NARUC Winter Policy Summit

Committee on Energy Resources and the Environment

NASEO - NARUC's Grid-Interactive Efficient Buildings (GEB) Initiative

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Grid-interactive Efficient Buildings

NARUC-NASEO Working Group Discussion

David Nemtzow
Director, Building Technologies Office
2/11/19

WHO WE ARE

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Building Technologies Office (BTO)

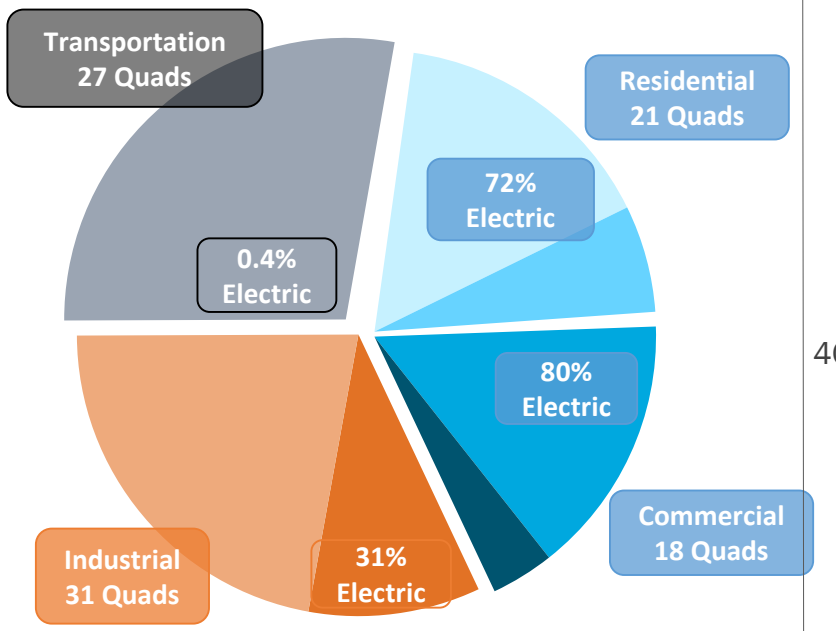
BTO is within US DOE's Office of Energy Efficiency and Renewable Energy (EERE)

FY 2019 budget is $226M, ~10% of EERE's $2.4B budget; DOE budget ~$35.7B

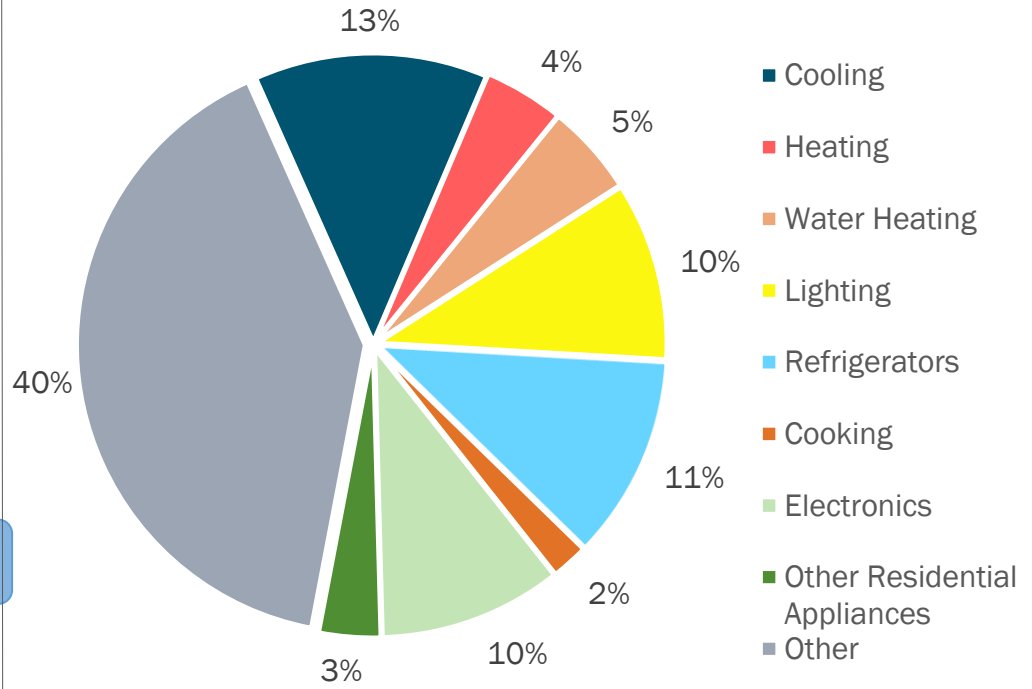
ENERGY EFFICIENCY	RENEWABLE POWER	SUSTAINABLE TRANSPORTATION
Advanced Manufacturing	Geothermal Technologies	Bioenergy Technologies
Building Technologies	Solar Energy Technologies	Fuel Cell Technologies
Federal Energy Management	Wind Energy Technologies	Vehicle Technologies
Weatherization & Intergovernmental	Water Power Technologies	

Energy Use in the U.S. Building Sector

Energy Use



Building Electricity Use



Buildings Energy Use: 40% of U.S. total

Buildings Electricity Consumption: 75% of U.S. total

Buildings Peak Electricity Demand: ~80% of regional total

U.S. Building Energy Bill: US$380 billion per year

Source: EIA 2017 Annual Energy Outlook

BTO Approach

BTO invests in energy efficiency & related technologies that make homes and buildings more affordable and comfortable, and make the US (and beyond) more sustainable, secure and prosperous. Approach includes:

R&D

Pre-competitive, early-stage investment in next-generation technologies

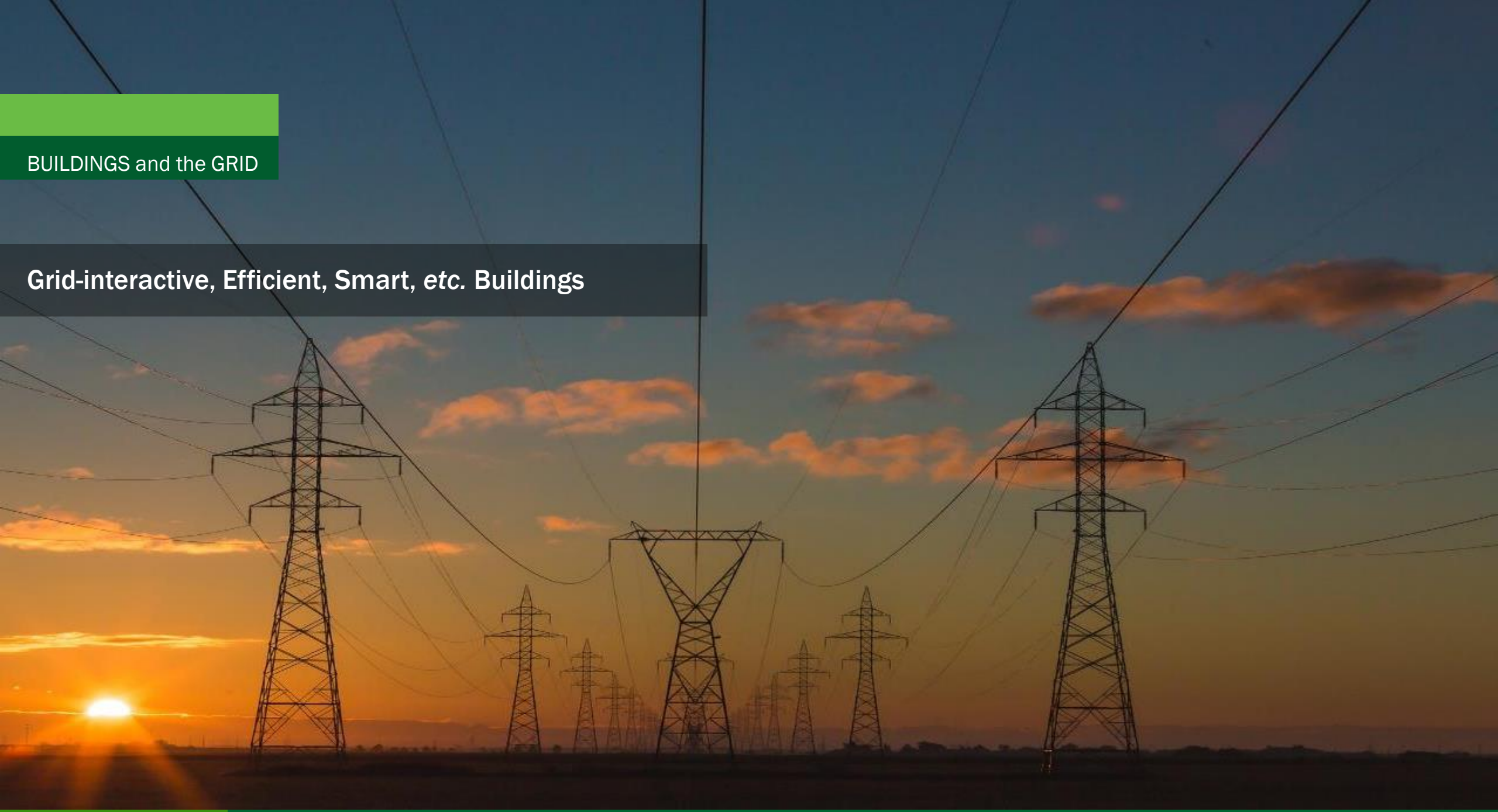
Integration

Technology validation, field & lab testing, metrics, market integration

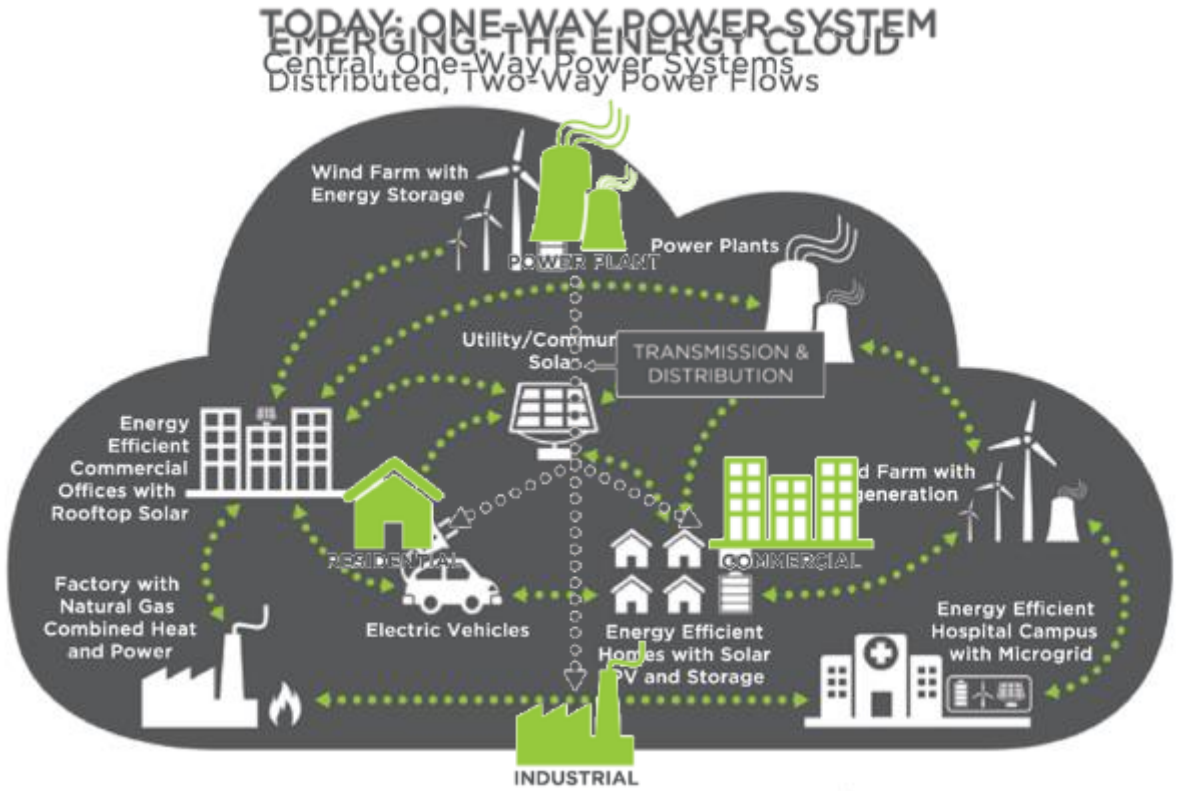
Codes & Standards

Whole building & equipment standards technical analysis, test procedures, regulations

Grid-interactive, Efficient, Smart, *etc.* Buildings



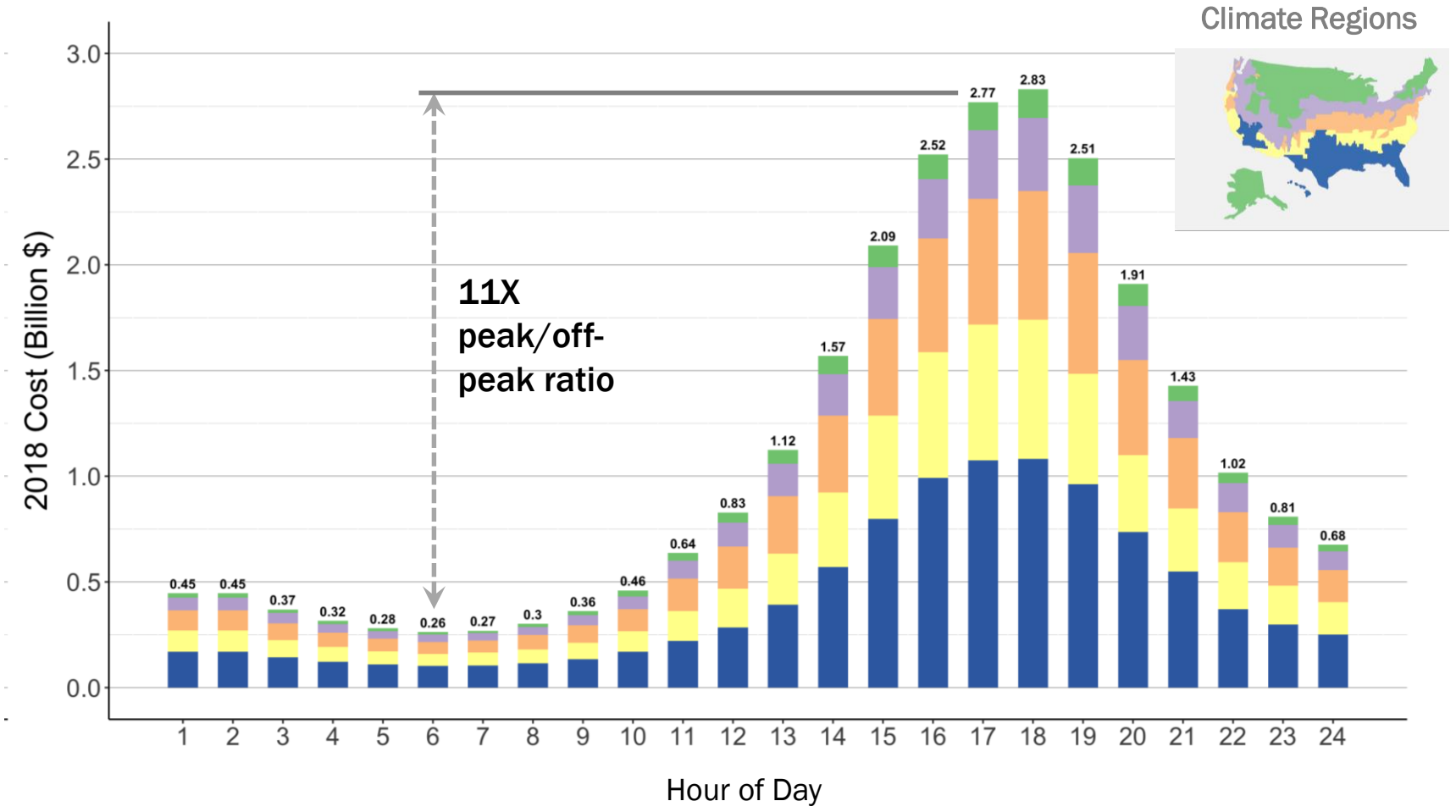
Moving Towards the Grid of the Future



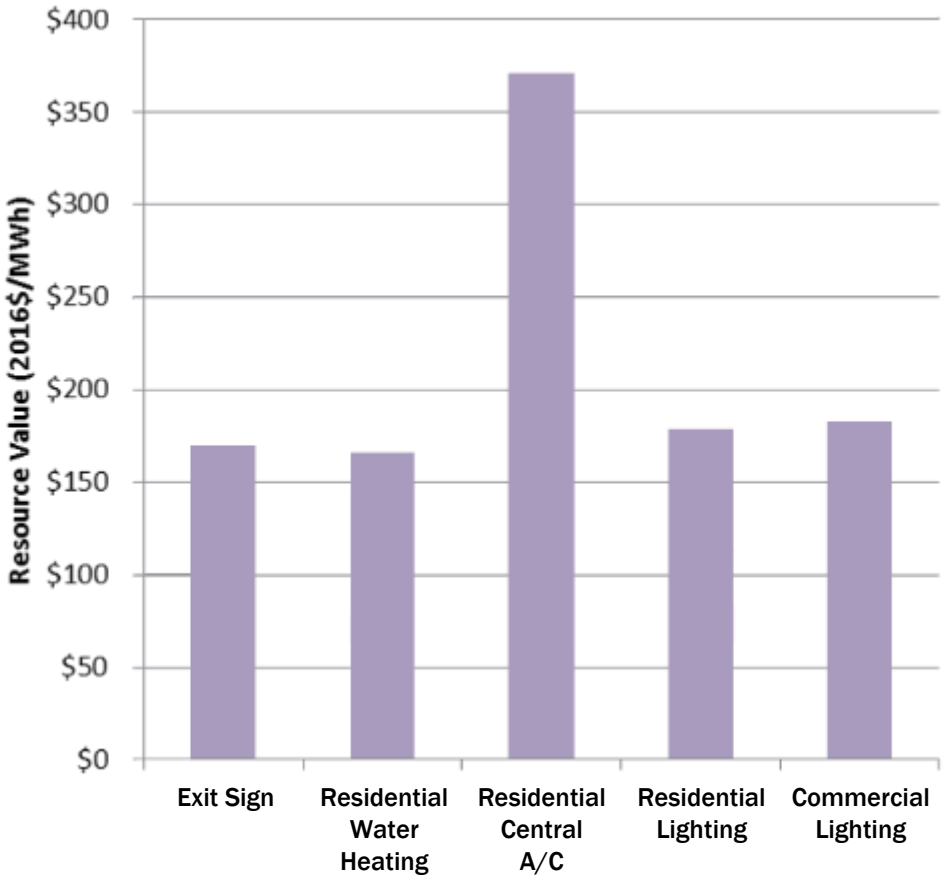
Source: Navigant

Time Isn't Always on Our Side

Hourly Residential Cooling Cost Totals by Climate Zone in 2018 (May-Sep)



Not All Energy Efficiency is Equally Valuable



Time-varying value of energy efficiency savings by load shape

(Massachusetts case study, reflects publicly available data only)

Source: *Time-Varying Value of Electric Energy Efficiency June 2017* N.Mims, T.Eckman & C.Goldman, LBNL, for BTO

Flexible Building Loads

Provide options to increase electricity system reliability & energy affordability

Support all generation options resulting from grid modernization

Optimize energy use based on customer preferences

Respond to innovations in the energy economy

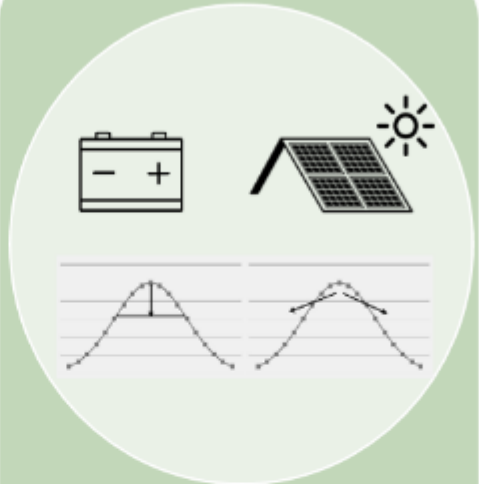
Key Aspects of a Grid-Interactive Efficient Building

Smart

Sensing, control, analytics co-optimize efficiency, flexibility, and occupant needs

Connected

Two-way communication with flexible technologies, grid, occupants



Flexible

Flexible loads, DG/DERs/storage can reduce, shift, modulate grid-level energy use

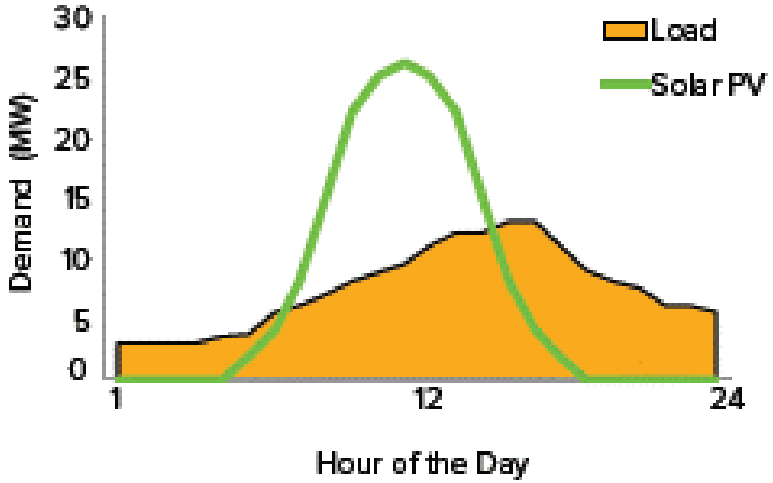
Efficient

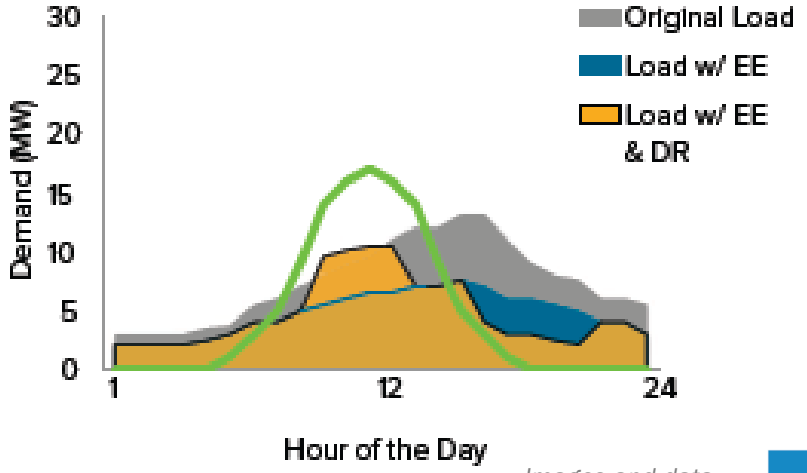
Persistent low energy use minimizes demand on grid resources and infrastructure, save energy & money!

Impact on a Building's Energy Use

Solar PV

Energy Efficiency, Demand Response, then Solar PV





Images and data courtesy of PG&E

Flexible Building Services Provided by GEB

Efficiency

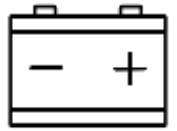
- Reduced overall demand, including during high-cost periods
- Efficient appliances, insulated envelope
- **Grid Service: Reduce generation and T&D upgrade**

Shed Load

- Reduced demand during generation balancing annual peak demand
- Thermostat setpoints; IT equipment
- **Grid Service: Reduce generation capacity, T&D upgrade**

Shift Load

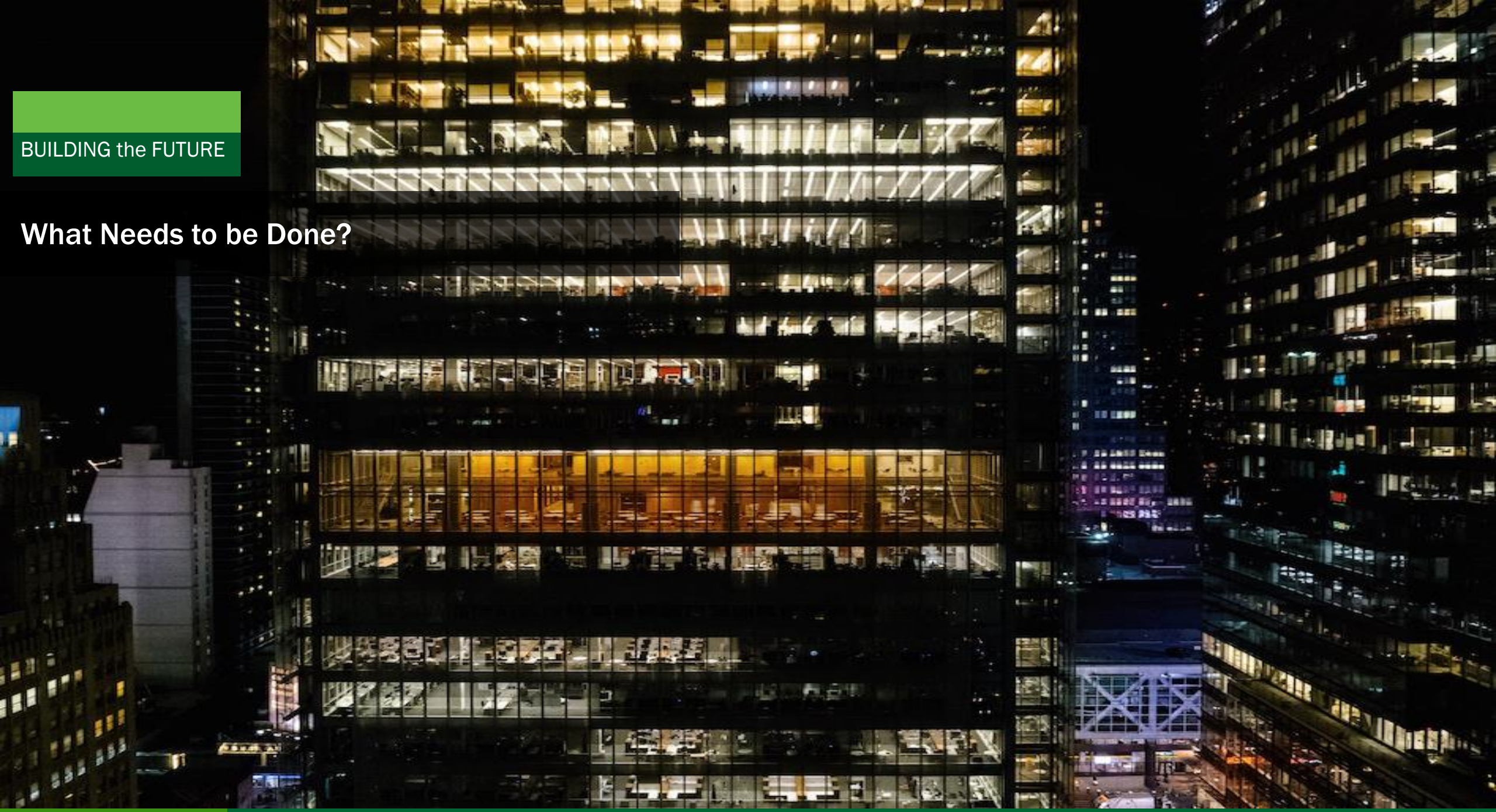
- Changes energy use to a different time
- Batteries, thermal mass and storage, smart appliances
- **Grid Service: Improve utilization of low-cost generation**



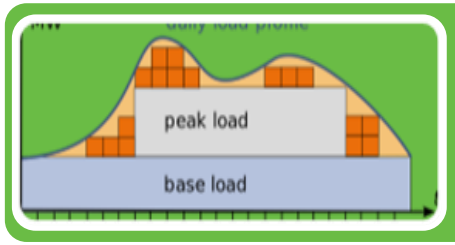
Modulate Load

- Modulates demand in response to a signal from grid
- SSLs, IT equipment, VFD equipment, batteries
- **Grid Service: Support frequency regulation**

What Needs to be Done?



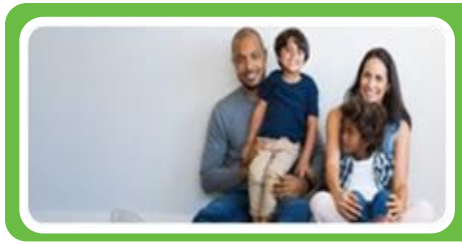
Benefits to States



✓ Potentially large approach to meeting grid modernization, energy, efficiency goals

✓ Increases reliability, resilience, flexibility of grid

✓ Enhances environmental performance of power system, including renewables integration and emissions goals



✓ Improves energy affordability, end users' options and competitiveness

BTO's Grid-interactive Buildings Portfolio

VALUE OF GEB

Key Question: *How do time & the interaction of flexibility options impact value / improve affordability?*

Outcome: *Identify values to stakeholders, quantification of national value.*

TECHNOLOGY OPTIONS

Key Question: *Which end use technologies provide solutions to specific grid needs?*

Outcome: *Prioritize technologies / solutions based on grid services.*

OPTIMIZATION FOR GEB

Key Question: *How to optimize for flexibility while maintaining or improving building operation /occupant comfort / productivity?*

Outcome: *Solutions that meet grid operator & building occupant needs.*

VALIDATION

Key Question: *Do technologies perform as predicted / meet grid operator & building occupant needs?*

Outcome: *Verification of technologies / strategies, increasing confidence in the value of energy flexibility.*

2019 BTO Planned Activities and Projects

✓ **Continued Feedback on Concept**

Flexible Building Loads Request For Information – Comments Due by March 1 at 5 p.m. Eastern

- https://eere-exchange.energy.gov/Default.aspx#Foaldd5fd318d-0a38-44fc-b1ab-aa54579c6177

- IEA *Modernising Energy Efficiency through Digitalisation*
- U.S. State/regulatory working group with states and utilities (right now, right here)
- Time-sensitive Valuation working group and webinars (Ongoing)
- BTO Peer Review (April, Washington, DC)
  - www.energy.gov/eere/buildings/building-technologies-office-2019-peer-review
- Multiple Technical Advisory Groups on GEB projects (Ongoing)
  - If interested in joining any project TAG, contact: monica.neukomm@ee.doe.gov

✓ **Refined Determination of Opportunity**

- GEB Technical Report Series (Drafts complete for BTO Peer Review in April)
  - If interested in reviewing drafts, contact: monica.neukomm@ee.doe.gov
- GEB Resource Potential (fall)

✓ **Upcoming Competitive Funding**

- Grid Modernization Lab Consortium – 2nd round of focus areas and projects (January)
- Inclusion in non-governmental and national lab competitive funding RFPs (spring/summer)

✓ **More to come!**

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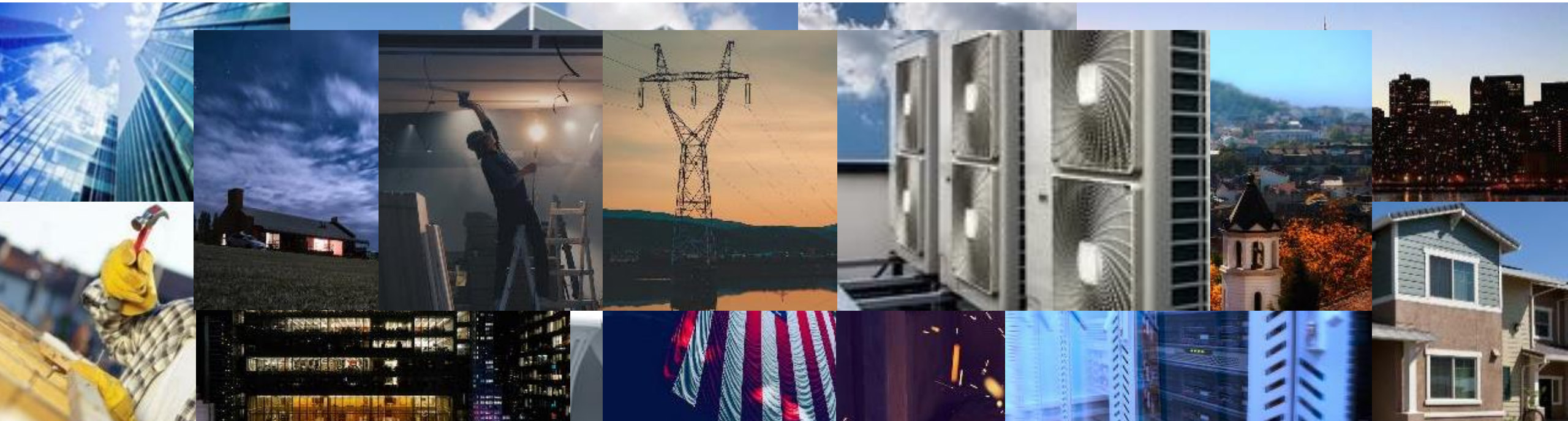

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National Association of State Energy Officials

NARUC
National Association of Regulatory Utility Commissioners

Winter Summit

NASEO-NARUC Grid-Interactive Efficient Buildings Working Group: Goals and Engagement

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National Association of Regulator Utility Commissioners

NARUC Winter Policy Summit
ERE Committee
February 11, 2019

NASEO-NARUC Grid-Interactive Efficient Buildings Working Group: Goals and Engagement

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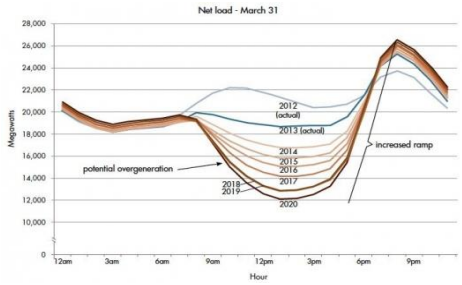
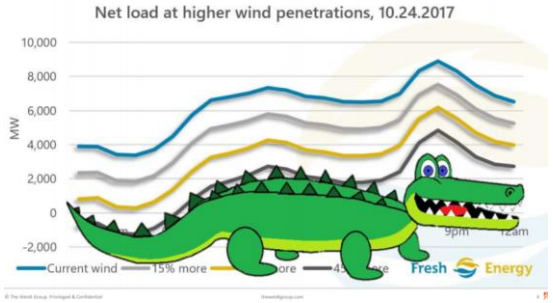
- Advancing technologies create opportunities for additional benefits:
  - More impactful and flexible load management
    - Reduce peak demand
    - Make buildings more flexible, or even dispatchable, to act as demand-side resources and virtual energy storage
    - Improve integration of variable resources (both distributed and grid-side) and distributed energy resources
    - Engage in transactive energy
  - Enhance energy efficiency
  - Enhance environmental performance.
  - Resilience benefits (to both grid and buildings/facilities)
  - Resource optimization (building/facility, distribution, grid) and cost savings (to businesses, households, grid)





NASEO-NARUC Grid-Interactive Efficient Buildings Working Group: Goals and Engagement

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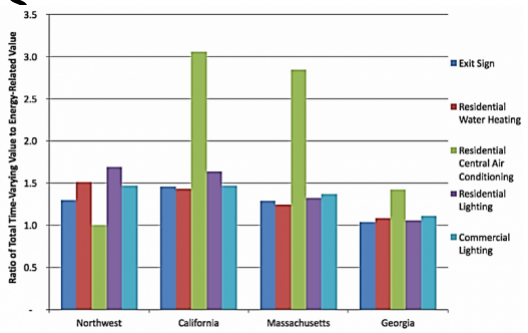
NASEO / NARUC / DOE think states would benefit from:

- Learning about GEB technologies, applications, and their scale and scope
- Identifying private and public sector expertise and resources
- Exploring opportunities and impediments (technical and non-technical)
- Sharing state priorities, concerns, interests
- Informing federal, private, and state RD&D decisions
- Recognizing temporal and locational value of energy efficiency and other distributed resources
- Clarifying electric system (consumer and grid-facing) requirements
- Enhancing energy system reliability, resilience, and affordability



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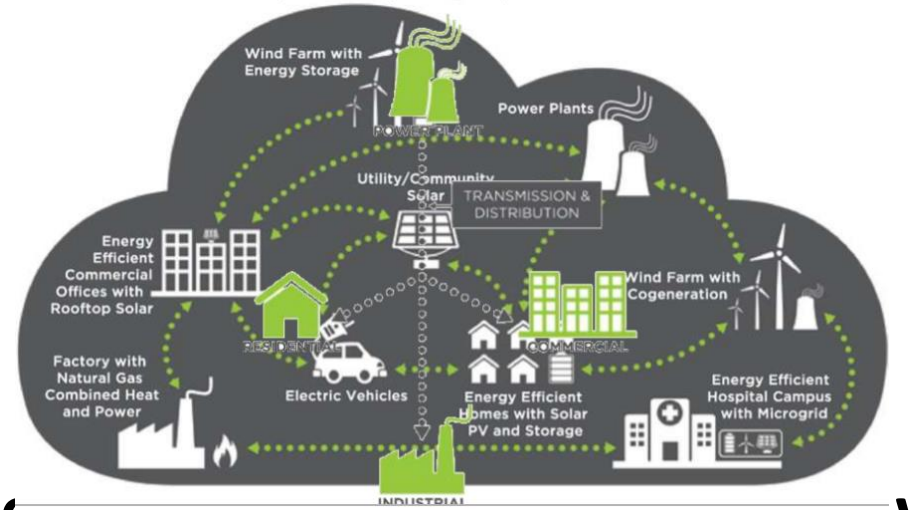

- How can we optimize facility interactions with the grid?
- How can states create policies, programs, and regulations to advance such optimization through GEB?

NASEO-NARUC Grid-Interactive Efficient Buildings Working Group: Goals and Engagement

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NASEO-NARUC GEB State Working Group (~10 states)

- **Members:** SEOs, PUCs, DOE, invited experts
- **Goals:**
  - Inform states on GEB research, technology, implementation
  - Identify state contexts that foster or hind
  - Market, economic, policy, regulatory
    - Receive feedback on priorities, interests,
  - Identify information needs, gaps
  - Inform RD&D priorities, potential pilots
- **Activities:**
  - Quarterly calls / webinars
  - Fall 2019 workshop
  - Likely at NASEO Annual Meeting, Sept. 15-18, Manhattan Beach, CA

NASEO-NARUC Grid-Interactive Efficient Buildings Working Group: Goals and Engagement

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NASEO / NARUC / DOE will develop supporting resources:

- Briefing papers
  - Technical and non-technical GEB considerations
  - One paper on residential sector GEB
- Scoping GEB roadmapping kit
  - Help states to explore GEB in their state contexts
- *Possible support for state pilots*
  - *Inform development of pilots to explore and address priority issues*
  - *Next slide*

NASEO-NARUC Grid-Interactive Efficient Buildings Working Group: Goals and Engagement

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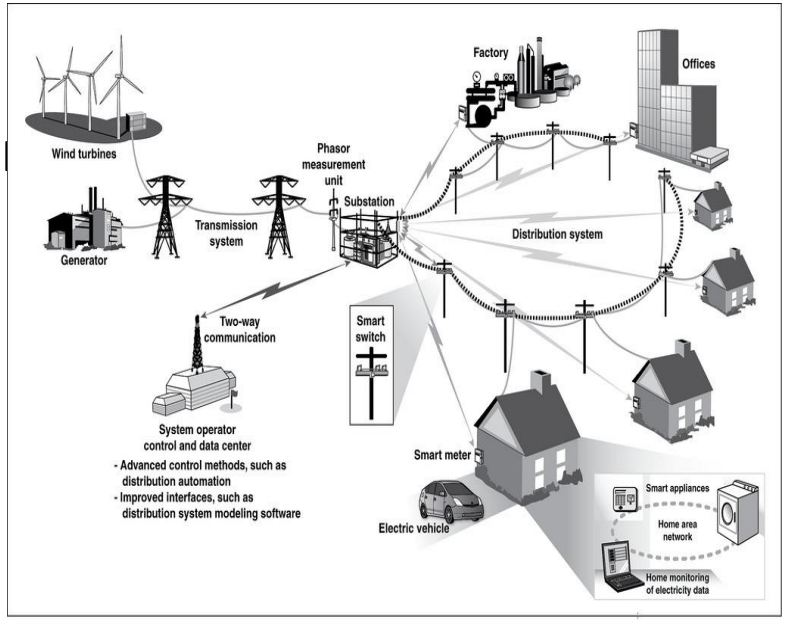
Potential National Laboratory direct assistance to scope pilots

- Outline elements, questions, considerations for GEB pilots and demos
- Support state convenings, research, technical consultations
- Identify policy and regulatory options & opportunities to facilitate GEB pilots/demonstration

- May lead to policy and regulatory pilots
- May lead to physical pilots/demonstratio



Source: GAO analysis.

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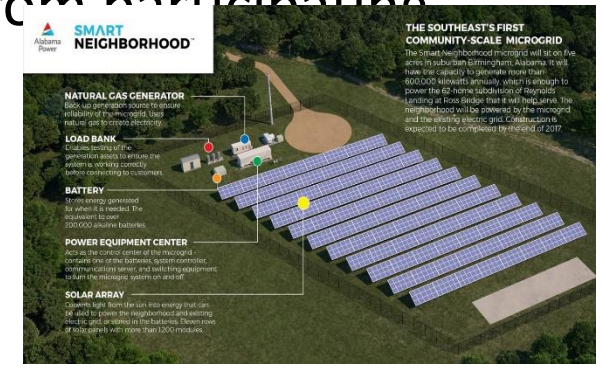
FYI: Complementary Utility GEB Working Group

- Managed by the American Council for an Energy-Efficient Economy (ACEEE)
- Peer network of utility energy efficiency, demand response, grid mod staff
  - Identify utility activities and regulatory issues that foster or hinder GEB integration
  - Inform RD&D and potential pilot projects and programs
- Utility engagement webinar series
- Opportunities for technical assistance by request from participating utilities



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- **State expression of interest due February 21**
  - Letter or e-mail from SEO and/or PUC with point of contact
    - *Please talk to each other!* (but don't need both to sign on)
  - Express desire to join the working group
    - Interests, concerns
    - What your state hopes to gain from and to contribute to the working group
    - Pertinent efforts underway or contemplated (projects, pilots, demonstrations, policy or regulatory actions, studies, roadmaps, etc.)

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Resources

- DOE GEB page https://www.energy.gov/eere/buildings/grid-interactive-efficient-buildings

- 2018 NASEO Annual Meeting (Detroit, MI) https://annualmeeting.naseo.org/agenda
  - Grid-Interactive Efficient Buildings: Energy Efficiency & Grid Optimization - David Nemtzow (U.S. DOE)
  - What's Next for Energy Efficiency: Grid Interaction - Chris Baker (The Weidt Group)
  - Grid Interactive Efficient Building - Jan Berman (PG&E)
  - Smart Neighborhood - James Leverette (Southern Co.)

Grid-Interactive Efficient Buildings:

Facilitating State-Supported Research Coordination and Analysis, and Development of State-Led Pilots

Questions/inquiries:

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Danielle Sass Byrnett dbyrnett@naruc.org

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