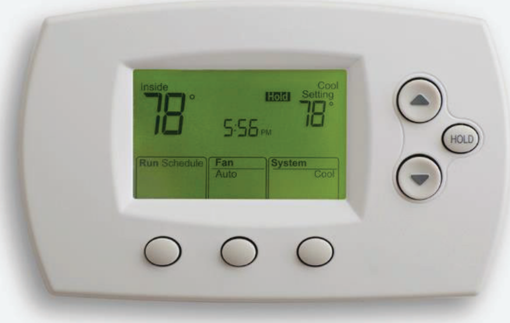
E-6. Encourage Residential Participation in Existing Demand Response Program(s)



GHG Mitigation Potential

0.02%

Up to 0.02% reduction in GHG emissions from residential building electricity

Co-Benefits (icon key on pg. 34)

Climate Resilience

Strategic energy conservation during demand response events reduces the strain on the overall grid, particularly the risk of power outages during peak loads. It can also reduce energy costs, particularly if extreme heat would otherwise increase these costs.

Health and Equity Considerations

Demand response programs can help residents save money on utility costs and reduce exposure to extreme heat, supporting greater resilience to climate health impacts. This can be especially critical for low-income and vulnerable residents.

Measure Description

This measure will require marketing and promotion of the local utility's manual (i.e., behavioral) demand response program(s) to encourage participation from residents in the project area. Buildings contribute to GHG indirectly through electricity consumption. During demand response events, program users shift or conserve electricity, thereby reducing the associated indirect GHG emissions. Methods of engaging customers in demand response efforts include offering time-based rates, such as time-of-use pricing, critical peak pricing, variable peak pricing, real-time pricing, and critical peak rebates. Users are encouraged to respond to time-based rates or other forms of financial incentives with smart phone app, email, phone call, and/or text notifications.

Subsector

Energy Efficiency Improvements

Scale of Application

Project/Site or Plan/Community

Implementation Requirements

See measure description.

Cost Considerations

The cost of providing the demand response program is borne by the local utility. Property owners will realize cost savings from reduced electricity use.

Expanded Mitigation Options

The electricity reduction cited in the GHG emissions quantification methodology is based on a *manual* demand response program. Residential participation in an *automated* program, which requires smart appliances for the relevant end uses and appliances (e.g., heating and cooling, dishwashers, washing machines), can reduce user fatigue while improving the electricity reduction rates, yielding improved GHG emissions reductions.

GHG Reduction Formula

$$A = -\left(B \times C \times \frac{D}{E}\right)$$

GHG Calculation Variables

ID	Variable	Value	Unit	Source
Output				
A	Percent reduction in GHG emissions from residential electricity	0–0.2	%	calculated
User Inputs				
B	Level of participation	0–100	%	user input
Constants, Assumptions, and Available Defaults				
C	Electricity reduction during demand response event	18	%	CEC 2020
D	Average number of demand response events	100	hours per year	U.S. DOE 2010
E	Hours in a year	8,760	hours per year	conversion

Further explanation of key variables:

- (A) – The output provides the percent reduction in GHG emissions from residential building *electricity*. To determine the percent reduction in GHG emissions from total residential building *energy* (i.e., electricity plus natural gas), the user would need to know the percent of total GHG emissions from electricity. For example, if 40 percent of building energy emissions come from electricity, the percent reduction in GHG emissions from total building energy could be calculated as follows.

  $$A_{energy} = \left(40\% \times A_{electricity}\right)$$

  Further, to determine the percent reduction in GHG emissions for a project with multiple residential buildings, the user would need to know the percent of total building energy emissions from each building. For example, if 67 percent of building energy emissions come from Building 1 and 33 percent come from Building 2, the percent reduction in GHG emissions from all building energy could be calculated as follows.

  $$A_{energy\_total} = \left(67\% \times A_{energy\_1}\right) + \left(33\% \times A_{energy\_2}\right)$$

- (B) – The level of participation refers to the percentage of households in the project area that enroll in the demand response program.
- (C) – OhmConnect is a demand response provider that challenges its users to reduce consumption during critical energy periods (i.e., events). OhmConnect measures the users' actual consumption against a calculated historical baseline and rewards them for the difference. A study of California OhmConnect users found that, on average, users reduced their energy consumption by 0.15 kWh, or 18 percent, during an

OhmConnect demand response event relative to what they would have consumed without an event (CEC 2020).

- (D) – It was estimated that demand response for managing peak loads involves, at most, 100 hours a year (U.S. DOE 2010). The user should input a project-specific value in the GHG reduction formula, if available.

GHG Calculation Caps or Maximums

It is assumed that the project's electricity demand 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 residential electricity consumption by providing incentives for expanded participation in an existing demand response program. In this example, the expected level of participation is 100 percent of households in the study area (B). The user would reduce GHG emissions from residential electricity by 0.2 percent.

$$A = -\left(\mathbf{100\%} \times 18\% \times \frac{100 \ \frac{hr}{yr}}{8{,}760 \ \frac{hr}{yr}} \right) = -0.2\%$$

Quantified Co-Benefits

Energy and Fuel Savings

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

Sources

- California Energy Commission (CEC). 2020. *Identifying Effective Demand Response Program Designs for Residential Customers*. November. Available: https://innovation.luskin.ucla.edu/wp-content/uploads/2021/01/Identifying-Effective-Demand-Response-Program-Designs-for-Residential-Customers.pdf. Accessed: October 2021.
- U.S. Department of Energy (U.S. DOE). 2010. *The Smart Grid: An Estimation of the Energy and CO_2 Benefits*. January. Available: https://energyenvironment.pnnl.gov/news/pdf/PNNL-19112_Revision_1_Final.pdf. Accessed: October 2021.