

Marines Battle Energy Waste

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Troops implement energy-efficiency plans



Executive Order 13123, signed by President Clinton in 1999, required in part that government agencies must reduce 1985 baseline energy consumption levels 30% by 1985 and 35% by 2010. Part of the solution for U.S. Marine Corps Base Camp Joseph H. Pendleton was to place heavy emphasis on lighting, through a comprehensive retrofit plan covering dozens of buildings.

Located roughly halfway between Los Angeles and San Diego, U.S. Marine Corps Base Camp Joseph H. Pendleton is basically a small city. It covers nearly 200 square miles, 17 of which are picturesque Pacific Ocean shoreline, disturbed only by passing cars along Interstate 5 and military helicopters flying overhead.



It's America's busiest military base, home to the 1st Marine Expeditionary Force and the 1st Marine Division, among numerous other commands, and hosts 60,000 military and civilian personnel each day. That translates to 6,000 buildings, from armories, hangars, and living quarters for Marine personnel to warehousing, gymnasias, and approximately 15.3 million square feet of office space--all of which require proper lighting levels in order for personnel to perform tasks efficiently.

In 1999, then-President Bill Clinton signed Executive Order 13123, which stated in part that government agencies must reduce 1985 baseline energy consumption levels 30% by 2005 and 35% by 2010. Though Camp Pendleton had a multi-phased energy reduction plan instituted in 1991, base energy manager Jeff Allen had to account for the new mandate.

Part of the solution was to place heavy emphasis on Camp Pendleton's lighting, through a comprehensive retrofit plan covering dozens of buildings. That included installation of Square D Powerlink lighting control systems from Schneider Electric along with replacement of high intensity discharge (HID) luminaires with more energy-efficient T5HO high-bay luminaires from Amerillum Corp., and incorporation of light harvest luminaires from DayLight Technology. The results of the Energy Office's energy reduction plan have been dramatic: As of mid-2006, base energy consumption has been reduced 31% from 1985 levels, while maintaining current light levels. Lighting control has been a major contributor by saving more than 500,000 kilowatt-hours (kWh) annually, amortized over three project phases. Plus, adding lighting control has enabled the base to receive the maximum amount of rebate dollars available from utility incentive sources to drive the project, while also reducing the payback period.

“To maximize energy reduction and eliminate energy waste, all energy-consuming systems are considered in the energy plan,” says Allen, in his ninth year as base energy manager. “Lighting represents a straightforward way to reduce energy consumption. It reduces energy use, prolongs lamp life, reduces maintenance costs, contributes to our energy reduction goal and creates a pressure-free environment for personnel, because lights go off on their own.”

Mandates Increase

Allen says increasing lighting efficiency has always been a part of Camp Pendleton’s energy reduction plan, considering that lighting accounts for typically 30% of a facility’s total electric load. The first four phases of the plan, covering most of the 1990s, included luminaire retrofits, which complemented efforts like installation of more energy-efficient boilers, motors, and compressors.

But with the advent of Executive Order 13123 and its energy-reduction mandates, lighting took on even greater importance for the base, and the Energy Office. Among its first steps, in fall 2001, was contracting American Lighting Supply, a San Diego-based lighting distributor with its own installation branch, to disconnect targeted fluorescent lamps and HID luminaires.

That’s when Energy Office personnel met Ben Van Etten, vice president of operations for American Lighting Supply. During the course of the project, they discussed improvements to the base’s lighting efficiency, including HID replacements and lighting control. That led to the Energy Office’s investigation of Powerlink products as a lighting control option, which spurred Van Etten to do the same because American Lighting Supply was considering bidding the project.

“Lighting carries an immediate turnkey savings,” Van Etten says. “But a good energy solution on the control side allows you to claim an extra 10 to 15% on top of that, so why wouldn’t you take it? Square D provided me a demonstration case and I was able to use it to finalize the design — how do I make low-voltage input control zones, how do I bring in multiple levels of control to integrate daylighting sensors, aside from the primary on-off function?”

American Lighting Supply won the bid and began installing Powerlink 1000 Level lighting control systems during Phase 6 of the energy reduction plan, which started in 2003. The system, which comprises lighting panelboards fitted with a



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controller that features 16 independently configurable time schedules and the ability to configure up to 64 lighting zones per controller, were installed in 18 buildings, including warehousing, service/maintenance buildings, and gymnasias. The work complemented replacement of existing HID luminaires with T5HO bi-level fluorescent high-bay luminaires manufactured by Amerillum, Vista, CA., and light harvest luminaires installed by San Diego-based DayLight Technology.

Van Etten and his crew collaborated closely with tenants of each individual building to contour its lighting control system to best meet occupant needs.

"Changing the light luminaires was a great start, but adding a secondary switch and programming really enhanced each building's Powerlink lighting control system and allowed more lights to be turned off when they aren't needed," he says. "For example, there was a gymnasium where lights were either all on or all off. We bi-leveled it, so an entire half can be on or off. If you have a full-on basketball game, you can turn everything on 100%, or if you're doing general maintenance, you can turn half of one court on 50%, just to give enough light to navigate without hazard.

"We really put thought into this," he says. "Because the lighting control system provided the flexibility of integrating an override switch with programming for existing lighting zones, why not capitalize on it?"

Allen adds that he wanted more than just lighting control. Powerlink products allowed him to improve the distribution side of the electrical system in the affected buildings by replacing outdated wiring, panels, gearboxes, and breakers. Van Etten discovered during the installation process that some of those components were World War II-era technology.

"The primary driver was energy reduction," Van Etten says. "But instead of addressing the luminaires only, it made more sense to upgrade electrical distribution system components as well. Jeff took a very proactive approach, which was to design for as few maintenance issues as possible. I've had one reprogramming call in three years."

Van Etten points out that the success of the lighting efficiency measures in Phase 6, including lighting control, led to their inclusion in Phase 7, which started in early 2004. The significant kWh and cost savings played a large role, certainly, but there were other considerations. For example, nuisance tripping and shorts virtually disappeared, which allowed better allocation of Allen's Square D-trained maintenance staff. Powerlink products also benefited the Marines.

"The last Marines out of a building at the end of the day may or may not turn the lights off," Van Etten says. "As long as the system is engaged, it will time itself out after a two-hour period. So if there is no activity, the lights will double-blink within a 5-minute period before they expire. If no one is there, the lights will

automatically shut off. If someone is there, they walk over the wall switch near the exit, where the low-voltage switch was, and push the override button to re-extend the time.

"All of our design was bi-level for California Title 24 compliance. We would set up a 3-hour and a 4-hour delay, so half of the luminaires would time out at 3 hours, and the second half would time out an hour later, so no one was ever in the dark."

Lighting Control



The lighting retrofit plan at U.S. Marine Corps Base Camp Pendleton included installation of Square D Powerlink lighting control systems from Schneider Electric, T5HO high-bay luminaires from Amerillum Corp. and light harvest luminaires from DayLight Technology.

Phase 7 brought daylighting and Powerlink products together in the more than 25 affected buildings. "Phase 7 was a daylighting project, which incorporated the same programming scheme for lighting control, but we introduced daylighting control modules into the system," Van Etten says, adding Powerlink 2000 Level systems were installed in that phase. That enhanced the capabilities of the 1000 Level system by facilitating breaker control from switches and the daylighting control modules.

"We need to meet a minimum 30 footcandle (fc) threshold, and we can do that with artificial light, 100% natural light or with a marriage of both," Van Etten says. "So we did a reverse tier. We made half of the luminaires turn off when it hit its baseline threshold, and the rest of them turn off when it hit 50 fc, because that exceeded the footcandle requirement for that building. As the sun sets at day's end, the high threshold would trip, so half the luminaires had the availability to become active. That means occupants could go over the wall switch, push the button and lights would come on, because the daylighting luminaire sent the signal to the Powerlink panelboard to release the circuit to turn on.

"So once we set the system's thresholds, lights would turn off when there was enough ambient light coming in through the daylighting cells. At that point, it would not give the customer the opportunity to go push the override switch because the ambient light levels were still high, so the lights remained off. Once the light levels fell, the switch would re-engage and the customer could push the switch and get light for a two-hour period."

Mark Memmott, CEO of Daylight Technology, estimates his company has manufactured more than 2,600 light harvest luminaires at Camp Pendleton, covering more than 150 existing buildings, since his company began work at the base in 2003. Adding daylighting control modules to the benefits of the Powerlink system enhanced the positive effects of daylighting.

"To have automated lighting control is the best thing possible, because it's not personally driven," Memmott says. "If you're depending on someone to turn off a switch when daylight increases, it will never happen. The total cost savings can be quantified across the board, because it's proven that at a certain light level, the lights are going to go off.

"Plus, the overall energy reduction using a Powerlink system in conjunction with daylighting is increased because it can be connected to the base's energy management system," he says. "For Jeff to be able to accurately monitor energy usage and generate hard data that can help improve lighting efficiency, that type of automation is necessary, or you can't do it."

Daylighting and Powerlink products also combine to increase the energy efficiency provided by the replacement T5HO fluorescent high-bay luminaires, says Amerillum's Justin Ryver.

"The HID luminaires operated at about 450 W, but a four-lamp T5 HO luminaire needs only about 234 W while maintaining the current light levels," Ryver says. "When you incorporate daylighting and the control system, you are capturing additional savings by shutting those luminaires off during peak daylight times. You also get the on-off capabilities of the fluorescent T5HO lamps, which ties back into the control system, meaning there is the ability to turn them off and an hour later turn them back on and have an immediate response with full brightness. With HID, you need a 5- to 10-minute warm up to get full brightness."

The Future

The momentum built in Phases 6 and 7 have carried over to Phase 8. DayLight Technology is installing Powerlink 2000 Level systems, along with manufacturing daylighting cells, as part of Phase 8 in more than 25 buildings, 19 with Powerlink panels and photosensor controls, and 23 with daylighting cells. Plans are already in the works for Phase 9, which could include the latest incarnation of Powerlink products, the remote monitoring capabilities of the Web-enabled 3000 Level system. Currently, all monitoring is done by field inspection, Allen says; project funds for Phases 6 through 8 didn't include remote monitoring capability.

The ability to monitor all buildings with lighting control from any computer connected to the Internet is a natural progression, Van Etten says.

"For Phase 7 and 8, I specified the Powerlink 2000 Level system because it's more robust when you start working with daylighting," he says. "But I would love to see everything

we've done changed out for 3000 Level controllers and then linked together. At that point, you're maximizing everything to the extent that if Jeff knows two-thirds of the base is deployed, he can make sure everything is in the 'off' mode in appropriate buildings. It's a good common sense approach."

Allen is resolved that lighting control will not only be a part of Phase 9, but beyond.

"In most cases, the light levels at work sites are higher, with lower energy use," he says. "Because of that, we are encouraging the use of this lighting technology in all new buildings. Once this phase of the project is completed, we will move on to another phase and install technology in all cost-effective applications. These projects are reflective of the teamwork required to push an effective energy program forward to meet the federally mandated goals."



In this before and after photo, incorporation of measures like Square D Powerlink lighting control from Schneider Electric, T5HO high-bay luminaires from Amerillum Corp. and light harvest luminaires from DayLight Technology improved lighting levels in this workspace.