City of Los Angeles

“Changing our Glow for Efficiency”

Los Angeles, CA
June 2013
City of Los Angeles Facts

✓ 2nd largest City in the USA
✓ 472 sq mi
✓ 6500 miles of streets
✓ Population of 4 Million
✓ $7.2 Bi. City Budget for 2012
✓ Power Utility owned by the City
Bureau of Street Lighting

• One of five Bureaus in the Department of Public Works, Est. in 1925

• 210,000 streetlights with over 400 different styles

• 4500 miles of streets are illuminated
Bureau of Street Lighting Operations

- Street Lighting Maintenance Assessment Fund
- All maintenance and engineering work In-House
  214 Employees
- $25 Mil. Annual Budget – Appropriation for FY 12/13
Operational Challenges for Bureau of Street Lighting

- Energy Usage - 190 million kWh/year (2008)
- 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

“Mayor’s Green Initiative for City of Los Angeles”

PARTNERS

Los Angeles Department of Water & Power

CLINTON FOUNDATION

BUREAU OF STREET LIGHTING
DEPARTMENT OF PUBLIC WORKS

CITY OF LOS ANGELES
City of LA - LED Program

- Convert 140,000 streetlights to LED
- Install Remote Monitoring System
- Timeline – 4 years
- Total Cost - $57 million
- Loan $40 million
- City crews
- Program payback – 7 years
- Launched – February 2009
LED Program Goals & Benefits

• Reduce energy consumption by 60%

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

• Maintenance Savings - $2.5 million/year; Longer life of LED fixtures (10-15 yrs.)

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

• White Light, perception of improved lighting/visibility/dimming capability
LED Conversion of 140,000 streetlights in the City of Los Angeles
Testing and Evaluation

- **Testing Phases**
  - Process done every six months

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

**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.

LED Units that requested Evaluation/Test

- Requests Received: 244
- Met minimum requirements: 84
- Installed at Site and Tested: 71
- Approved: 20
Summary of City of LA Specifications

- 4000 K
- 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 http://bsl.lacity.org
LED Conversion Project
Implementation Process

Engineering
- Testing & Evaluation
- Specifications
- Design & Plans

Installation
- Procurement
- Delivery
- City Forces & Rental Trucks

GIS
- As-Built & GIS
- Bills
- Dollar Savings & CO2 Emission Reductions
L.A. Lighting the Way
Statistics

- Jobs Created
  - Manufacturer: 227
  - City of LA: 15
- Truck rentals: 7
- No. of Crews: 7

Workload

- Weekly Installations: 1,000
City of Los Angeles - LED Conversion Project

Local
Streets

Major
Streets

LED LUMINAIRE
CONVERSION STATUS
LOCAL AND MAJOR STREETS
APRIL 1, 2013

- MAJOR STREETS CONVERTED
- LOCAL STREETS CONVERTED
- UNCONVERTED
- MAJOR STREET / FREEWAY
- CITY BOUNDARY
- INTERMITTENT WATERBODY
- PERENNIAL WATERBODY
City of Los Angeles – Bureau of Street Lighting
LED Conversion Project

140,000 LED Streetlights

63.3% Energy Savings

$7 Million Savings

45,700 Metric Tons
CO2 Reduction

Cars
(approx.)
9,500 cars off the road

Homes
(approx.)
Energy for 6,800 homes
<table>
<thead>
<tr>
<th>Year</th>
<th>Avg. Price</th>
<th>Efficacy</th>
<th>Life</th>
<th>Warranty</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>$432</td>
<td>42 Lm/W</td>
<td>80,000 hrs</td>
<td>5 yrs</td>
</tr>
<tr>
<td>2010</td>
<td>$298</td>
<td>61 Lm/W</td>
<td>111,000 hrs</td>
<td>6 yrs</td>
</tr>
<tr>
<td>2011</td>
<td>$285</td>
<td>72 Lm/W</td>
<td>&gt;150,000 hrs</td>
<td>6 yrs</td>
</tr>
<tr>
<td>2012</td>
<td>$245</td>
<td>81 Lm/W</td>
<td>&gt;150,000 hrs</td>
<td>7 yrs</td>
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</table>
LED Program
Street Lighting Energy Cost

March 13, 2012
Start of LED Program
Remote Monitoring System
Street Lighting and Controls

- 210,000 streetlights in the City of Los Angeles
- 54,027 street lighting controls installed
- Majority installed over the last 3 years (with our LED program)
Remote Monitoring System
Existing Street Lighting Controls

• System utilizes mesh network and gateway
• Server hosted by manufacturer
• Provide streetlight diagnostics (operations, power consumption etc.)
• On/Off ability
• Lighting Control integrated in PE cell
• No GPS self activation. Manually activated with a Bar Code scanner
Remote Monitoring System
Street Lighting Control - Challenges

- Deployment Challenges
  - Stickers and bar coding
  - Cumbersome Process
  - Too much inputting
  - Too many devices
  - Too much time for activation
  - Field crew vs. contractor
- Interference – 3G, 4G to what’s next.
- Ornamental Systems
Remote Monitoring System
Street Lighting Control - Future Needs

- Better commissioning deployment
  - GPS built-in option
  - Remote activation
- Meter grade accuracy (2% or less)
- Flexibility for use with decorative systems
- Power back-up system on devices
- No monitoring fees
- Cost Reduction – more affordable
- Systems Compatibility – Standardization
Before and After Pictures of Program

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

AFTER – 180 W LED (180 W)
6th Street Bridge over Los Angeles River

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

BEFORE
200 W HPS
(240 W)

Fc.: 1.59
Ave./Min.: 2.3
Max./Min.: 5.23

La Brea Avenue – HPS
Before and After Pictures of Program

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fc.</td>
<td>1.08</td>
<td>64 W LED (64 W)</td>
</tr>
<tr>
<td>Ave./Min.</td>
<td>1.71</td>
<td></td>
</tr>
<tr>
<td>Max./Min.</td>
<td>2.52</td>
<td></td>
</tr>
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</table>

La Brea Avenue – LED
Before and After Pictures of Program

BEFORE
400 W HPS
(465 W)

VENTURA BLVD.
–
HPS

Fc.: 2.99
Ave./Min.: 1.83
Max./Min.: 3.15
Before and After Pictures of Program

Fc.: 1.76
Ave./Min.: 1.52
Max./Min.: 2.22

After
168 W LED
(168 W)

Ventura Blvd. – LED
Before and After Pictures

BEFORE – 100 W HPS (138 W)

AFTER – 70 W LED (70 W)

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

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

Fc.: 1.46  
Ave./Min.: 6.63  
Max./Min.: 18.32

BEFORE  
150 W HPS  
(190 W)

Ocean Front Walkway, Venice – HPS
Before and After Pictures of Program

Fc.: 1.90
Ave./Min.: 3.29
Max./Min.: 7.44

AFTER
72 W LED
(72 W)

Ocean Front Walkway, Venice – LED
“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.
Maintenance Savings

- Single Streetlight Repairs
  FY 2009: 23,500
  FY 2012: 17,400

- Total Streetlight Repairs
  FY 2010: 70,000
  FY 2012: 46,300
Handling and Installation

- Smaller/lighter units, easy to install and transport
- No need to carry components in trucks for maintenance
- Reduction in warehousing space
- Packaging – 50% reduction compared to 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
LED Performance

- Availability of house-side shield
- 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, the more glare complaints we received from people
LED Performance

- **Lumen Depreciation**
  
<table>
<thead>
<tr>
<th>Years</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>3 YEARS</td>
<td>13%</td>
</tr>
<tr>
<td>5 YEARS</td>
<td>15%</td>
</tr>
</tbody>
</table>

- **Annual Dirt Depreciation**
  
  4%

- **Failure Comparison (average)**

  - **HID** – 10% (based on past installation history)
  - **LED** – 0.2% (based on 189 units from 98,000 installed)
## Results

### Program vs. Actual

<table>
<thead>
<tr>
<th>Category</th>
<th>Program Goals</th>
<th>Actual</th>
</tr>
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<tbody>
<tr>
<td>Total Units Installed</td>
<td>110,000</td>
<td>140,000</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 and Recycle $1,088,734 in revenue</td>
</tr>
</tbody>
</table>
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>
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</thead>
<tbody>
<tr>
<td></td>
<td>2009</td>
<td>2011</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>
<tr>
<td></td>
<td><strong>46,860</strong></td>
<td><strong>41,944</strong></td>
</tr>
</tbody>
</table>

- Most units installed in residential, local streets
Cost Breakdown

Unit Cost Breakdown for 2011/12 Fiscal Year - LED Program

- Materials 85%
- Engineering 10%
- Labor 5%

- Material - $261.92
- Engineering - $31.66
- Labor - $15.42

TOTAL COST PER UNIT = $309
Sepulveda Tunnel under LAX LED Lighting Project

- 2080 foot-long divided tunnel under LAX
- Built in 1953 as part of State Highway 1
- Old Lighting System – High Pressure Sodium

- New Lighting System – 572 LED fixtures, Range: 30-120 LED’s
- Energy Savings: 64%
- Wireless Remote Controls System
Sepulveda Tunnel under LAX

400W HPS Light pipe
Sepulveda Tunnel under LAX
Sepulveda Tunnel under LAX

Light Transition within Tunnel

Dimming Levels
- Noon: 100%
- 75%
- 50%
- 25%
- 20%
- 10%

Time:
- Dawn
- Dusk
- Nighttime

Cd/SqM

Tunnel Entrance → Tunnel Exit
“Moving Forward”
LED Decorative Fixtures

- More than 70,000 existing decorative fixtures
- About 400 different styles
- Color Temperature range – 3000 Kelvin
- Presently testing and evaluating LED and Induction units
“Moving Forward”
LED Decorative Fixtures
“Moving Forward”
LED Lamps for Decorative Fixtures

800 – 1780 lumens
2700 K
Los Angeles Basin – View from Mt. Wilson After LED Retrofit Project – 2012
THANK YOU

City of Los Angeles

Bureau of Street Lighting

http://bsl.lacity.org