LED lighting….it’s here to stay!

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Osseo case study conclusions:

- LED was the correct choice (performance and financial)
- recommended light levels achieved from half the energy of metal halide lamping
- predicted LED life provides substantial maintenance savings
- achieved the predicted long-term cost savings
- light levels are being maintained as predicted (better than conventional metal halide lamping)
Osseo actual performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculated values</td>
<td>0.3 FC</td>
<td>2.7 FC</td>
</tr>
<tr>
<td>Measured values October 2009</td>
<td>0.6 FC</td>
<td>2.6 FC</td>
</tr>
<tr>
<td>Measured values October 2013</td>
<td>0.6 FC</td>
<td>2.8 FC</td>
</tr>
<tr>
<td>Measured values October 2014</td>
<td>0.5 FC</td>
<td>2.5 FC</td>
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</tbody>
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*Approximately 22,000 hours burn time

**Estimated yearly energy savings:** $10,059
**Actual yearly energy savings:** $9,936*
**Maintenance:** Virtually none required

*Estimated based on limited data points
how far has LED come? where is it going?

• lighting performance sufficient for most applications
• rated life ranges from 70,000 hours to 100,000+ hours due to technical advances
• installed cost still somewhat more than conventional HID lamping (but coming down)
• energy and maintenance savings is significant
• “controllability” greatly exceeds that of conventional lamping
LED lighting performance

• lumens-per-watt matches or exceeds that of conventional lamping
• LED generally has better “deliverability” than conventional (less light lost)
• LED has better lumen maintenance (better retention of lumens throughout rated life)
• Color temperature: 2,700K to 6,500K available
• these factors are why LED is now being employed for most applications
significant maintenance advantage!

- typical life span now 100,000 hours or more by most major manufacturers (laboratory results)
- 25 years of service if used 4,000 hours per year
- life can be further extended with dimming control
- heat dissipation is key – the cooler they run, the longer they last
capital cost

- LED still has “first cost” premium compared to conventional lamping
- When built, the per fixture premium for Osseo was $500, with projected payback of 6.6 years
- for acorn globes similar to Osseo project, that cost is presently about $300 per fixture
- If built today, city of Osseo would realize project payback in four years
Alexandria, MN: relighting Broadway Avenue

- construction completed Oct. 2014
- new traditional appearance post top, 80W, dual globes 16 feet high
- lighted street width of 80 feet (twice the width of Osseo project)
- pre-project average light level: 1.3 FC. Post-project: 1.5 FC
- energy use cut in half
- simple payback projected to be 4.8 years versus predecessor
what about high-output applications?

- several manufacturers have industrial “high-bay” lighting products (ambient temperature an issue?)
- MNDOT using LED for freeway lighting at 40-plus-foot mounting heights
- based on product availability for high-bay applications, high-mast freeway lighting may soon follow
- some manufacturers offer luminaires designed for auto sales lots, which require high-light levels
- manufacturer Musco advertises LED lighting for Twickenham Stadium in the UK
what does future hold?

• capital costs continue to decrease with increasing sales volume
• energy and maintenance savings will continue improvement, but less dramatically than recently
• economic attractiveness will increase
• based on these observations, future of lighting will be predominated by LED