City of Los Angeles

“Changing our Glow for Efficiency”

Municipal Solid State Lighting Consortium - LED Workshop

Los Angeles
April 2012
City of Los Angeles Facts

• 472 Sq. Mi.
• 6500 Miles of streets
• 22 Departments
• 2nd largest City in the USA
• $6.7 Bi. City Budget for 2011
• Population of 4 Million
• Utility owned by the City
Bureau of Street Lighting Operations

- One of five Bureaus in the Dept. of Public Works, Est. in 1925
- 210,000 streetlights with over 400 different styles
- 4500 miles of streets are illuminated
- $22 Mil. Annual Budget Appropriation for 2011
Bureau of Street Lighting Operations

• Street Lighting Maintenance Assessment Fund

• All maintenance and engineering work in House/214 Employees

• More than 70,000 streetlight repairs per year
**Geographic Information System**

- Complete geographic database (GIS) with over 210,000 streetlight poles.

- This database has all streetlight attributes including light source, and all plans associated with the location.

- Direct connection between the geographic database (GIS) and our Computer Aided Drafting (CAD) environment.

- This database is used for our maintenance and repair, billing purposes, planning and design including maps for our LED program.
Intersection / Address Search

Search for an intersection by entering a primary and cross street name.
Example: Spring and Temple

Primary street:
Cross street:

Submit  Return

Search for an address by entering a number and street name *
Example: 200 Spring

1149 S Broadway

Submit  Return

* UPDATE: Entering the street direction is no longer required.
All matching addresses will be shown (e.g., 200 N Spring St, 200 S Spring St, etc.) and the desired address can be selected from the list.
Bureau of Street Lighting
Asset Maintenance System
Job Report

Job Report

The incident you selected has the following job(s):

Return

Incident: 185523
Job number: 1
Crew leader: V. HERNANDEZ
Actual repair hours: 1
Job status: complete
Job date: 4/13/2009
Resolution: None specified
Resolution description: ISA; POST S/S; GLASSAWIRE; MISSING; LUM TILTED; ORDERED PARTS.
Overtime: No
Date entered: 4/16/2009 9:38:02 AM
Last update: 4/16/2009 9:38:02 AM
Last update by: rlangda

Crew usage information

<table>
<thead>
<tr>
<th>Job</th>
<th>Class</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>St. Ltg. Electrician</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>Electrical Craft Helper</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>Assistant St. Ltg. Electrician</td>
<td>1</td>
</tr>
</tbody>
</table>

Equipment usage information

<table>
<thead>
<tr>
<th>Job</th>
<th>Equipment</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DIGGER DERRICK TRUCK (39798)</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>COMPRESSOR DUMP TRUCK (39499)</td>
<td>1</td>
</tr>
</tbody>
</table>

Return
### Open Incidents Summary Report

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>conduit hit</td>
<td>3</td>
</tr>
<tr>
<td>construction</td>
<td>19</td>
</tr>
<tr>
<td>inspect</td>
<td>1</td>
</tr>
<tr>
<td>LED installation</td>
<td>46</td>
</tr>
<tr>
<td>multiple lights out</td>
<td>53</td>
</tr>
<tr>
<td>other damage</td>
<td>14</td>
</tr>
<tr>
<td>other failure</td>
<td>16</td>
</tr>
<tr>
<td>post hit</td>
<td>99</td>
</tr>
<tr>
<td>single light out</td>
<td>202</td>
</tr>
<tr>
<td>vandalism</td>
<td>16</td>
</tr>
</tbody>
</table>

Total: 469

Run date: 6/23/2010 10:30:05 AM
### Repair Equipment

<table>
<thead>
<tr>
<th>Equip. no.</th>
<th>Equipment description</th>
<th>Cost per hour</th>
<th>In-service?</th>
</tr>
</thead>
<tbody>
<tr>
<td>00000</td>
<td>NO EQUIPMENT UTILIZED (N/A)</td>
<td>$0.00</td>
<td>yes</td>
</tr>
<tr>
<td>02520</td>
<td>SEDAN - SUPV II (SEDAN)</td>
<td>$0.00</td>
<td>yes</td>
</tr>
<tr>
<td>10051</td>
<td>HERTZ RENTAL AERIAL LIFT (487-38-6001)</td>
<td>$56.59</td>
<td>yes</td>
</tr>
<tr>
<td>10055</td>
<td>HERTZ RENTAL AERIAL LIFT (487-31-6001)</td>
<td>$56.59</td>
<td>yes</td>
</tr>
<tr>
<td>10057</td>
<td>ALTEC LOANE AERIAL (Indiana 1034092) (AERIAL LIFT)</td>
<td>$56.59</td>
<td>yes</td>
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<tr>
<td>10058</td>
<td>HERTZ RENTAL AERIAL LIFT (487-019.Lic# 756512) (AERIAL LIFT)</td>
<td>$56.59</td>
<td>yes</td>
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<tr>
<td>10059</td>
<td>HERTZ RENTAL PORTABLE COMPRESSOR (Lic # SE 564123) (PORT COMPRESSOR)</td>
<td>$16.31</td>
<td>yes</td>
</tr>
<tr>
<td>10062</td>
<td>HERTZ RENTAL PORTABLE COMPRESSOR (Lic # SE564126) (PORT COMPRESSOR)</td>
<td>$16.31</td>
<td>yes</td>
</tr>
</tbody>
</table>
Operational Challenges for Bureau of Street Lighting

- Energy Usage - 190 million KWH/year
- Energy Cost - $16 million/year
- No meters. Energy calculated from GIS system, nominal wattage, KWH price per time of use.
- Proposition 218 & frozen Assessments
City of Los Angeles – LED Program

PARTNERS

Los Angeles Department of Water & Power

CLINTON FOUNDATION

2008

BUREAU OF STREET LIGHTING
DEPARTMENT OF PUBLIC WORKS
CITY OF LOS ANGELES
WHY Program was Developed

- Contribute to Mayor’s Green Initiative for City of Los Angeles
- To reduce energy consumption by 40%
- To reduce maintenance costs - Longer life of fixtures
- Reduction in carbon emissions
City of LA - LED PROGRAM

- Convert 140,000 streetlights to LED
- Install Remote Monitoring System
- Timeline – 5 years
- 20,000 in first year; 30,000 2nd to 5th
- Total Cost - $57 million
- Loan $40 million
- City crews
- Program payback – 7 years
- Launched – February 2009
LED Program

Benefits

• **Energy Savings** – 68,000,000 KWH/year, $7.5 million/year

• **Maintenance Savings** - $2.5 million/year

• **Environment** - Reduce 40,500 tons of CO2/year

• **White Light**, perception of improved lighting/visibility/dimming capability

• **Installation of remote monitoring units**
LED CONVERSION OF 140,000 STREETLIGHTS IN THE CITY OF LOS ANGELES
• **Testing Phases**
  - Process done every six months

• **Specifications**
  - Revised based on testing results and technology improvements

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**TESTING AND EVALUATION**

- **Total Met minimum requirements**: 147
- **Installed at Site and Tested**: 31
- **Units Approved**: 9

(Bar chart showing LED Units that requested Evaluation/Test)

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**Total Met minimum requirements**

**Installed at Site and Tested**

**Units Approved**
TESTING AND EVALUATION

**Lighting Evaluation**
Illumination, Luminance, Uniformity Ratio, Color Temperature, Brightness.

**Electrical Evaluation**
Power consumption, Power Factor, Harmonic Distortion, Remote Monitoring Device compatibility, Remote Dimming/Controls.

**Mechanical Evaluation**
Disconnects, fixture assembly and ease of installation.
Summary of City of LA Specifications

- 4000° K TEMPERATURE
- Warranty 6 years
- 70% delivery of initial lumens at 50,000 hours
- Minimum of 45% energy savings
- 3-prong twist-lock PE receptacle
- House-side light control
- Size, Weight, Packaging, Initial Lumens and Efficacy
- Bureau’s Webpage: http://bsl.lacity.org/
Public Outreach

• Improved Lighting
• No Cost
• No Negative Impact
• Surveys
• Dedicated telephone line
• Website – www.bsl.lacity.org

The Bureau of Street Lighting has started to replace existing modern streetlight fixtures (see inset picture) in the City with Light Emitting Diode (LED) units. This program will save energy by 40%, approximately 40,500 tons of carbon emissions per year, and reduce maintenance of the City’s street lighting system. The replacement will be completed through City forces.

Presented by the
CITY OF LOS ANGELES - DEPARTMENT OF PUBLIC WORKS
BUREAU OF STREET LIGHTING
If you have questions, please visit our website at http://bsl.lacity.org or call (213) 447-1891
Current Status of LED Program

- 73,114 fixtures installed up to date
- 7,946 KW TOTAL Energy savings
- 19,169 MT of CO2 reduced annually
- Mostly on residential, local streets
- $2,866,224 Annual Energy Savings
City of Los Angeles
Bureau of Street Lighting
LED Conversion Program

Engineering → Testing & Evaluation → Specifications → Design & Plans

Installation → Procurement & Delivery → City Forces & Rental Trucks

Geographical Information System (GIS) And Savings → As-Builts and GIS → Bills → Dollar Savings & CO₂ Emission Reductions
LED Program
Street Lighting Energy Cost

Energy Cost

March 13, 2012
Before and After Pictures of Program

BEFORE (200 W HPS)
6th Street Bridge over Los Angeles River

Fc.: 4.31
Ave./Min.: 2.40
Max./Min.: 5.4
Before and After Pictures of Program

AFTER (LED)
6th Street Bridge over Los Angeles River

Fc.: 3.48
Ave./Min.: 1.63
Max./Min.: 2.67
Before and After Pictures

La Mirada Ave. – Seward St. to Wilcox Ave.

BEFORE (100 W HPS)

Fc.: 0.68
Ave./Min.: 13.60
Max./Min.: 54.80

AFTER (LED)

Fc.: 0.46
Ave./Min.: 2.42
Max./Min.: 4.32
Before and After Pictures of Program

Hoover St. – 32nd St. to 30th St.

BEFORE (310 W HPS)

Fc.: 2.56
Ave./Min.: 2.33
Max./Min.: 5.35

AFTER (LED)

Fc.: 1.42
Ave./Min.: 1.80
Max./Min.: 3.30
# LED Energy Efficiency Program

## Total Savings By Council District - LED Conversion Program

<table>
<thead>
<tr>
<th>Council District</th>
<th>Total Number of Units</th>
<th>Total Nominal Wattage Before (kW)</th>
<th>Total Nominal Wattage After (kW)</th>
<th>% Energy Savings</th>
<th>Annual CO2 Reduction (Metric Tons)</th>
<th>Annual Energy Savings (MWh)</th>
<th>Annual Energy Savings ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2880</td>
<td>577.5</td>
<td>219.8</td>
<td>62.0%</td>
<td>863.5</td>
<td>1,460.3</td>
<td>$129,090.28</td>
</tr>
<tr>
<td>2</td>
<td>2284</td>
<td>377.3</td>
<td>102.2</td>
<td>72.9%</td>
<td>663.7</td>
<td>1,122.4</td>
<td>$99,364.60</td>
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<tr>
<td>3</td>
<td>4289</td>
<td>687.2</td>
<td>235.0</td>
<td>65.8%</td>
<td>1,090.9</td>
<td>1,844.9</td>
<td>$163,087.58</td>
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<tr>
<td>4</td>
<td>3150</td>
<td>550.6</td>
<td>188.5</td>
<td>65.8%</td>
<td>873.5</td>
<td>1,477.3</td>
<td>$130,592.12</td>
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<tr>
<td>5</td>
<td>4347</td>
<td>718.6</td>
<td>219.8</td>
<td>69.4%</td>
<td>1,203.4</td>
<td>2,035.2</td>
<td>$179,912.93</td>
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<tr>
<td>6</td>
<td>1509</td>
<td>255.6</td>
<td>113.9</td>
<td>55.5%</td>
<td>342.0</td>
<td>578.3</td>
<td>$51,123.81</td>
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<tr>
<td>7</td>
<td>4665</td>
<td>816.1</td>
<td>312.1</td>
<td>61.8%</td>
<td>1,216.1</td>
<td>2,056.6</td>
<td>$181,806.46</td>
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<tr>
<td>8</td>
<td>9778</td>
<td>1,596.8</td>
<td>621.0</td>
<td>61.1%</td>
<td>2,354.2</td>
<td>3,981.4</td>
<td>$352,295.20</td>
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<tr>
<td>9</td>
<td>5644</td>
<td>1,026.1</td>
<td>395.3</td>
<td>61.5%</td>
<td>1,521.9</td>
<td>2,573.8</td>
<td>$227,520.19</td>
</tr>
<tr>
<td>10</td>
<td>7100</td>
<td>1,236.8</td>
<td>441.1</td>
<td>64.3%</td>
<td>1,919.8</td>
<td>3,246.7</td>
<td>$287,007.99</td>
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<tr>
<td>11</td>
<td>1090</td>
<td>172.2</td>
<td>72.8</td>
<td>57.7%</td>
<td>239.8</td>
<td>405.5</td>
<td>$35,843.22</td>
</tr>
<tr>
<td>12</td>
<td>9288</td>
<td>1,544.8</td>
<td>663.9</td>
<td>57.0%</td>
<td>2,125.2</td>
<td>3,564.2</td>
<td>$317,725.70</td>
</tr>
<tr>
<td>13</td>
<td>3841</td>
<td>737.1</td>
<td>260.4</td>
<td>64.7%</td>
<td>1,150.2</td>
<td>1,945.2</td>
<td>$171,956.87</td>
</tr>
<tr>
<td>14</td>
<td>4963</td>
<td>944.2</td>
<td>339.5</td>
<td>64.0%</td>
<td>1,458.8</td>
<td>2,467.1</td>
<td>$218,088.98</td>
</tr>
<tr>
<td>15</td>
<td>8186</td>
<td>1,400.8</td>
<td>511.3</td>
<td>63.5%</td>
<td>2,145.9</td>
<td>3,629.1</td>
<td>$320,808.37</td>
</tr>
</tbody>
</table>

| Total            | 73114                 | 12,642 kW                         | 4,696 kW                         | 62.9%            | 19,169 MT                          | 32,418 MWh                | $2,866,224               |

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"Bright Lights, Safe Nights"

Ed Ebrahimian, Director
“Lessons Learned”

• “TRUST BUT VERIFY” – Not all claims manufacturers make are true.

• “REALITY VERSUS THEORY” – The change from HPS to white light with the LEDs is being perceived as a significant increase in lighting levels.

• “ENERGY SAVINGS ARE REAL” – As the LEDs improve, and the manufacturers develop the technology, the energy savings are being realized and continue to increase.

• “IMPROVED VISIBILITY” – The change from HPS to white light have improved visibility as noticed by residents and encouraged by the Police Department.
“Lessons Learned”

• “HANDLING AND INSTALLATION”
  - Smaller/lighter units, easy to install and transport. Weight reduction between 15% and 55% depending on the wattage size
  - No need to carry components in trucks for maintenance
  - Reduction in warehousing space - No need to store components
  - Packaging – Volume of LED units has been reduced by at least 50% from the HID units

• “LED ADVANTAGES”
  - Improved uniformity ratios – “Carpeted Effect”
  - Allows for designs with smaller wire and conduit sizing
  - Compatible with Remote Monitoring Systems
  - Option of dimmable driver
  - Instant ON and OFF operation
“Lessons Learned”

• “PERFORMANCE”

➢ Use of Type II light distribution on local streets instead of the historically Type III

➢ House-side shield available

➢ Improved visibility and reduction of hot-spots

➢ Ratio of Maximum/Minimum has become more relevant than ratio of Average/Minimum

➢ The cooler the color temperature of the LEDs, the more glare complaints we received from people
“Lessons Learned”

• “PERFORMANCE”

➢ Lumen and Dirt Depreciation Study Results

<table>
<thead>
<tr>
<th></th>
<th>LUMEN</th>
<th>DIRT</th>
<th>TOTAL (LED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 YEARS</td>
<td>13%</td>
<td>4%</td>
<td>17%</td>
</tr>
<tr>
<td>4 YEARS</td>
<td>8%</td>
<td>9%</td>
<td>17%</td>
</tr>
</tbody>
</table>

➢ Comparison of failures of new roadway lighting equipment installed after 24 months of initial operation:

Average failure of HID - 10% (based on past installation history)

Average failure of LED - 0.2% (based on retrofit LED program)
## “Lessons Learned” Program Vs. Actual

<table>
<thead>
<tr>
<th>Category</th>
<th>Program Goals</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Units Installed</td>
<td>70,000</td>
<td>73,114</td>
</tr>
<tr>
<td>Energy Savings</td>
<td>40%</td>
<td>63%</td>
</tr>
<tr>
<td>Performance</td>
<td>Uniformity a Concern</td>
<td>Good Uniformity, better than HPS</td>
</tr>
<tr>
<td>Community Feedback</td>
<td>Anticipated Negative</td>
<td>Mostly Positive</td>
</tr>
<tr>
<td>City Crews and Union Hall</td>
<td>20 units/day/crew</td>
<td>30 units/day/crew</td>
</tr>
<tr>
<td>Removed HID Units</td>
<td>Recycle old units</td>
<td>Auction - $513,858 in revenue</td>
</tr>
</tbody>
</table>
"Lessons Learned"

Unit Cost Breakdown for the first year LED Program

- **Engineering** - $30.13
- **Labor** - $42.58
- **Material** - $422.62

**TOTAL COST PER UNIT** = $495.33
"Lessons Learned"
Citywide Crime Statistics

Incidents between hours of 7 PM to 7 AM

<table>
<thead>
<tr>
<th>CRIME TYPES</th>
<th>YEAR</th>
<th>%REDUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2009</td>
<td>2011</td>
</tr>
<tr>
<td>Total</td>
<td>46,869</td>
<td>41,944</td>
</tr>
<tr>
<td>Vehicle Theft</td>
<td>15,778</td>
<td>13,632</td>
</tr>
<tr>
<td>Burglary-Robbery-Theft</td>
<td>19,967</td>
<td>18,406</td>
</tr>
<tr>
<td>Vandalism</td>
<td>11,115</td>
<td>9,906</td>
</tr>
</tbody>
</table>

• Most units installed in residential, local streets
THANK YOU

City of Los Angeles
Bureau of Street Lighting
Ed Ebrahimian, Director

http://bsl.lacity.org/