US Army Corps of Engineers

# ENGINEERING AND CONSTRUCTION BULLETIN

**No. 2012-15** **Issuing Office:** CECW-CE **Issued: 25 April 2012** **Expires: 25 April 2014**

**Subject**: Exterior Lighting Performance Standard

**References:**

a. Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings, Memorandum of Understanding (MOU), 2006.

b. Army Energy Security Implementation Strategy, 13 JAN 2009

c. Energy Independence and Security Act (EISA) of 2007 (i.e. §321, §322, and §324)

d. Technology Deployment Matrix, DOE Federal Energy Management Program: http://www1.eere.energy.gov/femp/technologies/newtechnologies_matrix.html

e. DesignLights™ Consortium (DLC): http://www.designlights.org/

f. Engineering and Construction Bulletin (ECB) 2011-1, 19 Jan 2011, Subject: High Performance Energy and Sustainability Policy

g. USACE Sustainability Plan: https://eko.usace.army.mil/usacecop/environmental/sustainability/

**Applicability**: Directive and Guidance

1. **Purpose**: to provide direction and guidance to implement a new standard for exterior lighting energy performance into the Military Construction, Army (MCA) program, including SRM and O&M activities encompassing new construction, renovation, and routine O&M. This ECB is effective when issued. FY14 projects and beyond are expected to comply with these standards. Prior-year project design teams are asked to seek opportunities to implement these standards as their project schedules and funding allow.

2. **Background**. The Department of Defense, the Department of the Army, and the US Army Corps of Engineers adhere to the Guiding Principles (Reference a), which include the establishment of performance goals for energy use, the optimization of energy efficiency, and the reduction in environmental impacts of materials. Similarly, the Army Energy Security and Implementation Strategy (Reference b) also includes Energy Security Goals to reduce energy consumption, increase energy efficiency, increase use of renewable energy, and reduce adverse impacts on the environment. The USACE Sustainability Plan (Reference g) includes similar energy and sustainability related goals for Civil Works projects and Corps-owned facilities. The implementation of the Standards in this memorandum advances the Department of the Army and the Corps of Engineers toward these goals in our use of exterior lighting.

A little over a year ago, ECB 2011-1 (Reference f) included Solid State Lighting (SSL) among energy performance enhancements considered viable for a wide range of building types and climactic regions. Advanced exterior lighting technologies available on the market today offer significant cost savings to the taxpayer in the future. For example, in their Advanced Street Lighting Assessment Project, the City of San Diego concluded, "…LED [Light-Emitting Diode] and induction light sources can provide energy savings of up to 40% without compromising the light characteristics required of street lights." In addition to energy savings, operation and maintenance savings will also be realized due to longer lamp life reducing the frequency of costs associated with replacement. Many LED and Induction light sources are rated to last five to ten times longer than the metal halide or high pressure sodium lamps in use today. The resulting cost savings from reduced maintenance requirements are just as significant as the energy cost savings and must be included in cost analyses. As an illustration, a retail center parking lot project studied by the Department of Energy found that the energy savings alone of $34,688 over their life cycle wouldn't justify the incremental up-front cost of $43,310 for SSL fixtures over traditional Metal Halide fixtures. However, including the greater savings in maintenance costs of $36,360 over their life cycle resulted in a net realization of $7,105/year in cost savings.

3. **Applicability**. This standard applies to exterior lighting illuminating any building, site, property, structure, gate, sign, roadway, parking lot, pathway, sidewalk, landscape, structure, etc. that is owned, operated by, or constructed to be leased to the Department of the Army. This includes all Sustainment, Restoration, and Modernization (SRM) and Military Construction activities within the United States, its territories, and overseas on permanent Active Army installations, Army Reserve Centers, Army National Guard Readiness Facilities, and Armed Forces Reserve Centers, regardless of funds source. This applicability includes exterior lighting related to our Civil Works projects and Corps-owned facilities.

4. **Objectives**. The objective of this standard is to meet or exceed the performance requirements of the EISA 2007 sections in Reference c. While these sections reference certain technologies, this standard specifies net light output for the luminaire per unit of energy input, otherwise known as luminaire efficacy, regardless of the light generating technology utilized by the fixture. Significant strides have been achieved in recent years in the technological development from dim LEDs to the modern spectrum of SSL technologies today. Induction lighting technology also provides higher performance and longevity than other technologies in use. Both SSL and Induction lighting technologies scored in the upper tier of technologies ready for deployment in a recent study by the Department of Energy (reference d.) The study weighed energy savings potential to the Federal sector, life-cycle cost effectiveness, and probability of market success. The future may hold advancements not yet imagined. Therefore, the standards herein are performance-based to allow for the use of better technologies as the marketplace evolves.

5. **Performance Standard**.

a. **General**. Exterior lighting technology should be selected based on a balance of energy performance and quality of light, while remaining life cycle cost effective and environmentally responsible. Exterior lighting systems or fixtures selected for use should have demonstrated adherence to quality standards by being recognized by the DesignLights Consortium (reference e) or equivalent industry sources, the EPA ENERGY STAR Program, the DoE Federal Energy Management Program (FEMP) or

other third party qualifier appropriate to the technology. Manufacturers should also stand behind their products by providing a Luminaire Warranty for at least 5 years or more. Design teams should carefully consider the occupancy and purpose of the lighting requirements and incorporate energy-saving controls, sensors, and the use of bi-level fixtures to provide exterior lighting levels only as appropriate and only during the hours of night needed. Other energy-saving and lighting quality design considerations include ensuring better uniformity of lighting distribution to required levels to reduce over-lit hotspots and control light trespass outside the area of intended coverage.

b. **Exterior Lighting Performance by Application**. Exterior Lighting Systems should meet, at a minimum, the better of the standards below in Table 1 or the DLC Product Qualification Criteria (reference e) or future Energy Star qualification or FEMP designation requirements. The standards below exceed the current version 1.6 of the DLC Product Qualification Criteria, but it is assumed that as the market evolves a future version will ultimately surpass these standards. FEMP will soon be incorporating commercial exterior lighting into their designation program. Once established, a FEMP Designation will become a preferable source for selection.

(1) **General Exterior Lighting.** Typically lighting to provide visibility for security and people moving along established circulation pathways through an illuminated area to or from a destination. Examples include roadways, parking lots, parking structures, sidewalks, tarmacs, service areas, and secondary exits from buildings.

(2) **Architectural Lighting.** Lighting in use where exterior spaces are occupied at night for a functional purpose, such as plazas, gas stations, pavilions, or amphitheaters. Also, for use where a higher quality of light is desired, such as building entrances, wall-wash luminaires, illumination of architectural or landscaping features, sculpture, displays, exhibits, flags, gates, primary signage, etc.

(3) **Exceptions:** Where a non-white light color is specifically desired by aesthetic design or a color-specific functional requirement (e.g. water feature lighting, entertainment, signal lights, airfield lights, marine wildlife protection, etc.), the CRI and CCT Range values indicated may not apply. Specialized lighting, such as lighting for monitoring systems designed to use non-visible spectrum light, are also exempt from the minimum CRI and CCT standards as well. Luminaires primarily powered by on-site renewable energy (e.g. solar and/or wind) are also exempt from the requirements herein.

*Table 1 – Minimum Exterior Lighting Performance by Application. These values represent minimum standards and do not supersede higher standards that may also be applicable or specified by design.*

| **Application** | **Luminaire Efficacy** | **CRI** | **Nominal CCT Ranges** | **Lamp Life** |
|---|---|---|---|---|
| General Exterior Lighting | ≥65 | ≥65 | 3000-5700 | 36,000 |
| Architectural Lighting | ≥50 | ≥80 | 3500-5000 | 36,000 |

Notes:
Luminaire Efficacy (with total fixture load including ballast/driver loads) is minimum in Lumens per Watt.
CRI (Color Rendering Index) shown is minimum and is a value without units
CCT (Correlated Color Temperature) Range is in Kelvin Temperature
Minimum Lamp Life is in Rated Hours for the technology (e.g. TM-21)

c. **Life-Cycle Cost Analysis (LCCA) and Renewable Energy Opportunities**. Many exterior lighting installations offer opportunities to advance the goals of increasing the use of renewable energy due to the cost of connecting remote fixtures back to grid power. On-site renewable or alternative energy power system cost over a 40-year life-cycle should be compared to the cost of the conventional grid-connection infrastructure, operation and maintenance costs thereof, proper time-of-use grid energy cost with line losses and price escalation. Renewable or alternative energy systems should be used wherever the payback period less is than or equal to the life cycle period. Design team selections and Value Engineering evaluations are to prioritize a reduced total cost of ownership during the full life-cycle period over the first costs of design and construction. Final LCCA should be in accordance with 10 CFR 436 methodology.

6. A request for an exemption through HQ USACE may be made for any specific requirement included herein or by reference that the Project Delivery Team determines would adversely affect mission performance, security requirements, health, safety, or welfare. The exemption shall only apply to the specific requirements in conflict. Any approved exemptions to this standard shall be documented with reference to the specific requirement in conflict and included in the project documentation.

7. The Headquarters USACE point of contact for this standard is Eric Mucklow at 202-761-0522 or eric.mucklow@usace.army.mil.

//S//
JAMES C. DALTON, P.E., SES
Chief, Engineering and Construction Division
Directorate of Civil Works