Grid-Interactive Efficient Buildings

Midwest Building Energy Codes Conference

Denver, CO

November 14, 2019

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ACEEE

American Council for an Energy-Efficient Economy

Agenda

Background

Grid-interactive Efficient Buildings (GEBs)

- Defining GEBs
- Benefits of GEBs

Barriers, Recommendations, & Conclusions

- Barriers
- Recommendations
- Conclusions
- Key Resources

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Background

Since 2017, ACEEE has released reports on smart & connected buildings, energy storage, and GEBs.

Smart Buildings

- Smart Buildings: Using Smart Technologies to Save Energy in Existing Buildings (2017)
- Smart Buildings: A Deeper Dive into Market Segments (2017)
- Emerging Opportunities: Achieving Deeper Energy Savings through Integrated Building Systems (2019)

Energy Storage

- Emerging Opportunities: Energy Storage (2019)

Grid-Interactive Efficient Buildings

- State of the Market: Grid-interactive Efficient Building Programs (2019)

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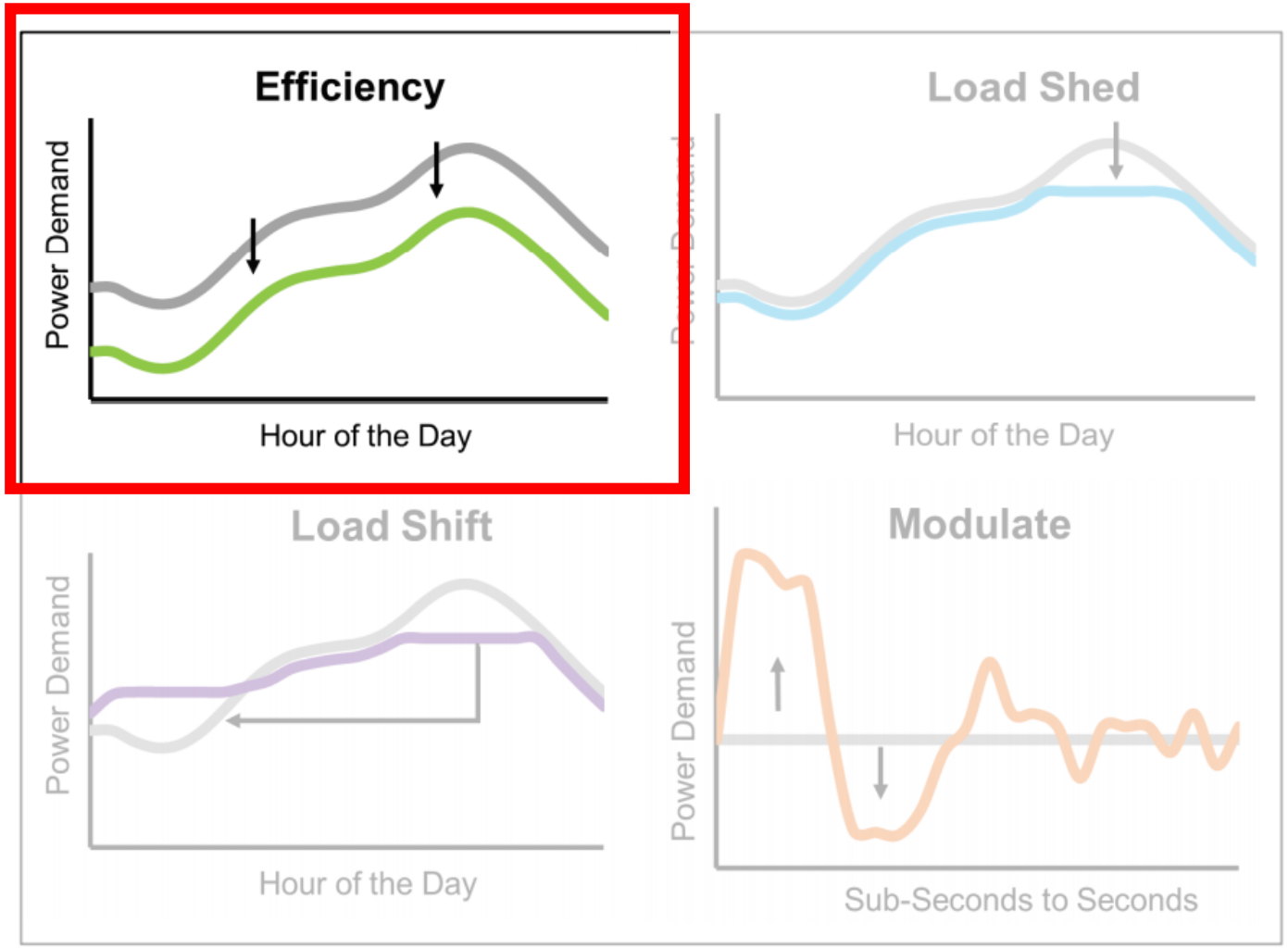
We also lead a GEB working group for utilities

Historically, ACEEE's research focused on kWh, however we are increasingly interested in kW.



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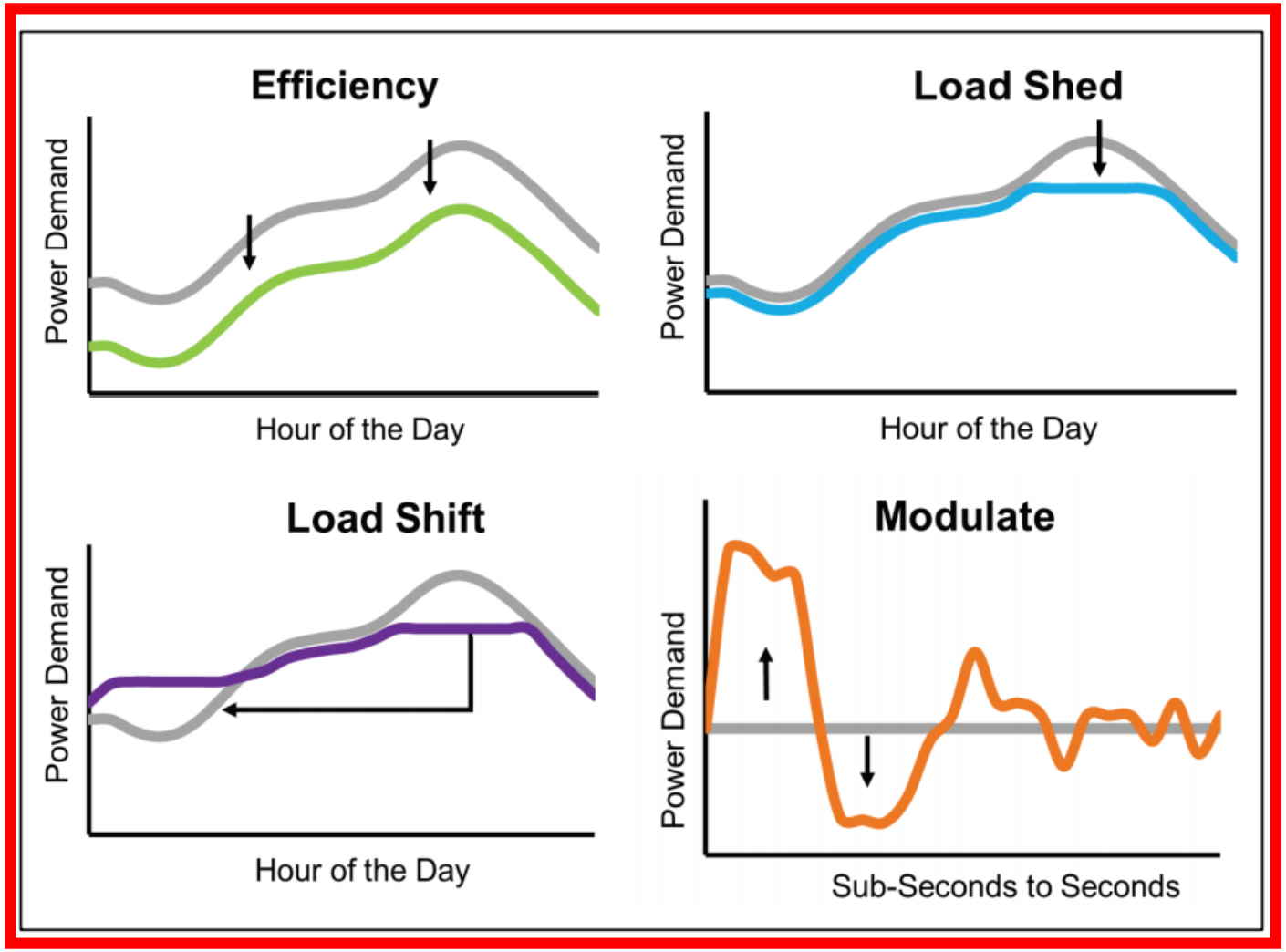

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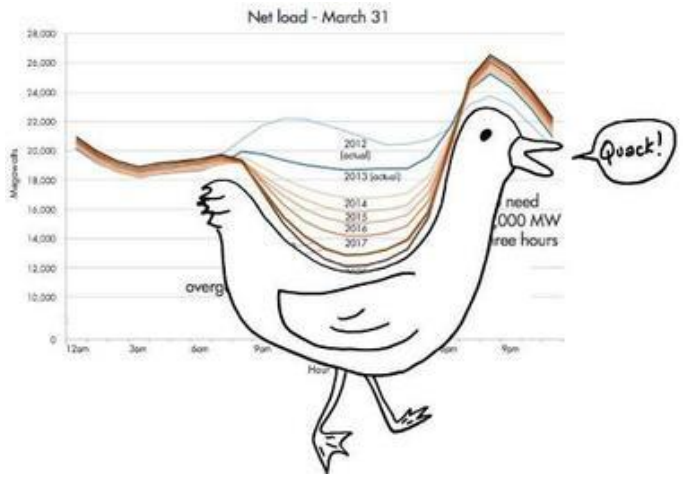
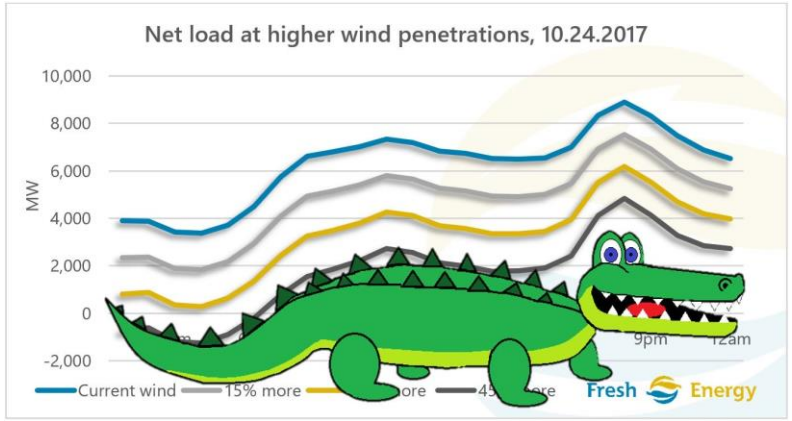
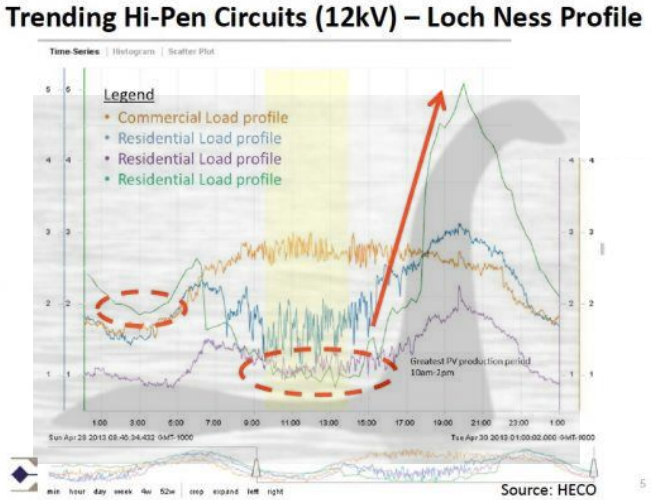
Rapid changes to the grid from technologies (e.g., solar PV) and policies (e.g., electrification) can strain the grid.



California 'Duck' Curve



Midwest 'Gator' Curve



Hawaii 'Nessy' Curve

insideenergy.org/2014/10/02/ie-questions-why-is-california-trying-to-behead-the-duck/

www.greentechmedia.com/articles/read/renewables-integration-in-the-midwest-is-a-whole-other-animal

https://www.greentechmedia.com/articles/read/hawaiis-solar-grid-landscape-and-the-nessie-curve

Grid-interactive Efficient Buildings (GEBs)

What is a GEB?

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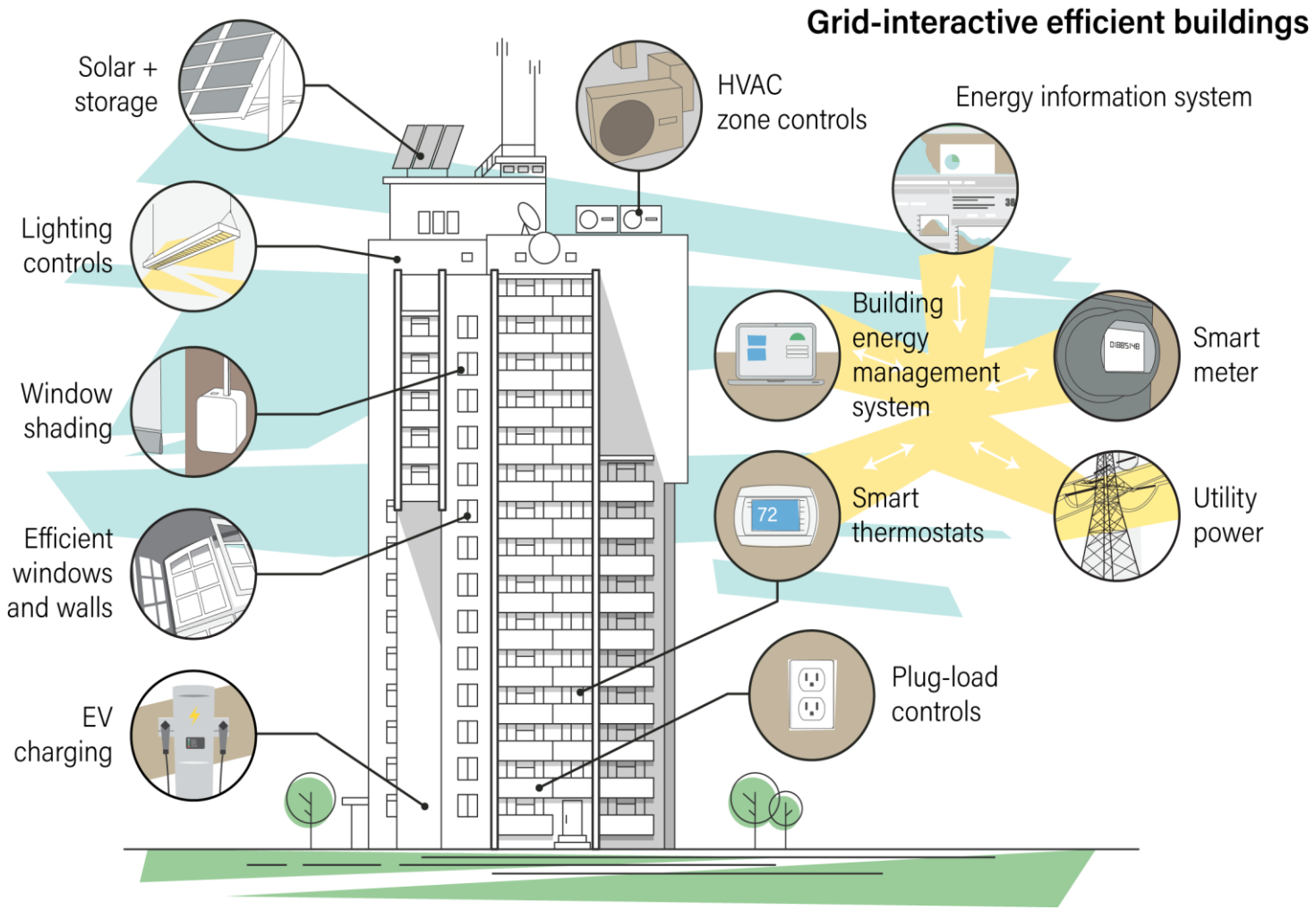
Grid-interactive efficient buildings (GEBs) are highly-efficient buildings that can communicate with and serve as a resource for the grid (e.g., shift or shed loads).

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

Key GEB technologies can save energy and/or interact with the grid.



aceee.org/white-paper/gebs-103019

Often an “aggregator” acts as an intermediary between utilities and buildings.

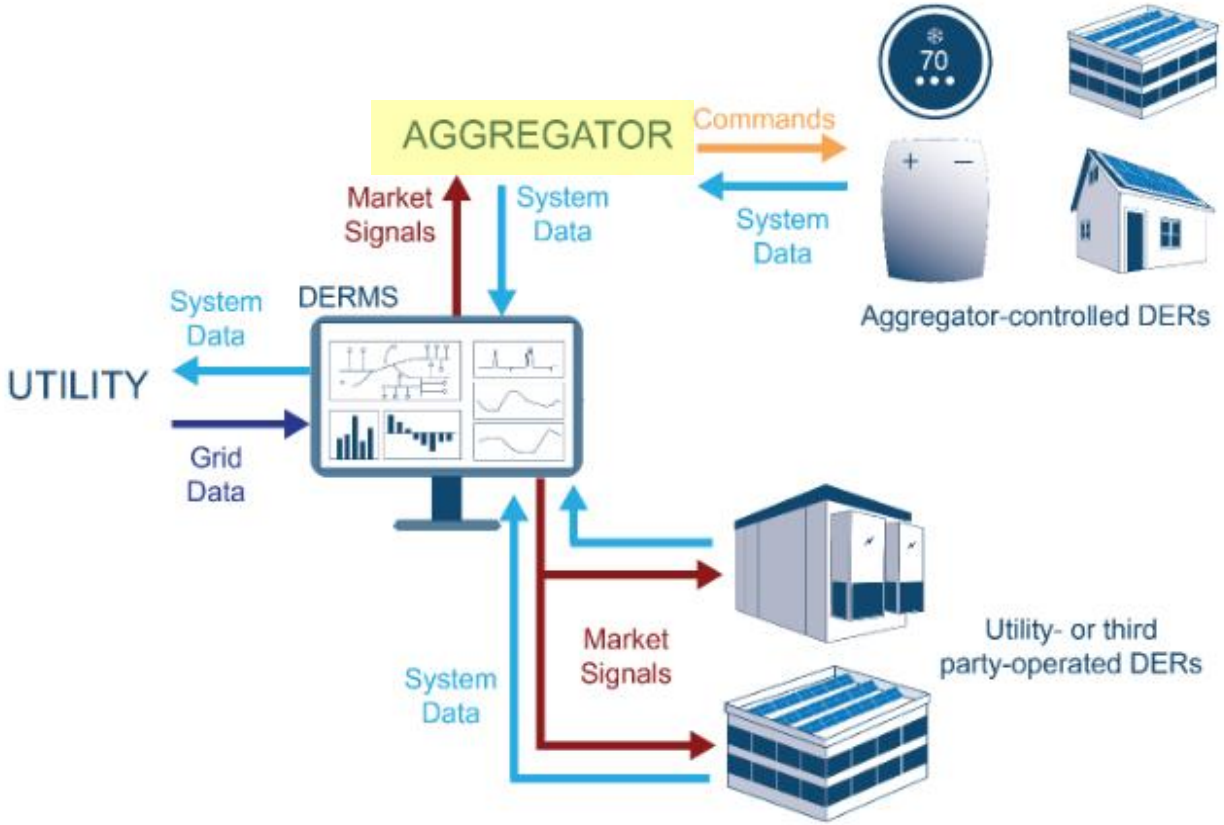


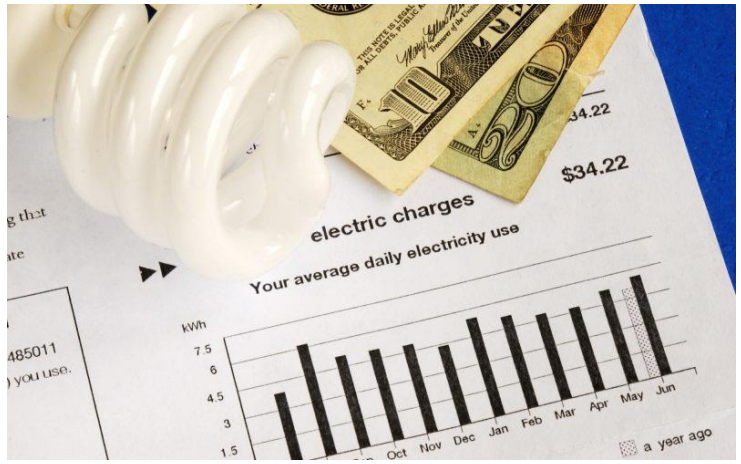
Figure 1. Example DER aggregation program structure and component interaction

Fully automated GEBs are mostly limited to the residential sector

GEBs benefit cities and states in a few ways.

Reduce emissions

Reduce grid strain



Reduce bill costs

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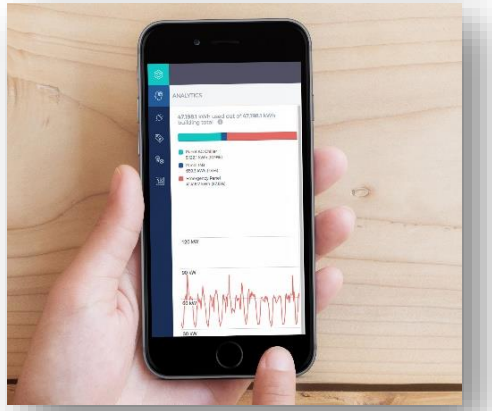
Barriers, Recommendations, & Conclusions

Top barriers for GEBs include:

Interoperability



Metrics

Workforce

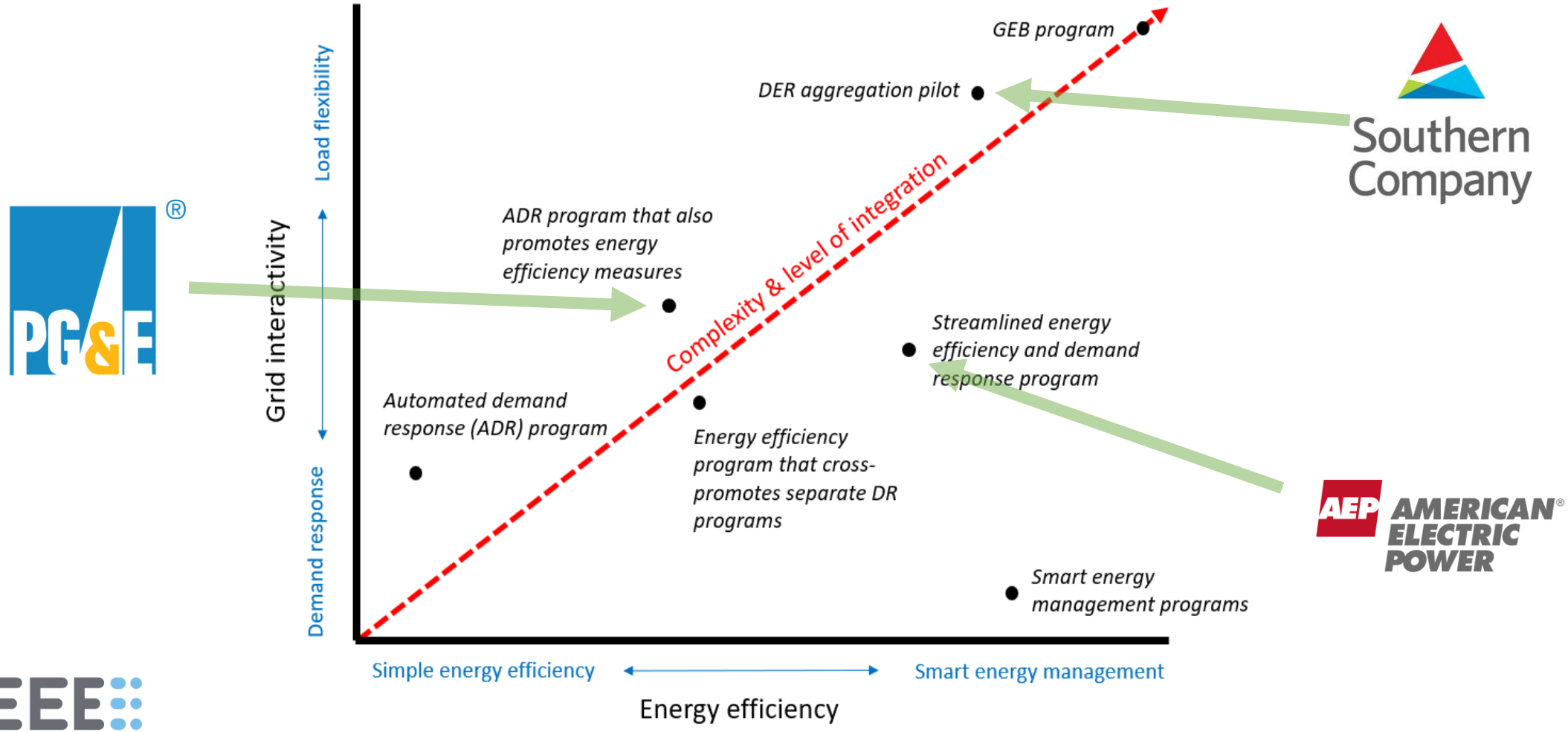
Policy

Cybersecurity

California Senate Bill 49 is one example of a GEB-enabling policy.

(1) Adopt, by regulation, and periodically update, standards for appliances to facilitate the deployment of flexible demand technologies. These regulations may include labeling provisions to promote the use of appliances with flexible demand capabilities. The flexible demand appliance standards shall be based on feasible and attainable efficiencies or feasible improvements that will enable appliance operations to be scheduled, shifted, or curtailed to reduce emissions of greenhouse gases associated with electricity generation. The standards shall become effective no sooner than one year after the date of their adoption or updating.

Utility programs can also help pave the way to GEBs by valuing both efficiency and demand response.



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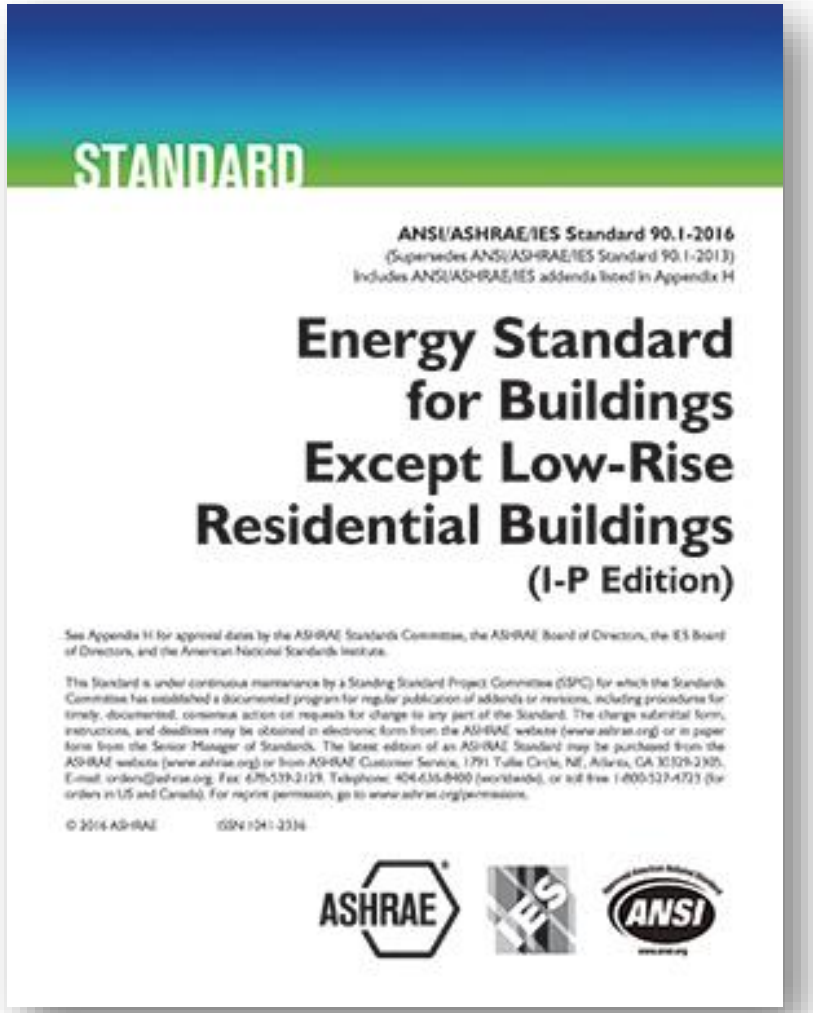
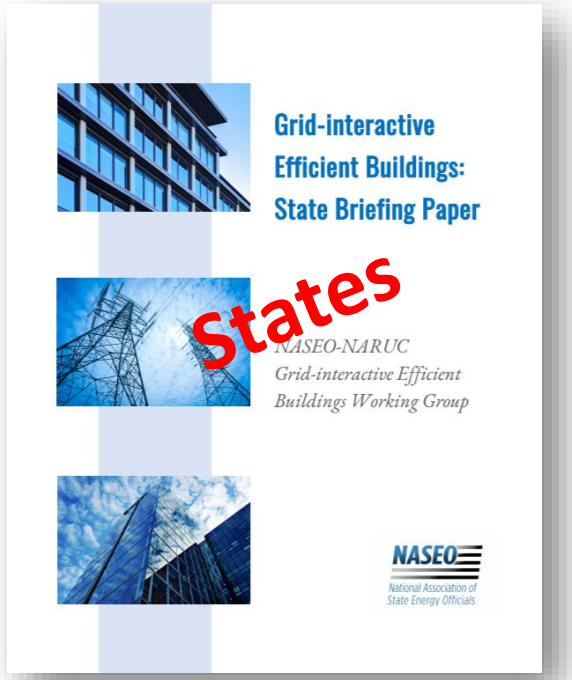
Regarding codes, the ASHRAE 90.1 energy storage working group is looking into TOU rates to value grid services.

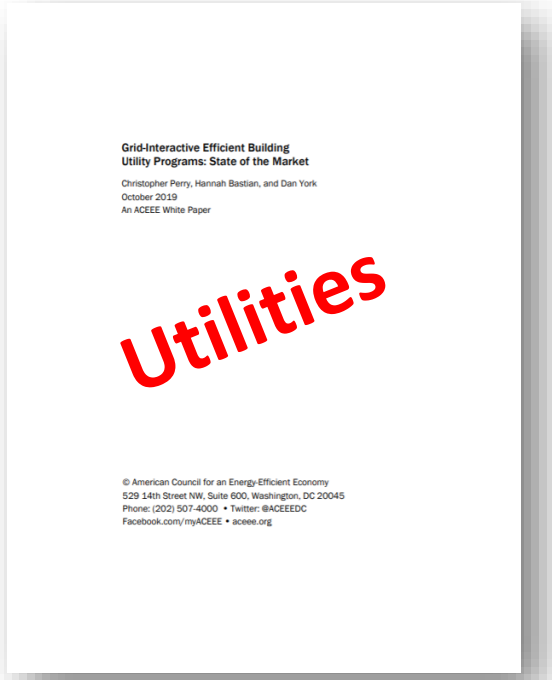


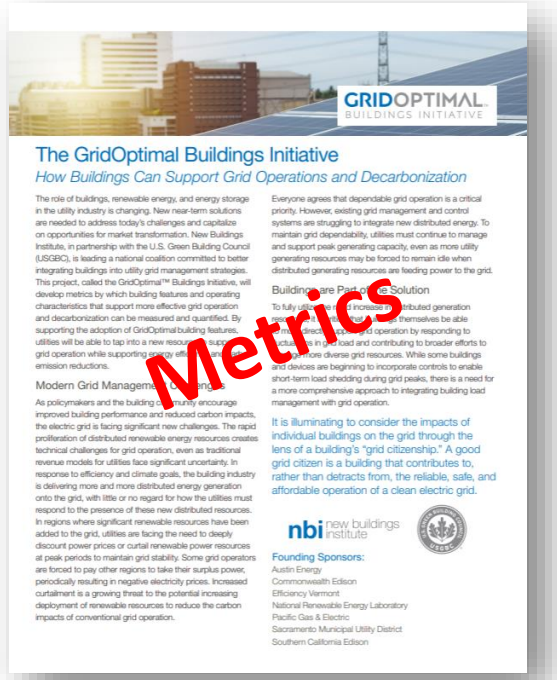
Conclusions

1. Cities and states can use GEBs to help meet their energy and greenhouse gas emission reduction goals
2. Load flexibility from GEBs can help cities and states respond to our rapidly changing electricity grid
3. The GEB industry is still nascent – it currently lacks sufficient interoperability protocols, valuation metrics, and policy support
4. This is a multi-pronged effort, where stakeholders like governments, utilities, and codes will all play a role

Key resources







www.energy.gov/sites/prod/files/2019/04/f61/bto-geb_overview-4.15.19.pdf

aceee.org/sites/default/files/gebs-103019.pdf

naseo.org/data/sites/1/documents/publications/FINAL-GEB-NASEO-report-full.pdf

https://newbuildings.org/resource/gridoptimal/

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Thank you!

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