Towson University
Phase II, An LED Evolution: Case Study

Stephen E. Kolb, Energy Manager, Towson University
Agenda Today

• Importance of Best In Class Products and how to select them wisely
• How to establish the most effective Campus Lighting Standard
• TU transitions to LED Lighting
• Brief overview of LED Fundamentals
• Specific Applications: LED Troffers, LED Down Lights, LED Area Lights, LED Parking Structure Lights, LED Screw In Lamps
• TU Troffer “Mock Up” in General Services Building consisting of over 12 different 2x2 LED models/manufacturers

GoGreen CONSERVE
Brief Overview of Towson University

- 2nd Largest College Campus in Maryland
- Sitting on 328 acres
- 56 Buildings of all types/age
- Appx. 25,000 faculty, staff and students
- Known nationally for Teaching and Health Care Programs
- Annual Energy Spend close to $10 million
Why do we care about lighting?

• Lighting represents 25% to 40% of a building's typical electrical load.

• Lighting affects productivity and health—must provide safety.

• We often don't realize the amount of actual lighting load in our buildings.

• “Currently we are going through a lighting evolution that we have not seen since the invention of fluorescent lighting in the 1940’s.” DOE 2014, IEA Publication

• “Not since the beginning of electric lighting have managers seen such a rapid change in technology or such rapid acceptance and implementation of it.” Campus Sustainability May 2015

• “The technology is changing so fast that every six months or so, manufacturers make improvements that make it impossible to create long-term, project-standard specifications.” LD+A Publication July 2014
2014 TU Standardizes on LED---everywhere!

- 2012/2013/2014 TU Testing LED fixtures everywhere as prices decrease and performance increases

- 2014 TU makes LED the Standard for all lighting fixtures for new buildings/ major projects
Why LED??

- Excellent light quality, high CRI
- Most efficient lighting technology available (now over 100 lpw typical)
- Solid State technology
- Easiest technology to control (dimming, day-lighting, occupancy, etc.)
- Most environmentally friendly
- Prices have fallen to where it now makes sense in almost all applications
- Lumens per Watt (efficacy) expected to reach 200 within the next decade while fluorescent/HID technology remains nearly flat
DOE just released efficacy projections for LED, Fluorescent, Halogen, HID, and Incandescent technologies.

http://www.eia.gov/todayinenergy/detail.cfm?id=15471#
TU Recent LED Installations/Tests (interior and exterior)
Important considerations when selecting LED

- 2015 IECC/2013 ASHRAE/IES Standard
- Understand fc requirements, LPD
- Run Photometric Calculations for typical space
- Use DLC approved fixtures, look for Energy Star, UL
• In several dining halls, art galleries, and in multiple classroom and office buildings, .....installed 11, 14, and 17 Watt, 600, 900, and 1200 lumen Cooper Halo down-lights (Replaced 45 Watt, 54 Watt CFL's and 90 Watt incandescent ). Some have been installed since 2009. 90% of installations are 600 lumen, 11 Watt)

• In outdoor canopy locations, installed 26 Watt, 1800 lumen Lithonia Gotham LED down-lights with automatic daylight dimming controls
In several parking lots just installed 210 watt, 20,000 lumen Lithonia outdoor area lights—most with occupancy sensors to dim 50%. (Replaced 400 MH. Reduced energy by over 50%)
Installed 50 Watt, 4000 Lumen LED Selux Saturn Walkway Lights on 12 Foot Pole—used for pedestrian walkways and driveways.
High Bay LED Mock-Up

- In Towson Center Arena, installed high bay LED mock-ups of 3 manufacturer’s: Lithonia, Cooper, GE, Cree

- Lumen range 26,000 to 30,000. Fixture wattage range 200 to 300 watts. Replacing 1000 watt mercury vapor/ metal halide and 500 watt halogen fixtures

- Athletics dept., Maintenance dept., and students to assist in selection process

- Heavy emphasis on robustness, light quality, efficiency, dimmability and cost
Recently installed 30 watt, 2700 lumen Cooper “Crosstour” Wall-packs on several buildings and exterior of parking garages. (Replaced 100 watt and 150 watt HPS & MH fixtures)
This summer is 3 years since installing (1,800) 60 Watt, 29 Watt, 5000 lumen Beta/Cree LED parking structure fixtures. **Lights dim 50% when no occupancy**

( Replaced 150 watt and 175 watt MH and HPS fixtures. Failure rate has been 1-2%)
Towsontown Parking Garage Monthly Electricity Costs $$$

<table>
<thead>
<tr>
<th>Month</th>
<th>Cost ($)</th>
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<tbody>
<tr>
<td>Jul-10</td>
<td>9000</td>
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<tr>
<td>Aug-10</td>
<td>8500</td>
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<tr>
<td>Sep-10</td>
<td>8000</td>
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<tr>
<td>Oct-10</td>
<td>7500</td>
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<td>Nov-10</td>
<td>8000</td>
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<tr>
<td>Dec-10</td>
<td>9000</td>
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<tr>
<td>Jan-11</td>
<td>7000</td>
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<tr>
<td>Feb-11</td>
<td>8000</td>
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<tr>
<td>Mar-11</td>
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<td>Apr-11</td>
<td>8000</td>
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<tr>
<td>May-11</td>
<td>9000</td>
</tr>
<tr>
<td>Jun-11</td>
<td>7500</td>
</tr>
<tr>
<td>Jul-11</td>
<td>8500</td>
</tr>
</tbody>
</table>
Towsontown Parking Garage Monthly Cost $$ After LED Lighting Upgrade

Cost ($)
In 2013, 2014 installed a building mock-up of 2x2 LED “troffers” comprising of 12 different models/manufacturers throughout the TU General Services Building.

- Developed spread sheet comparing important characteristics including watts, lumens, LPW, CRI, Kelvin, light quality, appearance, price, fixture robustness, etc.

- Gathered feedback from students and staff members as well as maintenance folks.
## Mock-Up of 2’x2’ LED Troffers

**Project:** 2x2 LED Troffer Mock-Up  
**PM:** Stephen E. Kolb

<table>
<thead>
<tr>
<th>Manufact</th>
<th>Model</th>
<th>Part Num</th>
<th>Watts</th>
<th>Lumens</th>
<th>LPW</th>
<th>CRI</th>
<th>Kelvin</th>
<th>Budget</th>
<th>Dim Notes</th>
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<tbody>
<tr>
<td>H</td>
<td>Cooper Metalux Er22EN-LD1</td>
<td>34.8</td>
<td>3424</td>
<td>100</td>
<td>80</td>
<td>4000</td>
<td>y</td>
<td>~$150</td>
<td>edgelit, efficient, no movable parts, shallow footprint, excellent di</td>
</tr>
<tr>
<td>L</td>
<td>Cree CR22</td>
<td>32W3200</td>
<td>32</td>
<td>3200</td>
<td>100</td>
<td>85</td>
<td>4000</td>
<td>y</td>
<td>efficient, odd looking panels</td>
</tr>
<tr>
<td>K</td>
<td>GE Luminatio ET220A3A</td>
<td>50</td>
<td>3550</td>
<td>71</td>
<td>80</td>
<td>4000</td>
<td>y</td>
<td>y</td>
<td>very light, maint friendly, inefficient</td>
</tr>
<tr>
<td>J</td>
<td>GE Luminatio ET220A1A</td>
<td>50</td>
<td>3220</td>
<td>64</td>
<td>80</td>
<td>3000</td>
<td>y</td>
<td>y</td>
<td>very light, maint friendly, inefficient</td>
</tr>
<tr>
<td>I</td>
<td>Finelite HPR-LED HPR-A-2x2</td>
<td>37</td>
<td>3460</td>
<td>94</td>
<td>83</td>
<td>4000</td>
<td>y</td>
<td>y</td>
<td>nice distribution, on board controls, very deep fixture, bulky</td>
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<tr>
<td>G</td>
<td>Cooper Corelite R2-WL-2L</td>
<td>38.4</td>
<td>3042</td>
<td>79</td>
<td>85</td>
<td>4000</td>
<td>Y</td>
<td>Y</td>
<td>well constructed, clean design, inefficient</td>
</tr>
<tr>
<td>C</td>
<td>Cooper Metalux A 2AC-LD2-3</td>
<td>39.3</td>
<td>3370</td>
<td>86</td>
<td>85</td>
<td>4000</td>
<td>Y</td>
<td>Y</td>
<td>some diodes failed, ok overall</td>
</tr>
<tr>
<td>A</td>
<td>Lithonia VTLED 2VTL236L/</td>
<td>36</td>
<td>3617</td>
<td>100</td>
<td>82</td>
<td>4000</td>
<td>Y</td>
<td>y</td>
<td>Center removable plastic lens, very efficient,</td>
</tr>
<tr>
<td>B</td>
<td>Lithonia 2RTLED 2RTL233L</td>
<td>38</td>
<td>3300</td>
<td>87</td>
<td>82</td>
<td>4000</td>
<td>y</td>
<td>y</td>
<td>Dual removable plastic lens, less efficient,</td>
</tr>
<tr>
<td>F</td>
<td>Maxlite MAXLED MLFP22DP</td>
<td>45</td>
<td>3500</td>
<td>78</td>
<td>82</td>
<td>3500</td>
<td>Y</td>
<td>y</td>
<td>flat panel, edge lit, less efficient</td>
</tr>
<tr>
<td>E</td>
<td>TCP 2x2LED TRV2</td>
<td>38</td>
<td>3200</td>
<td>84</td>
<td>NA</td>
<td>3000</td>
<td>Y</td>
<td>y</td>
<td>poor construction, flimsey movable parts, inefficient</td>
</tr>
<tr>
<td>D</td>
<td>Nulite Sottile L2D</td>
<td>51</td>
<td>3722</td>
<td>73</td>
<td>87</td>
<td>4000</td>
<td>Y</td>
<td>Y</td>
<td>poor construction, flimsey movable parts, inefficient</td>
</tr>
</tbody>
</table>
Recently added TCP PAR LED and A type LED to our standard after many tests. Most PAR 38 lamps are 11 and 14 Watt, 1100 lumen. (Replaced Halogen 90 Watt)
Learnings/Tips

- Do a lot of testing, mock-ups, pilot projects, etc.
- Develop strong relationship with partners/vendors
- Increase use of step-dimming, continuous dimming, day-lighting.
- Used Purpose Built components/fixtures
- Install occupancy data loggers to justify sensors
- Follow IECC /ASHRAE/IES guidelines
- Run calculations/photo-metrics for all typical spaces
- Follow NEC/local codes
- Write a very detailed contract, scope of work, timeline, expectations, standards, inspections, etc.
Questions??

Stephen E. Kolb, Energy Manager Towson University
skolb@towson.edu