The GridOptimal Buildings Initiative

How Buildings Can Support Grid Operations and Decarbonization

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 and decarbonization 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 while supporting energy efficiency and carbon emission reductions.

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 and climate 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 increasing deployment 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 and devices are beginning to incorporate controls to enable short-term load shedding during grid peaks, 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.

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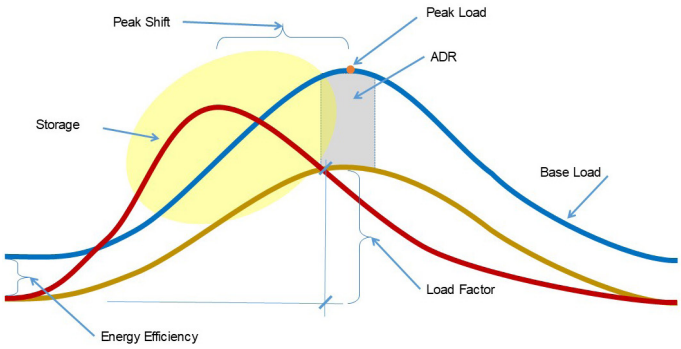
How Can GridOptimal Enhance Building-Grid Citizenship?

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 next stage of widespread energy efficiency incentive programs, since the new dynamics of grid operation require a focus on ***when*** buildings use and supply 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



How Can GridOptimal Help Decarbonize Buildings and the Grid?

Achieving aggressive climate goals will be impossible without decarbonizing both buildings and the grid. GridOptimal metrics will enable building designers, owners, and operators to identify and employ strategies to maximize building energy use when grid-supplied electricity's carbon impact is low (i.e. when there are more renewables in the mix) and to minimize building energy use during expensive, high-carbon peak times. By better aligning building energy usage with low-carbon time periods, buildings can play an integral role in decarbonizing the electricity grid.

GridOptimal Building Strategies

A wide range of features, strategies, and technologies can enhance a building's grid citizenship. Some key terms are defined in the box to the left.

Permanent Efficiency

- Fixed shading, electrochromic glass, and automated blinds can reduce and alter solar heat gain patterns.
- Enhanced envelope, HVAC, lighting, and other efficiency measures not only reduce a building's total load but also typically improve the load factor.

Peak Shifting and Flexible Loads

- Smart controls and efficient systems, on their own or in tandem with building features like thermal mass and energy storage, can minimize peak demand and enable buildings to react quickly to grid needs.

Dispatchable Energy Storage

- Intelligent, grid-integrated communication elements can automatically respond to grid signals. Smart systems and devices, from HVAC to lighting and electric vehicles, can align building energy use with grid operation priorities and renewable energy availability.

By encouraging the deployment of these strategies, GridOptimal will empower tomorrow's buildings to positively contribute to the operation of a clean, safe, affordable, and reliable grid.

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