E-7. Require Higher Efficacy Public Street and Area Lighting

GHG Mitigation Potential

Moderate

Potentially moderate reduction in GHG emissions from street lighting

Co-Benefits (icon key on pg. 34)

Climate Resilience

Installation of more efficient lights can reduce the strain on the overall grid and reduce energy costs.

Health and Equity Considerations

Blue or full spectrum light may increase perceptions of safety but inhibit sleep patterns of nearby residents and reduce night sky visibility. Work with communities to determine appropriate color temperatures.

Measure Description

This measure will require the installation of higher efficacy public street and area lighting in place of typical or existing lamps. Lighting sources contribute to GHG indirectly through the production of the electricity that powers the lights. Installing more efficacious lamps, such as light-emitting diodes (LEDs), will use less electricity while producing the same amount of light, thereby reducing the associated indirect GHG emissions. In a 2012 survey of 212 California cities, 852,000 of the 1,100,000 streetlights (76 percent) were identified as high-pressure sodium lamps, while only 2 percent were LEDs (CLTC 2012).

Subsector

Energy Efficiency Improvements

Scale of Application

Plan/Community

Implementation Requirements

Users may take credit only if they are retrofitting existing street and area lights. This includes streetlights, pedestrian pathway lights, area lighting for parks and parking lots, and outdoor lighting around public buildings.

Cost Considerations

More energy-efficient lighting options are typically more expensive than less efficient ones, leading to greater installation costs. However, the replacement of less efficient lighting with more efficient bulbs reduces energy consumption and thereby reduces energy costs. Additionally, the rated life of more efficient bulbs is typically longer than less efficient ones, which reduces the frequency of replacement costs.

Expanded Mitigation Options

Incorporation of solar fixtures onto the street and area traffic lights would further reduce grid-supplied electricity consumption and associated emissions.

GHG Reduction Formula

$$A = \frac{B_1 \times C_1 - B_2 \times C_2}{B_1 \times C_1}$$

GHG Calculation Variables

ID	Variable	Value	Unit	Source
Output				
A	Percent reduction in GHG emissions from outdoor street and area lighting	[ ]	%	calculated
User Inputs				
B_1	Number of existing lighting heads to be replaced	[ ]	lighting heads	user input
B_2	Number of proposed new lighting heads	[ ]	lighting heads	user input
C_1	Average power rating of existing lamp type	[ ]	watts	user input
C_2	Average power rating of proposed lamp type	[ ]	watts	user input
Constants, Assumptions, and Available Defaults				
	None			

Further explanation of key variables:

- (B_1 and B_2) – The number of existing and proposed lighting heads are required in the GHG reduction formula in case the new type of lamp results in less heads needing to be installed.
- (C_1 and C_2) – Lumens are the measure of the amount of light perceived by the human eye. Luminous efficacy is the amount of visible light emitted for a given amount of power. This measure assumes that the replacement lighting would provide the same number of lumens per area as the existing lighting and that only the power rating would change. See Table E-7.1 in Appendix C for a range of typical power ratings and efficacies of various outdoor lamp types (CLTC 2015). These values are for reference only for providing the user a list of existing and replacement lighting options. The user should input project-specific values in the GHG reduction formula, if available.

GHG Calculation Caps or Maximums

It is assumed that the electricity demand of the project's lighting is currently being met by grid electricity that requires *some* amount of fossil fuel–based energy generation, which emits GHGs from fuel combustion. In other words, the local electricity provider has an energy intensity factor (lb of CO_2e per MWh) greater than zero. For projects that are served by electricity providers already with a renewable portfolio of 100 percent, this measure could have no reduction in GHG emissions. If the electricity provider is using REC to meet a 100 percent renewable portfolio goal, then some emissions reductions may be achieved. This measure would still result in the co-benefits of reduced electricity use and enhanced energy security.

Example GHG Reduction Quantification

The user reduces the energy consumption of outdoor lighting by installing higher efficacy lighting. If the number of existing and proposed lighting heads are both 100 (B_1 and B_2), the power rating of the existing high-pressure sodium lamps is 120 watts, and the power rating of the proposed LED lamps is 80 watts, the user would reduce GHG emissions from outdoor lighting by 33.3 percent.

$$A = \frac{100 \text{ heads} \times 120 \text{ watts} - 100 \text{ heads} \times 80 \text{ watts}}{100 \text{ heads} \times 120 \text{ watts}} = -33.3\%$$

Quantified Co-Benefits

Energy and Fuel Savings

The percent reduction in electricity achieved by the measure is the same as the percent reduction in GHG emissions (A).

Sources

- California Lighting Technology Center (CLTC). 2012. *The State of Street Lighting in California, 2012.* University of California, Davis. February. Available: https://cltc.ucdavis.edu/publication/state-street-lighting-california-2012. Accessed: January 2021.
- California Lighting Technology Center (CLTC). 2015. *2013 Title 24, Part 6 Outdoor Lighting Guide.* University of California, Davis. March. Available: https://cltc.ucdavis.edu/sites/default/files/files/publication/2013-title-24-outdoor-lighting-guide-mar15.pdf. Accessed: January 2021.