

Leveraging Lighting for Energy Savings: GSA Northwest/ Arctic Region

The Northwest/Arctic Region branch of the U.S. General Services Administration (GSA) won a 2015 Lighting Energy Efficiency in Parking (LEEP) Award for cutting energy use by 74% at the Fairbanks Federal Building Parking Garage in Fairbanks, Alaska.

The GSA replaced 220 high-pressure sodium (HPS) fixtures with an equal number of light-emitting diode (LED) fixtures in the four-story, 600-space parking facility adjacent to the Fairbanks Federal Building.

The conversion cut energy use by 180,000 kilowatt-hours (kWh) annually, garnering the GSA the Exemplary Federal Parking Facility Award from the LEEP Campaign. The U.S. Department of Energy and industry associations are collaborating via the LEEP Campaign to promote the use of energy-efficient lighting in parking lots and structures.

Project Drivers and Successes

The GSA's mission is to provide the best value in real estate, acquisitions,

Fairbanks Federal Building Parking Garage by the Numbers

Total area of parking structure	100,000 ft ²
Number of parking spots	600
Simple payback	9.7* years
Total annual energy savings	180,000 kWh
Total annual energy cost savings	\$30,000

* Does not include maintenance cost savings



The Northwest/Arctic Region branch of the GSA improved safety and energy efficiency in their Fairbanks Federal Building parking garage used by federal employees and a lower level used by the U.S. Marshals and the District Court. A 74% savings was realized by replacing 220 HPS fixtures with 220 LED fixtures.

Photo courtesy of GSA.

and technology services. GSA is able to provide good value by achieving economies of scale and by sourcing the most robust and energy-efficient products.

The award-winning parking garage lighting project was part of a larger lighting initiative throughout the region and a natural continuation of earlier sustainability efforts.

The Fairbanks Federal Building is a unique and challenging facility due to the extreme weather conditions of the Alaskan location. Summertime highs can reach 100°F and winter-time lows can drop as low as 50°F below zero. The lighting products that are chosen must be able to function across this wide range of temperatures.

Advantages beyond energy savings also figured into choosing LEDs. Improved user satisfaction, safety, and security were top concerns since the parking garage features an enclosed lower level used by the U.S. Marshals Service and the District Court.

Both concerns are addressed by the improved visibility resulting from the higher color rendering, broader light spectrum, and increased lighting uniformity that LEDs provide. HPS lamps have a color rendition index (CRI) of only about 20 while LEDs have a CRI of about 65.

Old Versus New Fixtures at Federal Building Parking Garage: 74% Savings

	HPS	LED
Number of fixtures	220	220
Rated lamp wattage	150 W	43 W
Input power	183 W	48 W
Lighting power density	0.20 W/ft ²	0.06 W/ft ²
Energy use	239,800 kWh	59,800 kWh

Benefits of High-Efficiency LED Lighting

- energy savings
- no mercury
- quick start
- long life
- reduced maintenance
- reduced light pollution
- safety and security

The increased CRI that LEDs offer provides improved visibility for parking lot users. Instant-on performance, with no run-up or re-strike delays, also improves safety.

Before the retrofit, the parking facility fixtures had to be left on continuously because they were not wired for individual control. The fixtures are now outfitted with photocell sensors allowing outside perimeter lighting to

Lessons Learned

- Conducting a photometric analysis of the space beforehand will allow the project to optimize lighting fixtures to occupant needs.
- Current LED product quality can vary significantly among manufacturers; thermal and electrical design weaknesses in some products can lead to rapid lumen depreciation or premature failure. Due diligence is required in their proper selection and use.
- LED technology is improving very rapidly. Interested users should check information sources on product performance and lifetime, such as the DOE Solid-State Lighting website www.ssl.energy.gov.

take advantage of the extended daylight hours in summer months. Adding lighting controls during the installation increased savings without greatly affecting project cost or scope.

The new lighting also brings a smaller environmental footprint. DOE studies have shown that LEDs have significantly lower effects on the environment compared to other light sources, when manufacturing, transportation, and energy use is considered over the lifecycle of an LED. Replacing the HPS lamps with LED lamps resulted in a reduction of more than 100 tons of CO₂ emissions.

At the LEEP-winning site, GSA realized a 74% energy savings, with a simple payback calculated from energy savings alone at 9.7 years. Energy cost savings are nearly \$30,000 annually. The electricity rate in Alaska is 17 cents per kWh, which is 50% more than the U.S. average.

Because the project is encompassed in ongoing efficiency efforts, the specification and procurement went smoothly. However, the post-installation consensus is that project savings could have been increased if a photometric analysis had been conducted beforehand to verify how many fixtures were needed. The enhanced distribution of the LED fixtures would have enabled the GSA to get adequate light coverage from fewer fixtures for further cost savings.



The central Alaska location of the Fairbanks Federal Building offers extreme conditions for garage lighting with subzero temperatures and long winter operating hours. LEDs are well suited to this harsh environment with long life for fewer lamp replacements, instant-on even in the cold, excellent color rendition in the long twilight hours, and high energy savings, which make the lamps especially cost-effective given Alaska's high electric rates.
Photo courtesy of GSA.

Next Steps

The success of the Fairbanks Federal Building parking lot lighting effort has prompted plans for improving parking lot lighting across GSA's Northwest Arctic Region, which encompasses Alaska, Idaho, Oregon, and Washington. LED retrofit projects for interior lighting applications are also being considered for GSA buildings in the region.



This comparison of LED and HPS lighting in another parking garage demonstration project conducted by PNNL shows how the brighter LED lighting dramatically improves color rendition and visibility.
Photo courtesy of Pacific Northwest National Laboratory.

Federal Energy Efficiency Requirements for Exterior Lighting

Although every site, whether federal, private, commercial, or industrial, can benefit from the energy savings, maintenance savings, and lighting quality improvements, federal sites have another motivator. They must ensure compliance with the multiple laws, executive orders, and Federal Acquisition Regulations which mandate that federal agencies meet efficiency requirements in all procurement and acquisition actions that are not specifically exempted by law.

Federal purchasers must buy, specify, and contract for ENERGY STAR® compliant products. In cases where there is no ENERGY STAR® product category, the agency should comply with FEMP-designated efficiency requirements.

The table below lists the minimum federal efficiency requirements that various categories of exterior lighting must meet to be eligible for purchase by federal agencies.

For more information on high-efficiency lighting technologies and information for federal agencies, including lighting requirements language for contracts, visit energy.gov/eere/femp/covered-product-category-exterior-lighting. See below and to the right for links to guides and sample specifications documents.

Find qualifying products at www.lightingfacts.com/LFPowered/FEMP

FEMP and the DOE LED Lighting Facts® program have partnered to offer a tool that allows federal users to identify LED exterior lighting products that meet the minimum federal efficiency requirements for the six categories of exterior lighting shown in the table below. In addition to having a pre-screened list of products, federal users can screen on a large range of other product metrics, including color temperature, power factor, and beam angle.

Efficiency Requirements for Federal Purchases

Category - Exterior Lighting	Luminaire Efficacy Rating (Lumens/Watt*)
Fuel pump canopy luminaires	70
Parking garage luminaires	70
Outdoor pole/arm-mounted area and roadway luminaires	65
Outdoor pole/arm-mounted decorative luminaires	65
Outdoor wall-mounted luminaires	60
Bollards	35

* Luminaire Efficacy Rating (LER) = total light output emitted by the luminaire divided by the total power input. "Fixture" and "luminaire" are interchangeable terms and refer to the overall light fixture.

Design Guidance for Federal Sites

These guides provide design guidance for FEMP-designated product categories such as outdoor, roadway, and parking garage luminaires.

Guide to FEMP-Designated Parking Lot Lighting
energy.gov/eere/femp/downloads/guide-femp-designated-parking-lot-lighting

Guide to FEMP-Designated Parking Structure Lighting
energy.gov/eere/femp/downloads/guide-femp-designated-parking-structure-lighting

Proven Specifications

Use these specifications, developed by the DOE's Better Buildings Alliance and the DOE Municipal Solid-State Street Lighting Consortium to specify performance expectations, warranty, and testing requirements for your exterior lighting projects.

LED Site Lighting (Parking Lot) Specification

apps1.eere.energy.gov/buildings/publications/pdfs/alliances/cbea_led_site_lighting_spec.pdf

High Efficiency Parking Structure Specification

apps1.eere.energy.gov/buildings/publications/pdfs/alliances/creea_parking_structure_spec.pdf

Wall Pack Lighting Specification and Appliance Guidance

www4.eere.energy.gov/alliance/sites/default/files/uploaded-files/high-efficiency-wall-pack-specification.pdf

Model Specification for LED Roadway Luminaires

<http://energy.gov/eere/ssl/downloads/model-specification-led-roadway-luminaires-v20>

"It might only take one person to change a light bulb, but it took dedicated efforts by the many thoughtful leaders of LEEP award winners to demonstrate how much can be gained through advanced, cost effective lighting technologies in parking lots and garages. These innovative solutions also enhance safety and improve working conditions for customers, tenants and employees."

David Danielson,
 Assistant Secretary for Energy Efficiency and Renewable Energy

Lighting Energy Efficiency in Parking (LEEP) Campaign



On June 29, 2015, GSA Region 10 was 1 of 18 organizations recognized for exemplary energy savings at an award ceremony conducted in Los Angeles, CA, by the LEEP Campaign, an effort to promote high-efficiency lighting in parking facilities. GSA Region 10 won the Exemplary Parking Facility award, achieving 74% energy savings through a lighting retrofit in the Fairbanks Federal Building parking structure.

Together winning projects achieved savings of about 70 million kWh or \$7 million in electricity savings by providing energy-efficient lighting to 200 million ft² of parking lots and structures, with an average payback of less than 6 years. LEEP Participants are collectively saving over 160 million kWh and over \$17 million annually, based on 470 million ft² of high-efficiency parking lighting logged as of September 2015.

LEEP encourages facilities to install energy-efficient lighting and/or to install lighting occupancy or daylight controls to cut energy use by 30% compared to the lighting power density values specified in ASHRAE/IES Standard 90.1-2010. LEEP's overall goal is to achieve 750 million ft² of planned or installed high-efficiency parking lighting by May 2016.



Through the Better Buildings Alliance, members in different market sectors work with the U.S. Department of Energy's (DOE) exceptional network of research and technical experts to develop and deploy innovative, cost-effective, energy-saving solutions that lead to better technologies, more profitable businesses, and better buildings in which we work, shop, eat, stay, and learn. Join today to start saving energy in your commercial buildings through programs like the Lighting Energy Efficiency in Parking (LEEP) Campaign, www4.eere.energy.gov/alliance, www.leepcampaign.org.

Photo courtesy of MC Realty.

Join the LEEP Campaign www.leepcampaign.org

Federal sites are encouraged to join the LEEP campaign. LEEP will provide you with

- technical assistance
- information on financing and incentives
- lighting savings calculators.

Federal sites commit to

- building or retrofitting at least one parking lot or structure with high-efficiency lighting. (Sites built or retrofitted with complying fixtures any time after January 2010 are eligible to compete.)
- Share your results.

Report your actual energy savings by May 2016 for a chance to be recognized at the LEEP awards at the International Parking Institute Conference and Expo in Nashville, TN, May 17-20, 2016.

LEEP Award Categories Include:

- Highest *absolute savings* at a single site (parking lot): retrofit and new construction
- Highest *absolute savings* at a single site (parking structure): retrofit and new construction
- Highest *percentage savings* at a single site (parking lot): retrofit and new construction
- Highest *percentage savings* at a single site (parking structure): retrofit or new construction
- Best use of controls
- Largest number of sites upgraded
- Largest percentage of sites upgraded
- Largest portfolio-wide energy savings
- Exemplary award for achievement in federal facilities.

To see past years' winners go to:
<https://www4.eere.energy.gov/alliance/activities/technology-solutions-teams/lighting-electrical/leep-campaign>

The LEEP Campaign is sponsored by the Building Owners and Managers Association (BOMA) International, the Green Parking Council, the International Facility Management Association (IFMA), the International Parking Institute (IPI), and the U.S. Department of Energy Better Buildings Alliance.



U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

For more information, visit:
femp.energy.gov

PNNL-SA-114169 January 2016

FEMP
Federal Energy Management Program