

Marine Corps Base Quantico Achieves 85% Savings in Parking Lighting

With technical assistance from the Federal Energy Management Program (FEMP), the Marine Corps Base Quantico (MCBQ) recently undertook a major overhaul of its outdoor lighting, boosting safety and security throughout the site, while cutting energy costs and earning a national award in the process.

The MCBQ replaced nearly 2,000 old and inefficient street lights, parking lot lights, and exterior area lights across the 1,000-acre site, which includes about 100 parking lots.

The MCBQ replaced its mercury vapor and high pressure sodium fixtures with light-emitting diode (LED)-based fixtures. The LED fixtures save energy both because the LEDs produce more lumens per Watt and because less light is “wasted.” Due to their directional nature, nearly all of the light produced by the LED fixtures is aimed downward. The LED light source can be better sized to the amount of light output actually needed because the lights do not have to be oversized to compensate for light that is emitted skyward or lost in the fixture.

MCBQ by the Numbers

Number of Parking Lots Retrofitted	101
Total Upgraded	90%
Total Area	3,779,092 ft ²
Total Number of Parking Spots	11,578
Total Energy Savings	459,346 kWh
Average Energy Savings per Parking Lot on Base	66%
Total Annual Energy Cost Savings	\$32,000



The Marine Corps Base Quantico (MCBQ) in Virginia replaced 2,000 old parking, street, and outdoor light fixtures with efficient LED lights to save energy while increasing safety and security. The MCBQ is home to the Marine Corps’ Officer Candidates School and the Combat Development, Recruiting, Systems, and Training and Education commands as well as approximately 3,400 of the Marine Corps’ 200,000 active service members. Training facilities for the Federal Bureau of Investigation and the Drug Enforcement Administration are among the other activities located at the MCBQ. *Photo courtesy of MCBQ.*

LEDs have excellent color rendering. They start instantly rather than taking time to ramp up like mercury vapor lamps. LEDs are mercury free, resulting in fewer disposal issues than there are with mercury-containing lamps. The steady-state technology and lack of glass and igniters contribute to reduced breakage. This, together with their long lamp life, means that LEDs provide considerable labor cost savings because the fixture does not have to be serviced as much as traditional lamp technologies. And, LEDs can provide significant energy savings compared to other light sources.

This energy savings was dramatically proven at the MCBQ where in one parking lot alone the base realized an energy savings of 85% when the existing mercury vapor fixtures were replaced with LED fixtures. Three 78-Watt LED fixtures provide adequate light for the entire 9,800-ft² parking lot. The Base won an award for “Highest Percentage Energy Savings in a Retrofit at a Single Parking Area” from the Lighting Energy

Efficiency in Parking (LEEP) Campaign. This campaign is a collaborative effort of the U.S. Department of Energy and industry associations to promote the use of energy-efficient lighting in parking lots and structures.

Project Drivers and Successes

The Energy Independence and Security Act of 2007 requires the U.S. Department of Defense to reduce building energy consumption by 30% by 2015, relative to a 2003 baseline. The outdoor lighting retrofit at MCBQ is one part of the Marine Corps’ efforts to help the military comply with that requirement. The project was initiated by the MCBQ’s Environmental and Energy Management System Team, which sets the objectives for energy and environmental programs on the base. The Marine Corps’ Energy Investment Program, which supports building efficiency projects, also played a role.

Benefits of High-Efficiency LED Parking Lot Lighting

- Energy Savings
- No Mercury
- Quick Start
- Long Life
- Reduced Maintenance
- Reduced Light Pollution
- Safety and Security

The award-winning 9,800-ft² parking lot lighting project was part of a larger lighting initiative on the base to replace all outdoor lighting more than 20 years old with efficient LED lighting. Of the base's 101 parking lots, 90% have gotten new LED lights since the project began. The parking lots range in size from 1,781 ft² to 309,218 ft² representing a total area of nearly 4 million ft² of lighted space, enough to park 11,578 cars. Project planners estimate the retrofits will save the Marine Corps 459,346 kWh annually, or more than \$32,000 per year in electricity costs. There are also maintenance staff labor savings attributed to fewer lamp replacements.

In determining the cost effectiveness of the project, the MCBQ team calculated savings based on a 12-hour operation day and an off-peak electric rate of \$0.07/kWh. Non-energy-related annual cost savings were estimated based on replacing one-third of the lamps per year at an estimated labor cost of \$13.75 per lamp. The simple payback calculated by the MCBQ for this project was 18-25 years. If MCBQ undertook this project today, the payback would likely be 5-7 years because LED fixture prices have come down, and due to other factors.

Although a lighting upgrade could replace only the lamp, not the whole fixture, the team found that replacing the entire fixture would be more cost effective and provide better performance.

According to Kirk Nelson, MCBQ's Director of Installations and Environment, advantages beyond energy savings fueled interest in the exterior lighting project. The base was interested in LEDs because they offer significant maintenance savings and improved night visibility. The new fixtures provide greater lighting coverage in the parking areas.

The project took advantage of the Marine Corps Energy Investment Program, which is part of the Military Construction Program and is designed to fund

energy-related projects, requirements, and mandates. See www.mcicom.marines.mil/Units/GFFacilities/GF1Energy/GF1EIPICIP.aspx.

The lighting project was a natural continuation of earlier sustainability efforts. In 2013, MCBQ received the Marine Corps Large Shore Top Platinum Secretary of the Navy Annual Energy and Water Management Award for its FY 2012 efficiency accomplishments.

Next Steps

The success of the parking lot lighting replacement project has prompted plans for improving lighting in and around 63 MCBQ buildings. For example, safety and security concerns are driving plans to install LED site lighting in Camp Upshur, a remote area of the base where exterior lighting is often non-existent.

LED lighting will be installed on 57 wooden utility poles. Together the poles will support about 214 LED luminaires. In addition, 150-Watt high-intensity discharge (HID) lamp wall packs mounted on surrounding buildings will be replaced with 22-Watt LED wall packs. All of the LED fixtures will be equipped with photocell controls to automatically operate the LEDs to provide exterior light from dawn to dusk.

Old Fixtures versus New Fixtures: 85% Savings in the 9,800 ft² Lot Retrofit

	Mercury Vapor	LED
Number of fixtures	3	3
Rated lamp wattage	400 W	N/A
Input power	454 W	78 W
Luminaire lumens	16,800	4,323
Energy use	6,570 kWh	968 kWh
Manufacturer rated life	24,000 hours	70,000 hours



This aerial photo of the Marine Corps Base Quantico (MCBQ) shows the site of the 9,800-ft² parking lot (outlined in blue) where mercury vapor fixtures were replaced with LED fixtures, resulting in an energy savings of 85%. *Photo courtesy of MCBQ.*

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, 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

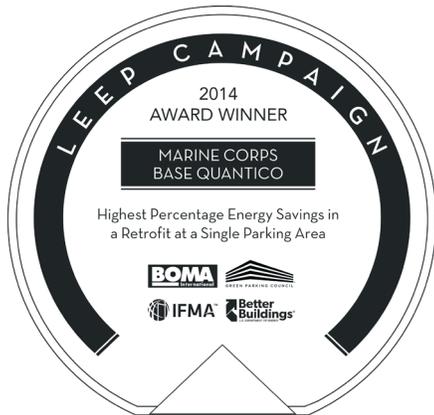
Wall Pack Lighting Specification and Appliance Guidance

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

Lessons Learned

- MCBQ began this large-scale lighting projects with a site survey of all existing lighting so that post-retrofit savings can be verified.
- The quality of currently available LED products varies significantly among manufacturers. Thermal and electrical design issues in some products can lead to rapid lumen depreciation or premature failure. The MCBQ needed to use due diligence for proper fixture selection.
- LED technology is improving rapidly and the quantity of available products is expanding daily. The MCBQ consulted DOE-sponsored lighting research such as CALiPER test results and GATEWAY demonstration program reports, available on the DOE Solid-State Lighting website at www.ssl.energy.gov

Lighting Energy Efficiency in Parking (LEEP) Campaign



On April 15, 2014, the MCBQ was one of 12 organizations recognized for energy savings in parking lot and parking structure lighting at an award ceremony conducted in Washington, D.C. by the LEEP Campaign, an effort to promote high-efficiency lighting in parking facilities. The MCBQ won for achieving 85% energy savings in a parking lot lighting retrofit that cut energy use from 6,570 kWh to 968 kWh.

Together winning projects achieved savings of 36 million kWh or \$3.5 million in electricity savings by providing energy-efficient lighting to 140 million ft² of parking lots and structures, with an average payback of less than 6 years.

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 levels specified in ASHRAE Standard 90.1-2010. LEEP's overall goal is to achieve 500 million ft² of planned or installed high-efficiency parking lighting by March 2015.



This side-by-side comparison from a DOE Solid-State Lighting GATEWAY retrofit demonstration project illustrates the difference in lighting quality between high-pressure sodium (on the left) and LED lighting (on the right). Another type of high-intensity discharge (HID) lighting, the mercury vapor lamp, produces a bluish-greenish white light. While LED fixtures have a light efficacy ranging from 20 to 120 lumens per Watt (lm/W), the efficacy of mercury vapor fixtures ranges from 15 to 45 lm/W. High pressure sodium fixtures have LERs ranging from 30 to 83 lm/W. Metal halide fixtures have LERs ranging from 20 to 75 lm/W. *Photos courtesy of Pacific Northwest National Laboratory.*

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 expected and actual energy savings by March 2015 for a chance to be recognized at the LEEP awards at the BOMA International 2015 Every Building Conference and Expo in Los Angeles, CA, June 28-30, 2015.

LEEP Award Categories

- Highest *absolute savings* at a single site (parking lot): retrofit
- Highest *absolute savings* at a single site (parking structure): retrofit
- Highest *percentage savings* at a single site (parking lot): retrofit
- Highest *percentage savings* at a single site (parking structure): retrofit
- Highest *absolute savings* at a single site (parking lot): new construction
- Highest *absolute savings* at a single site (parking structure): new construction
- Highest *percentage savings* at a single site (parking lot): new construction
- Highest *percentage savings* at a single site (parking structure): new construction
- Best use of controls
- Largest number of sites upgraded
- Largest percentage of sites upgraded
- Largest portfolio-wide energy savings

For more information visit
www.leepcampaign.org

The LEEP Campaign is sponsored by the 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.



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For more information, visit:
femp.energy.gov

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FEMP
Federal Energy Management Program