GridOptimal Buildings Initiative

How Buildings Can Support Grid Operations

The role of buildings, renewable energy, and energy storage in the utility industry is changing. New near-term solutions are needed to address today's challenges and capitalize on opportunities for market transformation. New Buildings Institute, in partnership with the U.S. Green Building Council (USGBC), is leading a national coalition committed to better integrating buildings into utility grid management strategies. This project, called the GridOptimal™ Buildings Initiative, will develop metrics by which building features and operating characteristics that support more effective grid operation can be measured and quantified. By supporting the adoption of GridOptimal building features, utilities will be able to tap into a new resource to support grid operation.

Modern Grid Management Challenges

As policymakers and the building community encourage improved building performance and reduced carbon impacts, the electric grid is facing significant new challenges. The rapid proliferation of distributed renewable energy resources creates technical challenges for grid operation, even as traditional revenue models for utilities face significant uncertainty. In response to efficiency goals, the building industry is delivering more and more distributed energy generation onto the grid, with little or no regard for how the utilities must respond to the presence of these new distributed resources. In regions where significant renewable resources have been added to the grid, utilities are facing the need to deeply discount power prices or curtail renewable power resources at peak periods to maintain grid stability. Some grid operators are forced to pay other regions to take their surplus power, periodically resulting in negative electricity prices! Increased curtailment is a growing threat to the potential of renewable resources to reduce the carbon impacts of conventional grid operation.

Everyone agrees that dependable grid operation is a critical priority. However, existing grid management and control systems are struggling to integrate new distributed energy. To maintain grid dependability, utilities must continue to manage and support peak generating capacity, even as more utility generating resources may be forced to remain idle when distributed generating resources are feeding power to the grid.

Buildings are Part of the Solution

To fully utilize the rapid increase in distributed generation resources, it is critical that buildings themselves be able to more directly support grid operation by responding to fluctuations in grid load and contributing to broader efforts to manage more diverse grid resources. While some buildings are beginning to incorporate demand management control features that allow short term load response to grid peak, there is a need for a more comprehensive approach to integrating building load management with grid operation.

It is illuminating to consider the impacts of individual buildings on the grid through the lens of a building's "grid citizenship." A good grid citizen is a building that contributes to, rather than detracts from, the reliable, safe, and affordable operation of a clean electric grid.

nbi new buildings institute

U.S. GREEN BUILDING COUNCIL USGBC

Founding Sponsors:

Austin Energy
Commonwealth Edison
Efficiency Vermont
National Renewable Energy Laboratory
Pacific Gas & Electric
Sacramento Municipal Utility District
Southern California Edison

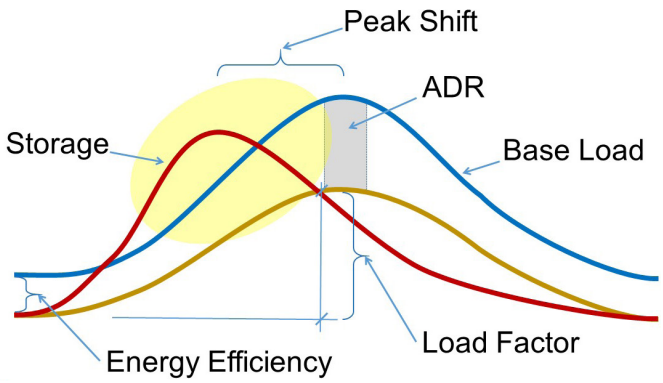
How Can GridOptimal Enhance Building-Grid Citizenship?

GridOptimal is developing pilot projects, metrics, and strategies whereby building features that directly contribute to better grid operation can be identified by designers and incentivized by utilities. This is the natural evolution of widespread energy efficiency incentive programs, since the new dynamics of grid operation require a focus on ***when*** buildings use energy, not just on ***how much*** energy they use. The opportunity exists to design buildings to routinely shift peak energy use and adjust loads to contribute to stable grid operations rather than to exacerbate grid shortages and oversupply.

How Can Buildings Respond to Grid Operation?

The diagram shows the different aspects of building response to grid conditions. Conventional **energy efficiency** typically lowers a building's energy **base load** as well as its **peak load**. Often, this increases the **load factor**. In regions with **automated demand response (ADR)** already deployed as part of utility grid operation, buildings are incentivized to shed some load during peak demand events (as defined by the utility). Another important strategy is to **shift peak** building load, using **energy storage** as well as operational strategies, outside of the utility's peak time, especially if that coincides with the availability of solar photovoltaic generation. The GridOptimal Buildings Initiative seeks to significantly expand the scale and variety of building responses to grid conditions.

How GridOptimal Targets Building Loads



Opportunities for Building-Grid Integration

Permanent Efficiency – Building features and strategies which reduce total building loads.

Peak Shifting – Passive or operational features which modify the time of peak building energy use to adapt to long term grid supply characteristics.

Dynamic Response – Building features which can be used to reduce building energy use to address short term grid constraints based on price signals.

Dispatchable Energy Storage – Actively managed building features and energy use patterns based on direct grid signals.

Grid Friendly Building Strategies

A range of building design and operating strategies can contribute to active building load management. Thermal mass and night ventilation can pre-cool buildings to reduce and delay mid-day cooling loads. Fixed shading can reduce and alter the daily pattern of solar gain into the building. Occupancy sensors that reduce services to vacant spaces, and smart controls that schedule hot water, appliance, battery, and vehicle charging loads to coincide with utility surplus instead of peak periods can all improve the interaction between buildings and the grid.

By encouraging the deployment of these strategies, and quantifying their distribution and dispatch capability for utility managers, the GridOptimal Initiative can help buildings become a more integrated part of utility operation. This will allow the utility grid to make more effective use of the rapidly increasing renewable resources on the grid to effectively offset conventional fossil fuel generating resources.

For more information about the GridOptimal Buildings Initiative, contact Mark Frankel or Alexi Miller.

Mark Frankel
mark@newbuildings.org

Alexi Miller
alexi@newbuildings.org

newbuildings.org/gridoptimal-initiative/

GRIDOPTIMAL™
BUILDINGS INITIATIVE