Analysis of Energy Efficient Highway Lighting Retrofits

SPR Project C-14-12

Principle Investigator: Lighting Research Center, Rensselaer Polytechnic Institute (LRC, RPI)

July 24, 2017
Objective of Project

- Light emitting diodes (LEDs) are evolving rapidly and becoming more energy efficient and long-lasting.

- Can NYSDOT take advantage of new lighting technologies, particularly LEDs, to improve existing highway lighting while reducing energy and maintenance costs?

- Tasks included documenting existing lighting, evaluating the photometric performance of LED retrofit options, and conducting economic analyses for two locations:
  - Southern State Parkway, Long Island (freeway)
  - NYS Route 5 (Central Avenue), Albany County (major arterial)
Example of Project Findings

### Measurement and Calculations

**Comparison of LED Retrofit Options**

<table>
<thead>
<tr>
<th>Luminaire</th>
<th>Ave.</th>
<th>Max.</th>
<th>Min.</th>
<th>Ave/Min</th>
<th>Max/Min</th>
<th>Lumen/Lavel</th>
<th>Watts</th>
<th>Lumens</th>
<th>Efficacy</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>8.9</td>
<td>15.7</td>
<td>2.9</td>
<td>3.1</td>
<td>5.5</td>
<td>0.3</td>
<td>140</td>
<td>8627</td>
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<tr>
<td>B</td>
<td>12.7</td>
<td>26.2</td>
<td>2.5</td>
<td>5.1</td>
<td>10.6</td>
<td>0.2</td>
<td>148</td>
<td>10900</td>
<td>74</td>
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<tr>
<td>C</td>
<td>12.6</td>
<td>20.5</td>
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<td>2.1</td>
<td>3.5</td>
<td>0.2</td>
<td>143</td>
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<tr>
<td>D</td>
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</tbody>
</table>

**Central Avenue LED Option B**

- **Luminaires**: 150
- **Wattage**: 295 W
- **Subtotal**: 44250 W
- **Power Savings (%)**: 49.8%
- **Power Savings**: 22050 W
- **Hours/yr**: 4380 hr
- **kWh/yr savings**: 96579 kWh/yr
- **Cost/kWh**: $0.15
- **Energy savings/yr ($)**: $15,240
- **Luminaire price (ea)**: $708 ea
- **Luminaire cost**: $106,200
- **Installation cost**: $16,500
- **Payback**: 8 yr

**Central Avenue LED Option C**

- **Luminaires**: 150
- **Wattage**: 295 W
- **Subtotal**: 44250 W
- **Power Savings (%)**: 51.5%
- **Power Savings**: 22800 W
- **Hours/yr**: 4380 hr
- **kWh/yr savings**: 98864 kWh/yr
- **Cost/kWh**: $0.15
- **Energy savings/yr ($)**: $15,759
- **Luminaire price (ea)**: $730 ea
- **Luminaire cost**: $109,500
- **Installation cost**: $16,500
- **Payback**: 8 yr
Summary of Findings

- The project results indicated that LED retrofit options could feasibly improve light levels while reducing energy use for both locations
  - Energy use reductions of 7%-48% were identified
  - CO₂ emissions could be reduced by up to 400 tons annually
- Specifications should consider warranty and radio interference issues
- NYSDOT is collaborating with New York State Energy Research and Development Authority (NYSERDA), the local municipalities and the electric utility to install LEDs at one of the test locations; scheduled completion in 2018
Project Team

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