



Best Practice: LED Street Lighting System

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CITY: LOS ANGELES

**POLICY AREAS: CITY PLANNING; CLIMATE CHANGE;
ENERGY**

BEST PRACTICE

Los Angeles' **LED Street Lighting Energy and Efficiency Program** is the largest environmentally friendly LED (light-emitting diode) lights project ever undertaken by a city. Launched in 2009, the City aims to replace its 140,000 streetlights during the five year program. To date, over 36,000 LED lights have already been installed. This program is implemented by the Los Angeles Bureau of Street Lighting.

ISSUE

The Los Angeles Street Lighting System had 140,000 streetlights that used approximately 197,000,000 KWH per year. Energy costs were a real concern.

Street Lighting maintenance is primarily funded from the Street Lighting Maintenance Assessment Fund (SLMAF), which generates \$42 million dollars annually. This fund covers all costs associated with the operation and maintenance of the City's street lighting system: energy cost, material, labor, fleet, cost for other City entities support, and material. The SLMAF has been frozen since 1996 with the passage of Proposition 218, which hampers the City's ability to adjust the fund to correspond with the inflation index without directly going to the voters for that authority. Meanwhile, the operational cost of the Bureau has continued to increase. In 2007, the Bureau's current expenditures totaled \$52 million annually with approximately \$15 million for electricity paid to the Department of Water and Power (DWP). This situation led to a projected future deficit for the continued operation and maintenance of the City's street lighting system.

The Bureau identified this dilemma and worked with the City Administrative Officer (CAO) and other departments to address the issue of the projected deficit in an effort to continue to maintain excellent customer service and provide roadway and pedestrian lighting for the City of Los Angeles.

In an effort to enhance customer service and increase efficiency, the Bureau has actively kept a pulse on all new developing technology. This has become increasingly important due to ever-increasing costs in energy, labor, and material or the maintenance of the City's streetlight system. This endeavor led the Bureau to establish a New Technology Group for testing and evaluation of cutting-edge technology. The Bureau extensively tests products in various pilot programs including solar lighting, LED outdoor lighting fixtures, induction lighting to replace incandescent lamps, and remote monitoring technologies for street lighting fixtures.

GOALS AND OBJECTIVES

Beyond saving on energy costs, retrofitting the street lighting system will enhance public safety, improve transportation and add aesthetic value to the City's historic fabric.

In coordination with the Mayor's leadership on advancing energy efficiency throughout the City, the Bureau strives to be conscious of the impact of excessive energy use, hazardous materials, and other environmental impacts to the City.

With the assistance of staff from the Clinton Climate Initiative, we determined that this retrofit plan is estimated to save 68,648,000 KWH of electricity annually, which translates into 40,591 tons of carbon emissions eliminated over the 5-year period. In addition, the lifespan of the LED units will be two to three times longer than existing stock, thereby reducing fleet maintenance, gas usage, and trucks on the City streets. This will further reduce our carbon footprint on the environment. Furthermore existing fixtures in the City's system all have a small amount of mercury as well as other chemicals that require hazardous disposal procedures. The LED fixtures have no trace of mercury or chemical components.

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A typical streetlight lamp will last from four to six years. LED fixtures have a longer life span, which is estimated from ten to twelve years. This will reduce the replacement of end-of-life fixtures on an annual basis and will provide the Bureau with considerable savings in labor and material. The estimated accumulative amount of maintenance savings is \$1.3 million during this 7-year project (from retrofit to end-of-life loan) and this will be expended for annual debt service, which will be from 2009 to 2016. Thereafter the maintenance savings will improve the budgetary balance of the SLMAF starting in 2016 by \$2.5 million annually.

IMPLEMENTATION

The City of Los Angeles has over 140,000 streetlights that light two-thirds of the City providing illumination for vehicular and pedestrian traffic. The history of roadway lighting has evolved over the last 100 years from the incandescent lamp, mercury vapor, and metal halide to high pressure sodium each bringing a greater efficiency in lighting output and energy savings. This development in the industry has now evolved into the LED lamp for streetlight use.

In early 2008, the Mayor's Office established a collaborative working relationship with the Clinton Climate Initiative (CCI) to study the Mayor's environmental initiatives. The Mayor's Office and the Bureau of Street Lighting collaborated with CCI's Outdoor Lighting Program to review the latest technology, financing strategies and public private implementation models for LED retrofits. CCI's modeling and technology analysis, as well as its financial advisory, served as key reference sources for the development of this comprehensive retrofit plan.

In February 2009, the City announced a partnership between the Clinton Climate Initiative and the City of Los Angeles to develop the largest LED (light-emitting diode) green street light program ever undertaken by a city.

The green street light program will replace 140,000 of the City's traditional street lights with environmentally friendly LED lights: providing a 40% energy savings, reducing maintenance and energy costs, and reducing carbon dioxide emissions by 40,500 tons per year – the equivalent of taking 6,700 cars off the road. Currently, the City's 140,000 street lights use 68 gig watt hours of electricity at an annual cost of \$15 million, emitting 40,591 metric tons of carbon dioxide.

To be completed within five years, the project is funded through a combination of energy rebates, the street lighting assessment fund and loans - which will be repaid over seven years entirely through savings in energy and maintenance costs. In the eighth year, after the loan is repaid, the City is projected to save \$10 million annually through the more efficient and modern LED lighting.

How LED technology fixtures work:

LED fixtures consist of multiple rows of semi-conductor diodes that emit light when an electrical current is applied. The first light emitting diode was reported in 1907 with the first visual spectrum of red, which was developed in 1962 for commercial use. The wavelength of the light emitted, and therefore its color, depends on the energy of the material used. White LED diodes can be produced by a blue chip with a phosphor coating that is used to create the wave shift necessary to emit white light from a single diode. Each diode is about 1/4 inch in diameter and can be grouped together for higher intensity applications such as roadway lighting. LED lights are more durable and damage resistant than other bulbs and LED lights do not flicker. They are very heat sensitive and require a high quality heat sink to obtain the maximum life of the diodes. The new LED fixtures will also be installed with remote monitoring units which will automatically report streetlight failures directly to the Bureau of Street Lighting for immediate repair. Street lighting costs represent one of the largest components of a city government's utility bill, often accounting for 10 percent to 38 percent of the total bill. With nearly 35 million street lights in the United States, about 1 percent of all electricity is used by street lighting systems. CCI currently is building upon its efforts with Los Angeles and working with other cities on large-scale street lighting retrofit projects.



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GREEN LA

By reducing energy demand and displacing the use of dirty coal, the LED Street Lighting Program furthers Mayor Villaraigosa's goal of turning Los Angeles into the greenest big city in the country. On May 15, 2007, Mayor Villaraigosa unveiled GREEN LA – An Action Plan to Lead the Nation in Fighting Global Warming. GREEN LA sets Los Angeles on a course to reduce the City's greenhouse gas emissions 35 percent below 1990 levels by 2030, going beyond the targets of the Kyoto Protocol and representing the most ambitious goal of any large US city. The cornerstone of GREEN LA is increasing the City's use of renewable energy to 35 percent by 2020.

COST

Estimated Total Project Cost: \$57 million

The program is funded through a loan, energy rebate, and the Street Lighting Maintenance Assessment Fund. The loan debt service payments will be paid through savings from current energy and maintenance costs with no adverse impact to the General Fund.

Street Lighting maintenance is primarily funded from the Street Lighting Maintenance Assessment Fund, which generates \$42 million dollars annually. This fund covers all costs associated with the operation and maintenance of the City's street lighting system, energy cost, material, labor, fleet, cost for other City entities support and material. This revenue has been frozen since 1996 with the passage of Proposition 218, which hampers the City's ability to adjust the SLMAF to correspond with the inflation index without directly going to the voters for that authority.

Meanwhile, the operational cost of the Bureau has continued to increase. The Bureau's expenditure in 2007 totaled \$52 million annually with approximately \$15 million for electricity paid to DWV. This situation led to a projected future deficit for the continued operation and maintenance of the City's street lighting system. The Bureau analyzed the anticipated revenues and expenditures for future years and projected a deficit in fiscal year 2011-12. This deficit was discussed during the budget process and as an on-going dialogue with the CAO in order to propose solutions to continue to maintain excellent customer service. In this manner, the Bureau closely tracked the technology market, seeking to take advantage of lighting advances and utilize it to create budgetary efficiencies. The five year phased-in LED conversion proposal included a requested loan amount of approximately \$40 million. The energy and maintenance savings generated from this project will be used to pay for the entire loan with no adverse impact to the General Fund. Future projected savings after the loan retirement will serve to address projected budgetary deficits in the SLMAF. The Bureau was eager to take advantage of this financial and environmental opportunity as a way to improve the quality of life for Angelenos by demonstrating the best in municipal operating practices.

Based on the developing technology and the changing nature of this market, the Bureau is recommending that deployment be completed through City forces with Bureau salary costs enrolled into the loan. This will minimize the cost of the installation, change orders, and allow the Bureau to maintain the flexibility required for a successful project.

The program will need one Project Engineer, one Street Lighting Engineering Associate, one Street Lighting Electrician Supervisor, and four 2-person crews consisting of a Street Lighting Electrician and Assistant Electrician in the first year with two additional 2-person crews added in the second year of implementation. The labor costs for this program will be approximately \$1 million the first year, \$1.5 million the second, \$1.6 million the third, \$1.6 million the fourth, and \$1.7 million the last year for a grand total of \$ 7.4 million during the full five year installation plan. In addition to personnel the Bureau will be requesting \$150,000 in the Hiring Hall and \$75,000 in the overtime accounts to compensate for annual vacancies, delays in hiring and other various factors that can contribute to delays in construction projects. This safety measure will ensure the implementation schedule of LED fixtures.

Material

The Bureau will require funding in the 8780 Account to purchase the LED fixtures and remote monitoring units to be deployed throughout the installation period. The account will need \$8.7 million the first year, \$12.7 million the second, \$10.4 million the third, \$8.4 million the fourth, and \$8.3 million the last year for a grand total of \$ 48.5 million during the full five-

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year installation plan. These numbers include an initial cost of \$450 per LED fixture compared to \$150 for current street lighting fixtures. It is anticipated that this cost will decrease throughout the 5 year program. The Bureau requested \$40,000 in Contractual Services to properly acquire independent testing of fixtures submitted to verify reliability and performance. The Bureau intends to take full advantage of the rapidly developing LED market by bidding annually on LED fixtures, capitalizing on technological advances during this project and in expectation that the costs of LED devices will continue to decrease. At the same time, it allows the Bureau to evaluate product quality.

Equipment

The Bureau has evaluated the option of purchasing equipment vehicles for this program versus leasing. Due to delays in purchasing vehicles, leasing is the most economical and efficient way to complete the program. The Bureau will require a total of \$630,000 to lease vehicles for five years compared to an estimated \$1.32 million to purchase. The Bureau intends to rent six aerial lift trucks at an estimated cost of \$120,000 for each year for a grand total cost of \$630,000 during the full five-year installation plan. In addition, the equipment account will include costs for rental of a mobile modular lease and associated furniture and IT needs.

City Impact

The retrofit program has built-in savings that will pay for the loan and provide energy and maintenance savings for future years. If the City does not choose to take this opportunity and retrofit the City's streetlights, the Bureau's deficit will not be reduced and may require either a General Fund subsidy, reduction of services, and/or initiating a citywide ballot measure to capture increasing costs due to inflation.

RESULTS AND EVALUATION

With over 36,500 LED lights installed, the total savings for the City as of February 2011:

Total Nominal Wattage Before: 6,244 kW
Total Nominal Wattage to Date: 2,648 kW

Estimated Energy Savings: 40%
Actual Energy Savings: 57.6%

Annual CO2 Reduction: 8,674 Metric Tons

Annual Energy Savings (MWh): 14,668 MWh

Annual Energy Savings (\$): \$1,297,173



TIMELINE

2007: LED outdoor lighting technology has made tremendous strides within the last few years in light output and color rendition. Bureau staff was tasked a year ago to conduct a pilot program looking at various manufacturers and installing these units in field applications. In addition, other cities have been conducting similar programs with compelling results. Current LED technology has exceeded the existing lamp efficiencies for roadways, and in addition to the energy savings, there are several other benefits, including maintenance savings and carbon emission reductions that must be factored into the equation.

July 2008-Present: The Bureau undertook a pilot project to determine which manufacturers offer the best energy-efficient unit that is ready for retrofit of existing fixtures, easy to install and that is in compliance with all mandated standards and codes.



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Present-Project Completion: Continuous testing of equipment to specify purchase of best available equipment. Pilot projects every six months.

June 2011: Complete installation of 50,000 additional lights

June 2012: Complete installation of 30,000 additional lights

June 2013: Complete installation of 30,000 additional lights

June 2014: Complete project with installation of final 30,000 lights.

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This report is based on an exhibition from the 2009 Copenhagen Climate Summit for Mayors Future Cities Exhibition. Innovative initiatives demonstrating how cities around the world are combating climate change were on display. Facts and figures in this report were provided by the highlighted city government to New York City Global Partners.