NASEO-NARUC Grid-Interactive Efficient Buildings Working Group

Action Steps for States: Moving Towards a Future With Demand Flexibility

August 13, 2019 3:00 pm ET

Welcome and NASEO-NARUC GEB Working Group

***Rodney Sobin**, NASEO, Senior Program Director*

Grid-interactive Efficient Buildings Summary

***Monica Neukomm**, U.S. Department of Energy*

Action Steps for States: Moving Towards a Future With Demand Flexibility

***Lisa Schwartz**, Deputy, Energy Markets & Policy Group, Energy Analysis & Environmental Impacts Division, Lawrence Berkeley National Laboratory*

Q&A

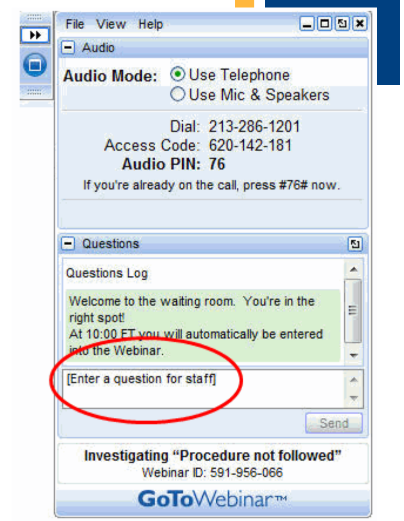
NASEO
National Association of State Energy Officials

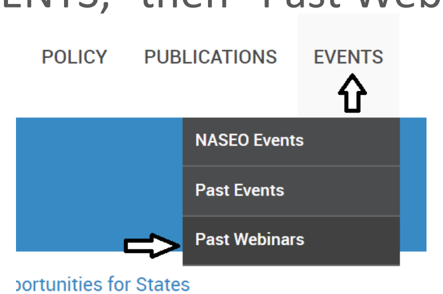
Action Steps for States: Moving Towards a Future With Demand Flexibility

August 13, 2019 3:00 pm ET

Logistics:

- All attendees are muted.
- Please use the GoToWebinar question box to ask questions or “raise hand” to be recognized and unmuted.
- Webinar recording and slides will be posted.
  - Access via NASEO webpage (www.naseo.org); go to “EVENTS,” then “Past Webinars”

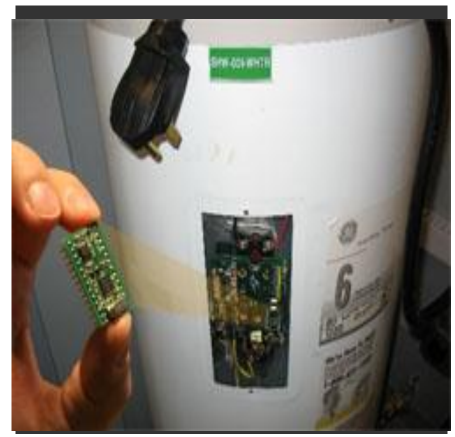




+

Grid-Interactive Efficient Buildings: NASEO-NARUC Working Group

NASEO
National Association of State Energy Officials

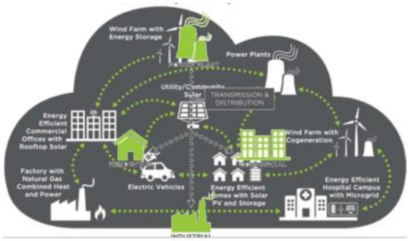


Rodney Sobin
Senior Program Director
National Association of State Energy Officials

Webinar
August 13, 2019

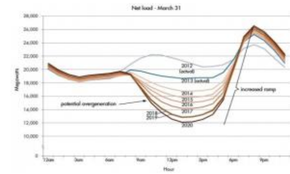
+ Grid-Interactive Efficient Building Opportunities

- Advancing technologies open opportunities for more flexible building/facility load management:
  - Reduce costs, enhance resilience, reduce emissions
  - Reduce peaks, moderate ramp rates, provide grid services
  - Enhance energy efficiency
  - Integrate distributed and renewable resources



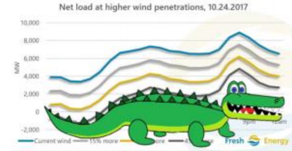
- **How can we optimize facility interactions with the grid?**
- **How can states fashion policies, programs, and regulations to advance such optimization through GEB?**
- **What are roles for states, facility operators, utilities, product and service providers, and others?**

+ NASEO-NARUC Grid-Interactive Efficient Buildings Working Group



- NASEO-NARUC GEB Working Group
  - Supported by U.S. DOE BTO
  - Inform states about GEB technologies and applications
  - Identify opportunities and impediments
    - Non-technical and technical
  - Identify and express state priorities, concerns, interests
  - Recognize temporal and locational value of EE and other DERs
  - Enhance energy system reliability, resilience, and affordability

  - **Inform state planning, policy, regulations, and programs**
    - Advance potential roadmaps and pilots
    - National Lab technical assistance



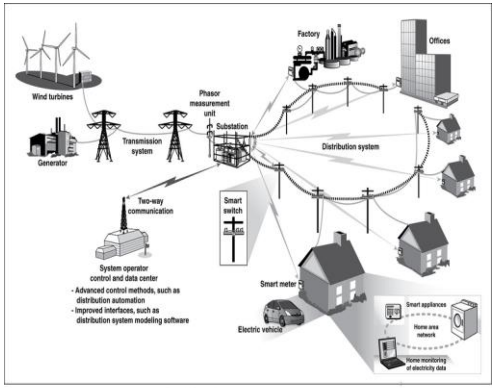
+ NASEO-NARUC Grid-Interactive Efficient Buildings Working Group

- NASEO-NARUC GEB Working Group
  - Webinar series—available to all states
  - Briefing papers—non-technical and technical considerations

  - Working Group state engagement
    - State specific calls
    - Topical exchanges
    - **Workshop at NASEO Annual Meeting, Sept 16, 2019**
  - Scoping of model GEB road mapping kit
    - Help states explore GEB in their state contexts
  - Scoping potential state pilots
    - Inform development of pilots to explore priority issues

+ NASEO-NARUC Grid-Interactive Efficient Buildings Working Group

- Potential National Laboratory help for Working Group states
  - Scope potential pilots, roadmaps
    - Outline elements, questions, considerations for GEB pilot projects
    - Support state convenings, research, technical consultations
    - Identify policy and regulatory options to facilitate GEB pilots/demonstration
    - Can lead to policy and regulatory pilots
    - Can lead to physical pilots/demonstrations



Source: GAO analysis.

NASEO-NARUC Grid-Interactive Efficient Buildings Working Group

- Working Group co-chairs:
  - Kaci Radcliffe, Oregon Dept. of Energy
  - Hanna Terwilliger, Minnesota PUC staff
- Working Group states:

Colorado	New Jersey
Connecticut	New York
Florida	Oregon
Hawaii	South Carolina
Massachusetts	Tennessee
Michigan	Virginia
Minnesota	Wisconsin

NASEO-NARUC Grid-Interactive Efficient Buildings Working Group

https://naseo.org/issues/buildings/naseo-naruc-geb-working-group

Questions/inquiries:

Rodney Sobin rsobin@naseo.org and Maddie Koewler mkoewler@naseo.org

Danielle Sass Byrnett dbyrnett@naruc.org

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Grid-interactive Efficient Buildings Summary

Monica Neukomm

Building Technologies Office, DOE

www.energy.gov/eere/buildings/geb

Grid-interactive Efficient Buildings and Demand Flexibility

Grid-interactive Efficient Building	An energy efficient building that uses smart technologies and DERs to provide demand flexibility for grid services, occupant needs and preferences, and cost reductions in an optimized way	Demand Flexibility*	Capability provided by DERs to adjust load profiles across different timescales

Distributed energy resource – A resource sited close to customers that can provide all or some of their immediate power needs and can be used by the utility system to either reduce demand (e.g., energy efficiency) or provide supply (e.g., solar PV, CHP) to satisfy the energy, capacity or ancillary service needs of the grid

Smart technologies for energy management - Advanced controls, sensors, models and analytics used to manage a range of energy assets, while responding to changing ambient and grid conditions, saving energy and meeting occupants requirements

** "Load flexibility" may be used interchangeably with demand flexibility*

Key Characteristics of GEB

EFFICIENT

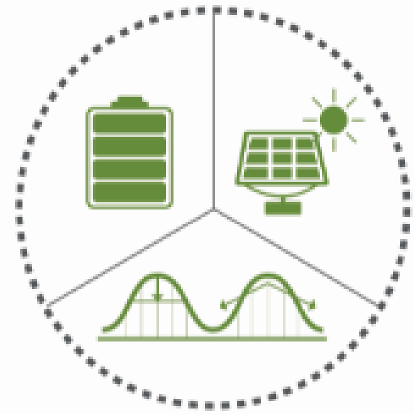
Persistent low energy use minimizes demand on grid resources and infrastructure

CONNECTED

Two-way communication with flexible technologies, the grid, and occupants

SMART

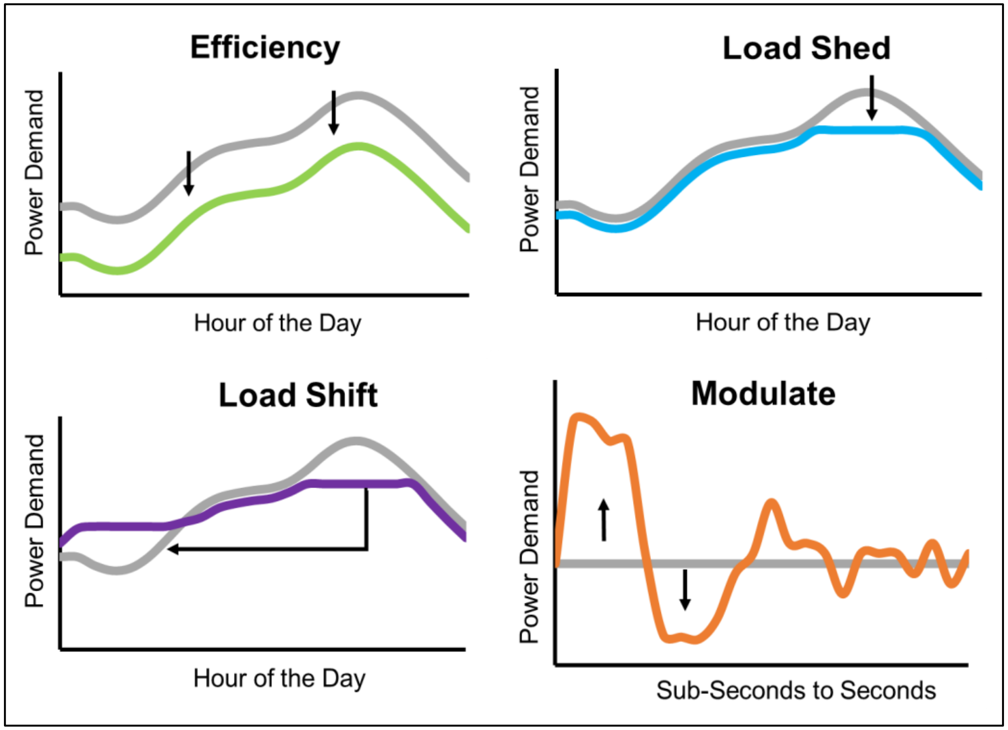
Analytics supported by sensors and controls co-optimize efficiency, flexibility, and occupant preferences

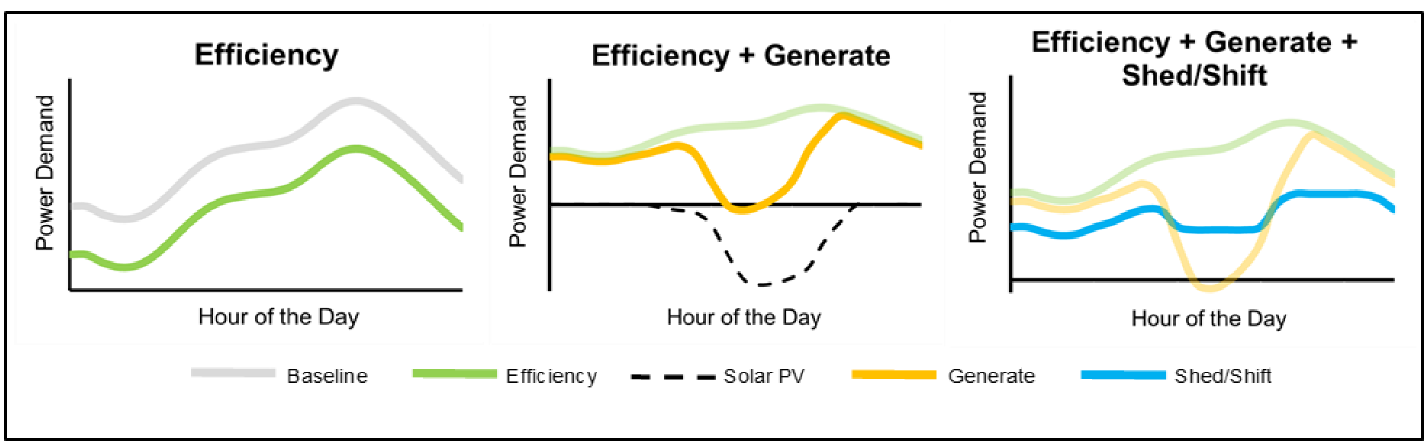


FLEXIBLE

Flexible loads and distributed generation/storage can be used to reduce, shift, or modulate energy use

Load management strategies possible with GEB





Report series underway to address key state and local government opportunities for Grid-interactive Efficient Buildings

In partnership with

Lawrence Berkeley National Lab

About SEE Action

- Professional network of state and local governments and their stakeholders, energy experts and industry representatives
- Facilitated by the US DOE Office of Energy Efficiency and Renewable Energy, Office of Electricity, and US EPA Climate Protection Partnerships Division

www.seeaction.energy.gov

1 Introduction

- Key technology trends
- Value proposition for grid & customers
- Critical actors and their emerging opportunities

2 Assessing Value

- Valuing demand flexibility
- Methods to determine economic value of services provided by GEBs
- Implementation considerations

3 Assessing Performance

- Audiences/needs for performance data
- Practices and protocols, data and analytical tools that are needed
- Putting assessments into practice

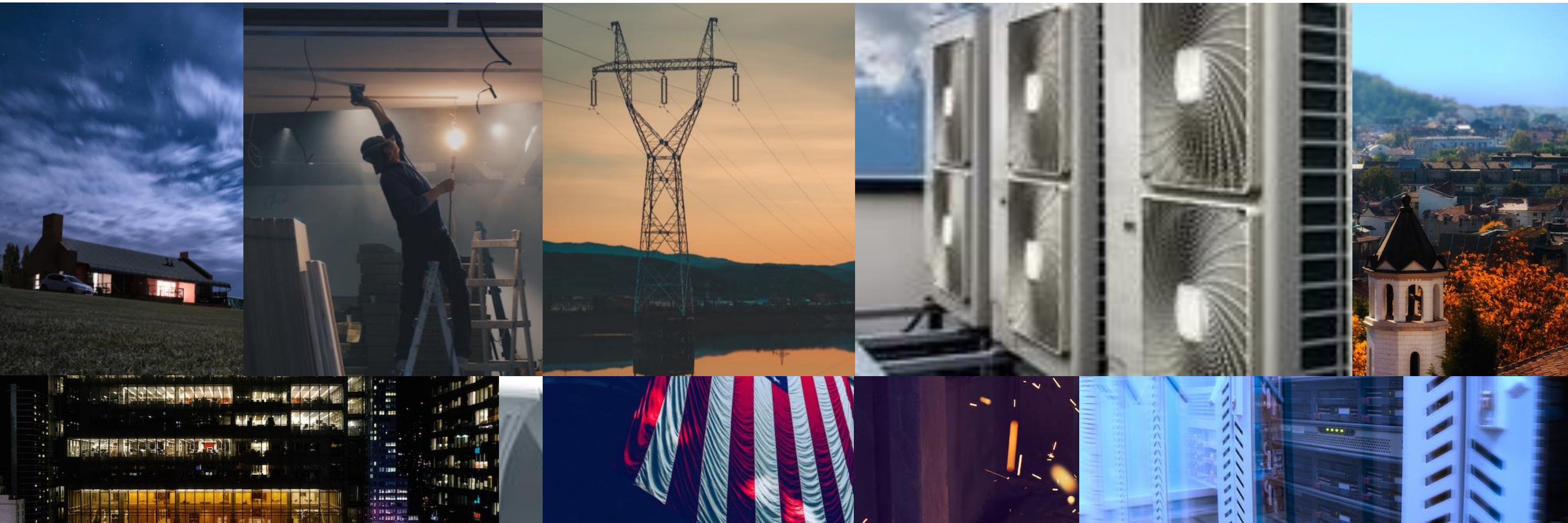
Other reports TBD

MONICA NEUKOMM

monica.neukomm@ee.doe.gov

Building Technologies Office, U.S. DOE

www.energy.gov/eere/buildings/geb



Action Steps for States: Moving Towards a Future With Demand Flexibility

Lisa Schwartz, Electricity Markets and Policy Group

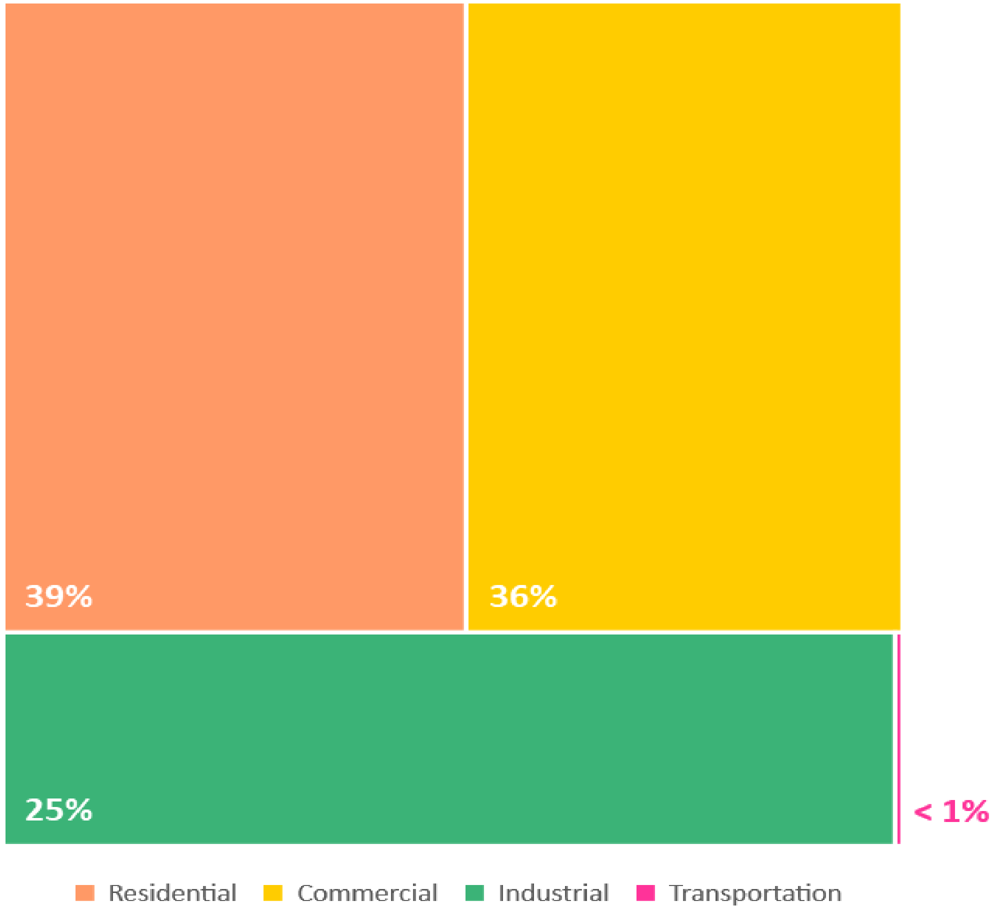
NASEO-NARUC Grid-interactive Efficient Buildings Working Group webinar

August 13, 2019

This presentation was supported by the U.S. Department of Energy's Building Technologies Office under Lawrence Berkeley National Laboratory Contract No. DE-AC02-05CH11231

Electricity Use by U.S. Buildings

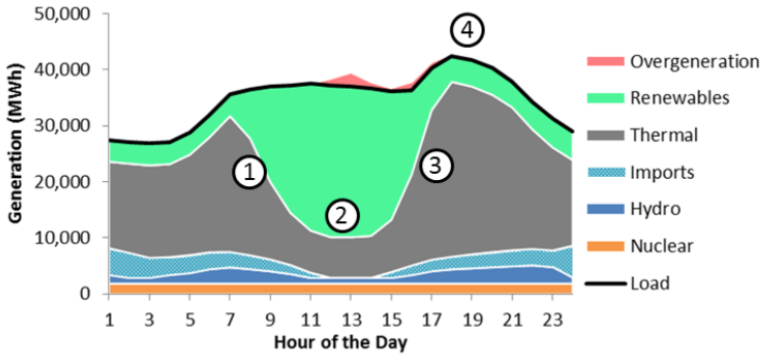
- Buildings account for 75 percent of electricity consumption and in some regions up to 80 percent of peak demand.
- With many adjustable loads, buildings also represent the largest source of demand flexibility.

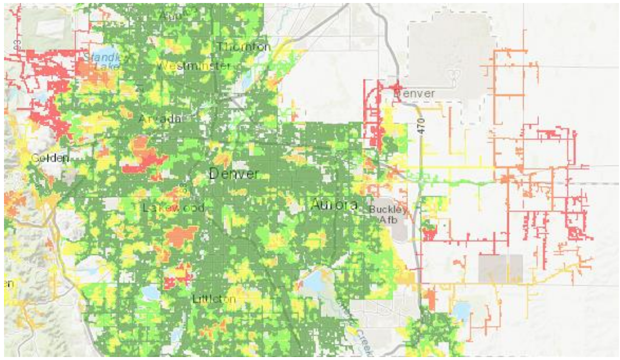


U.S. Energy Information Administration (EIA), Monthly Energy Review. June 2019, Table 7.6

Demand Flexibility and State Goals

- Helps meet multiple state policy goals
  - Energy-related goals like resilience and reliability, energy affordability, emissions, energy efficiency, renewable energy generation, electrification, energy security, grid modernization
  - Other goals such as economic development and critical infrastructure
- Reduces stress on grid
  - Growth in peak demand
  - Infrastructure constraints for T&D systems
  - Increasing share of variable renewable generation — utility-scale and distributed
  - Electrification of space and water heating, industrial processes and transportation
- Provides higher value than traditional grid solutions with additional benefits:
  - For consumers — e.g., asset value, more control over energy use
  - For society — e.g., jobs, energy security, resilience, environmental and public health benefits
- Improves building performance
  - States can lead by example to reduce energy waste, emissions, and electricity costs and improve resilience.





Top figure: High levels of variable renewable generation increase multi-hour ramping (1, 3) and intra-hour variability and short duration ramps (1-4) for thermal power plants. Generation also may be curtailed (2).
Bottom figure: This map of the Denver area indicates areas where only limited (orange) or no (red) solar PV can be installed without infrastructure upgrades or additional demand flexibility.

Key Actions States (and Local Governments) Can Take to Advance Demand Flexibility

	Gov. Office	PUC	SEO	Other Agencies*	City/County	Utilities	RTO/ISO	Bldg. owners**
1. Gather Information and Identify Opportunities								
• Consider how demand flexibility can support goals	●	●	●	●	●	●	●	●
• Inventory options and select opportunities for early action	●	●	●	●	●	●	●	●
• Participate in pilot projects and share best practices		●	●	●	●	●		●
2. Develop and Implement Strategies to Integrate Demand Flexibility								
• Develop a roadmap to advance demand flexibility	●	●	●	●	●	●	●	●
• Develop mechanisms to allow building owners, operators and occupants to earn compensation for providing grid services		●	●			●	●	●
• Conduct outreach and education about opportunities and benefits		●	●	●	●	●	●	●
3. Accelerate Adoption								
• Assess and remove barriers to advancing demand flexibility in buildings for grid services***	●	●	●	●	●	●	●	●
• Update economic valuation methods for DERs as energy assets for utility programs, plans and procurements***		●				●		●
• Establish practices for robust and cost-effective assessments of demand flexibility performance***		●	●	●	●	●	●	●
• Regularly assess and report on progress	●	●	●	●	●	●	●	●

**For example, state departments of general services, codes, environment, economic development, and transportation, and financing authorities*

***Best opportunities for owners and operators of privately owned buildings to support state and local activities*

****Subject of forthcoming SEE Action reports.*

Example: Steps for Getting Started

	Gov. Office	PUC	SEO	Other Agencies*	City/County	Utilities	RTO/ISO	Bldg. owners**
1. Gather Information and Identify Opportunities								
Consider how demand flexibility can support goals								
• Catalog ways demand flexibility can help achieve energy-related goals (e.g., resilience and reliability, energy affordability, emissions, energy efficiency, integrating variable renewable generation, electrification, energy security, grid modernization) and other aims (e.g., economic development, critical infrastructure)	●	●	●	●	●	●	●	
• Establish team to consider how demand flexibility can contribute to achieving these goals	●	●	●	●	●	●	●	●
Inventory options and select opportunities for early action								
• Catalog existing pilots, standards, programs, procurements, policies and regulations that address demand flexibility		●	●	●	●	●	●	●
• Consider ways to further integrate demand flexibility in these areas (e.g., lead by example, building operator training, energy savings performance contracting, benchmarking and transparency, DER incentives, smart cities, performance standards for existing buildings, state building energy codes and appliance standards)	●	●	●	●	●	●	●	●
• Identify planning processes that can address demand flexibility goals (e.g., integrated resource plans, efficiency and other DER plans, and plans for distribution systems, transmission expansion, grid modernization, transportation electrification, resilience, energy security) and initial integration steps		●	●	●	●	●		
• Identify DER requirements that may need updating (e.g., revising energy efficiency resource standards to also target peak demand savings, modernizing demand response requirements to better integrate variable renewable generation and EVs, requirements for participating in electricity markets)	●	●	●	●	●	●	●	

	Gov. Office	PUC	SEO	Other Agencies*	City/County	Utilities	RTO/ISO	Bldg. owners**
Participate in pilot projects and share best practices								
• Identify opportunities to collaborate on test beds for individual buildings, campuses, and commercial developments to gain experience, validate demand flexibility performance, and demonstrate value to the utility system and building owners and operators		●	●	●	●	●		●
• Conduct pilots for public buildings and campuses to test demand flexibility technologies and microgrids		●	●	●	●	●		●
• Test approaches for hard to reach audiences, including low-income households and small and medium commercial buildings		●	●	●	●	●		●
• Share results across the jurisdiction and in regional and national forums		●	●	●	●	●		●

Example Strategies to Integrate Demand Flexibility: Develop a Roadmap

	Gov. Office	PUC	SEO	Other Agencies	City/County	Utilities	RTO/ISO	Bldg. owners
2. Develop and Implement Strategies to Integrate Demand Flexibility								
Develop a roadmap to advance demand flexibility								
• Engage key stakeholders (e.g., third-party program administrators, DER service providers, DER aggregators, contractors, consumer representatives, trade associations for building owners and operators, energy service companies) and use public meetings to discuss strategies	●	●	●	●	●	●	●	●
• Establish principles (e.g., related to cost-effectiveness, consumer and utility system benefits, equity, resilience)	●	●	●	●	●	●		
• Create a comprehensive and collaborative approach with steps to advance demand flexibility through programs, planning processes, standards, policies and regulations (e.g., through a Governor's executive order, MOU across agencies, multistate partnership)	●	●	●	●	●	●	●	
• Estimate benefits and costs to determine cost-effective achievable potential of demand flexibility for residential and commercial buildings and best opportunities for action		●	●	●	●	●	●	●
• Make a public commitment toward achieving this potential with specific multiyear targets	●	●	●	●	●	●		
• Develop interim and long-term metrics for measuring progress	●	●	●	●	●	●	●	
• Update roadmap on a regular schedule (e.g., every three years)	●	●	●	●	●	●	●	●

Example for Accelerating Adoption:

	Gov. Office	PUC	SEO	Other Agencies	City/County	Utilities	RTO/ISO	Bldg. owners
3. Accelerate Adoption								
Assess and remove barriers to advancing demand flexibility in buildings for grid services								
• Technical (e.g., requisite building technologies and utility systems, cybersecurity, lack of integrated design and system approaches)		●	●	●	●	●	●	●
• Financial (e.g., cost-effectiveness, inadequate compensation through utilities or markets, upfront cost)	●	●	●	●	●	●	●	●
• Regulatory, market and other institutional barriers (e.g., restrictions on DER aggregation and participation, lack of compensation mechanisms, data access provisions and data privacy concerns, siloed DER programs, procurement provisions)	●	●	●	●	●	●	●	●
• Other (e.g., split incentives for building owners and tenants, lack of motivation and energy focus for building operators, workforce training needs)	●	●	●	●	●	●	●	●
• Determine which barriers are critical to address and develop strategies to overcome them	●	●	●	●	●	●	●	●

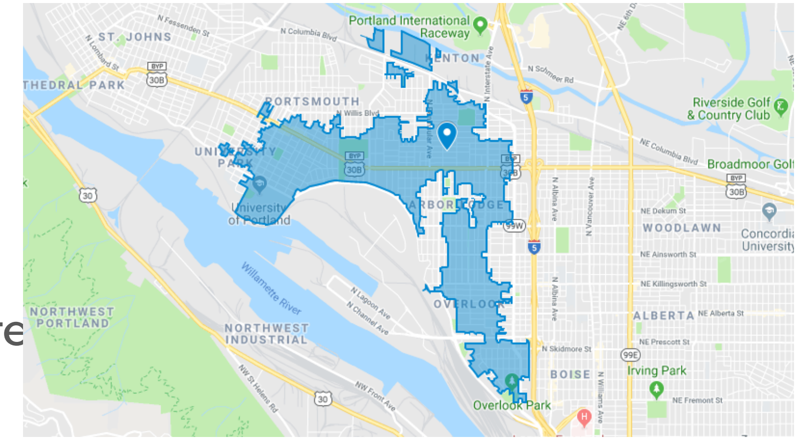
Potential Demand Flexibility Barriers for Utility Programs and Organized Markets

	Utility Programs	Organized Markets
Understanding the consumer value proposition for demand flexibility	☐	☐
Characterization of technical, economic, and achievable potential of demand flexibility by market sector, flexibility mode and grid service	☐	☐
Alignment of retail rate design, and utility program incentives and market compensation mechanisms for demand flexibility, with time-sensitive and locational value for electricity systems	☐	☐
Disincentives and lack of financial motivation for utilities to use buildings as energy assets	☐	
Methods for benefit-cost analysis for grid modernization investments to facilitate demand flexibility, such as AMI, distribution automation, advanced distribution management systems, and DER management systems	☐	
Insufficient integration of demand flexibility programs within a single utility or RTO/ISO and across programs operated by different entities within a jurisdiction	☐	☐
Lack of coordination between utilities and RTOs/ISOs (e.g., double-counting potential and conflicting rules, roles and responsibilities)	☐	☐
Constraints on third-party aggregation of DERs	☐	☐
Enhancements needed for economic valuation methods for planning and analysis	☐	☐
Updated practices needed to assess performance of demand flexibility	☐	☐
Data access provisions and data privacy concerns	☐	☐
Barriers to entry for DERs to compete in centrally-organized wholesale markets for energy, capacity and ancillary services, if DERs can meet grid service requirements		☐
Integration of demand flexibility within and across integrated resource planning, distribution system planning and transmission expansion planning	☐	
DER-specific issues (see backup slide)	☐	☐

Some Opportunities to Overcome Barriers

- **Studies** — e.g., consumer preferences, cost-effective achievable potential
- **Enhanced analytical methods and practices** — e.g., for valuation and performance assessment
- **Model standards** — e.g., for data access and privacy
- **Pilots** — e.g., to test new rate and program designs *(see next slide)*
- **Programs for residential and commercial buildings** — e.g., utility and state energy office programs
- **Financial incentives for utilities** — e.g., performance incentive mechanisms; multiyear rate plans (performance-based regulation)
- **Building energy codes and appliance standards**
- **Voluntary regional or national coordination** — e.g., regional organizations of states, multistate memorandum of understanding, national working groups
- **Governor's executive orders** — To get new programs going and coordinate across state agencies
- **PUC proceedings**
- **State legislative action** — e.g., to remove barriers to third-party aggregation while preserving consumer protection, to mandate data access for consumers and their designated third parties

Example utility pilot: Portland General Electric Test Bed



- Demand flexibility during peak events: summer/winter
- Residential customers
  - T'stats, direct load control, heat pump water heaters, EV chargers, battery storage
  - Value propositions
  - Peak time rebate
- Small and medium businesses
  - Direct installation of smart thermostats
  - Plans to add EV charging and storage
  - Coordinating with Energy Trust of Oregon on efficiency and solar incentives
- Focusing on neighborhoods served by 3 distribution substations
- Systemwide, targeting 69 MW of demand flexibility in summer and 77 MW in winter to fill a 2021 capacity gap identified in Integrated Resource Plan

https://www.portlandgeneral.com/our-company/energy-strategy/smart-grid/smart-grid-test-bed
https://edocs.puc.state.or.us/efdocs/UAA/uaa173123.pdf
https://www.portlandgeneral.com/-/media/public/documents/rate-schedules/sched_013.pdf

Lisa Schwartz, Deputy Leader

Electricity Markets and Policy Group

lcschwartz@lbl.gov; 510-486-6315

Visit our website at: http://emp.lbl.gov/
Click here to join the Berkeley Lab Electricity Markets and Policy Group mailing list and stay up to date on our publications, webinars and other events. Follow the Electricity Markets and Policy Group on Twitter @BerkeleyLabEMP

Extra slides

Potential DER-Specific Demand Flexibility Barriers

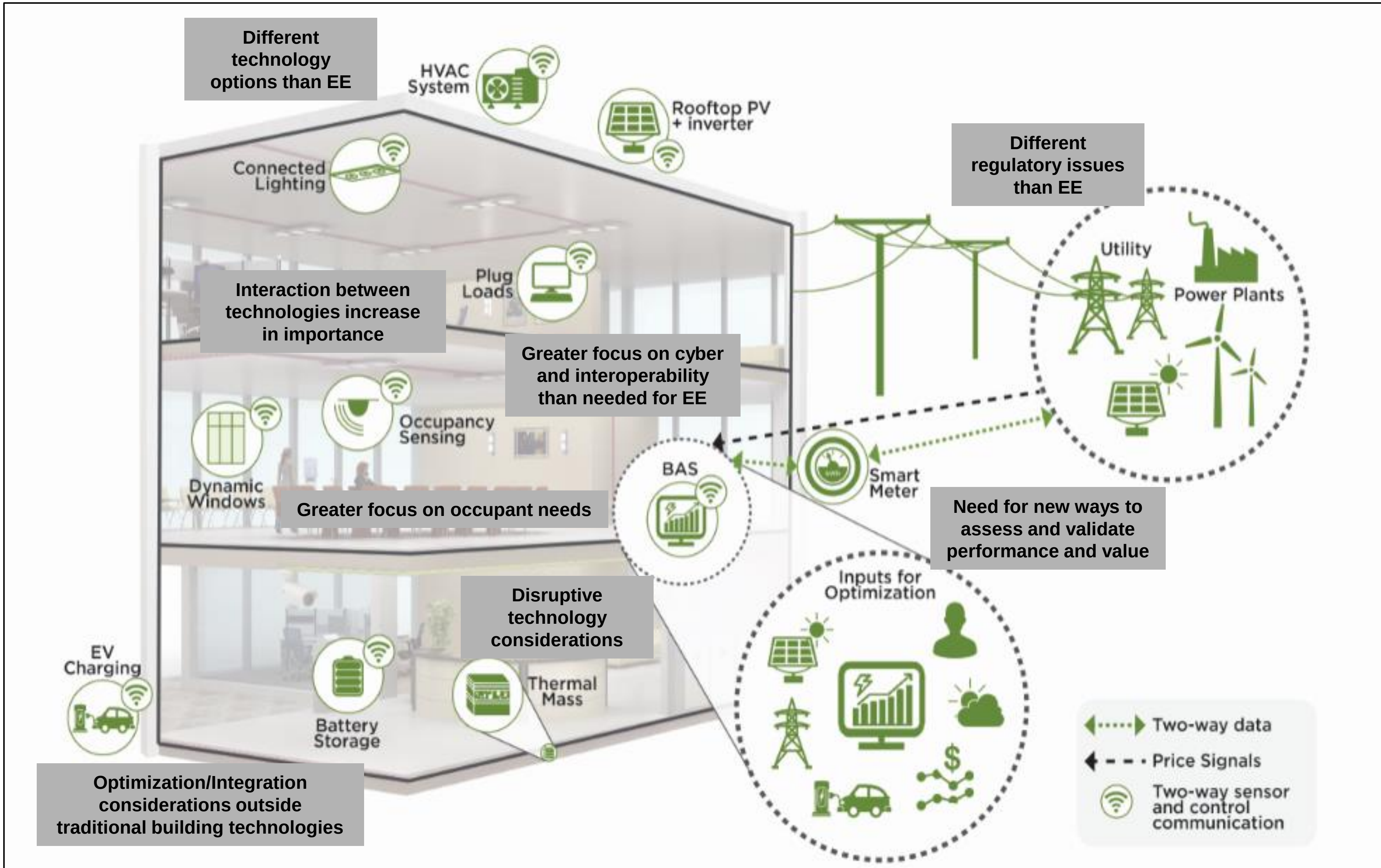
- **Storage** – Multiple classifications as a grid asset (generation, transmission, distribution or load), market versus rate-based services (and federal versus state regulation), monetizing value streams, ownership models, compensation structures, and requirements for duration and cycling

- **Distributed generation** (e.g., combined heat and power systems and solar PV) – Interconnection standards, procedures and agreements; compensation; standby rates; and treatment in state resource standards and centrally-organized wholesale markets

- **Demand response** – Lack of defined need, valuation and pricing issues, lack of dispatchability for some forms of demand response, AMI not deployed

- **Energy efficiency** – Upfront capital required, insufficient information, unpriced impacts, and split incentives ("principal-agent problem") — e.g., between building owners who purchase energy-consuming equipment and occupants who pay energy bills, and between builders focused on first costs and future owners also concerned about ongoing operating costs

Grid-interactive Efficient Building



Demand Flexibility Benefits

Benefit	Utility System	Building Owners/Occupants
Reduced operation & maintenance costs	✓	-
Reduced generation capacity costs	✓	-
Reduced energy costs	✓	-
Reduced T&D costs	✓	-
Reduced T&D losses	✓	-
Reduced ancillary services costs	✓	-
Reduced environmental compliance costs	✓	-
Increased resilience	✓	✓
Increased DER integration	✓	✓
Improved power quality	-	✓
Reduced owner/occupant utility bills	-	✓
Increased owner/occupant satisfaction	-	✓
Increased owner/occupant flexibility and choice	-	✓

Example Grid Services That Buildings With Demand Flexibility Can Provide

Grid Services	Potential Costs Avoided (or Deferred)
Generation	
Energy	Power plant fuel, operation and maintenance (O&M), and startup and shutdown costs
Capacity	Capital costs for new generating facilities and associated fixed O&M costs
Ancillary Services	
Contingency Reserves	Power plant fuel and O&M costs
Frequency Regulation	Power plant fuel and O&M costs
Ramping	Power plant fuel, O&M, and startup and shutdown costs
Delivery	
Non-Wires Solutions	Capital costs for transmission & distribution (T&D) equipment upgrades
Voltage Support	Capital costs for voltage control equipment (e.g., capacitor banks, transformers)