Street Lighting Technology Research

In conjunction with
Indiana Municipal Utility Group
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Modern Lighting Benefits

- Reduced cost (electric and maintenance)
- Increased reliability
- Whiter light than high pressure sodium.
- Energy savings → reduced emissions
- Improved safety
- Improved perception of neighborhood
- Reduced maintenance and longer life
- Light levels can be controlled by use and time of day or activity level
The cost of luminaires has significantly decreased and output has increased.

- Light output is trending to 130 Lumens /watt
- Cost of a 100W equivalent LED luminaire has greatly decreased and is approaching HPS. Cost of equivalent HPS is trending up. Cost for other LED equivalent wattages also decreasing.
- Life expectancy → 100,000 hrs
Modern Lighting Is Being Widely Implemented

- In the City of Los Angeles "Bright Lights, Safe Nights“ program a total of 167,028 (March 2016) of the existing 210,000 street lights have been converted from principally HPS to LED.

- Crime statistics comparing 2009 to 2012, as reported by the local police, indicate < in Theft From Vehicles of 10.67%, a < in Burgultry-Robbery-Theft of 6.40%, and a < in Vandalism of 10.90% for a total decrease in these categories of 8.9%.
In shifting to an optimized white light, visibility is increased resulting in both increases in safety as well as the perception and enjoyment of the community at night.

As stated by the Urban Age Institute, "It is however also becoming apparent that modern LED lighting increases citizens sense of safety, makes cities more inviting for tourism, and increases productivity at our workplaces (without having to work harder)."
Before
195 W HPS

After
88 W LED
55% energy savings

Source: City of Redlands, CA, presentation: "Energy Efficient Light Emitting Diode (LED) Street Lighting Conversion Study", Municipal Utilities and Engineering Department, 2010
Virginia Tech Research Study Compared the lighting level to crash rate ratios for 83,000 crashes and 2000 miles of roadway lighting
Local Issues

- There isn’t a generic luminaire that can satisfy all needs.

- Maximizing value requires consideration of luminaire design for a particular application.

- The number of luminaire types can be controlled and most of the benefit can still be obtained.
HPS                                    LED

Use an iterative implementation process that considers the specific needs of a region

- A cooperative involvement of the parties where everyone wins maximizes value.
- There are reported successes and failures
  - Often the negative outcomes resulted from lack of a comprehensive design as well as use of equipment that was not designed for the particular application or was technically behind the current state of the art.
Initial Lumen Depreciation
"Favorite Failures"

1. Power Supply/Driver components
2. LED failures (shorts, connections, board)
3. Moisture ingress, corrosion
4. Power quality (surge, noise,..)
5. Materials-related lumen depr
6. Color shift (materials related)
7. Color shift (LED)
8. Sensors, controls
Driver Reliability Testing
LEDs can cause glare, which may negatively impact adoption if not implemented correctly.
Impact on Neighborhoods

- Lighting assists in efforts to revitalize blighted or deteriorating neighborhoods.
- In street light performance tests conducted by the EERC in the field on city streets it has been noted on numerous occasions that the white light of LED luminaires makes it easier to detect vehicles, detail and motion in the areas illuminated by LED street lights as compared to the same area illuminated by HPS light.
- It is clear that the presence of LED street lights reduce safety concerns related to traffic during the data collection process.
- Transitioning to LED street lights substantially improves nighttime vision and in turn improve safety and security there helping improve the neighborhoods as a whole.
- The benefits provided by LED technology contribute to revitalization of areas by improving both the quality of lighting and the penetration of lighting.
- Good road lighting contributes to a feeling of security by residents.
The quality of the light as perceived by the public is essential in determining alternatives.
- Dark Sky issues
- Perception of glare can vary from person to person.
- White light improves perception of objects and ability to sense motion (human eye is the light sensor) when compared to monochromatic yellow light from HPS.
Opportunity to introduce new luminaires that have much higher efficiency and improved light quality as an alternative to replacing aging luminaires with HPS again.

- If sequenced in a consistent manner, a graded program over time will introduce upgrades at an initial cost slightly higher than HPS but would provide significant savings in energy and maintenance and overall improved value – Probabilistic Life Cycle Cost Analysis
Thank You!

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