

Net Zero Pilot Program Lights the Path to Big Savings in Guam

Because electricity costs are as high as \$0.50/kWh, an ambitious net zero energy/water waste goal was among the drivers that spurred the United States Army Reserve (USAR) 9th Mission Support Command (MSC) to implement a lighting retrofit program in Guam. The campaign netted the 9th MSC a 2016 award from the Interior Lighting Campaign.

The 9th MSC cut energy use by 62% by retrofitting 424 troffer light fixtures in the main headquarters building and training building at the Vicente T. Dydasco U.S. Army Reserve Center in Barrigada, Guam. The existing fixtures, which included two-lamp (56-W) and four-lamp (124-W) fluorescent lamps, were replaced with 36-W LED troffer fixtures, netting annual savings of 125,400 kWh savings.

Cost savings at the Guam site are calculated to be about \$51,400/year. This is in part because of the high cost of electricity at the site. Electric rates in recent years have ranged from a fiscal year (FY) 2014 high of \$0.50/kWh, to \$0.33/kWh in FY 2015 and \$0.41/kWh in FY 2016. Maintenance and replacement

Project at a Glance - Vicente T. Dydasco U.S. Army Reserve Center, Barrigada, Guam

Project Location	Barrigada, Guam
Total Area of Project	2 buildings - 25,900 ft ² total
# of Troffers Upgraded	424
Annual Energy Savings	125,400 kWh
Equals the Energy Usage of	≈ 11 Homes
Energy Use Reduction	62%
Annual Energy Cost Savings (2016)	\$51,400/yr
Simple Payback	5 years

cost savings are also anticipated because of the longer life of the new LEDs. The Philips Day-Brite LED luminaires have a rated lamp life of 50,000 hours and may yield yet another source of savings as staff have noted, with the new fixtures, they can turn on fewer lights to achieve comfortable light levels.

Project Drivers and Successes

One important driver for the lighting retrofit project was a Net Zero Pilot Program the Army Reserve began in 2013. The Guam site was 1 of 10 pilot sites chosen for the program, which seeks to make the entire base net zero in terms of its energy use.

Net zero energy use is achieved through energy-efficiency improvements that reduce energy consumption at the base to the point that on-site renewable power sources, such as photovoltaic panels, produce as much power as the site uses over the course of the year.

Lighting retrofits were identified as one of the highest potential energy savings measures of all the projects identified in the *Roadmap for Net Zero Energy, Water, and Waste at Guam U.S. Army Reserve Center* prepared by Pacific Northwest National Laboratory for the 9th MSC. Lighting was one of several energy-efficiency measures evaluated by PNNL, along with HVAC, insulation, and equipment retrofits, and measures for water savings and waste reduction, which are concurrent goals in this comprehensive net zero energy, water, and waste pilot program.

Additional drivers for the project include executive orders with which federal agencies must comply. This includes Executive Order 13693, which requires agencies to cut energy use 2.5% annually from 2015 until 2025. The troffer lighting retrofit project's potential for high energy savings and its inclusion in the



The U.S. Army Reserve 9th Mission Support Command (MSC) employs 3,500 Army reserve soldiers and 160 civilians at island and coastal sites ranging from Alaska, to American Samoa, Japan, Korea, Guam, and Saipan, with headquarters in Honolulu. Photo courtesy of the Army Reserve 9th Mission Support Command.

roadmap for the Net Zero Pilot Project helped secure funding through Army Reserve Installation Management for the retrofit. The funding process is highly competitive, and includes all Army Reserve sites.

The project's success has raised awareness in and the credibility of such energy-saving endeavors, and could help pave the way for future retrofit projects. Noted Christina Vicari, Energy Manager, "A lot of people were skeptical about investing in energy efficiency but, after getting the funding and seeing the results, they've realized it as a benefit."

Before and After Retrofit

	Before	After
	Fluorescent	LED
Number of Troffers	424	424
Wattage per Troffer	Mix of 56-W and 124-W 4-lamp	36-W
Annual Energy Use	201,600 kWh	76,200 kWh
Controls	None	None

ILC Awards Won

- Exemplary Federal Government Sector Site



LEDs replaced linear fluorescent tubes in 424 troffers for a 62% reduction in energy use, longer life, and maintenance savings.

Photo courtesy of the Army Reserve 9th Mission Support Command.

Lessons Learned

- Using the net zero roadmap afforded the opportunity to take a holistic approach rather than just considering projects individually.
- Performing a Comprehensive Energy and Water Evaluation (CEWE) for the location was essential to identify and evaluate all opportunities, which enabled a more organized, strategic, and efficient effort for project development and implementation.
- Documenting project progress with pictures can help in communicating project status to remote stakeholders, and pictures can help showcase the project in the future.
- Selecting knowledgeable and experienced installation contractors and vendors (in this case, DZSP21 and Beacon Construction) can improve the likelihood of a well-executed field installation.



Staff gave the LED lighting positive reviews, noting that after the retrofit they could turn on fewer lights because of the new lighting's increased brightness.

Photo courtesy of the Army Reserve 9th Mission Support Command.

Along with the successes, the project also faced challenges – among them, the complexity of coordinating processes involving multiple defense agencies, several levels of hierarchy within organizations, time limits on funding, different fee structures, and significant time zone variations. There is up to a 14-hour time zone difference between Guam and Washington, DC. Mid-way through the project, the responsibility for utility payments transferred from the budget office in Honolulu at the Army Reserve - 9th MSC to the Office of the Secretary of Defense, Army Reserve Allotment. This transition has increased the complexity of the approval process and increased the uncertainty about approval of other recommended projects.

Next Steps

More LED lighting projects are planned by the 9th MSC, as part of the Net Zero Pilot Program.

Both Saipan and American Samoa will have projects in 2017. They anticipate using similar, if not the same, lighting technologies as those used at Guam, given the success and positive feedback received.

Learn More

Army Reserve 9th Mission Support Command

www.usar.army.mil/Commands/Support/9th-MSC/



The Army Reserve 9th MSC's retrofit of troffer lights in its nearly 14,700-square-foot main headquarters building and 11,200-square-foot training building at the Guam base is expected to save about \$51,400/year in energy costs.

Photo courtesy of the Army Reserve 9th Mission Support Command.

Federal Energy Efficiency Requirements for Interior Lighting

Although every site, whether federal, private, commercial, or industrial, can benefit from the energy savings, maintenance savings, and lighting quality improvements, offered by energy-efficient lighting, 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.

ENERGY STAR® Lighting

Federal purchasers must buy, specify, and contract for ENERGY STAR®-compliant products. To find ENERGY STAR-qualified lighting products, see www.energystar.gov/productfinder/.

Federal Efficiency Requirements

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 interior LED lighting must meet to be eligible for purchase by federal agencies.

LED Luminaire Efficiency Requirements for Federal Purchases

Luminaire Type	Light Output	Luminaire Efficiency (LE)
Commercial, linear ambient	≥375 lm/ft	≥103 lm/W
Commercial, 1-foot by 4-foot troffers	≥1,500 lm	≥99 lm/W
Commercial, 2-foot by 2-foot troffers	≥2,000 lm	≥100 lm/W
Commercial, 2-foot by 4-foot troffers	≥3,000 lm	≥103 lm/W
Industrial, low bay	≥5,000 to <10,000 lm	≥103 lm/W
Industrial, high bay	≥10,000 lm	≥100 lm/W

as of October 2015

FEMP LED Purchasing Guidance

For more information on high-efficiency lighting technologies and information for federal agencies, including lighting requirements language for contracts, visit energy.gov/eere/femp/purchasing-energy-efficient-commercial-and-industrial-led-luminaires.

FEMP and the DOE LED Lighting Facts® program have partnered to offer a tool that allows federal users to identify LED lighting products that meet the minimum federal efficiency requirements.

The FEMP Acquisition Guidance Product List allows users to search for interior lighting products in the six categories in the table below that meet federal requirements. The tool provides a pre-screened list of products and federal users can screen on a large range of other product metrics, including color temperature, power factor, and beam angle. Find qualifying products at www.lightingfacts.com/LFPowered/FEMP.

Helpful Guides

Wireless Occupancy Sensors for Lighting Controls: An Applications Guide for Federal Facility Managers — This guide describes the different types of sensors, appropriate applications, and expected energy savings. www.energy.gov/sites/prod/files/2016/03/f30/wireless_occupancy_sensor_guide.pdf

Measurement and Verification of Energy Savings and Performance from Advanced Lighting Controls — This document provides a framework for measurement and verification. energy.gov/sites/prod/files/2016/03/f30/mv_lighting_control_wireless.pdf

Proven Specifications

Use these specifications, developed by DOE’s Better Buildings Alliance and the Designlights Consortium, to specify performance expectations, warranty, and testing requirements for your lighting projects.

Better Buildings Alliance Model Technical Specification: High-Efficiency Troffers
[betterbuildingsolutioncenter.energy.gov/sites/default/files/attachments/High Efficiency Troffer Performance Specification.pdf](http://betterbuildingsolutioncenter.energy.gov/sites/default/files/attachments/High%20Efficiency%20Troffer%20Performance%20Specification.pdf)

Designlights Consortium Networked Lighting Control Systems Specification
www.designlights.org/content/CALC/SpecificationAndQPL

“The marketplace is seeing a rapid adoption of highly-efficient indoor lighting and green leasing practices, as the price of cutting edge technologies and the risk of creative market approaches continue to decline. This is exemplified by the increasing number of organizations partnering with DOE to adopt the next technology or novel market strategy—and through this, showing the will to push the limits and benefits of energy efficiency in commercial buildings.”

Kathleen Hogan,
 Deputy Assistant Secretary for Energy Efficiency, U.S. Department of Energy

Interior Lighting Campaign



On June 27, 2016, the 9th was one of 13 organizations recognized for exemplary energy savings at an award ceremony conducted in Washington, DC, by the ILC, an effort to promote high-efficiency troffer lighting and control systems in buildings. The 9th won Exemplary Sector Award for a Federal Site.

In one year alone, 650,000 new high-efficiency troffer upgrades were planned or completed, equating to savings of 130 million kWh, and \$13.49 million. With nearly 50 participants and over 130 supporters, the ILC continues to accelerate the reduction in the amount of energy consumed by lighting in buildings nationwide.

The ILC encourages facilities to install energy-efficient lighting and to install lighting occupancy or daylight controls to cut energy use and deliver occupant satisfaction. By adopting more efficient troffer lighting, such as systems that meet the Better Buildings Alliance (BBA) [specification](#) for troffers, building owners can save up to 70% on a one-for-one basis, and up to 80% with the use of controls.

The ILC's overall goal is to achieve the replacement of 1 million planned or installed high-efficiency troffer lighting systems by April 2017.



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 and 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 Interior Lighting Campaign, www.interiorlightingcampaign.org.

Photo courtesy of Pacific Northwest National Laboratory.

Join the ILC

Federal sites are encouraged to join the ILC. The ILC will provide you with:

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

Federal sites commit to:

- building or retrofitting at least one building space with high-efficiency lighting. (Sites built or retrofitted with complying fixtures any time after January 1, 2013, are eligible to compete.)
- Share your results.

Report your actual energy savings by April 2017 for a chance to be recognized at the ILC awards event at the BOMA 2017 International Conference & Expo, June 24-27, 2017, in Nashville, Tennessee.

ILC Award Categories

The award categories for the interior lighting campaign include the following:

- Highest Absolute Annual Savings for Troffer Lighting Retrofits
- Highest Percentage of Annual Savings for Troffer Lighting Retrofits
- Highest Absolute Annual Savings for Troffer Lighting New Construction
- Highest Percentage of Annual Savings for Troffer Lighting New Construction
- Special Recognition Categories:
 - Best Use of Lighting Controls in a Single Building
 - Largest Number of Facility Projects
 - Largest Portfolio-wide Annual Absolute Energy Savings
- Exemplary Performance Awards may also be presented to participants in the federal sector.

The ILC is sponsored by the Building Owners and Managers Association (BOMA) International, the Illuminating Engineering Society, the International Facility Management Association, the U.S. General Services Administration, and the U.S. Department of Energy Better Buildings Alliance.



U.S. DEPARTMENT OF
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Energy Efficiency &
Renewable Energy

For more information, visit:
www.interiorlightingcampaign.org

DOE/EE - 1492 • PNNL-SA-121821 • November 2016

