



# The GridOptimal™ Initiative

## A New Rating System and Metric For Building-Grid Interactions

*New Buildings Institute  
U.S. Green Building Council*

# Agenda

- Background: Change is Coming to the Utility Industry
- Introducing The GridOptimal Initiative
- Rating Building-Grid Interactions
- Stakeholders and Applications
- Initiative Plan and Phases
- Participation Opportunities
- Q&A, Discussion

# nbi: the virtuous cycle

**NBI is a national nonprofit working to improve buildings for people and the environment.** We drive research, uncover solutions, and advance industry practices and policies that deliver positive change in the built environment.

## ***Program Areas:***

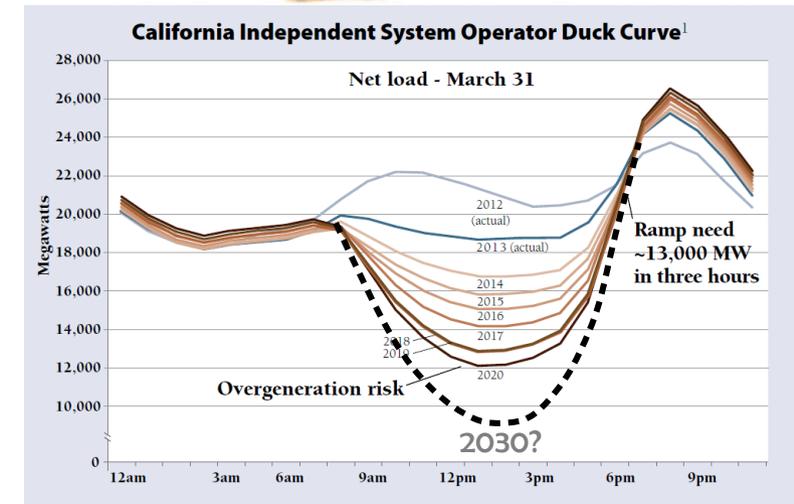
- 1. Best practices in new and existing buildings*
- 2. Continuous code and policy innovation*
- 3. Zero net energy leadership and market development*



# Change is Coming

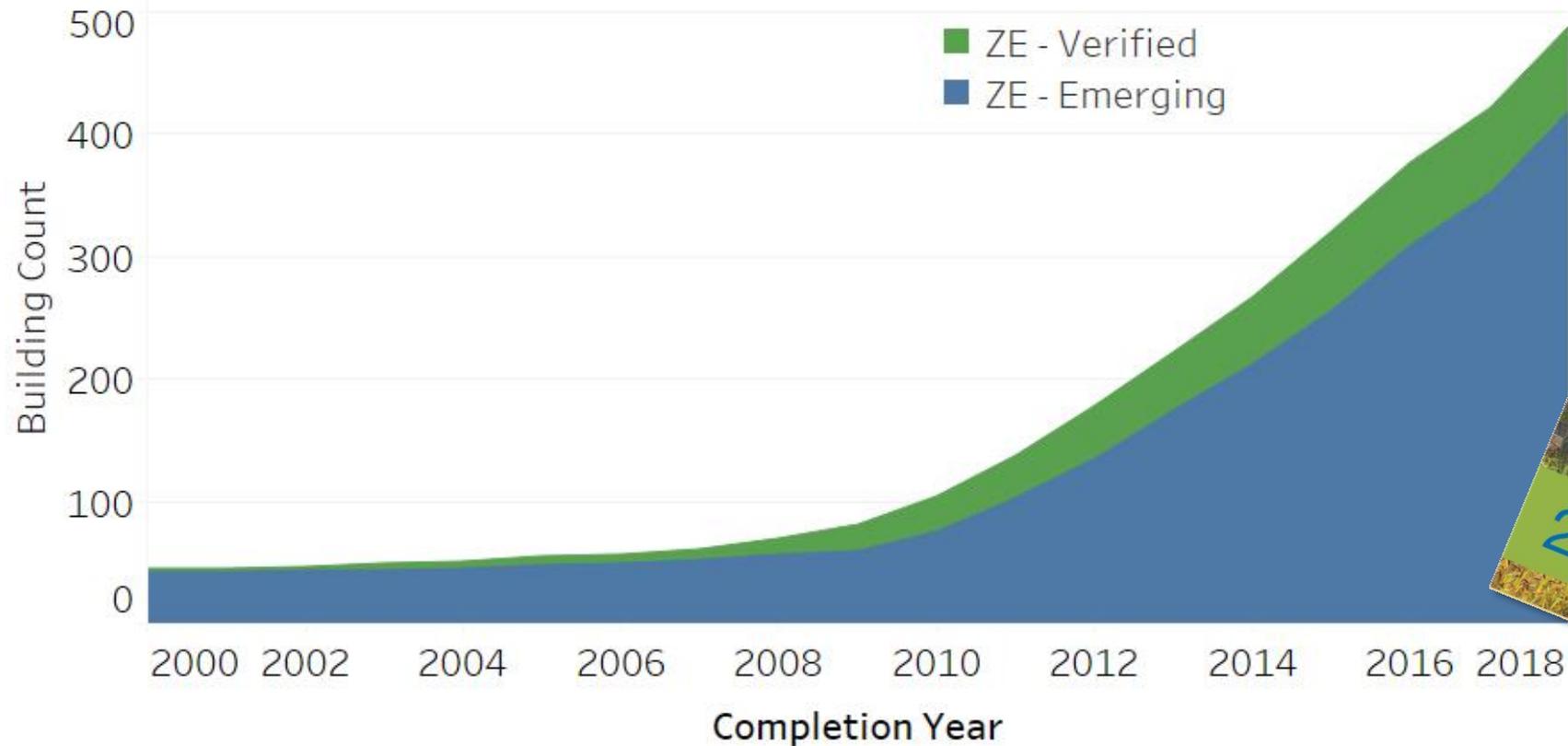
## What's Next for the Utility Industry?

- What is the role of buildings, renewable energy, and storage in the **utility of the future?**
- We are seeking **solutions to today's challenges** and opportunities for **market transformation.**
- We are assembling top experts to help **answer these questions.**



Source: Jim Lazar, 2016

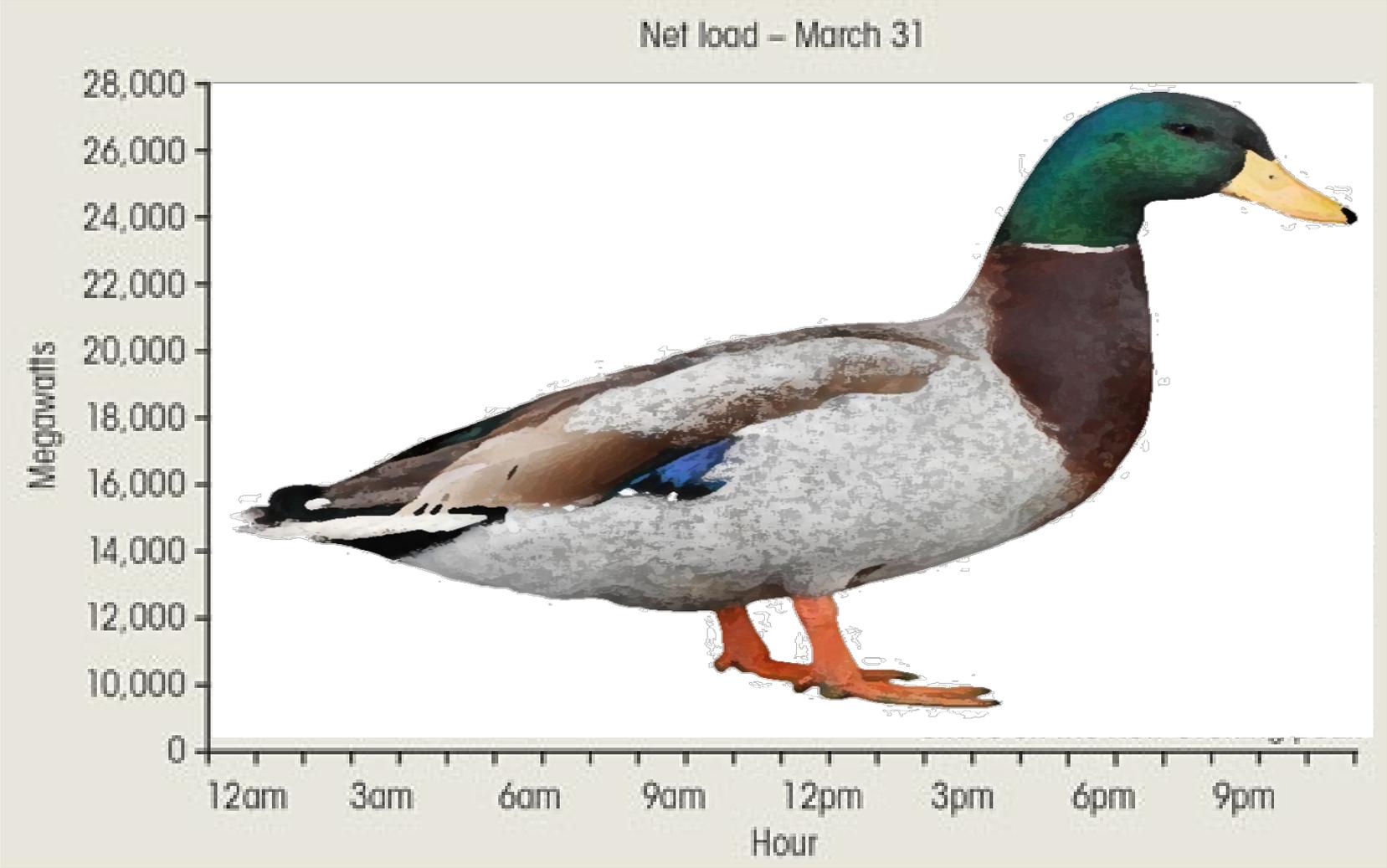
# Zero Energy Buildings *A Growing Trend*



# A Tale of Two ZE Building Typologies

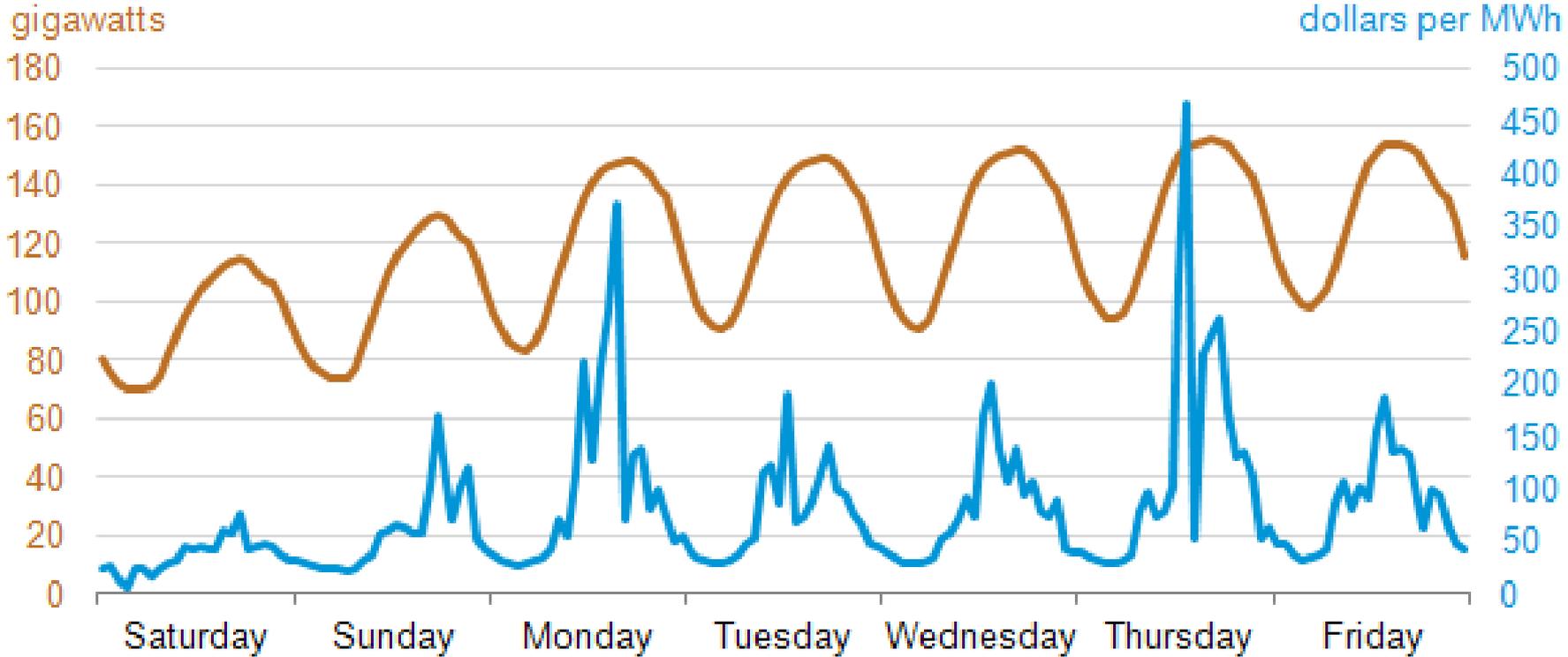
Renewable-Oriented	Efficiency-Oriented
<ul style="list-style-type: none"><li>• Minimally to moderately sensitive to the grid</li></ul>	<ul style="list-style-type: none"><li>• Highly grid-integrated and responsive</li></ul>
<ul style="list-style-type: none"><li>• Higher gross energy use</li></ul>	<ul style="list-style-type: none"><li>• Lower gross energy use</li></ul>
<ul style="list-style-type: none"><li>• Higher renewable generation</li></ul>	<ul style="list-style-type: none"><li>• Lower renewable generation</li></ul>
<ul style="list-style-type: none"><li>• <b>Active Strategies:</b> Mechanical HVAC Systems, Thermal Storage, Night Ventilation, Demand Response</li></ul>	<ul style="list-style-type: none"><li>• <b>Passive Strategies:</b> Daylighting, Building Orientation, High Insulation Levels, Passive HVAC, Built-In Shading</li></ul>

# The Duck Curve

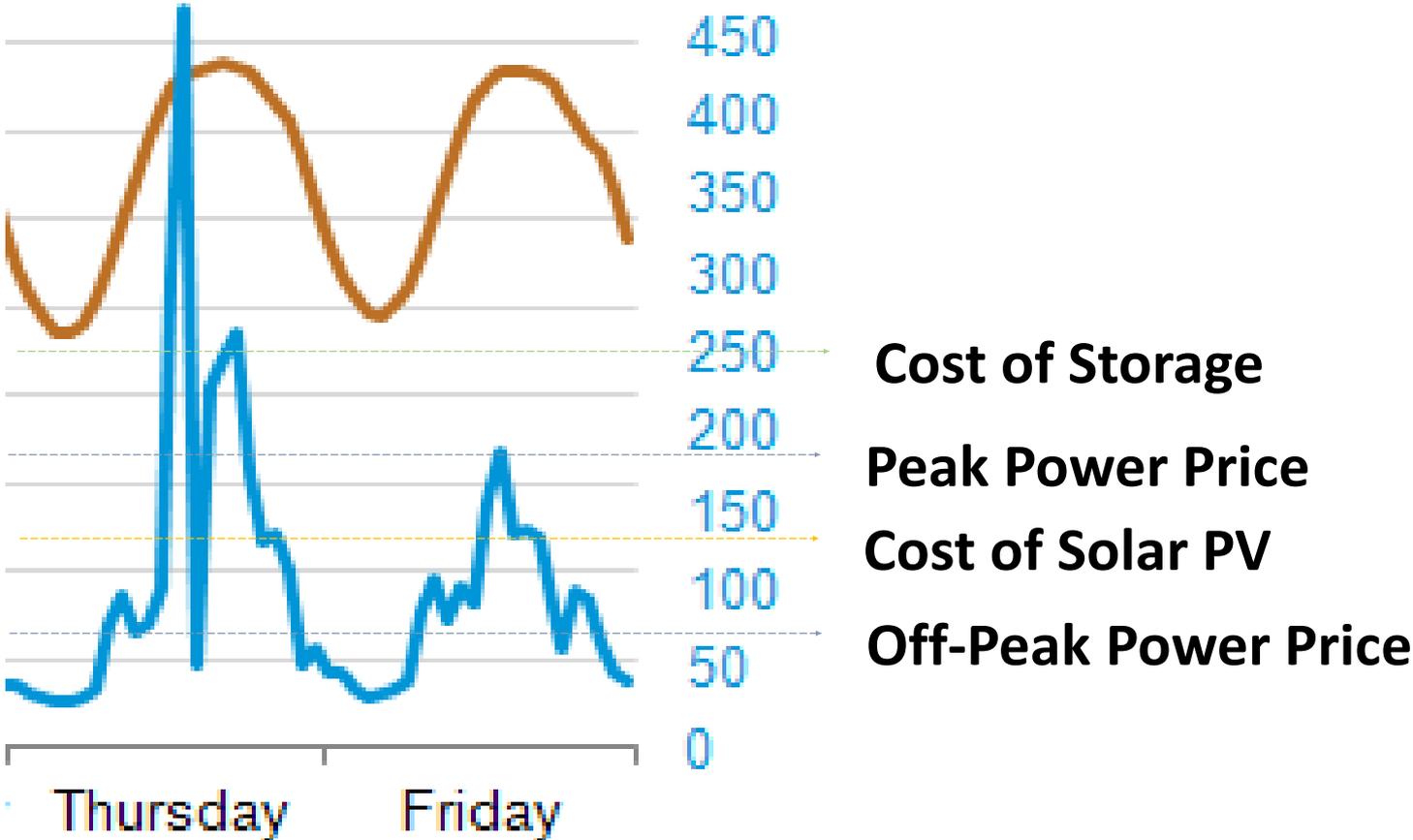


# Load Shapes vs. Spot Market

Hourly electricity demand and real-time energy prices in the PJM Interconnection  
Saturday, July 13 - Friday, July 19, 2013



# Consumer Price Signals are Changing



# GridOptimal: Why is it Needed?

**There are currently no metrics that define building-level grid citizenship, or rate building-grid interaction quality**

- Different players have **different language** to discuss the topic
- Grid operators and utilities are struggling to **integrate renewable energy** onto the grid
- Catalyze **harmonization** of building design with grid interaction to **reduce curtailment**.



# Critical Bridge Between Buildings and the Grid



## LEED v4 for BUILDING DESIGN AND CONSTRUCTION

Updated January 27, 2017

*Includes:*

- LEED BD+C: New Construction**
- LEED BD+C: Core and Shell**
- LEED BD+C: Schools**
- LEED BD+C: Retail**
- LEED BD+C: Data Centers**
- LEED BD+C: Warehouses and Distribution Centers**
- LEED BD+C: Hospitality**
- LEED BD+C: Healthcare**

nbi new buildings  
institute



## Letter of Inquiry Valuing Building-Grid Interactions by Developing and Implementing a New Rating System: *The GridOptimal™ Score*

February 2017

### Summary

The New Buildings Institute (NBI), in partnership with the US Green Building Council (USGBC), is seeking funds to support a multi-year effort to develop a comprehensive Grid Edge Initiative that will refine and disseminate a new building rating system called the GridOptimal™ Score.

### Introduction and Issues

The demand for fuels delivered to buildings increased constantly throughout the twentieth century and into the twenty-first century. Modern electric and gas utilities planned for constant growth. These utilities were generally required to anticipate how the steady increased growth in demand would need to be met with supply from generation resources and distribution infrastructure.

But this established paradigm is shifting. Several factors are aligning to bring major changes to the once-staid utility industry. The COP21 Paris Accord, now ratified by more than 75 countries representing 60% of global CO<sub>2</sub> emissions, will go into effect this year. Climate change is now considered a clear and present danger by nearly all major governments and policy makers around the world, and the building sector has been identified as providing the best near-term actions to stem greenhouse gas emissions. Here in the United States, buildings consume 75% of all electricity and are responsible for nearly half of all energy consumption<sup>1</sup>, making the building sector key to achieving climate goals.

Home of



[www.newbuildings.org](http://www.newbuildings.org)

623 SW Oak Street, Third Floor, Portland, OR 97205 | Phone 503 761 7339

# PEER

## PEER Assessment Overview for Campus Projects

November 2016

[PEER.GBCI.ORG](http://PEER.GBCI.ORG)



# GridOptimal™: Rating Building-Grid Interactions

## The GridOptimal Rating System includes a New Quantitative Metric for Building-Grid Interactions

- **Lower score is better**, like zEPI and EUI
  - Passive features
  - Dispatchable / Responsive features
- Defines a building's “**peakiness**” and “**grid citizenship**”
- Improves **integration of DERs** onto the grid

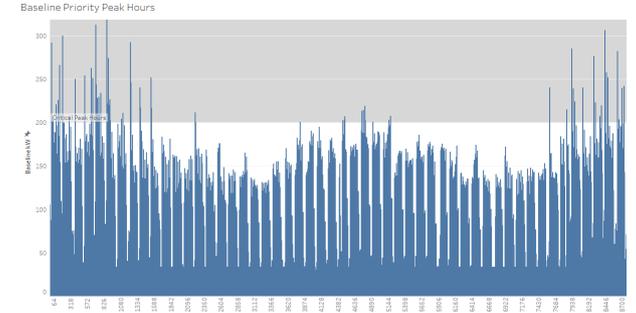
(Conference Paper: ASHRAE Winter Conference, January 2017)  
(Authors: Alexi Miller, PE & Jim Edelson)



# The GridOptimal™ Score: Rating Building-Grid Interactions

## ***Start with:*** min. 1 year of Load Profile Data

- 8,760 hrs Net Power Balance (kW Demand and kW Production) for **Rated Building & Baseline Building**



## ***End with:*** Simple, easy-to-understand key number(s)

- GridOptimal Score integrates **an asset and an operational rating** based on building-grid interactions and capabilities

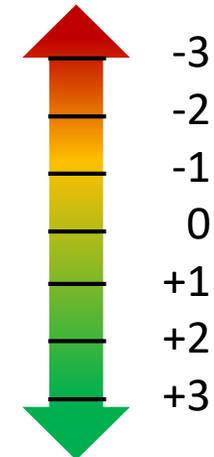


Image: Resnet

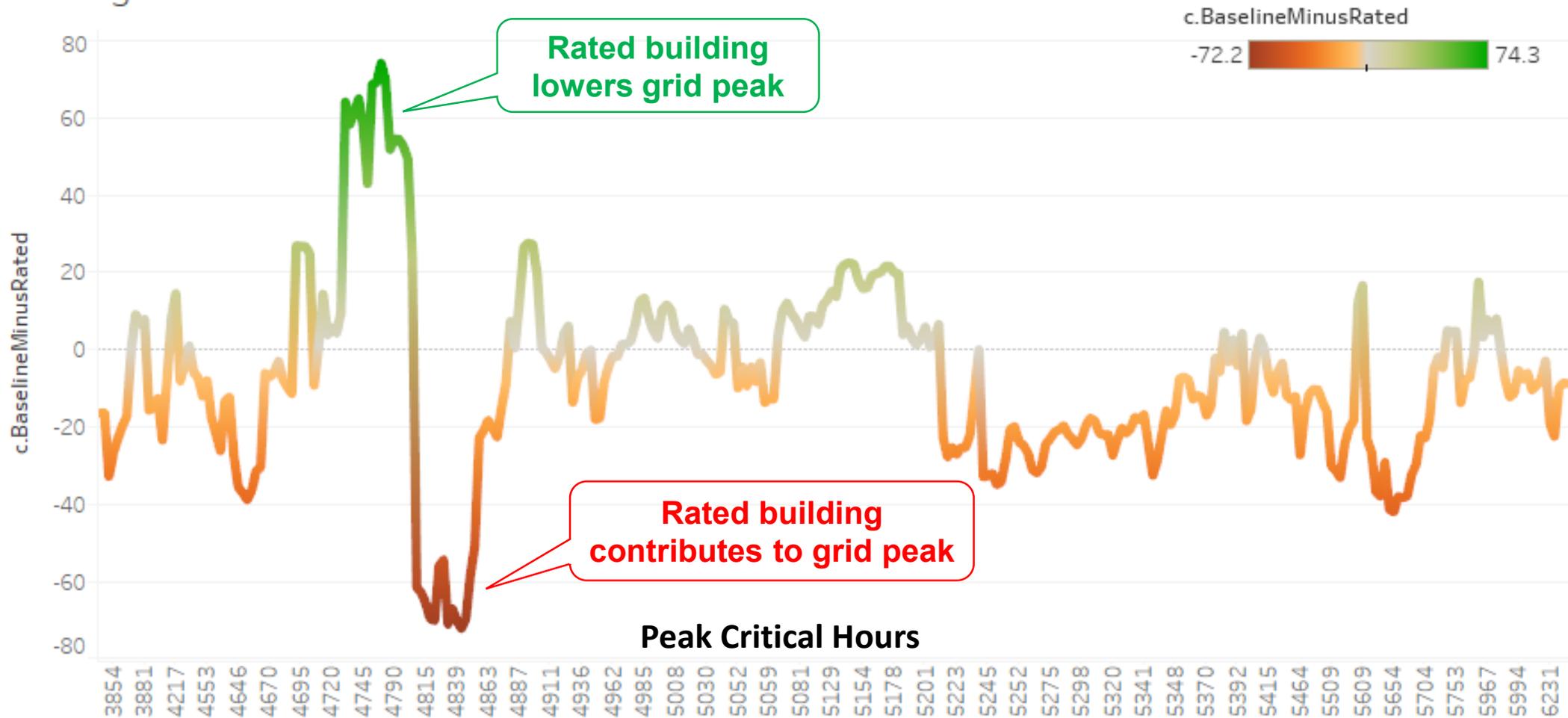
# GridOptimal™: Rating Building-Grid Interactions

## Four steps for GridOptimal scoring:

1. Identify critical hours from grid signature, peak, and negative peak
2. Compare rated building to baseline building demand during critical hours
3. Weight, aggregate, and score demand variance above/below baseline building
4. Adjust scoring based on other building characteristics (optional)

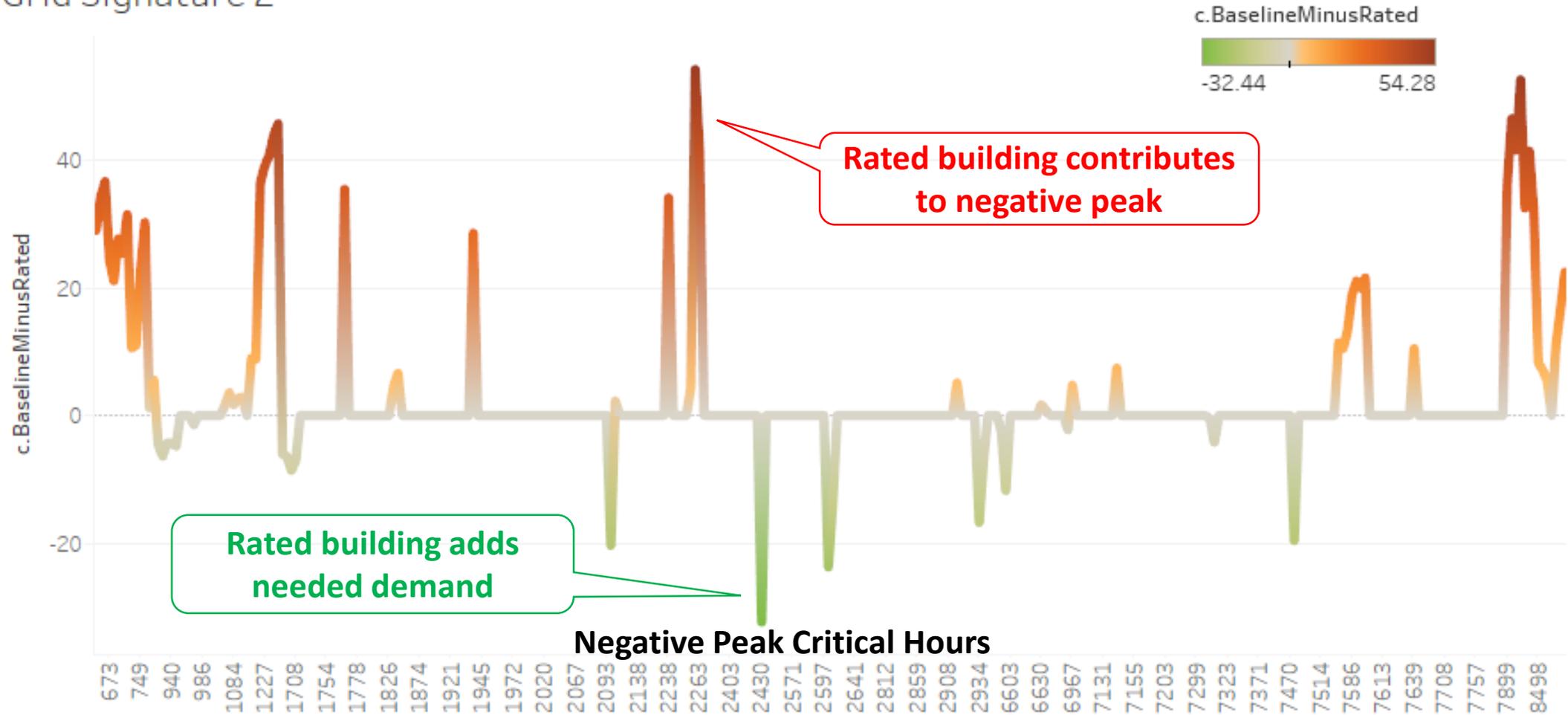
# GridOptimal™: Grid Signature

Grid Signature



# GridOptimal™: Grid Signature

Grid Signature 2



# GridOptimal™: Rating Building-Grid Interactions

## ***Calculation Inputs***

1. *Critical hour weight by severity of grid peak (% Peak Demand)*
2. ***Sum and weight of peak savings (kWh)***
3. ***Sum and weight of peak contribution (kWh)***
4. *Critical hour weight by severity of negative peak (% Negative Peak Demand)*
5. ***Sum and weight of negative peak demand addition (kWh)***
6. ***Sum and weight of negative peak contribution (kWh)***
7. *Adjustments for other building characteristics (responsiveness, EV/Storage, design features...)*

# GridOptimal™ : Layering Grid Resources

- Passive Design Elements
- Active Dispatchable Elements (ADR)
- Distributed Energy Resources
- EV / Storage Technologies



<http://www.lakeland.co.uk>

# GridOptimal™ : Building Strategies

## Load Shedding

- Thermostats, lighting, pumps...

## Peak Shifting

- Night ventilation, thermal storage, solar shading, occupancy shift, PV orientation...

## Dynamic Response

- Controls, software, dynamic vehicle charging schedule...

## Addressable Energy Storage

- Batteries, vehicles...



# Stakeholders and Market Applications

## ***Grid Perspective (Regulators, Utilities, Program Administrators):***

- Incentive Programs: Distributed Energy Resources & Buildings
  - Upfront incentive for GridOptimal design
  - Favorable rates
  - “New Business” charge for connecting a building to grid upon completion
- Target building upgrades for grid operation/stability
- Provide predictable building load reductions to grid managers and for bidding into electricity markets
- Reduced demand ramp up/down leads to greater overall generation efficiency and reliability for grid operator

## ***Building Perspective (Customers, Developers, Designers):***

- Design & Specification Process
- Real Estate & Building Asset Valuation
- Insulation against demand charge changes

## ***Regulatory and Policy Framework:***

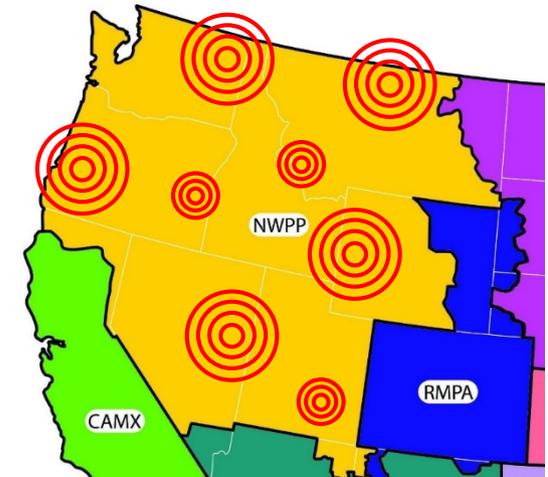
- Aligns with ZE Building Goals and Policies
- Regulatory and Policy Frameworks (e.g. CA Title 24, New York REV)
- Model Codes & Standards (e.g. ASHRAE 189.1, IECC, etc.)

# GridOptimal™: Rating Building-Grid Interactions

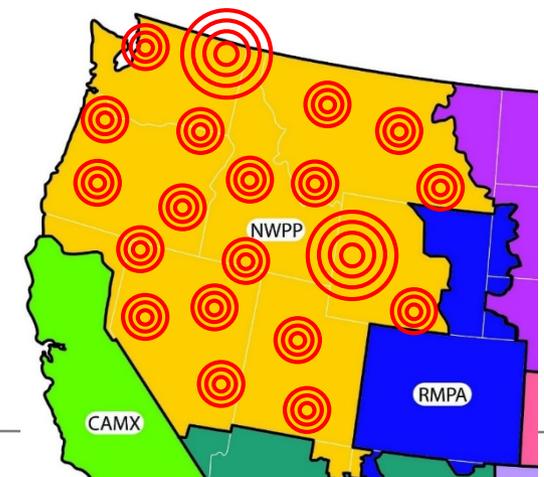
## Key Technical Benefits:

- Provide common language and **consistent metrics** to measure **grid citizenship**
- Allow utilities to provide incentives by referencing a **common, transparent, reliable standard**
- Ensure that **building staff are engaged** in energy performance
- Encourage **grid-sensitive, responsive building design AND operations**
- Reduce renewable energy **curtailment**
- Reduce strains on **voltage regulation**
- Provide **circuit-level production and demand management**
- Lower **distribution upgrade costs**
- Reduced **transmission loss**
- Increased **redundancy/backup**
- Improved **load matching flexibility**
- Lower **risk**

Central Generation



Distributed Generation



# GridOptimal + Commercial Real Estate

## *Key Benefits*

- Create a new revenue stream from existing assets
- Enhance access to utility incentives & programs
- Improve building valuation
- Return value to investors
- Improve Risk Management
  - Insulate against demand charges
  - Reduce bottom-line impacts of rate structure changes
- Meet Corporate Social Responsibility / Sustainability goals



# GridOptimal™: How will we do it?

- Bring together **key stakeholders and experts** to develop standards
- Establish **framework for rating system** that will result in program implementation
- Develop the **rating system**, leveraging existing standards
- Identify **pilot projects** and participants
- Outline **incentive programs** and financing mechanisms
- Provide **Educational Guidance**



# GridOptimal™: Tools & Resources

- Determine **performance-based data** needed
  - Meter-based performance analysis
- Building **modeling software methodology**
  - Building load shape – key characteristics and levers
  - Load shape by building type – baseline
  - Asset-based rating
- **Utility-based data** for each service territory
  - Understand critical constraints / opportunities
  - Prioritizing parameters and scenarios
- **Metric and Rating tool**
- Non-wires alternative **Application Guide**
- **Utility program criteria**
- **Model code criteria**



# Initiative Phases and Schedule

## Phase 1 – Technical Development – now

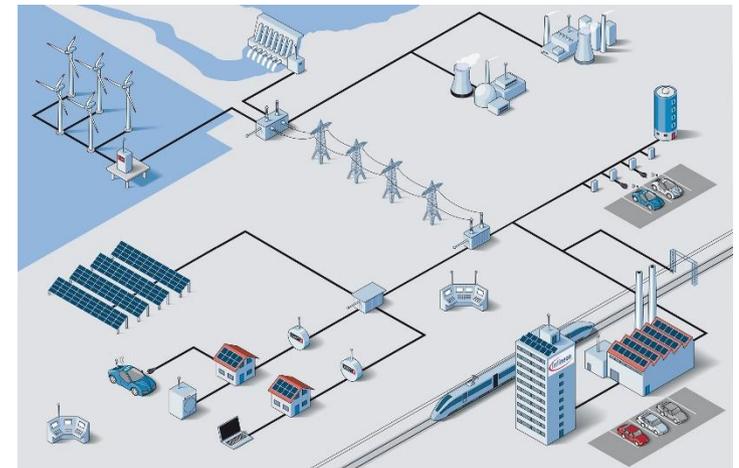
- Launch TAC and Market Scan
- Develop building modeling methodology/utility data framework
  - Scan available modeling software and systems
  - Standardization of utility data collection
- Initiate data collection and analysis/understanding

## Phase 2 – Metric and Rating System Creation and Standardization – Q2 2018

- Defining Metrics – which characteristics make up metric
- GridOptimal Score and Rating System – which elements determine score

## Phase 3 – Market Deployment – 2019

- Utility Program Criteria and Business Planning
- LEED and PEER integration – Pilot Credits
- Develop code criteria/venues for proposals



# How Can You Participate?

- Become a Founding Sponsor of the GridOptimal Initiative
- Join the Technical Advisory Committee
  - Guide GridOptimal development and implementation
  - Access to leading experts in a collaborative environment
- Host/Participate in Website, Webinars, Workshop(s)
- Use GridOptimal scores in utility programs
  - DER, building incentive programs
  - Prioritize energy efficiency projects by grid operation/stability
- Improve overall generation efficiency and reliability

# GRIDOPTIMAL INITIATIVE

SEARCH

## Our Work

Zero Net Energy +

Advanced Buildings +

Outcome-Based Performance +

Deep Energy Retrofits +

## Newsletter

Sign up to receive updates from NBI.

<https://newbuildings.org/gridoptimal-initiative/>





# Thank You!

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Courtesy: EHDD