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**ENERGY AND ATMOSPHERE - GREEN
BUILDING TECHNOLOGY TRAINING PROGRAM
FOR ENERGY AND GREEN BUILDING SPECIALISTS**

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GRID HARMONIZATION - CREDIT
FOR ENERGY AND GREEN BUILDING PROFESSIONALS

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LEARNING OBJECTIVES

- Intent of Grid Harmonization - Credit
- Behind the intent
- Step by Step Guidance
- Requirements
- Required Documentation
- Referenced Standards
- Connection to Ongoing Building Performance
- Terms and definitions



EA- CR(2) - DESIGN

INTENT

To increase participation in demand response technologies and programs that make energy generation and distribution systems more affordable and more efficient, increase grid reliability, and reduce greenhouse gas emissions.

POTENTIAL TECHNOLOGIES & STRATEGIES

Analyze the building's annual load shape and peak load based as calculated for EA prerequisite Minimum Energy Performance. Review the regional grid load profiles using the metric of peak load or peak carbon emissions. The U.S. Environmental Protection Agency's (EPA) Avoided Emissions and Generation Tool (AEGENT) provides regional grid emissions data; local utilities may also provide this data

GRID HARMONIZATION

REQUIREMENTS

Design building and equipment for participation in demand response programs through load shedding or shifting. On-site electricity generation does not meet the intent of this credit.

IMPLEMENTATION

REQUIRED DOCUMENTATION

Documentation	Case 1	Case 2
Proof of enrollment in DR program	X	
Evidence of ability to shed 5% of peak demand	X	X
Confirmation that system is capable of receiving and acting on external signal	X	X
Action plan for meeting reduction requirement during event	X	X
Inclusion of DR in CxM systems testing plan	X	X

BEHIND THE INTENT

Renewable energy generation can reduce carbon emissions and offer local environmental benefits by reducing air pollution. Some renewable energy systems capture wind or sunlight; others usefully employ materials that might otherwise be wasted. Renewable energy produced on-site protects projects from energy price volatility and reliance on the grid while reducing wasted energy lost in transmission. Ultimately, renewable energy production contributes to reducing a country's demand for imported energy.

BEHIND THE INTENT +

As the number of distributed energy resources, or grid-connected power generation from individual buildings, increases, the utility must integrate these resources while continuing to manage overall grid capacity and generation. Too much distributed generation that is not integrated into the energy system can impair grid operation. Buildings have the opportunity to support effective grid management by designing on-site electricity systems that are integrated components of the energy system, serving as resources for the grid rather than disruptors.

In addition to participation in a utility's demand response program, projects can install storage technologies and implement operational strategies that support effective grid management and increase grid reliability. Eligible technologies may include battery storage, flywheel energy storage, or thermal energy storage; load management strategies may include load shifting or flexible operating scenarios.

STEP-BY-STEP GUIDANCE

STEP 1. EXPLORE OPPORTUNITIES FOR RENEWABLES

Determine the most abundant renewable resources on site, such as sunlight, wind, or water, and explore opportunities for using renewable fuels, such as waste wood or biomass (see Further Explanation, Renewable Resource Considerations). [↗](#)

STEP 2. COMPARE REQUIREMENTS FOR RENEWABLE ENERGY SYSTEMS

Carefully evaluate the space requirements, costs, financial incentives, and efficiencies for each potential technology.

- Local funding, financing, and incentives for renewable generation projects may be available for certain technologies and may be a significant factor.
- Excess energy: If your building's energy demand at a given point can be sold to the utility company (net metering), the building owner receives the market rate, however, and cannot charge a premium for the renewable energy. If, effect, the grid serves as a storage system and feeds the project from having a storage system on site.
- Tying into an existing community system or creating a community system may lower cost barriers through economies of scale, because unit costs may decrease as system size increases. Community systems can also take advantage of one-sided demand on buildings that is occupied during the day and another building that is occupied at night could both take advantage of the same solar-fed heating system.
- Renewable energy may be available from a third-party system, or the project team may enter an agreement to install a third-party owner a system that serves the project. In such cases, project teams must take additional steps to ensure that the agreement complies for a set period of time and that the renewable energy credits (RECs) are retained (see Further Explanation, Renewable Energy Systems and Third Parties). [↗](#)
- Some systems that are commonly considered renewable do not qualify for this credit (see Further Explanation, Eligible Renewable Energy Systems). [↗](#)

STEP 3. SET RENEWABLE ENERGY TARGET

To establish the target renewable energy system size for the project, estimate the annual energy cost for the project.

- Projects that used modeling to achieve EA Prerequisite Minimum Energy Performance (Option 1) must base annual energy cost on the whole-building simulation results (see Further Explanation, Analysis). [↗](#)
- Projects that used a prescriptive path to achieve EA Prerequisite Minimum Energy Performance (Option 2 & 3) must use the U.S. Department of Energy's Commercial Building Energy Consumption Survey (CBECS) data to estimate annual energy use and cost (see Further Explanation, Example 2). [↗](#)
- Use after the maximum building system size that can be accommodated in the project or the available budget as the starting point to estimate the maximum number of points for this credit.
- To qualify toward credit points, the environmental benefits associated with generated renewable energy must be retained as it sold, purchased in an equivalent amount (see Further Explanation, Renewable Energy Certificates (RECs) and Carbon Offsets). [↗](#)

STEP-BY-STEP GUIDANCE

STEP 4. DESIGN AND SPECIFY SYSTEM CRITERIA

Many resources are available, some for no or little cost, for planning and designing a renewable energy system. Given basic information for the project, many manufacturers can complete the necessary calculations for the project team. Teams will also find software tools that help in using. If pursuing EA Credit Enhanced Commissioning, address commissioning of the system at this step.

STEP 5. CALCULATE RENEWABLE ENERGY COST CONTRIBUTION

Use Equation 1 to estimate the annual energy cost of the usable energy produced by the renewable energy system and calculate the points awarded. Then, the user whole-building simulations to comply with EA Prerequisite Minimum Energy Performance must use the results of the model in this calculation.

EQUATION 1 Percentage renewable energy cost contribution

$$\% \text{ renewable energy cost} = \frac{\text{Equivalent cost usable energy produced by renewable energy system}}{\text{Total estimated building annual energy cost}}$$

- Usable energy is defined as the output energy from the system less any transmission and conversion losses, such as standby heat loss or losses when converting electricity from DC to AC.
- The project may use the virtual energy rate or the actual utility rates (see Further Explanation, Equivalent Cost for Renewable Energy). [↗](#)

Projects served by a district energy system (DES) using renewable energy are eligible to receive credit for the percentage of its contribution. Use Equation 2 to determine the amount (see Further Explanation, Example 2). [↗](#)

EQUATION 2 Equivalent cost of renewable energy with district energy system

$$\text{Equivalent cost of DES renewable energy} = (\$ \text{ value of renewable energy used at DES} \times \% \text{ of DES energy delivered to building})$$

Projects generating renewable energy through a community or off-site facility have additional documentation requirements for the criteria used in the credit requirements.

REQUIREMENTS

NC, SCHOOLS, RETAIL, DATA CENTERS, WAREHOUSES & DISTRIBUTION CENTERS, HOSPITALITY, HEALTHCARE

Design building and equipment for participation in demand response programs through load shedding or shifting. On-site electricity generation does not meet the intent of this credit.

REQUIREMENTS +



Case 1. Demand Response Program Available and Participation (2 points)

- Participate in an existing demand response (DR) program and complete the following activities. Design a system with the capability for real-time, fully-automated DR based on external initiation by a DR Program Provider. Semi-automated DR may be utilized in practice.
- Enroll in a minimum one-year DR participation amount contractual commitment with a qualified DR program provider, with the intention of multiyear renewal, for at least 10% of the annual on-peak electricity demand. On-peak demand is determined under EA Prerequisite Minimum Energy Performance. The on-peak demand may vary based on the utility climate and pricing structures.
- Develop a comprehensive plan for meeting the contractual commitment during a Demand Response event.
- Include the DR processes in the scope of work for the commissioning authority, including participation in at least one full test of the DR plan.
- Include the DR program and any installed technologies in the building systems manual or include in the current facilities requirements and operations and maintenance plan if the project is not pursuing EA credit Enhanced Commissioning.
- Initiate at least one full test of the DR plan.



REQUIREMENTS +



Case 2. Demand Response Capable Building (1 point)

- Have infrastructure in place to take advantage of future demand response programs or dynamic, real-time pricing programs and complete the following activities:
- Install interval recording meters and have equipment capable of accepting an external signal.
 - Develop a comprehensive plan for shedding at least 10% of the annual on-peak electricity demand. On-peak demand is determined under EA Prerequisite Minimum Energy Performance.
 - Include the DR processes in the scope of work for the commissioning authority, including participation in at least one full test of the DR plan.
 - Include the DR program and any installed technologies in the building systems manual or include in the current facilities requirements and operations and maintenance plan if the project is not pursuing EA credit Enhanced Commissioning.
 - Contact local utility representatives to discuss participation in future DR programs.



REQUIREMENTS +



Case 3. Load Flexibility and Management Strategies (1-2 points)

Analyze the building's annual load shape and peak load based as calculated for EA prerequisite Minimum Energy Performance. Review the regional grid load profile using the metric of peak load or peak carbon emissions. The U.S. Environmental Protection Agency's (EPA) AVOIDED Emissions and Generation Tool (AVERT) provides regional grid emissions data; local utilities may also provide this data.

Coordinate review of building load shape and peak load with review of the regional grid profile to identify the best value load management strategies that the building can provide.

Implement one or more of the load flexibility and management strategies described below for a maximum of up to two points. All projects must install interval recording meters and have equipment capable of accepting an external signal.

Load Flexibility and Management Strategies:

- Peak Load Optimization: demonstrate that strategy reduces on-peak load by at least 10% as compared to peak electrical demand referenced to the ASHRAE 90.1-2006 compliant case (1 point)
- Flexible Operating Scenarios: demonstrate that strategy moves at least 10% of peak load by a time period of 2 hours (1 point)
- On-site thermal and/or electricity storage: demonstrate that strategy reduces on-peak load by at least 10% as compared to peak electrical demand (1 point)
- Grid resilience technologies: project served by utilities with resilience programs in place, which leverage strategies such as islanding and part-load operation, automatically achieve this credit (1 point)

Include installed technology in the scope of work for the commissioning authority. Include load flexibility and management strategies and installed technologies in the building systems manual, or include in the current facilities requirements and operations maintenance plan if the project is not pursuing EA credit Enhanced Commissioning.

Contact local utility representatives to discuss participation in future DR programs and to inform utility of building load flexibility and management strategies.



REQUIRED DOCUMENTATION

Documentation	Case 1	Case 2	Case 3
Proof of enrollment in DR program	X		
Evidence of ability to shed 10% of on-peak demand	X	X	X
Confirmation that system is capable of receiving and acting on external signal	X	X	X
Action plan for meeting reduction requirement during event	X	X	X
Inclusion of DR in CxA systems testing plan	X	X	X
Inclusion of DR and/or grid harmonization technologies in building systems manual	X	X	X
Documentation of one full test of the DR plan	X		
Narrative or report that includes: summary of building annual load shape and regional grid profile analysis; description of building load flexibility and/or management strategies implemented			X
Documentation of grid resilience program or technologies serving the project, as applicable			X

REFERENCED STANDARDS

✓Center for Resource Solutions Green-e Program: green-e.org

✓Commercial Building Energy Consumption Survey (CBECS): eia.gov/consumption/commercial

CONNECTION TO ONGOING BUILDING PERFORMANCE

Participation in a demand response program enables projects to support efficient energy generation and distribution systems, increase grid reliability, and reduce greenhouse gas emissions. For projects where no demand response program is available, implementing load flexibility and management strategies can help to achieve the same outcomes and support effective electrical grid management.

TERMS AND DEFINITIONS

✓ District energy system (DES) a central energy conversion plant and transmission and distribution system that provides thermal energy to a group of buildings (e.g., a central cooling plant on a university campus). It does not include central energy systems that provide only electricity.

✓ Solar garden a shared solar array or other renewable energy system with grid-connected subscribers who receive credit for the use of renewables using virtual net metering. Also known as a community renewable energy system. (Adapted from solargardens.org)



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