Committee on Energy Resources and the Environment

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

NARUC-NASEO Working Group Discussion

David Nemtzow
Director, Building Technologies Office
2/11/19
WHO WE ARE

Energy Efficiency & Renewable Energy

U.S. DEPARTMENT OF ENERGY

OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY
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 Use in the U.S. Building Sector

**Energy Use**
- Transportation: 27 Quads (0.4% Electric)
- Industrial: 31 Quads (31% Electric)
- Residential: 21 Quads (72% Electric)
- Commercial: 18 Quads (80% Electric)

**Building Electricity Use**
- Cooling: 13%
- Heating: 4%
- Water Heating: 5%
- Lighting: 10%
- Refrigerators: 11%
- Cooking: 2%
- Electronics: 10%
- Other Residential Appliances: 3%
- Other: 4%

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

Time Isn’t Always on Our Side

11X peak/off-peak ratio
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
<table>
<thead>
<tr>
<th><strong>VALUE OF GEB</strong></th>
<th><strong>TECHNOLOGY OPTIONS</strong></th>
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<tbody>
<tr>
<td><strong>Key Question:</strong> How do time &amp; the interaction of flexibility options impact value / improve affordability?</td>
<td><strong>Key Question:</strong> Which end use technologies provide solutions to specific grid needs?</td>
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<tr>
<td><strong>Outcome:</strong> Identify values to stakeholders, quantification of national value.</td>
<td><strong>Outcome:</strong> Prioritize technologies / solutions based on grid services.</td>
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<th><strong>OPTIMIZATION FOR GEB</strong></th>
<th><strong>VALIDATION</strong></th>
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<tbody>
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<td><strong>Key Question:</strong> How to optimize for flexibility while maintaining or improving building operation / occupant comfort / productivity?</td>
<td><strong>Key Question:</strong> Do technologies perform as predicted / meet grid operator &amp; building occupant needs?</td>
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<tr>
<td><strong>Outcome:</strong> Solutions that meet grid operator &amp; building occupant needs.</td>
<td><strong>Outcome:</strong> Verification of technologies / strategies, increasing confidence in the value of energy flexibility.</td>
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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#FoaIdd5fd318d-0a38-44fc-b1ab-aa54579c6177](https://eere-exchange.energy.gov/Default.aspx#FoaIdd5fd318d-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)
- 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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NASEO-NARUC Grid-Interactive Efficient Buildings Working Group: Goals and Engagement

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Director, Center for Partnerships & Innovation
National Association of Regulator Utility Commissioners

NARUC Winter Policy Summit
ERE Committee
February 11, 2019
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

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
• 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 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 hinder
  - Market, economic, policy, regulatory
  - Receive feedback on priorities, interests, concerns
  - 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 / 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
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/demonstration
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
NASEO-NARUC Grid-Interactive Efficient Buildings Working Group: Goals and Engagement

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

Resources


• 2018 NASEO Annual Meeting (Detroit, MI) [https://annualmeeting.naseo.org/agenda](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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