E-10-A. Establish Onsite Renewable Energy Systems–Generic

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

Onsite renewable energy can provide protection against grid disruptions, which can be critical to protect the health of vulnerable people, such as seniors and those who use electric medical equipment.

Measure Description

This measure requires electricity to be generated from an onsite renewable or zero-emission power system. This displaces 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. Some renewable energy systems, such as fuel cells, may not be completely GHG emissions-free, but may still have lower emissions than the electricity provided by the local electricity provider (unless the electricity provider has a relatively high renewable portfolio), thereby reducing GHG emissions. Zero-emissions power systems, such as PV panels, result in the greatest magnitude of emissions reductions. Onsite renewable systems can also provide back-up power as an alternative to diesel generators in the event of grid power outages or demand response events.

Subsector

Renewable Energy Generation

Scale of Application

Project/Site

Implementation Requirements

Renewable energy systems powered by solar and/or wind should be quantified under Measures E-10-B or E-10-C, respectively.

Cost Considerations

Installation costs for onsite renewable energy generation vary greatly depending on the type of energy system and the size of the installation, but overall, installation costs can be high. These costs are recouped by large cost savings as the property owner can use electricity produced on site instead of purchased from the grid, or even a net profit if excess energy is sold to an electricity provider. Additionally, initial installation costs can be partially offset by credits and rebates meant to encourage renewable energy generation.

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

$$A = \frac{-B}{C} \times \frac{E - D}{E}$$

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 onsite power system with measure	[ ]	kWh per year	user input
C	Total electricity demand	[ ]	kWh per year	user input
D	Carbon intensity of onsite power system	[ ]	lb CO_2e per MWh	user input
Constants, Assumptions, and Available Defaults				
E	Carbon intensity of local electricity provider	Tables E-4.3 and E-4.4	lb CO_2e per MWh	CA Utilities 2021

Further explanation of key variables:

- (D) – If the onsite power system is a zero-emission source, then the GHG emission reduction (A) is effectively equivalent to the ratio of electricity from the zero-emission system (B) to the total electricity demand (C). If the onsite power system is not a zero-emission source, then the GHG emission reduction calculation needs to consider the GHG intensity factor of the onsite power system (D) and the local electricity provider (E).
- (E) – GHG intensity factors for major California electricity providers are provided in Tables E-4.3 and E-4.4 in Appendix C. If the project study area is not serviced by a listed electricity provider, or the user is able to provide a project-specific value (i.e., for the future year not referenced in Tables E-4.3 and E-4.4), the user should use that specific value in the GHG calculation formula. If the electricity provider is not known, users may elect to use the statewide grid average carbon intensity.

GHG Calculation Caps or Maximums

It is assumed that the electricity demand of the 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 power system. In this example, the onsite power system would provide 2,000 kWh per year (B) at a carbon intensity of 50 lb CO_2e per megawatt-hour (D). The proposed project would have a total electricity demand of 10,000 kWh per year (C). It would be constructed in Southern California Edison's service territory and would begin operation by 2022. Without this measure, the project would, therefore, have an electricity carbon intensity of 351 lb CO_2e per MWh (E). The user would reduce GHG emissions from electricity use by 17 percent.

$$A = \frac{\frac{\text{-2,000 kWh}}{\text{yr}}}{\frac{\text{10,000 kWh}}{\text{yr}}} \times \frac{\frac{\text{351 lb } CO_2e}{\text{MWh}} - \frac{\text{50 lb } CO_2e}{\text{MWh}}}{\frac{\text{351 lb } CO_2e}{\text{MWh}}} = \text{-17\%}$$

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

- California Utilities. 2021. Excel database of GHG emission factors for delivered electricity, provided to the Sacramento Metropolitan Air Quality Management District and ICF. January through March 2021.