Ohio School Boards Association

Solar and LED – K12 Case Studies

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Presented by Greg Smith

1

Introductions

Greg Smith, President, Energy Optimizers, USA
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John Lewis, Board Member, Adams County/Ohio Valley Local

Energy Savings Projects and Lighting Retrofit Services

- ✓ **Over *$42,000,000* of Energy Saving Projects since 2009**
- ✓ **Over *12,000,000 square feet of* Energy Efficient Lighting Retrofit Projects since 2011**
  - *Vendor-neutral*
  - *Never had a change order –ever!*
- ✓ **17 Full-time Associates**
  - *Lighting, Mechanical and Energy Engineers*
- ✓ **Innovative, but practical**
  - *Cutting edge, not bleeding edge*
  - *"Cost-effective" approach*

2

"The bitterness of poor quality remains long after the sweetness of low price is forgotten"
– Benjamin Franklin

Committed to Quality. Committed to You.

3

Why look at Lighting Retrofits?

- ✓ **Improved Working Environment:** Lighting retrofits provide improved lighting for the spaces (increased productivity)
- ✓ **Best Payback/Savings:** Lighting typically provides the best return on investment/payback
  - **"Lighting represents roughly 40% of the energy consumption in the commercial building sector"** - US Dept. of Energy, 2008
    - **Interior Lighting Retrofits (Non-LED): 1-4 year typical payback**
    - **Exterior Lighting Retrofits (LED): 2-6 year typical payback**
      - ***Varies based on electric rates, run hours, rebates and O&M savings***

4

Identifying Opportunities

- ✓ **(4)+ years since last lighting upgrade**
  - Presence of T-12 lamps and ballasts
  - Presence of T-8 32 watt lamps
    - *Typical design of newer buildings*
  - Presence of non-fluorescent High Bays

- ✓ **HID**
  - Hi-Bay Storage & Shop Areas, Gymnasiums, Labs, Can Fixtures, etc.
    - *Typical design of newer buildings*
- ✓ **Exterior Lighting**
  - Hi-Bay Storage & Shop Areas, Gymnasiums, Labs, Can Fixtures, etc.
    - *Typical design of newer buildings*
- ✓ **Absence of Occupancy Sensors & Incandescent EXIT Signs**

5

Recent Trends: LED Lighting

- **Quality Improvements**
  - Market Leaders – Cree, Lithonia, Sylvania, GE
    - ✓ *Chips/Drivers – Cree, Nichea, LG, Sylvania, Samsung*
  - Improved light output and "spread" – especially exterior
  - Increased Life Expectancy (70,000 – 100,000 hours)
    - ✓ *Compared to 20,000 hours for metal halide*
- **More Energy Efficient**
  - Improved Efficacy (i.e. more light with less energy)
    - ✓ *455 watt parking lot head = 131 watt LED*
    - ✓ *270 watt parking lot head = 45 watt LED*

  Ex. Lithonia D-Series
    - ✓ *92-119LPW depending on drive current, Kelvin, & Distribution*

Advantages of LED

Recent Enhancements & Advantages of LED Lighting

- ❑ Continued Efficiency Improvements (lumens/watt)
  - ✓ CREE – Recently achieved 150 lumens per watt
- ❑ Color variations and options
- ❑ Instant on (unlike metal halide)

- ❑ Dimming capabilities
- ❑ No mercury or ultraviolet light

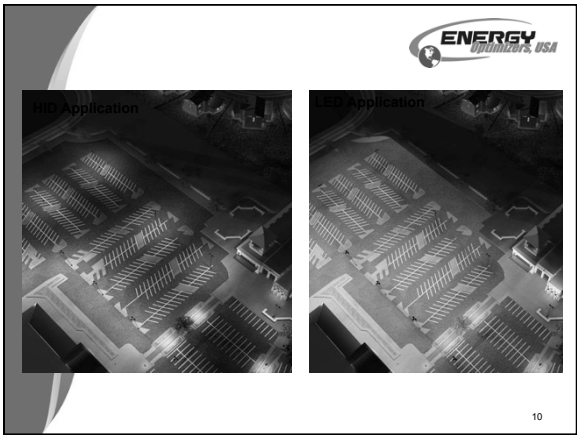
7

Recent Trends: LED Interior Solutions

- **Cost-Effectiveness Barrier**
- **Numerous retrofit solution strategies**
- **Linear Lamp Retrofit Solutions**
  - *Utilizes fluorescent performance characteristics*
  - *Internal ballasted LED tube*
  - requires disconnect of existing fluorescent ballast
  - *External ballasted LED tube*
  - requires disconnect of existing fluorescent ballast and install of new driver/ballast for LED tubes
  - "*Plug-n-Play" LED tube* simply uses the existing fluorescent ballast
- **Utilizes LED performance strengths**
  - ***Retrofit Panel Units***
  - ***New Fixtures***

Recent Trends: LED Lighting Exterior Solutions

- **Cost-Effectiveness Achieved**
- **Wide Ranging Distribution Types**



Utilizing LED Strengths

- Dimming Drivers are standard
  - Design with an eye to:
    - daylight harvesting
- Motion capture coupled w/ dimming
- Utilize dimming range vs. on/off controls in areas w/ safety concerns
- Exterior occupancy controls
  - Granular control & response

Quality Assurance

ENERGY STAR

DESIGNLIGHTS CONSORTIUM

lighting facts
A Program of the U.S. DOE

12

Renewable Energy Systems - Analysis

- Solar Photovoltaic (Solar Electric) – *Adams County Schools*
  - ✓ Approximate Installed Cost: $2,000 - $4,000 per KW
  - ✓ Approximate energy production (Ohio): 1,200 kWh per year
  - ✓ Energy Savings per year per KW = $120.00 (based on $0.10 per blended kWh utility rate)
  - ✓ ***10 - 25 year simple payback with no incentives***

13

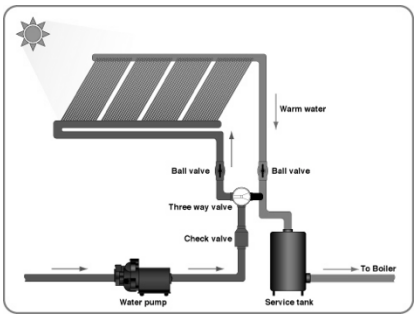
Solar Thermal Solutions

- Utilizes the sun's *heat* primarily for water systems
  - ✓ Domestic Hot Water
  - ✓ Swimming Pools
  - ✓ Faster payback than other solar alternatives

Cost-effective renewable application for schools

14

Solar Thermal System Diagram



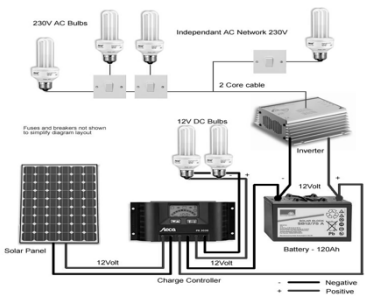
15

Solar Photo Voltaic (PV) Solutions

- Utilizes light particles for *electricity* production
- Created by "solar array"
  - ✓ Solar input collected on panels
  - ✓ Panels rated in Watts
    - 250W panel is typical
  - ✓ DC converted to AC using an "inverter"
  - ✓ Power fed to consumptive systems *OR* battery storage

16

Solar PV System Diagram



17

Solar PV – Cost Effectiveness

- Like LED, rapid decline in cost in recent years
- Small System = $3.10 per Watt installed
- Large System (i.e. 100kW & up)= $2.50 per Watt installed
- Approaching "Grid Parity"

18

Solar PV – Performance Life

- Standard 25 Year Warranty on panel
  - ✓ Maintain 80% of initial output at 25 years
  - ✓ 35 years of expected production life
  - ✓ Overall system (i.e. racking, wiring, etc.) warranties vary
  - ✓ NASA Glenn system still productive after 40 years

19

Funding Opportunities

Implement Energy Efficient Lighting Retrofits

- No Capital Outlay –

Lease to Purchase Lighting Program

- ✓ **3 - 10 year program**
  - ❖ **Savings typically is more than the lease payment**
    - ▪ ***Positive Cash Flow***
  - ❖ **No Increase in Taxes**
  - ❖ **Decrease of the General Fund**
  - ❖ **Savings Calculations are Straightforward (simple math)**

20

No Capital Solutions

Lighting Service Agreement

- ✓ **Similar to the "Lease to Purchase Lighting Program"**
- ❖ **No Financing Required** (simple service agreement with LOU)
- ❖ **Full Warranty for the Life of the Agreement (3 – 10 years)**
  - ▪ **Exterior LED Parts & Labor**
  - ▪ **Interior Material (use your staff labor)**

21

No Capital Solutions

PACE Project

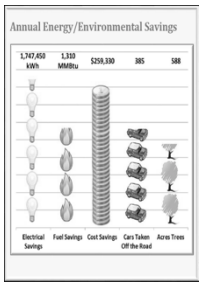
- ✓ **Similar to the "Lease to Purchase Lighting Program"**
- ❖ **Through Port Authority**
- ❖ **8-15 Year Bonds**
- ❖ **Debt attached to Building**
- ❖ **Paid back through Tax Assessments**

22

Adams County/Ohio Valley Local - Energy Savings Project

Annual Savings: $259,330*
Simple Payback: 9.49 years
Source of Funding: House Bill 264

- Lighting Retrofits
- Building Automation
- Dynamic Air Filtration System
- Kitchen Exhaust
- Walk-in refrigerator temperature controls
- Solar PV Array



Adams County/Ohio Valley Local - Energy Savings Project

The solar photovoltaic array, composed of 100,000 square feet of solar panels, will allow the district to harvest much of its electricity from the sun. As part of the project, the district also made improvements to all seven of its buildings, including the Ohio Valley Career Technology Center.

- Installed a 535 kW solar photovoltaic array, which is expected to provide the majority of the district's electricity
- Overhauled the CTC's boiler plant with new, energy efficient equipment
- Upgraded the CTC's fuel supply from oil to cleaner-burning propane
- Replaced interior lighting with more efficient lamps and remove unneeded lamps to cut waste
- Replaced exterior lighting by going to LED technology to improve energy efficiency while enhancing building safety, appearance and security

24

Adams County/Ohio Valley Local - Energy Savings Project

Continued…

- Installed occupancy sensors on many light fixtures to reduce wasted electricity
- Installed advanced energy management controls to provide real-time, web-based monitoring and management of the district's HVAC systems
- Installed energy-saving features to the kitchen exhaust fans and coolers.

25

Adams County/Ohio Valley Local

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26

Adams County/Ohio Valley Local

- **Questions:**
  - Describe the process of implementing this project and how it transitioned?
  - What suggestions would you have to fellow school board members on how to address questions from the public on "the school just renovated (or built) our buildings and now you are saying you need to enhance the buildings to save energy"?
  - As a Board Member, what was your thoughts when energy savings projects were discussed for buildings that were not very old?
  - How did the district promote the positive impact of these projects to the community?

27


Thank You
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