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Executive Summary:

Choosing Both Energy Efficiency and Light Pollution Mitigation for Commercial Outdoor Lighting

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DesignLights Consortium®
www.designlights.org

Executive Summary

The DLC is a nonprofit organization that provides decision makers with data and resources on quality lighting, controls, and integrated building systems to reduce energy consumption, carbon emissions, and light pollution. Collaborating with utilities, energy efficiency programs, manufacturers, lighting practitioners, building owners, and government entities, the DLC creates rigorous lighting performance criteria that keep pace with technology.

Amid growing awareness of light pollution's negative impacts on people, ecosystems, and the night sky, the DesignLights Consortium (DLC) created its LUNA program for outdoor LED products to mitigate the adverse effects of outdoor lighting. The DLC recently conducted a study with VH Lighting Services and Lighting Research Solutions to analyze the differences between LED fixtures that meet the LUNA Technical Requirements compared with DLC-qualified products that don't meet LUNA requirements. The study answers the question: What are the impacts on annual energy use, energy costs, and ROI if a city or town desires to use a retrofit solution that is both energy efficient and minimizes light pollution, rather than focusing on energy efficiency alone?

Many factors can impact light pollution, including light levels, color, fixtures, direction of light, BUG ratings, controls, and shields. Fixtures on the LUNA Qualified Products List (QPL) meet all the energy efficiency benchmarks of the DLC's Solid-State Lighting (SSL) Technical Requirements, plus additional criteria aimed at mitigating the unintended negative impacts of artificial light at night, including uplight control, light source color, shielding, and controllability.

To conduct this analysis, the research team investigated realistic outdoor lighting retrofit solutions that are energy efficient and minimize light pollution versus solutions focused on energy efficiency alone. The exterior grounds (parking lot) of a model high school and a main street in Fort Collins, Colorado served as application examples.

Findings

- The study found that using LUNA-qualifying products for the model high school parking application was not only an effective way to reduce light pollution, but also facilitated lower energy usage and greater cost savings compared to focusing on energy efficiency alone.
- For the model high school application, the study concluded that designing to use lower light levels had a bigger impact on reducing light pollution than did the optical distribution of fixtures, their BUG rating, and the use of shields. Using fixtures with low CCTs (i.e., less blue light) significantly reduced light pollution. See the DLC's Seven Strategies to Minimize Negative Impacts of Outdoor Light at Night resource for more information on how enabling controllability and reducing overlighting are the most effective strategies for reducing light pollution.
- The use of LUNA-qualifying products for the main street application also reduced light pollution, although energy consumption findings for the street scenarios varied depending on fixture type and specific product selection.
- In a retrofit scenario, where pole locations were already fixed, the study found that there may be tradeoffs between meeting illuminance, uniformity, and ordinance requirements.

Payback Period Findings

- The research team found that the ratio of realized energy savings to potential fixture costs clearly favored the use of LUNA products in many of the examined scenarios, but not all.
- Adding networked lighting controls (NLCs) altered the cost-effectiveness for both the model high school and main street projects. In all cases, using LUNA products along with an NLC system to dim LEDs to 20% of full power during the night (when the parking lot would be unoccupied and when traffic was lighter) provided additional energy savings.
- While adding NLCs was advantageous in terms of energy usage and light pollution reduction, it was not a cost-effective option due to the small-scale applications that were considered, and it increased the payback period of the lighting systems in general. From an economic standpoint, NLCs would receive a higher return on investment in larger installations.

Although energy savings and overall benefits varied somewhat from scenario to scenario, the findings indicate clear justification for utilities and other energy efficiency programs to incentivize LUNA-qualified products.