25 Energy Efficiency and Conservation Block Grant Participating Cities
U.S. Department of Energy
Executive Summary

Smart Lights for Smart Cities, hereafter referred to as “Smart Lights,” installed more than 5,700 streetlights in 25 Kansas City area communities as shown in the map on the preceding page of this report.

The initiative was funded by the U.S. Department of Energy’s Energy Efficiency and Conservation Block Grant (EECBG) program for the purpose of installing high-efficiency street-lighting technologies (primarily light-emitting diode or LED) from vendors selected through a vetted procurement process. This initiative was geared to transforming the metro area’s streetlight market.

Through Smart Lights, the Mid-America Regional Council (MARC) showcased different technologies and vendors, demonstrating firsthand the benefits of changing from mercury vapor (MV) and high-pressure sodium (HPS) streetlights to a more energy-efficient lighting system, involving induction or light-emitting diode technologies.

The key goal of Smart Lights was to provide evidence of which technologies saved the most energy, had the fewest maintenance issues and were the most cost-effective.

The expected benefits of the high-efficiency streetlights included:

- Greater energy efficiency.
- Reduction in maintenance.
- Longer life.
- Improved visibility.
- Minimum lumen depreciation.
- More and focused light.
- Minimal wasted light.
- Instant-on.

Participating cities were pleased with the performance of the new streetlight technology and there were very few concerns voiced from community members. The data collected during the grant period shows a significant energy savings in using high-efficiency streetlights. On average, the savings of the 250-watt equivalent is 55 percent compared to MV and 61 percent compared to HPS. There have been very few warranty issues (less than 1 percent) during the two years of operation.

A major outcome of the Smart Lights project was the exposure of city officials to high-efficiency lighting technology, and the education of public officials and residents. City leaders have seen firsthand the quality of the products and the energy savings that occur. As the price of LED technology continues to decrease, it is anticipated that more municipal governments will enter the high-efficiency streetlight market.

The majority of cities participating in the Smart Lights project lease their streetlights from utility companies, although a few cities have pursued streetlight ownership with the utility companies during the Smart Lights grant period. Owning the lights allow the cities to capture the projected cost savings for maintenance, operation and energy associated with the new high-efficiency lights. The cities of Fairway and Mission, Kan., were the first cities to complete the ownership process within the lifespan of the grant. The cities of Roeland Park, Prairie Village and Westwood, Kan., plan to explore ownership during fiscal year 2015.

Participating cities:

- Basehor, Kan.
- Edwardsville, Kan.
- Fairway, Kan.
- Gardner, Kan.
- Gladstone, Mo.
- Harrisonville, Mo.
- Kearney, Mo.
- Lansing, Kan.
- Lawson, Mo.
- Liberty, Mo.
- Merriam, Kan.
- Mission, Kan.
- North Kansas City, Mo.
- Oak Grove, Mo.
- Peculiar, Mo.
- Platte City, Mo.
- Pleasant Hill, Mo.
- Prairie Village, Kan.
- Raymore, Mo.
- Raytown, Mo.
- Roeland Park, Kan.
- Smithville, Mo.
- Spring Hill, Kan.
- Tonganoxie, Kan.
- Westwood, Kan.
Introduction

The Mid-America Regional Council (MARC) coordinated the Smart Lights initiative to help local governments in the Kansas City area install high-efficiency street-lighting technologies with $4,063,994 in funding through the Department of Energy’s Energy Efficiency and Conservation Block Grant program. The primary objective of the initiative was to transform the streetlight market in the region to adopt high-efficiency streetlights. Market transformation will be attained when:

- Feasibility and efficacy of a variety of street-lighting technologies and vendors can be demonstrated.
- Financial tools are created to fund future streetlight conversion projects.
- A new tariff and payment mechanisms are developed to incentivize the adoption of energy-efficient streetlights.

To achieve its objectives, the Smart Lights initiative engaged communities in the region through a partnership called the Smart Lights Coalition, which consisted of 25 cities with populations under 35,000, MARC and local utility providers, including KCP&L, Westar Energy and Platte-Clay Electric Cooperative.

This report summarizes Smart Lights’ anticipated impacts, strategy and timing, installations and outages, cost and environmental savings, community reaction, financing mechanisms, market transformation, and education and outreach efforts.

Anticipated Impacts

At the grant application stage, the anticipated impacts of the project were to identify, research and deploy various streetlight technologies and to create payment and tariff systems to encourage technology adoption. This included:

- A quantitative impact on the number of high-efficiency streetlights in the region, annual energy savings for coalition members and an annual reduction in carbon dioxide (CO₂) emissions. Access to proven technologies, financing and EECBG-formula cities retrofitting activities formed the basis for the expectation of a quantitative impact. The metropolitan area’s interest in new technologies, tightening local government budgets and adoption of LED traffic-signal technology were also key influencing factors.
- Purchase of 4,000 high-efficiency streetlights to be installed in participating communities with grant funds.
- Market transformation based on broad deployment of high-efficiency streetlights and extensive testing of induction and LED technologies. Appropriate ownership, tariff mechanisms and other state financing tools developed at the same time to encourage adoption of the new lights.
- Innovation in the customary flow of technology adoption. By leveraging the Smart Lights Coalition of cities, utilities and the regional council of governments, smaller cities were the early adopters of new streetlight technology, rather than innovation moving from larger to smaller cities.
Strategy and Timing

The approach for the Smart Lights initiative was developed over a three-year period, from 2010 to 2013.

- MARC formed the Smart Lights Coalition during the summer of 2010 (prior to the grant award) to serve as steering committee for the project. The coalition included 13 cities each from Kansas and Missouri with populations under 35,000. The cities ranged from inner-ring suburbs to rural communities. Ultimately, 25 cities opted to participate.

- Using research that KCP&L completed during its initial test demonstration of high-efficiency streetlights and input from the EECBG-formula cities, MARC and KCP&L issued a request for proposals on behalf of the coalition for the installation of high-efficiency streetlights. Five vendors were selected through the process: US Lighting and MHT Lighting for induction technologies; and EcoFit, Cooper Lighting and HD Supply (GE) for LED. Light installation began during the summer of 2011 with a pilot tariff was created in the same year. Installation continued through the winter of 2012. MARC owned the lights until ownership was transferred to the participating communities and utilities during the summer of 2013.

- Protocols were established for monitoring and evaluation to track factors such as energy use, product durability, longevity, maintenance costs, and light quality and coverage. KCP&L metered 10 groups of lights and MARC engaged its online public engagement platform (www.marckvoices.org) and also held in-person discussions around the region to evaluate public reaction to the new lights. Three EECBG-formula cities also tested streetlights. The cities of Shawnee and Olathe, Kan., evaluated both induction and LED lights, and the city of Kansas City, Mo., is conducting a comprehensive longitudinal study on LEDs.

- Coalition partners addressed barriers related to the performance, long-term maintenance and costs of high-efficiency streetlights. Existing tariffs and payment arrangements did not encourage the use of high-efficiency streetlights. The absence of such a tariff made it almost impossible for the cities to capture the real savings realized through use and adoption of the technology. As a result, KCP&L and Westar Energy successfully requested that the Kansas Corporation Commission and Missouri Public Service Commission establish a slightly reduced pilot tariff for the installed lights. A permanent tariff for energy-efficient streetlights is not anticipated to be determined until 2014, which is after the expiration of the grant.

- MARC reviewed the environmental ramifications of the new streetlights, considering the lights’ net benefit in terms of reducing air pollution, greenhouse gas emission and waste disposal.
Installations and Outages

LED streetlights were the primary lighting technology implemented during the grant period. A total of 5,524 lights were installed, with 229 of those purchased as reserve inventory for non-warranty situations. KCP&L had the largest number of installations, followed by city-owned installations and those of other utilities, including Westar Energy and Platte-Clay Electric Cooperative. The Smart Lights initiative exceeded its original goal of 4,000 installations by 30 percent because LED lighting technologies became less expensive as the grant period progressed. A minimal number of outages were reported after installations were complete.
Cost Savings

LED streetlights installed by the Smart Lights initiative demonstrated much lower energy usage than equivalent, conventional streetlights where HPS wattages ranged from 100 to 400 watts (W). When the initiative began, the coalition anticipated an annual utility bill savings of $131,981 per year for coalition members. Calculation of the true financial savings will not be available until the tariff for energy-efficient streetlights is determined. Until then, cities will extrapolate the savings based on metering results for their communities.

The city of Pleasant Hill calculated the average daily usage and dollars saved for a single month, for the 26 of their 60 installed streetlights, comparing April 2011 to April 2012 and 2013. The city has 26 LED streetlights positioned in three locations. Most are decorative lights that are located downtown. The few remaining are standard, high-efficiency fixtures that are posted in a downtown park. Average daily usage for all three locations decreased 37.7 percent from 2012 to 2013. Further, average daily costs dropped 41.8 percent over the same period.

<table>
<thead>
<tr>
<th>Example: Average daily streetlight energy savings with high efficiency streetlights in Pleasant Hill, Mo.</th>
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<tbody>
<tr>
<td>LED Street Light Locations</td>
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<tr>
<td>----------------------------</td>
</tr>
<tr>
<td>Wyoming Lot</td>
</tr>
<tr>
<td>City Hall Alleyway</td>
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<tr>
<td>Roundabout</td>
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<tr>
<td>Total</td>
</tr>
<tr>
<td>Savings (2012-2013)</td>
</tr>
</tbody>
</table>

The city of Fairway purchased its lights from KCP&L through a Street Light Sale Agreement. The city also executed a maintenance agreement and warranty with a qualified contractor. The purchase included all 334 of its streetlight fixtures and poles with the exception of any lights that involve co-location of other utilities, such as fiber optics. The city was able to purchase the lights with general fund dollars. The investment of more than $236,000 is estimated to pay for itself within three years and yield more than $77,000 per year in maintenance savings for the community.

<table>
<thead>
<tr>
<th>Example: High-efficiency streetlight maintenance savings with buy out in Fairway, Kan.</th>
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<tbody>
<tr>
<td>Number of streetlights</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>Maintenance</td>
</tr>
<tr>
<td>Electricity</td>
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<tr>
<td>Total</td>
</tr>
<tr>
<td>Current Costs</td>
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<tr>
<td>Savings</td>
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<tr>
<td>Price to Purchase</td>
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</tbody>
</table>
Environmental Savings

MARC used the Environmental Protection Agency’s Greenhouse Gas Equivalencies Calculator\(^1\) to compute the CO\(_2\) emissions saved when high-efficiency technologies were compared to conventional streetlights over a nine-month period, from August 2012 through March 2013. High-efficiency streetlights (Cooper, EcoFit and GE) emitted only 54.8 percent as much as traditional HPS lighting. The Greenhouse Gas Equivalencies Calculator equates the kilowatt hours (kwh) to the CO\(_2\) emissions generated.

<table>
<thead>
<tr>
<th>Streetlight type</th>
<th>Energy usage over 9 months (kwh)</th>
<th>Equivalent in CO(_2) emissions to gallons of gasoline consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-efficiency (53W)</td>
<td>168</td>
<td>13.3</td>
</tr>
<tr>
<td>Conventional HPS (100W)</td>
<td>472</td>
<td>37.3</td>
</tr>
<tr>
<td>High-efficiency Cooper (80W)</td>
<td>248</td>
<td>19.6</td>
</tr>
<tr>
<td>High-efficiency EcoFit (73W)</td>
<td>233</td>
<td>18.4</td>
</tr>
<tr>
<td>Conventional HPS (150W)</td>
<td>685</td>
<td>54.2</td>
</tr>
<tr>
<td>High-efficiency EcoFit (106W)</td>
<td>321</td>
<td>25.4</td>
</tr>
<tr>
<td>High-efficiency GE (127W)</td>
<td>361</td>
<td>28.6</td>
</tr>
<tr>
<td>Conventional HPS (250W)</td>
<td>1,234</td>
<td>97.6</td>
</tr>
<tr>
<td>High-efficiency GE (157W)</td>
<td>463</td>
<td>36.6</td>
</tr>
<tr>
<td>Conventional HPS (400W)</td>
<td>1,886</td>
<td>149</td>
</tr>
<tr>
<td>Total (High efficiency)</td>
<td>1,794</td>
<td>142</td>
</tr>
<tr>
<td>Total (Conventional)</td>
<td>3,277</td>
<td>259</td>
</tr>
</tbody>
</table>

1. www.epa.gov/cleanenergy/energy-resources/calculator.html
Community Reaction

From fall 2012 through winter 2013, MARC held a series of informal, community evaluation sessions for public works and police representatives and the general public to gauge their reaction to the lights. Sessions were held for the general public in Lansing, Prairie Village, Gladstone and Raymore. A special meeting for public works and police from participating cities was held at MARC, and public input was gathered through MARC’s online public engagement website, www.marckcvoices.com. In all, input was collected from 99 constituents.

Public works and police representatives note the following characteristics of the new lighting:

- Brighter appearance.
- Cleaner looking color.
- Better light for public works and safety activities.
- Provide more directional light, lighting both the sidewalk and street.
- Provide the ability to see greater distances and more details, even during rain, compared to HPS.
- Fewer maintenance calls.
- Interested in installing more.

Comments from the general public included:

- Better energy efficiency.
- High-efficiency light coverage is smaller than that of HPS lights.
- Appearance and color are acceptable; the light is better but its quality is harsher.
- Better color visibility improves safety, although visibility was not always good.
- Better sidewalk coverage since lights can be tipped for positioning.
- Concern for potential glare for drivers due to the taller lights.
Participating communities also tracked resident comments about the lights. More than 5,700 high-efficiency lights were installed through the Smart Lights initiative, with a combined total of 15 concerns received about the new lights. The majority of the concerns related to KCP&L’s lights and included comments about excessive light in windows (Kansas) or insufficient light (Missouri). Shields were installed to address the issue of too much light. Lights with higher lumen counts were installed when the issue was connected to low light levels.

**Kansas Comments**

- KCP&L: 6
  - Excessive light and dislike color
  - Excessive light vs. inefficient light
- Westar Energy: 3
- City-Owned: 0

**Missouri Comments**

- KCP&L: 4
  - Insufficient light
- Platte Co. Coop: 0
- City-Owned: 2
  - Insufficient light and other concerns

Before: 100 watt HPS
After: 70 watt LED

Residential street, Los Angeles
Respondents to the survey at www.marckevoices.com indicated that they generally preferred the LED streetlights to existing HPS or MV lights. They also preferred LEDs to conventional lights in terms of light color, brightness and glare, safety for motorists, pedestrians and cyclists.

**MARC Online Survey**

**General Preferences**

In general, do you prefer the new LED or the existing HPS street lights?

- New LED Lights: 29
- Old HPS Lights: 2
- Undecided: 6

**MARC Online Survey**

**Light Color**

Compare the white light of the LED to the yellow light of the HPS. Which do you prefer?

- LED Lights: 32
- HPS Lights: 5

**MARC Online Survey**

**Brightness & Glare**

How do you feel about the brightness and glare of the new LED street lights?

- Comfortable: 31
- Too Much: 29

- Brightness: 6
- Glare: 8

**MARC Online Survey**

**Safety**

Have the new LED street lights improved safety for motorists, pedestrians and cyclists?

- Yes: 32
- No: 5
Financing Mechanisms

At the beginning, Smart Lights Coalition members agreed to create a financial catalyst to capture 50 percent of the savings generated from the conversions. The coalition also anticipated that state funding mechanisms would be available to supplement financing needs. Unfortunately, a tariff for high-efficiency streetlights was not established during the grant period, so anticipated savings could not be captured and reinvested for accelerated installation of additional streetlights and market transformation.

The cities of Pleasant Hill, Prairie Village, Roeland Park, Fairway and Mission expressed interest in converting to energy-efficient streetlights and owning their lights. Community support, projected cost savings for streetlight operations and maintenance, and anticipated energy savings encouraged the pursuit of ownership.

Communities explored funding the cost of purchase through general obligation bonds to be repaid with general fund dollars. Some indicated that other tools, such as special road districts, streetlight utility fees, lease-purchase arrangements and energy cooperatives, may have greater potential. Additionally, Qualified Energy Conservation Bonds (QECBs) are available in Missouri. The bonds can be used for qualified projects that involve capital expenses for energy efficiency, such as streetlights. QECBs provide cities with tax credits that can be applied to the interest portion of the bond amount.

Market Transformation

The Smart Lights initiative anticipated that market transformation for high-efficiency streetlights would happen through the establishment of financing mechanisms for cities interested in fiscal savings. The lack of a tariff and initial maintenance and operation cost-saving figures caused cities to move toward a path for ownership as an alternative method of transforming the regional market.

MARC coordinated a series of conversations with funding experts and cities known to own or be considering ownership in Spring 2013 to learn more about their aspirations and develop post-grant plans for the energy-efficient streetlights installed through the Smart Lights initiative. Comments from the discussions related to:

- Actual calculations and/or projections for financial savings.
- KCP&L’s process for ownership.
- Challenges to and opportunities associated with ownership.
- Local ownership experiences.
- Advice for city managers and public works directors considering ownership.

During the discussion timeframe, the cities of Fairway and Mission completed the ownership process with KCP&L and these cities became the first of the participating cities to own and manage their lights as a result of involvement with the Smart Lights initiative. Fairway coordinated with the city of Leawood, which had previously purchased its streetlights from KCP&L, for assistance with the purchasing process.

Pleasant Hill has completed the purchase of an additional 26 streetlights from KCP&L, bringing to 60 the total number of streetlights owned by the City, metered by KCP&L, and retrofitted to LED through this project. The cities of Roeland Park, Prairie Village and Westwood plan to pursue ownership in the future.
The participating cities of Gardner and Harrisonville already own their streetlights and provide their own electricity. They have documented consistent energy savings (55 – 61 percent) with the high-efficiency streetlights.

Education and Outreach

The Smart Lights initiative conducted educational events and outreach throughout the grant period. MARC held 15 educational events (including community evaluation sessions), with 278 stakeholders. More than 9,000 regional stakeholders were provided with informational materials on the progress made by the Smart Lights initiative.

Two series of workshops featured national speakers.

- Bob Henderson led three workshops for regional stakeholders and utility representatives on March 21–22, 2012. Henderson has worked in lighting for 30 years as a consultant, lighting center principal instructor, lighting sales agent and utility lighting specialist. He has worked with cities and counties across North and South Carolina to develop more than 25 municipal and county outdoor lighting ordinances.

- On Feb. 19, 2013, Elizabeth Bellis led a workshop on financing options for high-efficiency streetlight technologies. Bellis is counsel and director of the QECB and WHEEL Programs at Energy Programs Consortium, a nonprofit organization sponsored by the National Association of State Energy Officials headquartered in New York City. She also works with other national organizations and foundations. Bellis presented data about QECB issuances to date and discussed potential obstacles and strategies QECB issuers have used to overcome them.

The Smart Lights initiative was mentioned in a national research report, “Smart Street Lighting LEDs, Communications Equipment, and Network Management Software for Public Outdoor Lighting: Market Analysis and Forecasts,” by Pike Research published in the fourth quarter of 2012. Copies of this report were made available to the 25 participating cities and the two primary electric utility companies for future reference.
Conclusion

The Smart Lights initiative was extremely successful in many aspects of the grant program. Partners were able to install 30 percent more high-efficiency streetlights than initially anticipated. A total of 5,753 streetlights were purchased. The total energy savings was well documented through evaluative processes reflecting, on average, a 55–61 percent reduction in energy usage. When compared to conventional streetlights, the high-efficiency streetlights made up only 54.8 percent of the total amount of emissions created from HPS lighting.

The participating communities all gained important knowledge about the efficacy of high-efficiency streetlight technologies. Going forward, community leaders will be able to examine the ongoing advances in street lighting based on their positive experience with the Smart Lights initiative.

Education and access to available financial resources encouraged more cities to plan for ownership. Representatives of the city of Harrisonville, Mo., have commented that the anticipated energy savings could be viewed as a selling point for communities, drawing additional residents and businesses. Other cities commented that the Smart Lights initiative enabled them to move forward with existing street lighting goals and/or develop new aspirations related to improved energy efficiency.

MARC will encourage streetlight ownership and support the creation of a permanent tariff for energy-efficient streetlights by serving as a resource for useful information about available financing mechanisms, including QECBs, available through state and/or local governments. The ownership process and financing tools are outlined in MARC’s Smart Lights Streetlight Ownership brochure.