E-10-C. Establish Onsite Renewable Energy Systems–Wind Power

GHG Mitigation Potential

Varies

Variable reduction in GHG emissions from building energy, 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

Consider noise impacts in places with nearby sensitive receptors.

Measure Description

This measure requires electricity to be generated from onsite wind power 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. Since wind turbines 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 wind power generation vary based on the type and size of the turbine, 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 instead of purchased from the grid, or even at 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 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

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

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 wind power 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 that can be supplied by wind power is highly dependent on location. To implement this measure, users should consider their project's location and other factors that may determine onsite wind power feasibility, such as cost, neighboring land uses, and local ordinances. The U.S. DOE has resources available for wind energy in California, such as wind speed maps (U.S. DOE n.d.). Additionally, the NREL's Wind Prospector is an interactive mapping tool, where users can determine if their project's location is likely to have suitable wind capacity factors (NREL n.d.).

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 wind power system. If the total electricity demand is 10,000 kWh per year (C), and the wind power system provides 1,000 kWh per year (B), the user would reduce GHG emissions from electricity use by 10 percent. The example measure emission reduction is calculated below.

$$A = \frac{\frac{-1{,}000\ \text{kWh}}{\text{yr}}}{\frac{10{,}000\ \text{kWh}}{\text{yr}}} = -10\%$$

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

- National Renewable Energy Laboratory (NREL). No date. *Wind Prospector*. Available: https://maps.nrel.gov/wind-prospector/?aL=MlB4Hk%255Bv%255D%3Dt%26VMGtY3%255Bv%255D%3Dt%26VMGtY3%255Bd%255D%3D1&bL=clight&cE=0&lR=0&mC=40.21244%2C-91.625976&zL=4. Accessed: March 4, 2021.
- U.S. Department of Energy – Office of Energy Efficiency and Renewable Energy (U.S. DOE). No date. *Wind Energy in California*. Available: https://windexchange.energy.gov/states/ca#maps. Accessed: March 4, 2021.