E-16. Require Zero Net Energy Buildings

GHG Mitigation Potential

Potentially large reduction in GHG emissions from building energy use

Co-Benefits (icon key on pg. 34)

Climate Resilience

Requiring ZNE buildings can reduce sensitivity to fuel price shocks or scarcity and offer more reliability if electricity providers have been adapted to climate change or less reliability if the grid has not been adapted. If the development produces and exports emission-free energy, this increases energy resilience and adds generation capacity to the overall grid, reducing risk of outages.

Health and Equity Considerations

As a ZNE building is likely to exclude or limit natural gas combustion, it would likely improve indoor and regional air quality.

Measure Description

This measure requires the user to operate their building at ZNE. A ZNE building foremost reduces GHG emissions by reducing energy use through more efficient design. Further, the building avoids GHG emissions either by using no emissions-generating energy sources or offsetting the building energy emissions by exporting emission-free energy (typically from onsite renewables). For residential buildings, the user can determine achievement of ZNE performance by entering the project details into the CEC's CBECC-Res 2019 executable file (Wilcox 2020). CBECC-Res 2019 uses the energy design rating, represented by the Time Dependent Valuation (TDV), as a way to express the energy consumption of a building as a rating score index (CEC 2018).

Subsector

Building Decarbonization

Scale of Application

Project/Site and Plan/Community

Implementation Requirements

CEC defines a ZNE Code Building as one where the net energy produced by onsite renewables is equal to the building energy consumption, measured using the CEC's TDV metric. The California Department of General Services defines ZNE more broadly, including not only buildings but campuses, portfolios, and communities (BluePoint Planning 2018).

Cost Considerations

ZNE buildings would have highly variable costs, including building onsite renewable energy, more expensive building materials to improve energy efficiency, and carbon offsets and/or renewable energy credits (RECs). While purchasing RECs may be less costly than building onsite generation, the project would not gain the co-benefits of greater energy resilience and contribution to grid capacity. And while all these costs may be high, the cost savings from reduced energy usage are also substantial.

Expanded Mitigation Options

Instead implement Measure E-17, *Require Renewable Surplus Buildings*, which results in a surplus of renewable energy and therefore increased GHG reductions and co-benefits.

GHG Reduction Formula

A = -100%

GHG Calculation Variables

ID	Variable	Value	Unit	Source
Output				
A	Percent reduction in GHG emissions from building energy	100	%	calculated
User Inputs				
	None			
Constants, Assumptions, and Available Defaults				
	None			

No further explanation of variables.

GHG Calculation Caps or Maximums

Measure Maximum

(A_{max}) The maximum, and, in fact, only percent reduction in GHG emissions from building energy for this measure is 100 percent. This assumes that the net amount of emissions displaced by onsite renewable energy resources is equal to the number of the emissions generated annually by the building electricity use and onsite fuel consumption.

Mutually Exclusive Measures

If the user selects this measure, they may not also select Measure E-17, *Require Renewable Surplus Buildings*, which represents a unique scenario in which the project produces more renewable energy than what is required to offset the emissions generated from energy consumed by the building and would be considered carbon-negative.

Example GHG Reduction Quantification

The user avoids building energy emissions by committing their project building to be ZNE. The user would reduce GHG emissions from building energy by 100 percent.

Quantified Co-Benefits

Energy and Fuel Savings

The percent reduction in electricity from an electricity provider and fuel consumption achieved by the measure is the same as the percent reduction in GHG emissions

(A). This measure, while not resulting in a net reduction in electricity consumption per se, would displace the building electricity from the grid.

Improved Air Quality

Electricity supplied by statewide fossil-fueled or bioenergy power plants generates criteria pollutants. However, because these power plants are located throughout the state and not typically in close proximity to the ZNE building site, the reduction in electricity use from this measure will not reduce localized criteria pollutant emissions.

For projects that are all electric or replace sources of fossil fuel combustion with electric infrastructure, the reduction in onsite fuel consumption from this measure would result in local improvements in air quality because the building fuel combustion occurs on site of the project (e.g., natural gas for space heating or water heating). The percent reduction in GHG emissions (A) is the same as the percent reduction in localized criteria pollutants from building energy achieved by the measure. In other cases, projects may achieve ZNE by offsetting emissions from onsite fuel combustion sources through the export of renewable energy generated to the electric grid. If the project would retain sources of fossil fuel combustion, there would not be a 100 percent reduction in local criteria pollutant emissions. The reduction in criteria pollutant emissions (B) achieved by the measure can be calculated as follows.

Criteria Pollutant Emission Reduction Formula

$$B = -C$$

Criteria Pollutant Emission Reduction Calculation Variables

ID	Variable	Value	Unit	Source
Output				
B	Percent reduction in criteria pollutant emissions from onsite fossil fuel use	[ ]	%	calculated
User Inputs				
C	Percent reduction in onsite fossil fuel use	0–100%	%	user input
Constants, Assumptions, and Available Defaults				
	None			

Further explanation of key variables:

- (B and C) – The reduction in criteria pollutant emissions may be less than 100 percent or even 0 percent if the project retains onsite fossil fuel sources (i.e., natural gas, propane) In this situation, the percent reduction in criteria pollutant emissions is equal to the percent reduction in onsite fossil fuel use.
- Please refer to the *GHG Calculation Variables* table above for definitions of variables that have been previously defined.

Sources

- Bluepoint Planning. 2018. *Commercial & District Zero Net Energy Framework*. April. Available: https://4eae5a23-44d0-418e-8d77-0e5a216d92ea.filesusr.com/ugd/cc790b_01490cf012b64cf7b369aab39a3750a9.pdf. Accessed: January 2021.
- California Energy Commission (CEC). 2014. *2013 Integrated Energy Policy Report*. January. Available: https://www.adaptationclearinghouse.org/resources/california-energy-commission-integrated-energy-policy-report.html. Accessed: January 2021.
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