Prospectus

The GridOptimal™ Initiative: A New Rating System and Metric for Building-Grid Interactions

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Summary

New Buildings Institute (NBI), in partnership with the U.S. Green Building Council (USGBC), is seeking partners to support a multi-year effort to develop a comprehensive Grid Edge Initiative that will refine and disseminate a building rating system called the GridOptimal™ Rating System and Metric.

Introduction and Issues

The demand for fuels delivered to buildings increased constantly throughout the 20th century and into the 21st century. Modern electric and gas utilities planned for constant growth. These utilities were generally required to anticipate how the steadily increasing growth in demand would need to be met with supply from generation resources and distribution infrastructure. But this established paradigm is shifting and several factors are aligning to bring major changes to the once-staid model for the utility industry.

Pressure to address climate change, improve building efficiency and solar penetration, and needed infrastructure investment in the electricity grid are driving opportunities to improve building-grid harmonization. This is also creating a need to address the challenge of renewable curtailment due to oversupply during periods of peak production. Here in the United States, buildings consume 75% of all electricity and are responsible for nearly half of all energy consumption[i], making the building sector key to achieving climate goals.

Interest in high-performance buildings with low energy demands is growing rapidly. Simultaneously, the price of photovoltaic (PV) panels has dropped exponentially, and distributed renewable energy systems are now within reach for many building owners. These trends are disrupting the very assumptions that underlie the utility business model of the last century and

are leading to new challenges and opportunities in this space. Traditionally, building-grid interactions have been one-way energy flows—electricity is delivered from the grid to the building. Often, at the building level, it has not mattered much when energy is consumed, after all it is the job of the utility company to deliver reliable, high-quality electricity and to meet any and all demand. However, when considered at the level of the grid operator or utility, one kilowatt-hour (kWh) is not always the same as another. During periods of peak demand, the utility typically needs to engage more expensive and carbon-intensive sources of generation or must buy electricity on the spot market.

Today grid operators and utilities are struggling to integrate renewable energy onto the grid in certain geographic areas. These issues are clearly explained by Jim Lazar using the "Duck Curve" concept.[ii] Rapid increases in renewable energy resources are already leading to technical and policy limits on new renewable energy sources that work against carbon reduction goals. Unless new strategies are developed to help integrate building and generating loads more effectively, the potential for carbon reductions from renewable energy will be constrained.

Work by NBI and other advocates is bringing zero net energy (ZNE) buildings into the mainstream. As these buildings increase their market share, it is more important than ever to consider how different energy efficiency and on-site generation strategies can interact with local electricity grids. Although a building may generate enough renewable energy onsite to offset the imported energy used over the course of the year, at any particular time it is very unlikely that the generation is actually equivalent to the usage. In effect, the building now treats the grid as an unlimited battery.

The major transformation of the building sector toward ZNE can only occur if the grid is able to absorb net renewable energy production when it is generated (or released from storage) while still remaining reliable, safe, and affordable. Today, many grid operators are struggling to integrate all renewable energy production while still meeting demand during peak hours, leading to actual curtailment of some renewable generation in the slack demand periods of some sunny and windy days.

The Value of a Score

Building-scale technologies are one critical component of the transformation of the power grid. However, at the building level there is a real lack of knowledge and incentive to encourage grid-friendly design and operation, even though buildings built today may interact with the grid for a century or more.

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. For instance, a building that is a good "grid citizen" may be carefully designed and operated in a way that minimizes its power demand during the grid's peak hours while maintaining energy-efficient operation throughout the year. Some features that may enhance a building's grid citizenship characteristics and capabilities are passive HVAC and lighting systems, energy storage systems, renewable energy generation management, and peak load management.

Across North America there are no metrics, quantitative or qualitative, that define building-level grid citizenship, or rate building-grid interaction quality. In Europe, some research has been done to define grid citizenship in buildings, but this is only at the research stage and there appear to be no current plans to expand this to a market-facing program. Current thinking on the topic is fragmented, and different players are using different language to discuss the topic from a variety of perspectives.

By creating a standardized metric that defines a building's contribution to the relevant utility grid scale – the building's operational performance as a grid asset—many doors open. Utilities may incentivize grid-sensitive design, for example. Government agencies may include the metric in their procurement requirements or in their climate policies. Designers and building owners can consider these impacts in a clear and present manner. As we develop a way to define building-grid interaction quality, the market can respond by developing solutions for many of the issues facing the utility grid today and in the future. Future building codes can begin to encourage the adoption of these solutions and help ensure that the buildings coming online are acting as good grid citizens.

There is a need and opportunity for respected national leaders on high-performance buildings such as NBI and the USGBC to provide objective clarity and consistency in a collaborative, inclusive process with the goal of creating standards and tools to meet these challenges.

Program Proposal

Valuing Building-Grid Interactions: Educating the Market and Developing and Launching the GridOptimal Building Rating System

The aim of this initiative is to provide standards, tools, and guidance to improve building-grid interactions in the built environment by empowering owners, architects, and engineers with a dedicated building rating system to help them achieve specific objectives. The initiative will build on NBI's history of published leadership on this issue, on USGBC's Performance Excellence in Electricity Renewal (PEER) power system rating project, and the market reach of the Leadership in Energy and Environmental Design (LEED) green building rating system, to develop and deploy a comprehensive rating system and certification protocol.

The proposed rating system would play a major role in bridging the gap in knowledge, understanding, and priorities between the two sides of the grid—operators and consumers. The resulting program would provide these key benefits:

- Provide a clear and consistent way, within a standardized framework, to measure a building's grid citizenship, improve building-grid harmonization, and reduce curtailment of renewables.
- Allow utilities to provide incentives by referencing a common, transparent, and reliable standard.
- Enable owners and the real estate industry to place a value on grid citizenship and grid-sensitive building operation, and better improve their ability to consider future cost and revenue streams.
- Ensure building Operators and Maintenance (O&M) staff are directly engaged in energy performance monitoring and improvement.
- Empower architects, engineers, and other members of the design community with a common language and consistent metrics regarding building-grid interactions to consider during the design process and enable them to communicate the impacts of design decisions to their clients.
- Provide regulators and policy makers with a way to encourage or require grid-sensitive building design and operation to ensure the stability, efficiency, and affordability of the grid.

- The rating system would be able to stand on its own or function as an overlay added onto another rating system, such as USGBC's LEED or PEER. This flexibility will ensure that rating benefits are as widespread as possible.

Development Methodology

NBI has developed this concept over the past several years and has solicited input from experts in the field. NBI staff have presented peer-reviewed papers on the topic at five national conferences, including ASHRAE, Greenbuild, Transactive Energy Systems, and the Getting to Zero National Forum, and have disseminated this conceptual rating through webinars and blog posts.

The GridOptimal Initiative will include a focus on developing and launching a program which establishes a governance structure and administrative framework for continuous maintenance of the rating system. The GridOptimal concept has been described by NBI in a white paper presented in January 2017 at the ASHRAE Winter Conference (Edelson and Miller 2017).

This program will enable the GridOptimal rating to become an important factor in rating building grid citizenship through voluntary certification and will include establishing a market-facing certification protocol and user interface. The core elements of the program are designed to create a governance structure, stakeholder group, and program implementation framework that will include the following:

1. Institute a governance structure that will bring together key stakeholders and subject matter experts in support of the development of building-level grid-citizenship standards and resources.
2. Establish the framework for the rating system that will result in the successful development and market implementation of the program.
3. Develop the GridOptimal Rating System, leveraging existing standards in the market.
4. Identify pilot projects and participants.
5. Outline utility and other incentive programs and financing mechanisms that can be employed to fund grid-sensitive design features in building projects, and investigate utility and other incentive options.
6. Provide educational guidance, tools, and other resources to stakeholders: webinars, workshops, reference guides, presentations, and white papers.
7. Complete pilot projects and make adjustments as necessary.
8. Launch full program and Rating System into market.

Next Steps

The GridOptimal Initiative will be NBI-led and is envisioned to be a three-year program with interim milestones. Oversight will include the creation of an Advisory Panel and a professional Technical Subcommittee. These formal structures will be comprised of key market actors and will convene additional stakeholders throughout the program's development and implementation. Key stakeholders will include utility representatives, distribution engineers and network experts, regulators, state and municipal government leaders, building owner representatives, architecture, engineering and construction professionals, and market players in the emerging world of transactive energy.

During the first phase of this project, the Advisory Panel and its Technical Subcommittee will work to refine the scopes of grid interactions that the rating will address. Potential scopes of grid interactions include the substation, distribution feeder, utility territory, state, Independent System Operator (ISO), and national levels. The Technical Subcommittee will work to identify key technical issues involved in preparing the rating system for the pilot phase. Feedback from grid engineers and network operators will be very important to making this accurate, scalable, and useful. Another major goal of the Technical Subcommittee will be to monitor and assess the relationship of the rating to evolving regional grid-specific characteristics. USGBC can assist in incorporating GridOptimal scores into its PEER rating system, and to use PEER as a bridge to work toward integrating GridOptimal into the LEED rating system in the future. USGBC also can play a key role in developing and defining key technical aspects of the GridOptimal rating system and in accelerating market penetration at scale.

NBI and USGBC will lead educational efforts in this space, including webinars, in-person workshops, interactive and printed resource guide materials, and more. NBI will also provide tools and guidance to help building owners, designers, and other stakeholders understand the importance of building-grid interactions and how the GridOptimal rating system works. Once completed, the program will provide a building-level rating system, a certification protocol, a user interface, and on-demand educational and reference resource materials.

Program Lead and Facilitator	Stakeholder Group:
New Buildings Institute	New Buildings Institute
U.S. Green Building Council	U.S. Green Building Council
	Rocky Mountain Institute
	Regional Energy Efficiency Organizations
	Public and Private Utilities
	Grid and Distribution Network Operators and Engineers
	Utility and Grid Regulators
	State and Local Governments
	Building Owners
	Facilities Staff
	Developers
	Architects, Engineers, and Designers
	Other Allied non-profits

Year One: Program Development	Year Two and Three: Program Development and Implementation
Secure Program funding	Launch pilot demonstrations
Convene Advisory Panel and Technical Subcommittee, hold kickoff meeting	Continue to convene Advisory Panel and Technical Subcommittee and coordinate stakeholder engagement
Solicit feedback about GridOptimal Rating System and Metric Methodology	Continue technical research and grid analyses to support technical criteria for Rating System and Metric Methodology
Address grid scoping issues, and identify key technical issues	Provide education about building-grid interactions (webinar series, workshops, etc.)

Conduct technical research and grid analyses to support technical criteria in rating system and metric	Branding and market development
Prepare GridOptimal Rating System Methodology for first public review	Expand website for more general market education
Investigate and recruit sites or markets for pilot demonstrations	Evaluate integration of GridOptimal score into USGBC's LEED rating system
Establish a web microsite for technical development and public comment	
Evaluate technical integration of GridOptimal metric into USGBC's PEER rating system	
Year One KPIs:	**Year Two and Three KPIs:**
GridOptimal Rating System and Metric Methodology scoped and technically defined	GridOptimal Score Pilot completed in at least 3 municipalities, utility territories, or other entities
GridOptimal Rating System and Metric Methodology put forward for public comment	Quarterly Advisory Panel and Technical Subcommittee meetings held
Advisory Panel and Technical Subcommittee formed and quarterly meetings held	Evaluation complete for integration of GridOptimal score into LEED rating system
Web microsite developed and launched	Educational materials distributed and at 4 four webinars/workshops delivered
At least 3 locations arranged for GridOptimal Score Pilots	Marketing materials developed and disseminated
GridOptimal scores integrated into USGBC's PEER rating system	

Budget and Timeline:

NBI and USGBC are currently seeking funding to launch this program. We anticipate this program will require funding of $300,000 per year for a period of three years for a total of $900,000. The program will involve the development of a governance structure, stakeholder group, primary research, development of the rating system and metric, selecting and supporting pilot trials, and initiating full market rollout and program implementation. We anticipate the program would be developed and delivered into the market over a period of two to three years, depending on the level of funding and occurrence of unanticipated operational challenges. If funding is assured, NBI and USGBC are prepared to launch this program in Q2 of 2017.

[i] In 2012, buildings consumed 47.6% of all primary (source) energy in the USA. See: Architecture 2030, http://architecture2030.org/buildings_problem_why/

[ii] The Duck Curve describes the shape of consumer energy demand (net demand including wind and solar) that drops significantly during peak daylight hours only to rise steeply in the early evening as solar PV goes offline and evening power demand peaks. This situation was once hypothetical but is now emerging as a major issue in California and in other markets. Jim Lazar of the Regulatory Assistance Project published an update to the original 2014 paper in early 2016. See www.raponline.org/knowledge-center/teaching-the-duck-to-fly-second-edition/.