The Value of Grid-Interactive Buildings to Building Owners

Getting to Zero Forum
zLab Workshop Summary

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Executive Summary

This report summarizes discussions and key findings generated during the zLab workshop that explored the value of grid-interactive buildings to building owners on October 9, 2019, during the annual Getting to Zero Forum in Oakland, CA. Hosted by Rocky Mountain Institute and New Buildings Institute, this inaugural change lab was designed to innovate and accelerate the transformation of the built environment. This session ran concurrent with two other change labs, one focused on innovative policies and the other on electrification.[1]

The zLab coincidentally occurred during the first of several electricity grid shutdowns by PG&E for fire prevention.[2] This event served as a stark reminder of the important role of resilience and grid interactivity in our buildings and the emphasis on cost-effective and grid-supportive solutions as opposed to sinking resources into diesel generators.

Grid-interactive buildings can provide significant value to utilities, grid operators, building owners, and society at large. Building owners are the linchpin to implementation, and yet little work has been done to identify their needs, benefits, pain points, and enablers to adoption. Previous efforts in incentive and demand response programs have demonstrated building owners are willing to participate when programs are structured right. This event explored the following critical questions:

What would motivate building owners at scale to implement grid-interactive buildings?	• What are the barriers today preventing adoption? • When does the financial value become significant enough to motivate building owners to retrofit? • Is financial value alone enough to motivate building owners? If not, what else drives decision-making? • How can/should utility incentives, rate design, policy, and regulation and play a role?

The workshop focused on the key barrier of cost and value, which is preventing widespread adoption of grid-interactive buildings. The following report walks through the workshop activities and findings.

[1] Additional information on the other zLab workshops can be found at https://gettingtozeroforum.org/zlabs/.

[2] https://www.nytimes.com/2019/10/09/us/pge-shut-off-power-outage.html and https://www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/public-safety-power-shutoff-faq.page

Key overarching themes that were discussed during the workshop include:

1. There is a great need for education and awareness, providing **clear and consistent messaging** to each distinct stakeholder group across the buildings industry on grid-interactive buildings. We need to drive a greater campaign around the value and critical services grid-interactive buildings provide. We need to tell the story differently—start speaking to the value drivers across many different individuals and leverage more mediums to reach new audiences with clear and consistent messaging.
2. **Aggregation** will drive greater penetration of grid-interactive buildings. Aggregation could come at several levels including:
    a. Aggregating groups of buildings to make a larger, more investable target for demand optimization
    b. Aggregating vendors providing services which would streamline implementation
    c. Aggregating building-level energy loads to maximize cost savings and provide the greatest beneficial impact to the grid

    This was a theme throughout the Getting to Zero Forum.
3. A **service provider model** could streamline services for building owners to implement grid-interactive measures. It was clear across different ownership groups that energy costs and savings are often not worth the hassle. A third-party intermediary could help arbitrage savings, manage building level equipment, absorb risk, and stabilize operating costs for building owners and occupants. This model should be explored further.
4. **Rate structure design and reform** will align incentives and benefits and strengthen the business case. Progressive rates can provide strong leverage in the market and create significant value streams for owners. The resulting financial value needs to be clear and be able to be locked-in for long enough to align with equipment investment lifecycles. While this was not a focus of this discussion, it emerged as a clear target area.
5. **Technology advancement through policies** could play a big role to advance technologies and break down the cost barrier. For example, if all thermostats can connect with the grid, there won't be higher costs for that level of sophistication.
6. There is a need to **arrange and test critical dependencies** across actions in this space to sequence the highest priority actions and current gaps. The action items discussed and mapped to the timeline on page 8 need further sorting and prioritization. Driving system-wide change requires a buckshot approach, rather than having a single silver-bullet solution.
7. **Carbon vs. cost-based decision-making**. In some grid regions, optimizing for cost savings may be detrimental to carbon savings (for instance, in California, the grid typically has the lowest carbon intensity in the middle of the day due to high solar penetration; however, current rate structures incentivize energy use during the middle of the night). We need better emissions data transparency and real time values to help decision makers and operators optimize building operations. The conversation needs to shift from energy to carbon—both in awareness, policies, programs, and regulation.

Next steps

What will RMI and NBI do?
Scaling grid-interactive buildings is an ongoing effort for RMI and NBI and many others. As a result of this workshop, we will take the findings and create a workplan that will guide our work over the next year. Specifically, RMI and NBI are focused on advancing grid-interactive programs, policies, research, and pilot projects.[3] RMI and NBI look forward to continuing the discussion. And we encourage everyone to join us at the 2021 Getting to Zero Forum, March 15–17, 2021.

What can you do?
First, continue telling the story, emphasizing the importance of grid-interactive strategies, and affirming the value that grid-interactive buildings can provide to both building owners and utilities.

Second, investigate opportunities in your work to leverage grid-interactive building strategies. Understand rate structure alternatives, favoring time-based and demand-based rates wherever possible. Consider measures that build load flexibility.

Third, ask about opportunities to reshape the buildings you live and work in. Talk to your landlord about energy demand as well as consumption. Examine your utility costs to see how much cost goes to demand charges, and how much savings is possible.

Last, leverage available data to make real time carbon-based decisions. For instance, if the grid region where you live and work has the highest carbon emissions between 2am-7am but energy costs are highest from 2pm-6pm (which is the case in Colorado during the summer months), consider design and operational strategies that reduce demand during late afternoon hours and shift that energy use to morning hours (e.g. space precooling or battery charging). Try to co-optimize for both low carbon and low cost.

RMI and NBI would like to thank all those who set aside time to join us and lend us your brainpower for the afternoon. Your great ideas and passion will help lead us into the future!

[3] Our grid-interactive buildings work can be found at www.rmi.org/gebs and https://newbuildings.org/resource/gridoptimal/. Links to additional resources are in the workshop pre-read in the Appendix.

Workshop Activities

The five-hour zLab workshop focused on overcoming market barriers in the context of four real projects. The group started the session with the industry framing of grid-interactive buildings and a high-level review of key industry barriers. Then, the group divided into four facilitated breakout groups, each representing a different ownership model—with the actual owner representatives present. The four groups were:

1. Privately held corporate ownership, long-term holds represented by Nicola Piell-Moelter with vmWare,
2. Public building owners, long-term holds represented by Kevin Powell with the General Services Administration
3. Merchant developers with build and hold or build and sell models represented by Kevin Bates with Sharp Development
4. Multifamily owners represented by Alexi Miller with NBI

Figure 1: Images of breakout groups

During the breakout groups, the groups explored the value stack, drivers, and risks for building owners—including both internal and external drivers. Then, the group came back together to assimilate action items on a timeline. The timeline focused on the 2020 and 2025 timeframes, with some actions extending into the future.

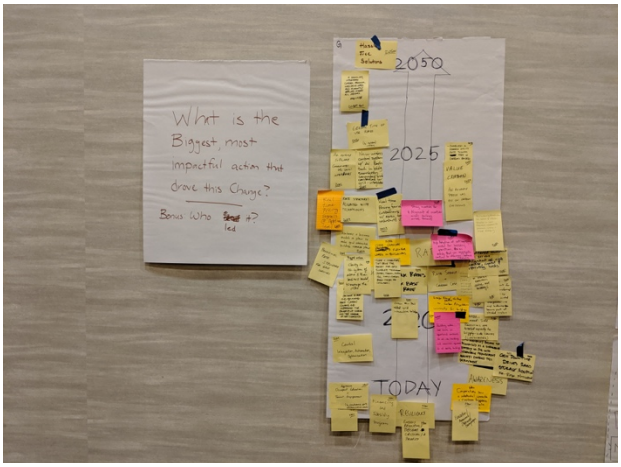


Figure 2: Images of zLab session

Key Outcomes:

Value Drivers

Each ownership group had specific drivers that provided value, as summarized in the table below. Notably, there were more commonalities than differences across ownership groups. Key value themes that spanned across ownership groups include:

- All groups described favorable economics, resilience, and tenant/occupant satisfaction as key drivers.
- Energy cost specifically was not mentioned as a significant value driver, insinuating two things: (1) Energy management is not a core motivator for building owners. It is a byproduct of keeping occupants content. (2) There may be a lack of awareness among owners and tenant groups around cost savings potential, in particular through demand charge reduction. Thus, there is an opportunity for new business models or vendors to provide strategic energy management.
- Occupants are key, both in terms of having "sticky tenants" and happy employees.

Value Drivers	
Privately held corporate owners Owner-occupied buildings with long-term holding periods	**Public building owners** Long-term holds, some leased, some agency/owner occupied
• Favorable economics • Resilience/business continuity • Sustainability • Employee value • Future-proofing (Mitigate future policy risk)	• Favorable economics (taxpayer value) • Resilience, continuity of operations • Employee value (tenant satisfaction) • Future-proofing • Avoid negative PR • Regulatory mandates

	• Lead by example • Avoid cyber threats • Unlock other drivers
Commercial Developers Build to hold or build and sell, leased buildings	**Multifamily homeowners** Small to mid-scale multifamily leased buildings
• Favorable economics (profitability) • Tenant retention (sticky tenants) • Resilience/business continuity (operations) • Resilience in market downturn • Basic efficiency • Marketability (ZNE cost, perception, recruiting tool)	• Favorable economics (profitability, lease rates) • Tenant retention • Marketability • Enticing features • Resilience and adaptation • Green buildings/sustainability • Utility cost savings

Risks

The group counterbalanced the visioning with a conversation around risks. A few of the risks that arose that could prevent building owners from investing in grid-interactive buildings include:

- Unsuccessful deployment: cost/energy/carbon savings not realized post construction
- High anticipated first cost
- Political blow back for promoting utility company closure
- Risk of stranded assets
- Financial savings may not be compelling/substantial enough
- Cybersecurity threats
- Technology inability—slow device compatibility, lack of control interaction
- Lack of awareness

Timeline with action items

In this back-casting exercise, the group identified the critical action items needed to make a future with widespread, cost-effective, carbon-cutting, grid-interactive buildings a reality. The action items represent more of an arc, rather than a sequential path and the primary focus was on actions for the immediate one to five years.

Short term:

- Aggressive occupant education and tenant engagement
- Improved energy technology
- Financing and subsidy programs
- Energy resiliency becomes a critical priority
- Grid downtime drives rapid storage adoption for risk mitigation
- Control integration, automation optimization
- Paradigm shift in the way building owners pay for energy
- Load flexibility becomes recognized as a sustainability strategy on par with renewable procurement markets to enable this deployment
- New policies to make building owners invest in efficiency and grid responsiveness
- Building codes set limits on operational emissions for all new buildings and transition requirements for all existing buildings
- All demand-side resources are treated equally to supply-side choices
- States initiate carbon-pricing mechanisms
- Allowance of third-party service providers to interact between utilities and buildings
- Conditioned environment as a service. Alignment of risk appetite, capital, and operating costs
- Peak rates 4X base rates
- Restructuring/redefining the nature of utilities in new business models to produce, shave, and trade energy
- High adoption of outsourcing model for building operations, an entity that can aggregate control for efficiency and demand flexibility
- Code changes mandated flexible loads in buildings
- Codes and incentives that drive the market for grid-enabled technology
- Beneficial rate structure for grid services
- Hardware and business models in place to make grid-interactive buildings commonplace

Mid term

- Realtime pricing signals at application level
- Realtime pricing for all customers and easy to understand
- Strong incentives for and alignment of incentives across developers, owners, and tenants
- An accurate price on carbon emissions
- Enabled a dynamic utility rate signal that is carbon based

Long term:

- All systems software communicates without special interfaces
- Extreme time-of-use rates, set by regulators and utilities
- A seamless, integrated control protocol was developed and elegantly applied across all sectors
- Hassle-free solutions

Action items to move the industry

In order to achieve grid-interactive buildings at scale, the main action items generated in the workshop (listed above) fall under seven key themes (not prioritized):

1. Rate structure reform (e.g., time-based and carbon-based rate structures, dynamic utility rate signal)
2. Supportive policies (e.g., carbon goals, energy savings targets)
3. Developing new utility programs (e.g., incentive programs, operating programs)
4. Technology advancement (e.g., controls, islanding, inverters)
5. Monetizing additional benefits (e.g., carbon, health, resilience, controllability for comfort)
6. Advancing market mechanisms (e.g., service offerings, rating systems, emerging programs or offerings)
7. Increase awareness (e.g., targeted education and outreach)

Appendix:

1. List of Attendees
2. Preread with workshop context and industry barriers
3. Agenda

List of Attendees:

	First	Name	Organization
1	Gregg	Ander	GDA-LLC
2	Fabienne	Arnoud	PG&E
3	Kevin	Bates	Sharp Development
4	Neil	Bulger	Red Car Analytics
5	Cara	Carmichael	RMI
6	Kimberly	Cheslak	IMT
7	Nick	Edney	McKinstry
8	Dave	Farnsworth	RAP
9	Angelique	Fathy	RMI
10	Mark	Frankel	NBI
11	Michelle	Frey	SF district council
12	Yihan	Hao	RMI China
13	Sheila	Hayter	ASHRAE
14	Karina	Hershberg	PAE
15	Marshall	Keneipp	Tierra Resource Consultants
16	Maddie	Koewler	NASEO
17	Rois	Langner	NREL
18	Mark	MacCracken	CALMAC
19	Jamie	Mandel	RMI
20	Alexi	Miller	NBI
21	Kaitlin	Moody	NYSERDA
22	Roch	Naleway	Portland General
23	Brendan	Owens	USGBC
24	Nicola	Peill-Moelter	VM Ware
25	Mark	Perepelitza	SERA
26	Kevin	Powell	GSA
27	Henry	Richardson	Wattime
28	Vaishali	Sampat	Kilroy Realty
29	Tori	Scarzello	Efficiency Vermont
30	Scott	Shell	EHDD
31	Ted	Tiffany	G+E Engineers
32	Tim	Unruh	NAESCO
33	Mark	Wilhelm	Tierra Resource Consultants

Getting to Zero Forum
zLab: The Value of Grid-Interactive Buildings to Building Owners
Pre-Read

This zLab workshop will be solutions oriented. We don't intend to discuss definitions and general industry barriers but rather spend our time together brainstorming solutions across actual ownership cases to build the value proposition for widespread adoption by building owners. This short summary is intended to cover the basics.

Topic Overview

Grid-interactive buildings are a reawakening of the building efficiency space. Presenting a new opportunity to save both money and carbon, grid-interactive buildings provide a forward looking and untapped potential across multiple stakeholder groups—building owners, grid operators, utilities, and ultimately all energy users and society at large.

What is a grid-interactive building?

The Department of Energy defines a grid-interactive building (GEB) as an energy efficient building with smart technologies characterized by the active use of distributed energy resources to optimize energy use for grid services, occupant needs and preferences, and cost reductions in a continuous and integrated way.[4]

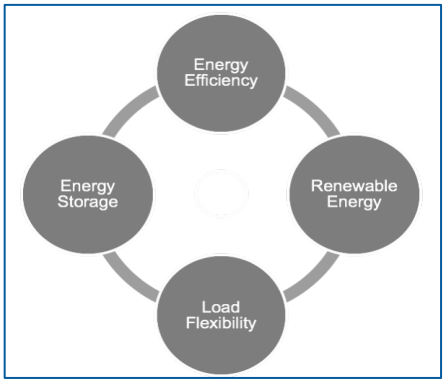

Figure 1: Key attributes of a grid-interactive building.

There are four key attributes to a grid-interactive building including energy efficiency, renewable energy, energy storage, and load flexibility. Grid-interactive buildings are unique in their ability to optimize across key attributes; today such attributes are often individually optimized. Grid-interactive buildings result in a less peaky, more flexible energy load profile which reduces operational costs, largely through demand charge savings.

Some technologies that support grid-interactive buildings are in use today. However, there are a few key differentiators between grid-interactive buildings and highly efficient buildings:

1. **Interoperability and intelligence from building to grid**: Grid-interactive buildings should receive utility price signals and share the availability of flexible loads within the building to modulate loads and optimize for cost, carbon, reliability, and other factors. Even buildings engaged in curtailment or demand response programs do not often have an automated process, and virtually no buildings automatically shift loads based on real-time changes in utility price signals.
2. **Interoperability and intelligence across building systems:** Grid-interactive buildings should have a unified, overarching, and intelligent system that controls HVAC, lighting, plug loads, thermal or electric storage, and other key building loads. Without cross-system interoperability and intelligence, buildings will fall short of their full potential to control electricity demand to save money and to interact positively with the grid. Many building loads (e.g., plug loads) are seldom controlled at all, let alone to optimize to utility price signals. Existing control systems vary widely

[4] https://www.energy.gov/sites/prod/files/2019/04/f61/bto-geb_overview-4.15.19.pdf

across building type, size, and vintage, but most building controls are not set up to coordinate across building systems.

3. **Load flexibility and demand-focused optimization**: Grid-interactive buildings should have the intelligence to track building demand, predict patterns that can help limit peak demand, and shift or shed demand rapidly in response to grid or building events. Using the same functions to limit building billing peak is often more cost-effective than responding to narrow demand-response events. The ability to predict weather patterns, track renewable energy generation curves, or predict building operational needs can allow a grid-interactive building to limit monthly peaks and reduce costs more than today's more traditional efficiency- and demand response-focused energy management practices.

Grid-interactive buildings provide significant direct and indirect benefits to building owners, including:

- Offering direct value to building owners by reducing energy and demand costs;
- Providing CO_2 savings and aligning with corporate sustainability objectives;
- Providing better control which can help deliver better occupant comfort, health, and productivity;
- Demonstrating leadership and market differentiation; and
- Providing societal benefits including lower generation capacity, transmission, and distribution infrastructure costs, which drive capital cost and operational savings for all grid users.

Additional value drivers will be explored during the workshop.

Importance and Urgency

Three key factors are driving urgency:

1. Grid-interactive buildings provide a significant and untapped source of value and cost savings for building owners.[5]
2. Grid-interactive buildings are essential to balance the electric grid as penetration rises among renewable energy (both behind the meter and grid side), end use loads are electrified (such as space heating, water heating, and cooking) and electric vehicles become more widespread.
3. Decarbonization goals and supporting policies are on the rise at the city, state, corporate, and utility levels; 100 percent carbon free goals cannot be achieved without building participation.

These present not only a significant value opportunity but also an imminent threat to our energy system and infrastructure if the industry doesn't embrace grid-interactive building measures.

RMI believes building owners are the linchpin to the implementation of grid-interactive buildings. Yet little work has been done to identify their needs, benefits, pain points, and enablers to adoption.

Barriers

The following is a list of the key barriers to implementing grid-interactive buildings today. This was derived from preworkshop surveys and industry research. During this workshop, we will focus on barrier #1.

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[5] https://rmi.org/insight/value-potential-for-grid-interactive-efficient-buildings-in-the-gsa-portfolio-a-cost-benefit-analysis/. This analysis found an average cost savings potential of 30% across 6 different buildings distributed across the US with sub-four-year paybacks.

1.	**Cost and Value**: High CapEx and OpEx, both perceived and actual, lack of clear structure for compensation, challenge making business case in certain portfolios/buildings
2.	**Awareness:** Many don't recognize it's an issue, solutions are too complicated, status quo, perceived comfort risks
3.	**Data:** Lack of data to make good decisions (e.g. time of use characteristics of building and grid); Lack of tools to manage and interpret the data for automatic, optimized building controls
4.	**Technology:** Lack of interoperability and intelligence in building control systems; strategies to implement in both new and existing buildings
5.	**Implementation**: Hassle factor, workforce lack of implementation partners and contractors, unclear what business entity type will provide the aggregation service
6.	**Cyber security**: Vulnerability of smart plugs to exploitation, data privacy
7.	**Regulation:** Uncertainty associated with evolving city sustainability goals; Lack of policy mandates or incentives
8.	**Utility engagement:** Misaligned incentives (demand charges discourage higher consumption during times of high supply); Lack of price signal; Resistance to change within utilities
9.	**Workforce:** Lack of trained labor force

Additional Resources

- *Rocky Mountain Institute – Grid-interactive buildings and GSA Value analysis: (https://rmi.org/gebs)*
- *U.S. General Services Administration – Green Building Advisory Committee*
    - *GEBs Task Groups: 1. Policy recommendations and 2. GEB in ESPC/UESC guidance*
- *DOE BTO – GEBs Homepage*
- *Laurence Berkeley National Lab – FlexLab*
- *New Buildings Institute – GridOptimal Initiative*
- *NASEO – NARUC GEB Working group*

Getting to Zero Forum - zLab
Wednesday October 9th, 12:00 – 5:30 PM
Marriott Oakland City Center, Grand Ballroom

The Value of Grid-Interactive Buildings to Building Owners and Decision Makers Workshop Agenda

Problem statement:
Grid-interactive buildings can provide significant value to utilities, grid operators, building owners, and society at large. Building owners are the linchpin to implementation, and yet little work has been done to identify their needs, benefits, pain points, and enablers to adoption. Previous efforts in incentive and demand response programs have demonstrated building owners are willing to participate when programs are structured right. How can and should we develop the right structure to enable more grid-interactive buildings? **What would motivate building owners at scale to implement grid-interactive buildings?**

Agenda:

Time	Topic
12:00 – 12:30 PM PT	**Networking and sign-in**
12:30 – 1:00	**zLab Welcome** Welcome, zLabs overview, breakout into 3 zLab groups
1:00 - 2:00	**Grid-interactive buildings zLab** Introductions, review objectives/outputs, agenda, ground rules, definitions
2:00 – 3:00	**Introduction of Case clinics, Develop owner value stack and risks** Four real owners present four real problems. Breakout groups. Examine the value stack and risks
3:00 – 3:15	Break
3:15 – 4:00	**Developing the external drivers, back casting solutions** In order to build a strong business case, what are the external drivers? What will be key drivers in the near future?
4:00 – 5:00	**Regroup and share value stack, risks, drivers and solutions. Discuss.** Report out from breakout groups
5:00 – 5:30	**Sharing findings across 3 zLabs, wrap up** zLabs come together as a group and report out conclusions.

Following the zLab workshops from 5:30 – 7:30 pm, there will be a Street Party and official kickoff for the Getting To Zero Forum with food trucks and live entertainment in front of the Marriott hotel. Everyone is welcome.

Desired outcomes:

- List of building owner barriers to adoption
- Summary of the value stack for grid-interactive buildings to building owners
- Summary of key drivers and actions for the industry in the next five years.