribution of energy use:
- Lighting 33%
- Chlllers 25%
- Bollers 23%
- Fans 7%
- Other 12%

Depends on HVAC in Building
Potential of No-Cost Savings

- How much does your school spend each year on energy?
- Elementary Schools: $70,000 to $150,000
  - 10% on $10,000
- Middle Schools: $100,000 to $200,000
  - 10% on $15,000
- High Schools: $200,000 to $650,000
  - 10% on $30,000
What to do?

- Easy ways to save 10%
  - No-cost strategies
  - Low-cost strategies
No-Cost Strategies

- Benchmark Schools
- Establish a recognition program
- Assign Responsibility
- Control classroom thermostats
- Turn off lighting
- Establish a plug load plan
- Keep windows and doors closed when HVAC is on
Benchmark and Recognition

- Determine Energy Use Intensity of each school and compare it to the EPA’s Energy Star Program
- Set goals for each school to reduce energy use 10% in the next year.
- Establish a recognition program i.e. display a ‘Little Green Schoolhouse’ if you meet targets.
Assign Responsibility

- Assign an individual or class to track monthly energy use, chart, and make information available to the school.
- Make teachers and staff aware of opportunities to save energy.
- Note where improvements can be made.
- We need to change bad habits to good habits.
Control Classroom Thermostats

- 1 degree temperature difference = 1% energy cost savings!
- Many kids dress in layers during the winter because classrooms/buildings are too hot
- Work with maintenance to balance temperatures.
- Turn down thermostat (controls) at night
Turn off lighting

- A single classroom uses about 2-3kW per hour. That is about $0.30 every hour, or $2.40 every day.
- Or, the equivalent of leaving on 20-30 100W light bulbs burning.
- Turning off lights when not needed saves considerable money AND makes the rooms more comfortable in the warm months!
- This can save up to 5% of lighting energy!
Plug Loads

- ‘Plug Loads’ are Educational Devices or appliances plugged into a school’s electrical system
- Examples in schools:
  - Copiers, Refrigerators, Pop Machines
- Examples in the classroom:
  - Computers, TV’s, DVD players, tape players, smart boards, boom box, radios, CD players, printers, scanners, copiers, fish tanks, mini-refrigerators, coffee pots, hot plates, overhead projectors, LCD projectors
- Simple rule – turn it off (unplug it) when not in use.
- If monitors do not go to sleep call IT (Screen Saver is not an Energy Saver!).
- This can save 2-5%!
A Recent Survey found the following (Lorenz V. Schoff, Energy Consultant):

- **High School**
  - 436 devices – Potential Load 104kW
  - Majority of devices computers or related items

- **Middle School**
  - 340 devices – Potential Load 81kW
  - Majority of devices computers or related items

- **Elementary School**
  - 262 devices – Potential Load 53kW
  - Computers in educational facilities average – 1.3 per thousand square feet

- Estimated to be 25% of Electrical Energy Use in a School
Phantom Loads

- Phantom Loads are anything plugged in that continues to consume power when turned off or in standby.
- This ‘off’ equipment can consume energy from 3 to 25 watts per hour when turned off!
- Some examples are:
  - Power supplies, transformers and inefficient electronic devices.
  - VCRs, DVD players and some audio systems and TVs.
  - Microwave ovens
  - Computers, digital monitors and printers
  - Air conditioning systems with remote control.
  - Devices with "Instant on" functions, with remote control receivers, or waiting for the user to interact.
  - Devices with a stand-by light or clock.
  - Devices that get warm or that have warm transformers when they are off.
- Phantom Loads can consume up to 5-10% of our utility use.
- Example: VCR flashing 12:00am - Over 4 years can consume >$11
How to Control Phantom Loads

- Disconnect device after every day or when not in use
- Plug into power strips and turn power strips off at the end of the instructional day
- Education (know what to turn off)
- Use of Computer Control Programs like:
  - EZ Wizard for individual PC’s
  - EZ Save is a free centrally administered tool to activate MPM Settings on an entire network
- To obtain these free programs go to www.energystar.gov/powermanagement
Manage heat flows

- Hot air rises.
- Stop the loss of energy
- Close doors to prevent drafts
- Don’t open windows if HVAC is on
- Open blinds and let sun light room (but not too much direct light) – Turn off the lights!
- Close blinds at night to hold in heat
Other Things to Do

- Turn off appliances during extended periods, i.e. summer break, winter or spring break. (It’s a great time to clean out that refrigerator)
- Talk with building janitorial/maintenance about their ideas
- Report leaking faucets/toilets
- Take the opportunity to teach the kids about energy waste and how to save.
- This isn’t limited to schools, look at administrative and transportation buildings, field houses, etc. There is potential energy waste in all these buildings!
Low-Cost Items

- In exchange for asking the teachers and staff to make changes, ask the Administration and the Board of Education to institute low-cost changes to improve the energy efficiency of our buildings.
- It often starts with the administration building adopting the same no-cost strategies as outlined for educational buildings!
- But, of course, there is more.
Low-Cost Strategies

- Most of these can be done in-house
  - Exit Lights
  - Plug Loads
  - Lighting
  - Gym Lighting
  - Occupancy Sensors
  - Water Use

Note: Rebates shown in the next few slides are based on 2007/2008 amounts. Next funding cycle has not been announced.
Exit Lights

- Change out incandescent and fluorescent exit lights to LED
- Change from incandescent at >28W to LED at <2 W

<table>
<thead>
<tr>
<th>Cost</th>
<th>Savings</th>
<th>Labor</th>
<th>Rebates</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>$20-30</td>
<td>$22/year</td>
<td>$40</td>
<td>$22</td>
<td>51%</td>
</tr>
</tbody>
</table>
### Vending Energy Management

- Install vending Energy Management systems on all vending machines.
- Rebates are available for $100 per beverage machine and $30 per snack machine (which cost $79 each)

<table>
<thead>
<tr>
<th>Cost</th>
<th>Savings</th>
<th>Labor</th>
<th>Rebates</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>$179</td>
<td>$220/year</td>
<td>$30</td>
<td>$100</td>
<td>105%</td>
</tr>
</tbody>
</table>
Re-lamp old Light Fixtures

- Change out T12 to T8
  - Clean fixtures and replace ballast.
- Costs about $60 per 2-lamp fixture and saves about $40/year.

<table>
<thead>
<tr>
<th>Cost</th>
<th>Savings</th>
<th>Labor</th>
<th>Rebates</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>$60</td>
<td>$40/year</td>
<td>$30</td>
<td>$14</td>
<td>54%</td>
</tr>
</tbody>
</table>
Gym Lighting

- Replace metal halides in gyms to high-bay fluorescents.
- For this you might have to hire a contractor, but the results are amazing!
- Plus, they can be turned off and on as needed, rather than left on all day.

<table>
<thead>
<tr>
<th>Cost</th>
<th>Savings</th>
<th>Labor</th>
<th>Rebates</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>$200</td>
<td>$42/year</td>
<td>$80</td>
<td>$47</td>
<td>16%</td>
</tr>
</tbody>
</table>
Occupancy Sensors

- Occupancy sensors in offices, classrooms, toilet rooms, janitor and maintenance rooms, etc.
- Numbers below are for a classroom turning off the lights for just one hour each day.
- Different types for different needs

<table>
<thead>
<tr>
<th>Cost</th>
<th>Savings</th>
<th>Labor</th>
<th>Rebates</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>$50</td>
<td>$65/year</td>
<td>$10</td>
<td>$25-50 ea</td>
<td>108%</td>
</tr>
</tbody>
</table>
Reduce Water Use

- Replace shower heads to low-flow
- Install aerators on faucets to cut hot water bills.
- Changing one shower to a 1.6 gpm head saves the following in energy cost to heat the water.
- Now that usage is lowered, imagine what new, smaller water heater would save!

<table>
<thead>
<tr>
<th>Cost</th>
<th>Savings</th>
<th>Labor</th>
<th>Rebates</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>$20</td>
<td>$21/year</td>
<td>$10</td>
<td>N/A</td>
<td>83%</td>
</tr>
</tbody>
</table>
But There is a Cost…

- Unfortunately, to save energy with the low-cost methods, we need to find money to invest in materials and labor.
- The amount of money needed depends on the rate you want to see change.
- Options
  - Reallocate funds or staff
  - Grants or donations
  - Life-Safety Dollars
  - Performance Contracting
SEDAC School Audits

- We have audited 10 educational facilities and have 4 more in progress.
- Energy savings ranged from 15 to 70 percent with an average of 29%. The high one included renewables.
- Cost savings ranged from 17 to 70 percent with an average of 31 percent.
- Average for K-12 was $48,636.
The SEDAC Top Energy Measures

- **Lighting:**
  - Super T8 fluorescent lighting with electronic ballasts and high-bay T5HO:
    - Existing buildings need retrofits and controls.
    - New buildings benefits from more efficient fixtures, better layouts, & motion detectors (integrated classroom lighting systems).
  - Compact fluorescent lamps for single lamp fixtures in place of incandescent lights, LED exit fixtures.
The SEDAC Top Energy Measures

Building & Envelopes (beyond code):

- Increased insulation levels (new construction).
- Infiltration air sealing and duct sealing.
- Better windows (insulated glass, Low-E, with U-values of 0.4 or less, thermally broken frames).
- New designs should incorporate daylighting.
- New designs should consider building orientation and massing.
The SEDAC Top Energy Measures

- Heating, Ventilating, & Air-Conditioning:
  - Sealed combustion high efficiency boilers and furnaces (>92%).
  - High efficiency Air-Conditioning units (EER13).
  - Geothermal and Cold Climate heat pumps.
  - Programmable thermostats.
  - DOAS/Ventilation heat recovery systems.
  - Demand control ventilation, or at least the ability to schedule ventilation rates.

Treat code requirements as minimums not maximums!
### Typical SEDAC Results

<table>
<thead>
<tr>
<th>ECRM 1 - Turn Off Lights</th>
<th>274,556 kWh</th>
<th>130 kW</th>
<th>-656 Therms</th>
<th>5% Energy</th>
<th>$27,198 Cost</th>
<th>- $0 IRR</th>
<th>$0 NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECRM 2 - Basement Lights</td>
<td>225,354 kWh</td>
<td>26 kW</td>
<td>-758 Therms</td>
<td>4.1% Energy</td>
<td>$22,054 Cost</td>
<td>$32,000 IRR</td>
<td>69% NPV</td>
</tr>
<tr>
<td>ECRM 3 - Trading Floor Lights</td>
<td>176,793 kWh</td>
<td>65 kW</td>
<td>-556 Therms</td>
<td>3.3% Energy</td>
<td>$17,349 Cost</td>
<td>$105,700 IRR</td>
<td>10% NPV</td>
</tr>
<tr>
<td>ECRM 4 - Low Power CPUs</td>
<td>135,106 kWh</td>
<td>37 kW</td>
<td>-506 Therms</td>
<td>2.5% Energy</td>
<td>$13,158 Cost</td>
<td>$50,000 IRR</td>
<td>23% NPV</td>
</tr>
<tr>
<td>ECRM 5 - RCx: Balance, Optimize</td>
<td>115,545 kWh</td>
<td>0 kW</td>
<td>1,427 Therms</td>
<td>3.2% Energy</td>
<td>$13,541 Cost</td>
<td>$40,000 IRR</td>
<td>32% NPV</td>
</tr>
<tr>
<td>ECRM 6 - RCx: RTU Gas Heat</td>
<td>520,455 kWh</td>
<td>0 kW</td>
<td>-23,070 Therms</td>
<td>-3.2% Energy</td>
<td>$24,710 Cost</td>
<td>$50,000 IRR</td>
<td>48% NPV</td>
</tr>
<tr>
<td>ECRM 7 - Solar PV w/ Rebates</td>
<td>40,906 kWh</td>
<td>0 kW</td>
<td>0 Therms</td>
<td>0.8% Energy</td>
<td>$6,627 Cost</td>
<td>$103,906 IRR</td>
<td>2% NPV</td>
</tr>
</tbody>
</table>

| PKG 1 - ECRMs 1-5 | 797,948 kWh | 169 kW  | 165 Therms | 16.4% Energy | $81,594 Cost | $227,700 IRR | 34% NPV |
| PKG 2 - ECRMs 1-6 | 1,308,953 kWh | 169 kW  | -22,485 Therms | 13.3% Energy | $105,857 Cost | $277,700 IRR | 36% NPV |
| PKG 3 - ECRMs 1-7 | 1,349,859 kWh | 169 kW  | -22,485 Therms | 14.1% Energy | $112,483 Cost | $381,606 IRR | 27% NPV |
DCEO Incentive Levels

Standard
- Set incentives for a standard list of equipment upgrades.

Custom
- 7 cents/kWh for measures with 1-7 year payback.

Caps
- $100,000 per program year (June to May).
- $\leq 100\%$ of Incremental Measure Costs (added cost of increasing efficiency beyond standard replacement option).
- $\leq 50\%$ of Total Project Costs.
Conclusions

- The time is now!
Discussion…