The Connected Future: Policy, Theory, and Infrastructure for Getting to Scale

nbi new buildings institute

Photo: Tilikum Crossing Bridge, Portland, Oregon; Credit: stubborn_facts

Alexi Miller, PE

Sr. Project Mgr.

New Buildings Institute

Today's Topics

- Introduction and Background
- Building-Grid Interactions and the Duck Curve
- Current and New Metrics for Building-Grid Interactions
- What's the Point of All This, Anyway?
- Water Heaters as an Enabling Technology

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:

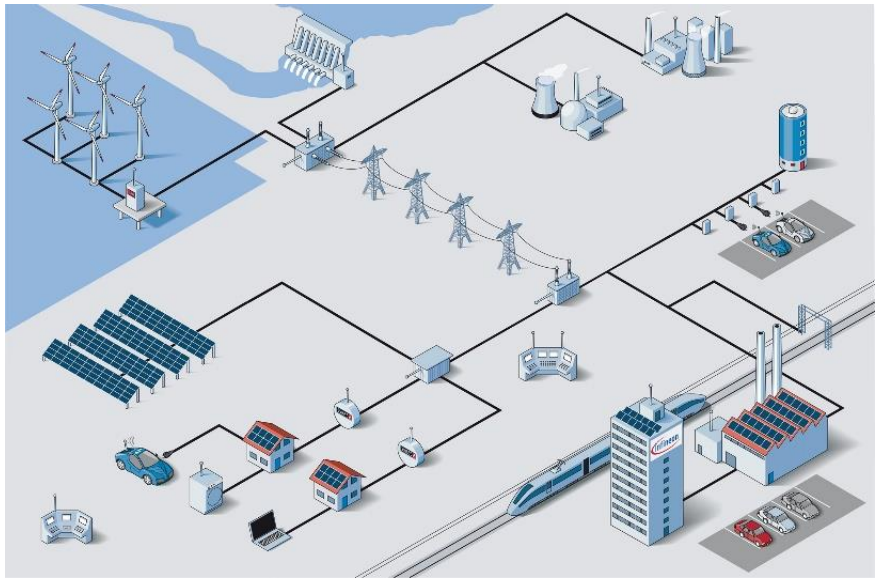
1. *Best practices in new and existing buildings*
2. *Continuous code and policy innovation*
3. *Zero net energy leadership and market development*

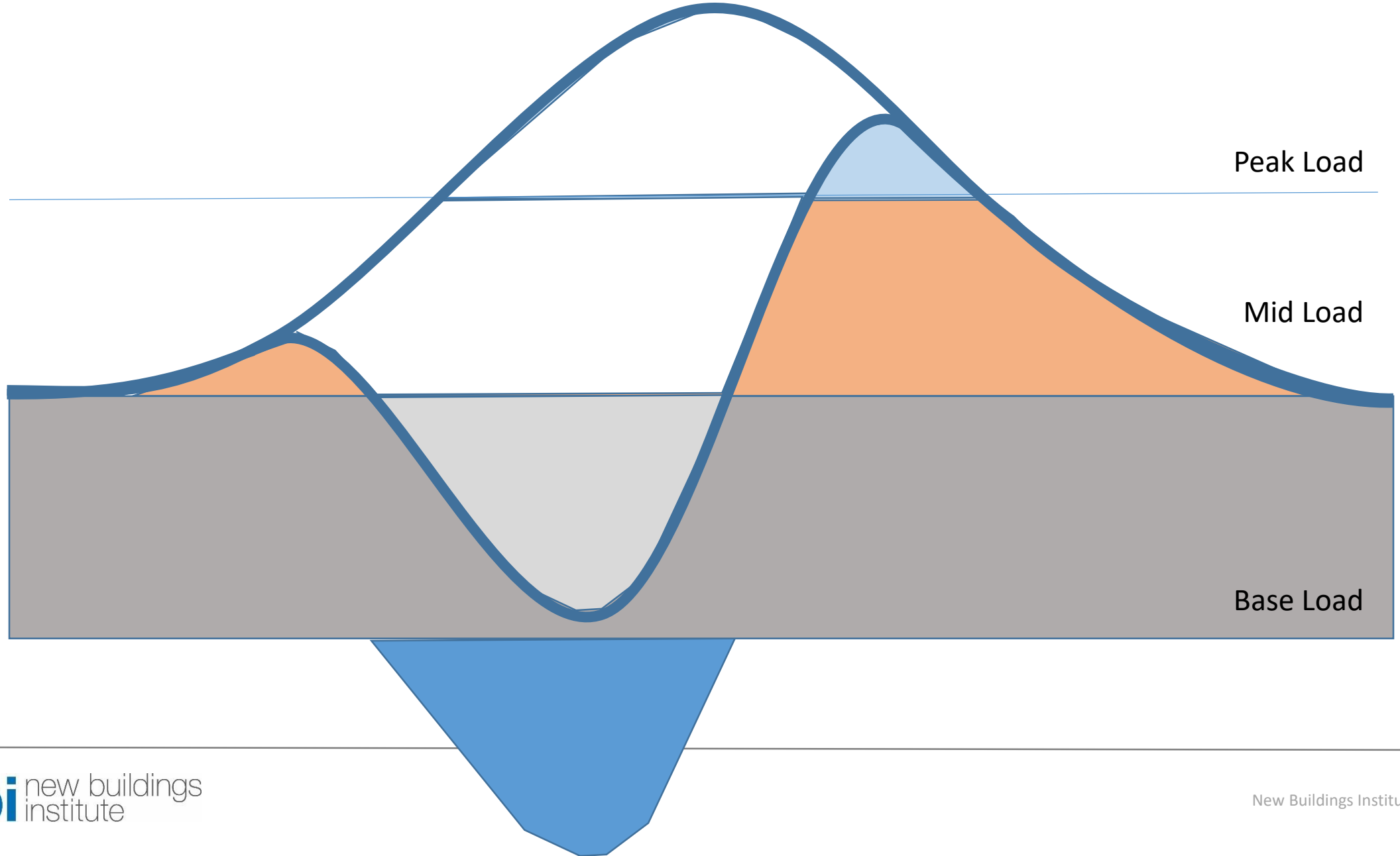
nbi new buildings institute

Change is Coming

What's Next for Buildings and the Grid?

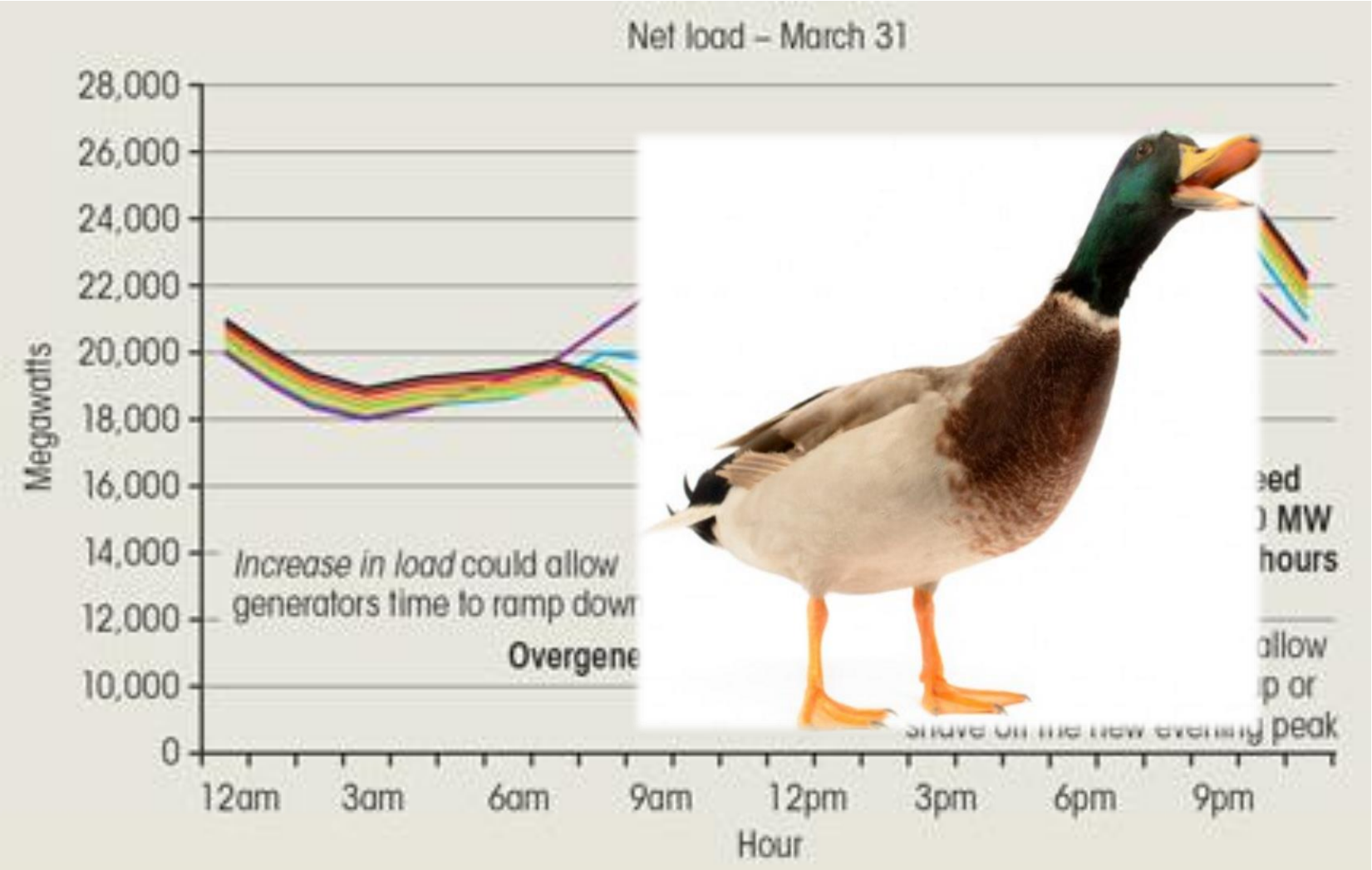
- What is the role of buildings, renewable energy, and storage in the **utility of the future**?
- Where do enabling technologies like **smart, grid-responsive water heaters** fit in?
- How can we help make buildings **better grid citizens?**



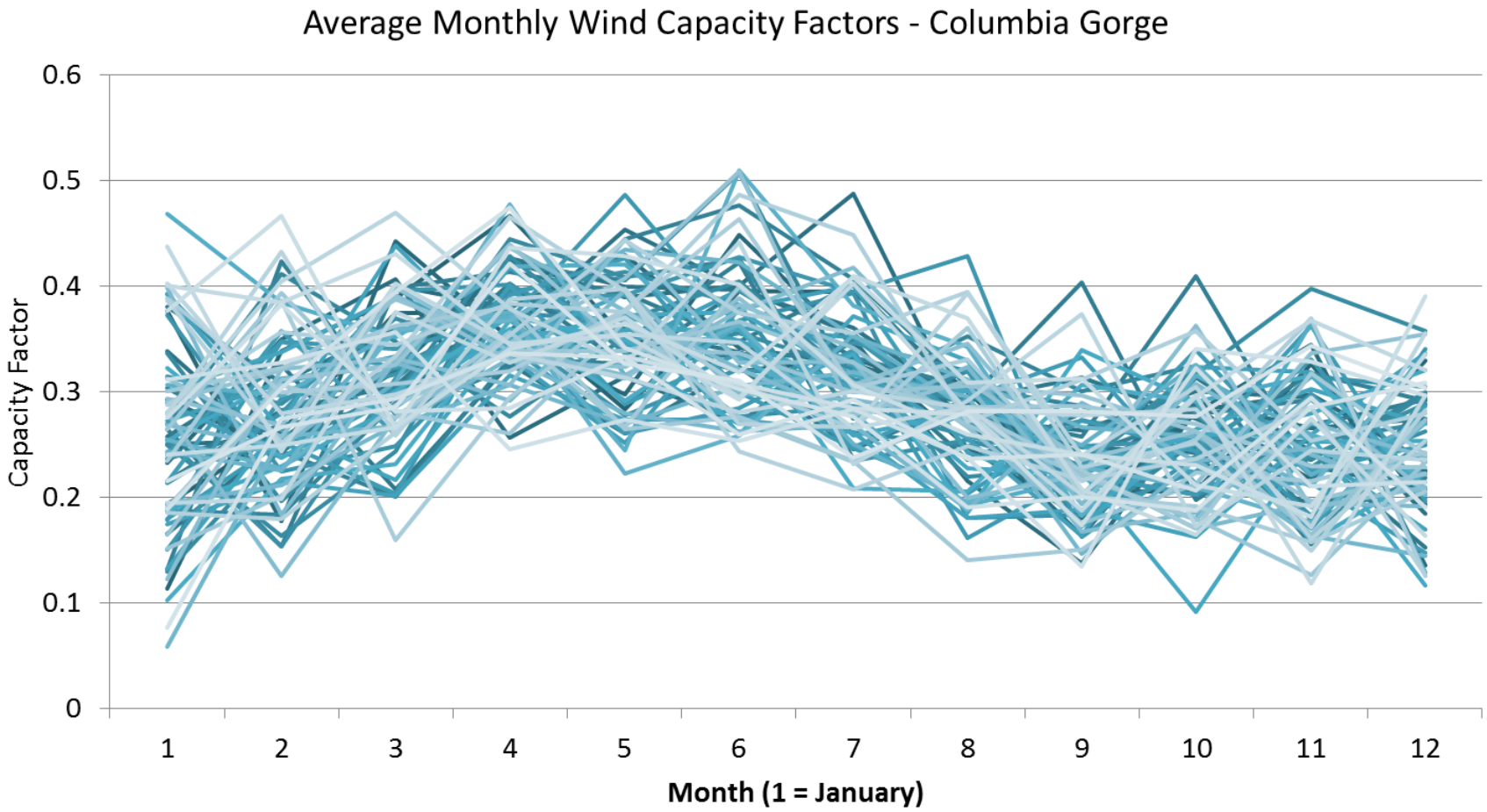


nbi new buildings institute

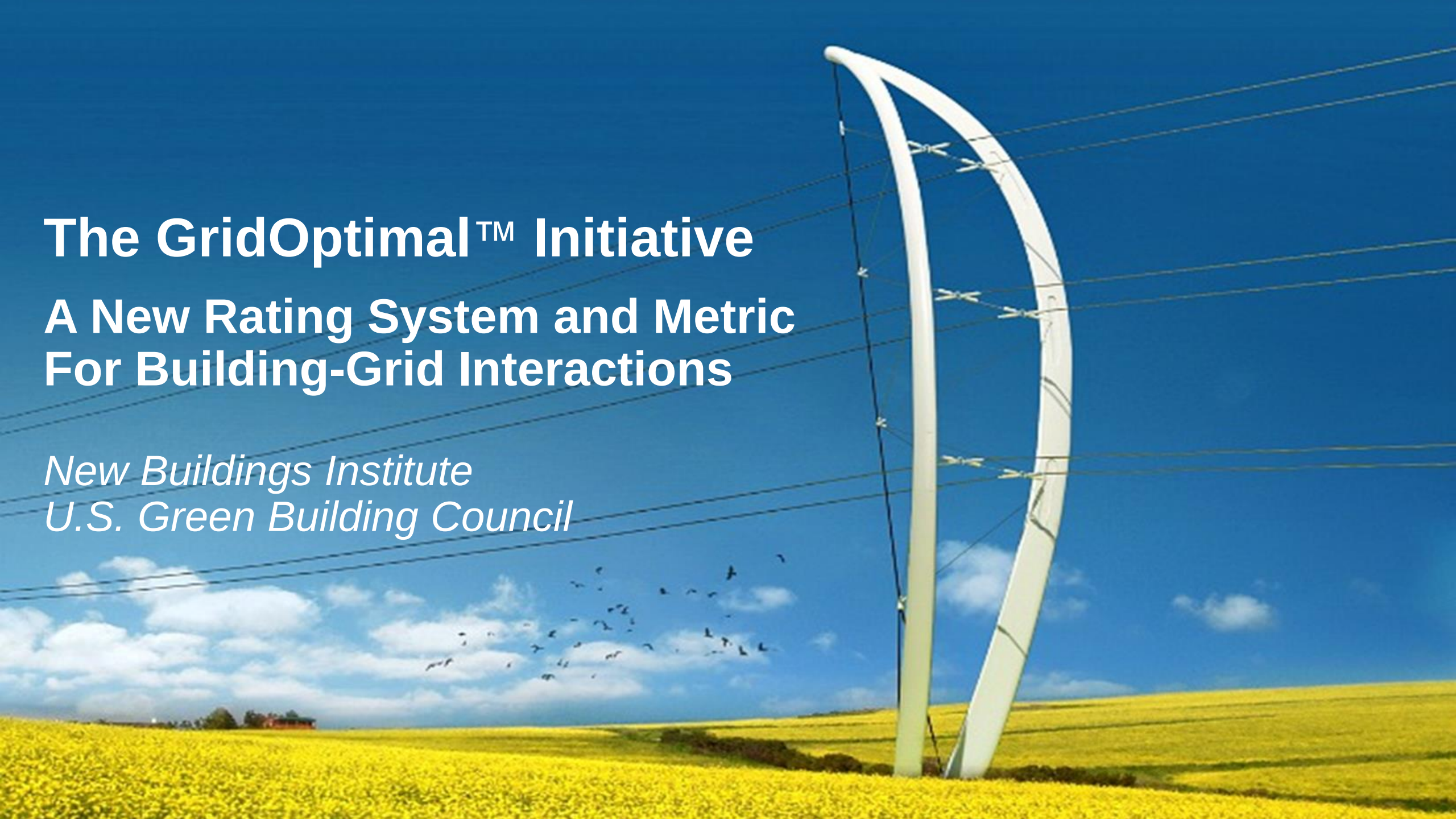
The Duck Curve



Volatile Resources in the Mix



nbi new buildings institute



The GridOptimal™ Initiative

A New Rating System and Metric For Building-Grid Interactions

New Buildings Institute
U.S. Green Building Council

GridOptimal: Why is it Needed?

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

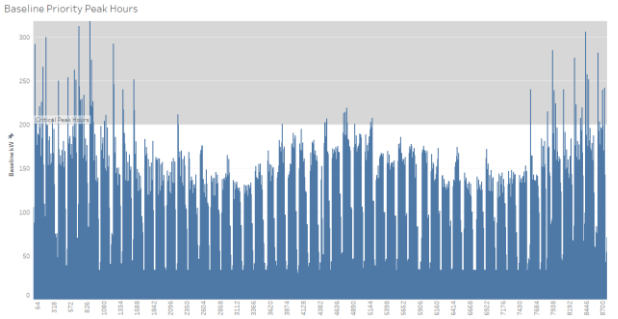
- Different players have **different language** to discuss the topic
- Grid operators and utilities are struggling to **integrate renewable energy** onto the grid
- Need to catalyze **harmonization** of building design with grid interaction

GridOptimal: Why is it Needed?

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

- Defines a building's **"grid citizenship"**
- Credit for **Building Technologies & Strategies**
  - Passive features
  - Dispatchable / Responsive features
- Improves **integration of DERs** onto the grid
- Ensures continued **affordability, safety, reliability, & resilience** for buildings and the grid

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

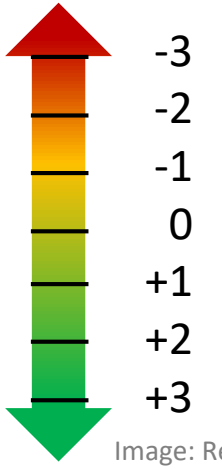
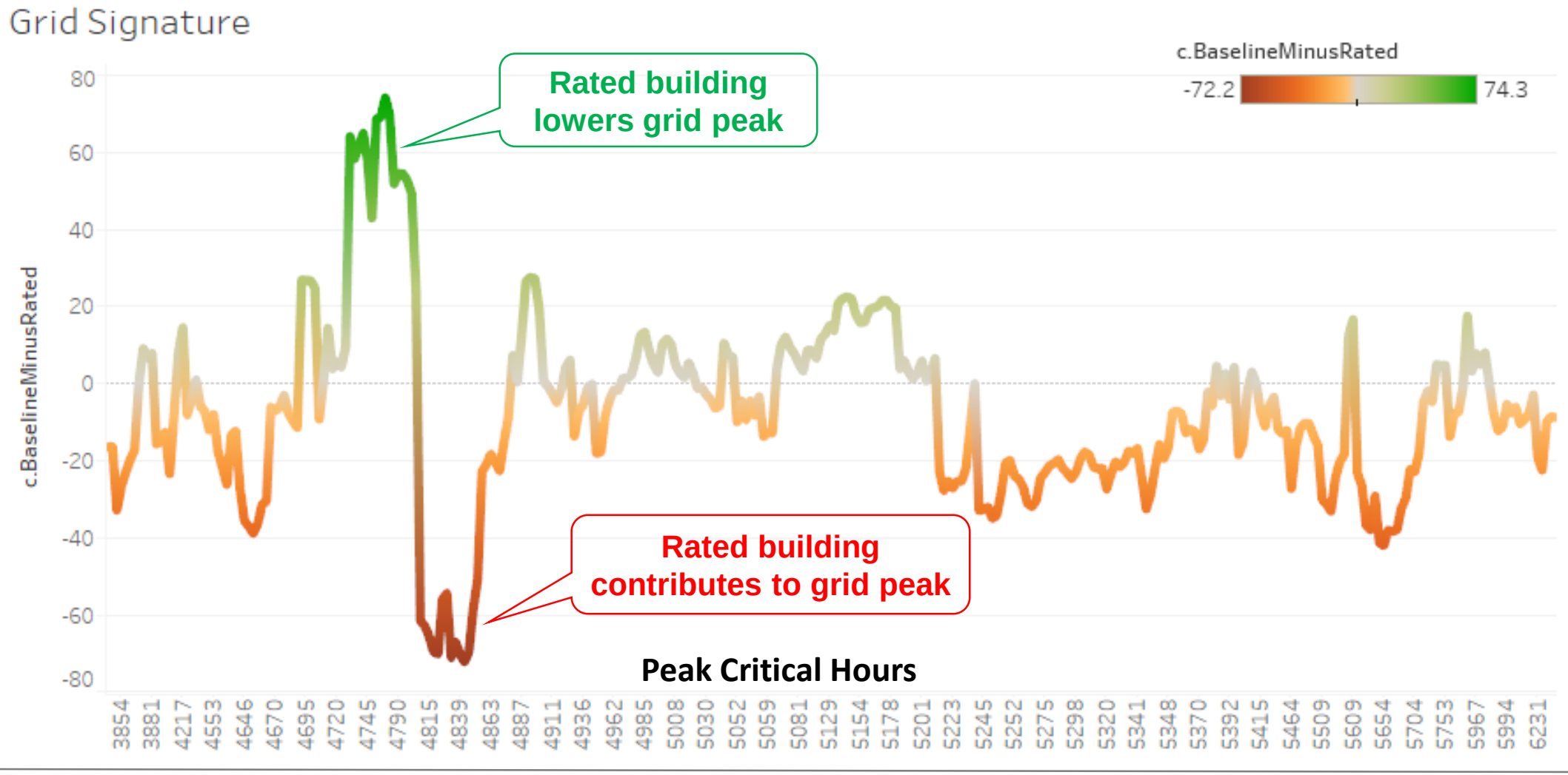


Image: Resnet

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

GridOptimal™: Grid Signature



nbi new buildings institute

GridOptimal™ : Layering Grid Resources

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

Image: www.lakeland.co.uk

GRIDOPTIMAL INITIATIVE

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

Building-Grid Interactions: Time Scales

- **Annual Basis**
  - Energy Use Intensity (EUI), Appliance Labels
- **Monthly Basis**
  - Most Utility Billing Cycles
- **Hourly Basis**
  - Building Simulation Models, Some Smart Meters
- **15-minute Basis**
  - Grid Resource Dispatch, Many Smart Meters, typical demand charge window
- **10-minute to 1-second basis**
  - Ancillary Services: Frequency Regulation, Spinning/Non-Spinning Reserve

Image: Roly Williams

nbi new buildings institute

What's the point of all this work, anyway?

Image: Navajo Generating Station, credit: Myrabella

Code Basis

- **“C101.3 Intent.** This code shall regulate the design and construction of buildings for the use and conservation of energy over the life of each building.” (IECC 2018)

Rooted in 1970s OPEC Oil Embargo

Resource Conservation Focus & Intent

Image: © CORBIS

nbi new buildings institute

Code Basis

- **Energy**: kWh, Therms, BTUs per year (IECC 2018)
- **Energy Cost:** $ per year (ASHRAE 90.1)
- **Time-Dependent Value (TDV):** kWh adjusted for value to grid by hour, per year (California Title 24)

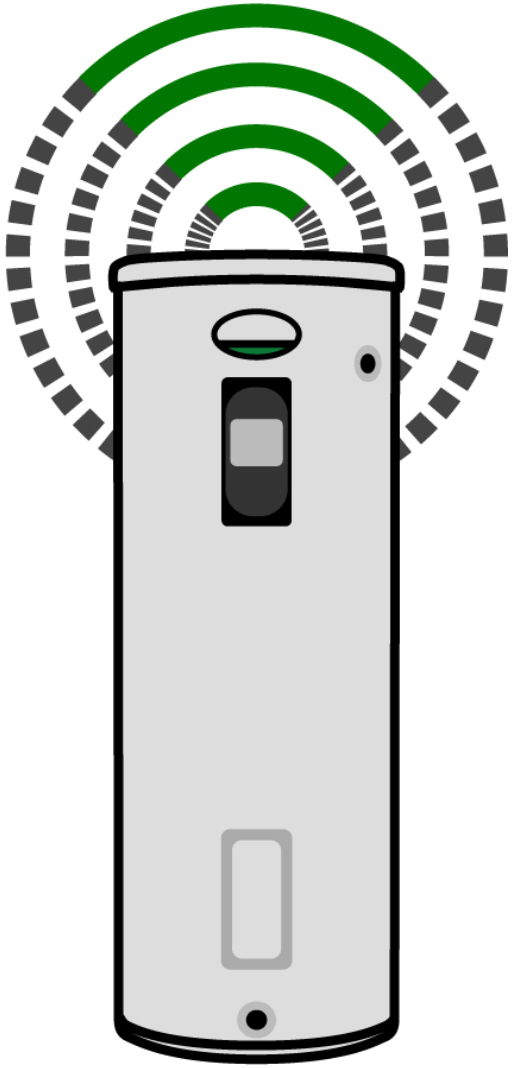
"Policy goals are shifting from the simple energy conservation focus of yesteryear toward achieving greenhouse gas (GHG) reductions…

To that end, we submit that *emissions efficiency* may be as or more important than *energy efficiency*" moving forward."

-Keith Dennis, Ken Colburn, Jim Lazar (Regulatory Assistance Project)

nbi new buildings institute

Enabling Technologies are Key



Images: BPA

nbi new buildings institute

GETTING TO zero
NATIONAL FORUM 2018

April 17-19, 2018
Grand Wyndam | Pittsburgh

gettingtozeroforum.org

The premier global event dedicated to defining the future of low and zero energy buildings.

- Share perspectives on the growth of ZE
- Build knowledge on policies driving projects, and design and operation best practices
- Collaborate on opportunities for ZNE to transform the built environment

Thank You!

Alexi Miller, PE

Senior Project Manager, NBI

alexi@newbuildings.org

David and Lucille Packard Foundation Building
Courtesy: EHDD