E-10-B. Establish Onsite Renewable Energy Systems–Solar Power

GHG Mitigation Potential

Varies

Variable reduction in GHG emissions from building energy use depending on renewable electricity generation compared to building energy consumption

Co-Benefits (icon key on pg. 34)

Climate Resilience

Installing onsite renewable energy systems provides backup generation sources that can contribute to generation capacity and reduce the risk of outages, particularly if an extreme event disrupts the grid. Onsite renewable energy can also reduce energy costs.

Health and Equity Considerations

Solar panels may conflict with tree canopies, which reduces temperatures and improves public health; projects should be carefully designed to minimize these conflicts.

Measure Description

This measure requires electricity to be generated from onsite PV systems, displacing the electricity demand that would ordinarily be supplied by the local electricity provider. Electricity generation provided by local electricity providers have varying carbon intensities based on the portfolio of energy sources. Because PV systems generate zero GHG emissions, this measure displaces the emissions that would have been produced had electricity been supplied by the local electricity provider, and thus results in a reduction in GHG emissions. Onsite renewable systems can also provide back-up power as an alternative to diesel generators in the event of grid power outages.

Subsector

Renewable Energy Generation

Scale of Application

Project/Site

Implementation Requirements

See measure description.

Cost Considerations

Installation costs for solar power vary on the type and size of the generator; however, initial costs are still considered high. These costs are recouped by large cost savings as the property owner can use electricity produced on site, or even a net profit if excess energy is sold to an electricity provider. Additionally, initial installation costs can be at least partially offset by credits and rebates meant to encourage renewable energy use. Solar power may require the purchase of additional property large enough to host the generators.

Expanded Mitigation Options

Pair with Measure E-23, *Use Microgrids and Energy Storage*, in Table 3-2 to store and then deploy surplus electricity generated from the renewable energy system. This would improve the capacity of the system to displace more grid-supplied electricity, further reducing associated emissions.

GHG Reduction Formula

$$A = \frac{-B}{C}$$

GHG Calculation Variables

ID	Variable	Value	Unit	Source
Output				
A	Percent reduction in GHG emissions from electricity use	0–100	%	calculated
User Inputs				
B	Electricity provided by PV system with measure	[ ]	kWh per year	user input
C	Total electricity demand	[ ]	kWh per year	user input
Constants, Assumptions, and Available Defaults				
	None			

Further explanation of key variables:

- (B) – The amount of electricity generated by a PV system depends on the size and type of the PV system and the location of the project. The user can use a publicly available solar calculator, such as the NREL PVWatts® Calculator, to estimate the size of the PV system needed to generate the desired amount of electricity. The only input required for this calculator is the location (i.e., zip code). Estimates of the amount of electricity that can be generated from 3, 5, and 10 kilowatt PV systems in cities around California are shown in Table E-10-B.1 in Appendix C (NREL 2017). Other calculators include Google's Project Sunroof (Google n.d.) and solar-estimate.org (2021).

GHG Calculation Caps or Maximums

It is assumed that the electricity demand of the user's project is currently being met by grid energy 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 kWh) greater than zero. For projects that are served by electricity providers with a renewable portfolio standard of 100 percent, this measure would effectively have no reduction in GHG emissions, although it would still result in the co-benefit of enhanced energy security.

Example GHG Reduction Quantification

If the user's project consumes electricity from a local electricity provider with a non-zero carbon intensity, the user can reduce the project's emissions from electricity consumption by displacing the electricity demand met by the local electricity provider with an onsite solar photovoltaic system. If the total electricity demand is 10,000 kWh per year (C), and the solar power system provides 5,000 kWh per year (B), the user would reduce GHG emissions from electricity use by 50 percent. The example measure emission reduction is calculated below.

$$A = \frac{\frac{-5{,}000\ \text{kWh}}{\text{yr}}}{\frac{10{,}000\ \text{kWh}}{\text{yr}}} = -50\%$$

Quantified Co-Benefits

Successful implementation of this measure would reduce grid electricity, and a portion of this electricity is supplied by statewide fossil-fueled power plants, which generates criteria pollutants. However, because these power plants are located throughout the state, the reduction in electricity use from this measure will not reduce localized criteria pollutant emissions and are, therefore, not discussed.

Sources

- Google. no date. *Project Sunroof*. Available: https://www.google.com/get/sunroof.
- National Renewable Energy Laboratory (NREL). 2017. NREL's PVWatts® Calculator. August. Available: https://pvwatts.nrel.gov/index.php. Accessed: January 2021.
- Solar-Estimate. 2021. Solar Calculator. Available: https://www.solar-estimate.org/residential-solar/solar-panel-calculators. Accessed: January 2021.