NASEO National Association of State Energy Officials

NARUC National Association of Regulatory Utility Commissioners

NASEO-NARUC Grid-Interactive Efficient Buildings Working Group:

DF/GEB and Electrification in Building Energy Codes and Performance Standards

May 11, 2022, 3:00 pm ET

Welcome: ***Rodney Sobin****, NASEO and* ***Danielle Sass Byrnett****, NARUC*

State and Local Building Policies and Programs for Energy Efficiency and Demand Flexibility

Rodney Sobin*, NASEO*

DF/GEB and Electrification in Building Energy Codes and Performance Standards:

Chris Perry*, Engineer, Building Technologies Office, U.S. DOE*

Ellen Franconi*, Sr. Energy Research Engineer, Pacific Northwest National Laboratory*

States updates and discussion

Wrap-up and Upcoming

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Logistics:

- Please mute when not speaking
- This Forum is meant to be interactive – we encourage discussion. Please use “raise hand” to be recognized. Chat function also available.
- We will record for internal use only; will *not* be disseminated.

NASEO-NARUC Grid-Interactive Efficient Buildings Working Group

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

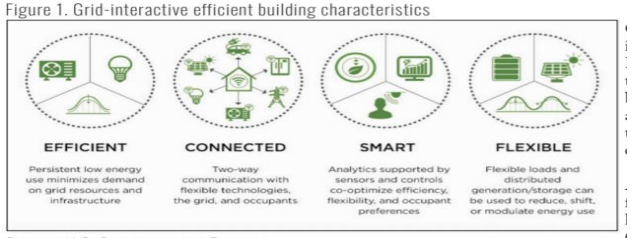
- Working Group co-chairs:
  - Gail Suzuki-Jones, Hawaii State Energy Office
  - Hanna Terwilliger, Minnesota PUC staff

- Working Group – 27 states:

Arkansas	Maryland	Oregon
Arizona	Massachusetts	South Carolina
California	Michigan	Tennessee
Colorado	Minnesota	Utah
Connecticut	Mississippi	Virginia
Florida	Nebraska	Washington
Georgia	New Jersey	Wisconsin
Hawaii	New York	Wyoming
Idaho	Pennsylvania	
Illinois		

Inquiries: GEB@naseo.org

Figure 1. Grid-interactive efficient building characteristics



Source: U.S. Department of Energy

NASEO-NARUC Grid-Interactive Efficient Buildings Working Group

https://www.naseo.org/issues/buildings/naseo-geb-resources

Upcoming

- Future GEB Working Group Forums:
  - July 13, 2022, 3:00-4:30 PM ET: Including demand flexibility and electrification in energy efficiency programs
  - September 14, 2022, 3:00-4:30 PM ET: Grid/distribution planning, including non-wires solutions

- LBNL, **The Role of Innovation in the Electric Utility Sector**, provides perspectives on innovation in the context of state regulation of utilities. Webinar May 12, 2022, 12 noon -1:30 p.m. ET

- NARUC, **Financial Toolbox on Electrification**, will address technology, economic, accounting, and customer considerations related to building electrification programs, including status and trends, cost-benefit approaches, and regulatory questions. Webinar May 26, 2022, 1:00 – 2:30 pm ET.

NASEO-NARUC Grid-Interactive Efficient Buildings Working Group

https://www.naseo.org/issues/buildings/naseo-geb-resources

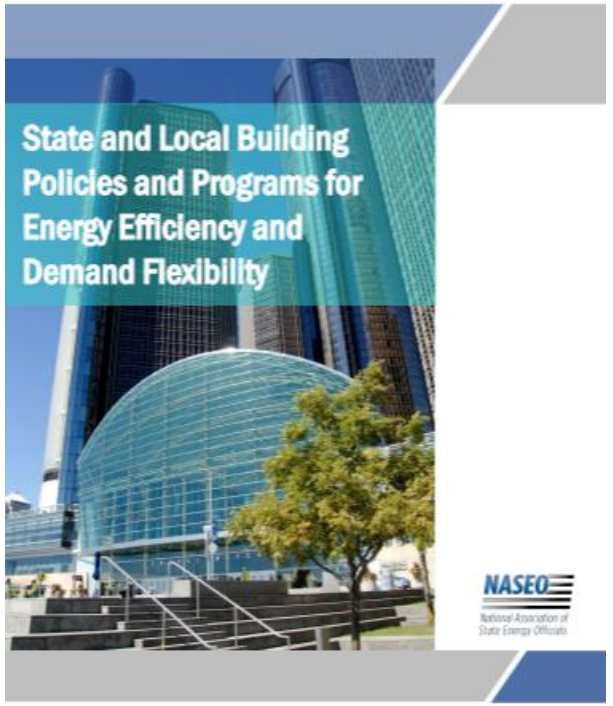
New

- Resources for the Future, **Greening the Grid through Demand-Side Automation**, April 4, 2022, 3:00 PM ET (recording available).
- Holland, C. and J. Homer (PNNL), **Pilot Considerations for Grid-interactive Efficient Buildings in Hawaii** (March 2022) - Prepared as part of technical assistance to the GEB Working Group, this brief supports the research, design, and creation of GEB pilots
- LBNL **Time-Sensitive Value Calculator**. The Calculator is a publicly available, free, Excel-based tool by Berkeley Lab that estimates the value of energy efficiency and other distributed energy resource (DER) measures using hourly estimates of electricity system costs.

NASEO-NARUC GEB Working Group

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

- ***State and Local Building Policies and Programs for Energy Efficiency and Demand Flexibility***
  - How to incorporate demand flexibility and time differentiation in building EE policies
    - Benchmarking and Transparency
    - Ratings and Labels
    - Building Performance Standards
    - Building Energy Codes
    - Appliance Standards
    - Zoning and Land-Use Regulation



NASEO-NARUC GEB Working Group

Table 1. Some Building Owner Value Streams from Demand Flexibility*

Energy costs	Lower electricity, natural gas, and other energy bills from reduced consumption due to energy efficiency and conservation.
Demand charges	Lower electricity bill demand charges from reducing peak building or facility demand.
Time-of-use and time-differentiated rates	Lower electricity bills from shifting usage of grid power from higher cost periods to lower cost periods; may include thermal or electrical energy storage; may include onsite generation.
Demand response programs	Compensation for reducing demand for grid power ("curtailment") during utility or grid operator declared periods of very high grid power demand ("DR events"); may include use of stored or onsite generated power; may include participation in a grid capacity market directly or indirectly (e.g., via DR service provider).
Grid service markets	Compensation for participation in grid service markets, such as for ancillary services, energy, and capacity (overlaps with DR programs); may involve export of onsite generated or stored power to grid; may include direct or indirect (via DR or other service provider) market participation.

- Additional values: utility and state incentives, reduced emissions, building value, resilience, insurance premium reduction, power quality, productivity/comfort/amenity.

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Table 2. Summary of Demand Flexibility Factors Applicable to Building Policies and Programs

Factor	Factor description	B&T[a]	Rating, labels[b]	BPS[c]	Codes[d]	Appl. stds.[e]	Zoning[f]
Peak Demand[g]	Monthly building peak electricity demand	x	x	x			x
Peak Demand Intensity	Monthly building peak electricity demand per sq. ft.	x	x	x			x
Coincident Peak Demand[h]	Building electricity demand during grid peak periods	x	x	x			
Localized Coincident Peak Demand	Building electricity demand during localized peak periods	x	x	x			x
DR Participation	Participation in demand response (DR) programs	x	x	x			x
DR/DF Capability	Building management system, equipment DR and DF capability	x	x	x	x	x	x
Time-Differentiated Emissions	Emissions calculation considers varied grid generation over time	x	x	x			
Time-Differentiated Cost-Effectiveness	Cost-effectiveness analysis considers time-of-use/time-differentiated utility rates and valuation				x	x	

- Discuses policies and programs (benchmarking, rating/labels, BPS, codes, zoning, …)
- Suggests approaches and metrics for including demand flexibility, time differentiation
- Resources and tools

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Table B-1. GridOptimal Summary Metrics

Metric	What is being measured
Grid Peak Contribution	Degree to which building demand contributes to load on the grid during system peak hours.
Onsite Renewable Utilization Efficiency	Building's consumption of renewable energy generated onsite (not exported to grid) over a year.
Grid Carbon Alignment	Degree to which the building's demand contributes to upstream (grid) carbon emissions over a year.
Energy Efficiency Versus Baseline	Percent better than energy code requires (annual total energy use).
Short-Term Demand Flexibility	Building's ability to reduce (shed) demand for one hour.
Long-Term Demand Flexibility	Building's ability to reduce (shed) demand for four hours.
Dispatchable Flexibility	Building's ability to automatically reduce (shed) demand for 15 minutes, controlled by utility or third party.
Resiliency	Building ability to island from grid and/or provide energy for critical loads for four to 24 hours; motor soft start capability to help grid restart after outage.

Source: Miller, A., and K. Carbonnier, 2020, "New Metrics for Evaluating Building-Grid Integration," 2020 ACEEE Summer Study on Energy Efficiency in Buildings.

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

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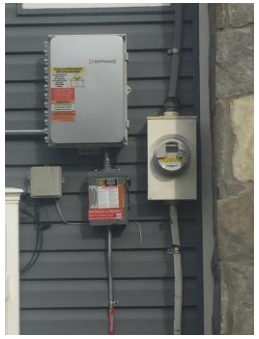

Some questions:

- **Is your state considering provisions to advance: (1) electrification, (2) demand flexibility/GEB in:**
  - **Building energy codes?**
    - **Model code proposals, state code adoption, stretch codes.**
  - **State appliance standards?**
  - **Building performance standards?**
  - **State or public building requirements? (New? Existing?)**

- **If so, any lessons and experiences to share?**
  - **Pilot or implementation results**
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- **Are utilities involved in such discussions?**

U.S. DEPARTMENT OF ENERGY

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GEB in Building Energy Codes

NASEO-NARUC GEB Working Group Meeting

Chris Perry, DOE and Ellen Franconi, PNNL

May 11, 2022

Agenda

- **Background**
  - Building Energy Codes Program
  - State Energy Codes
- **Demand Flexibility Provisions**
  - Energy Code Provisions
  - Building Performance Standards
- **Valuing Demand Flexibility**
  - National Model Energy Codes
  - State and Local Level
- **Conclusions**

Background on DOE Building Energy Codes Program (BECP)

Development

- ASHRAE Standard 90.1
- International Energy Conservation Code (IECC)
- National Green Building Standard committee
- DOE Determinations on code energy savings

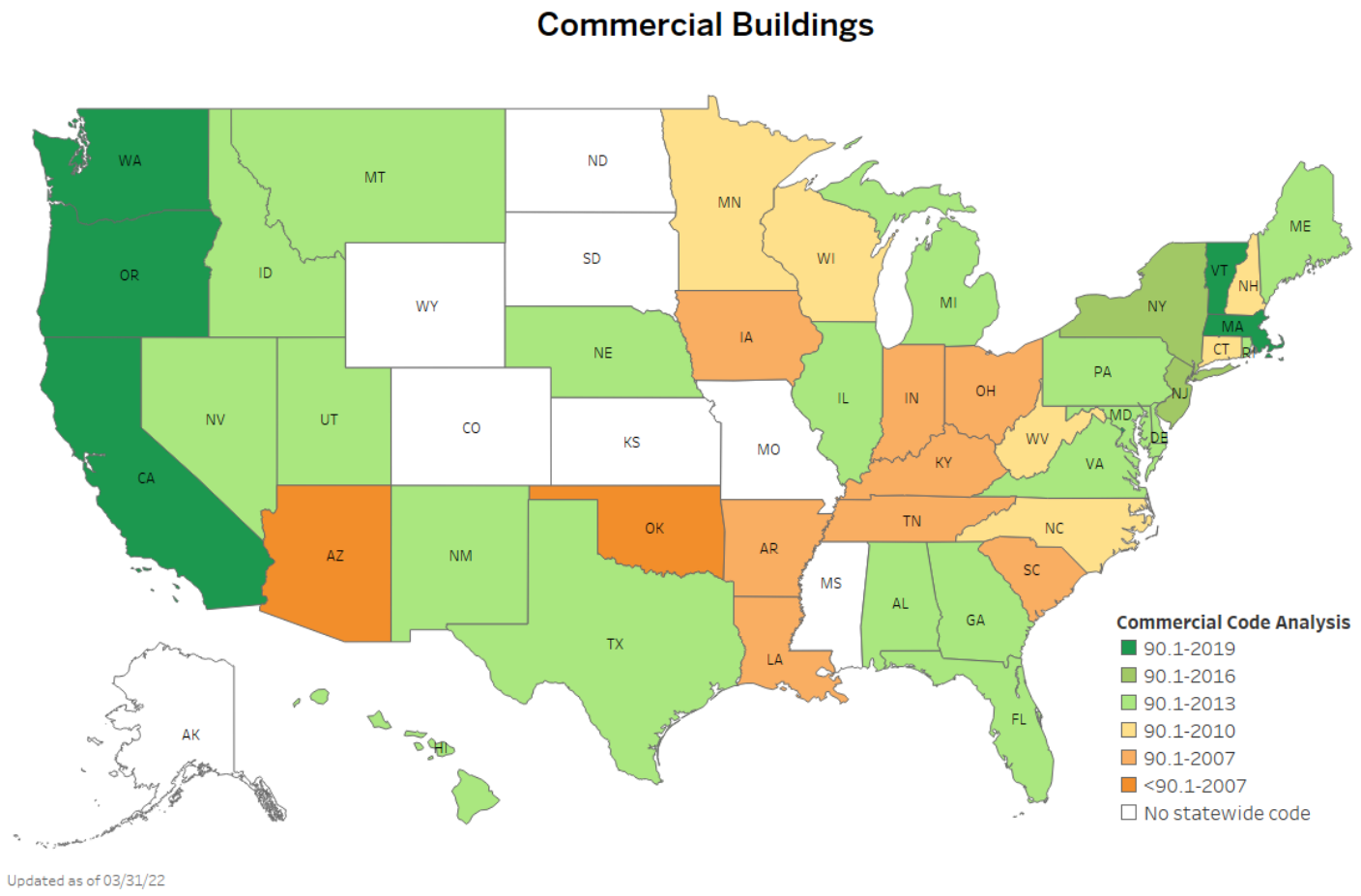
Implementation

- State technical assistance
- State-specific energy, cost and benefit analyses
- Compliance software tools & resources
- User Support
- Trainings
- Field study guideline and methodology

COMcheck REScheck

DOE is statutorily directed to participate in code development and consensus processes, review published editions of IECC and ASHRAE 90.1, and provide technical assistance to support state code implementation.

Background on State and Local Energy Codes



States may adopt model energy codes (as-is or amended), states or cities may develop their own codes, including stretch codes which go beyond model codes, and some have no statewide code (home rule).

www.energycodes.gov/status/commercial

How GEB Fits into Energy Codes

Table 2. Summary of Demand Flexibility Factors Applicable to Building Policies and Programs

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Time-Differentiated Emissions	Emissions calculation considers varied grid generation over time	x	x	x			
Time-Differentiated Cost-Effectiveness	Cost-effectiveness analysis considers time-of-use/time-differentiated utility rates and valuation				x	x	

Energy codes primarily incorporate GEB through proposals that require the capability to be demand flexible or through incorporating TOU rates into cost effectiveness.

www.naseo.org/data/sites/1/documents/publications/NASEO%20BldgPolicies%20EE%20and%20DF%20Feb%202021.pdf

Energy Codes Traditionally Focused on Efficiency

IECC code hearings (left) and an ASHRAE committee meeting (right)

Energy codes only recently began considering considered grid flexibility measures.

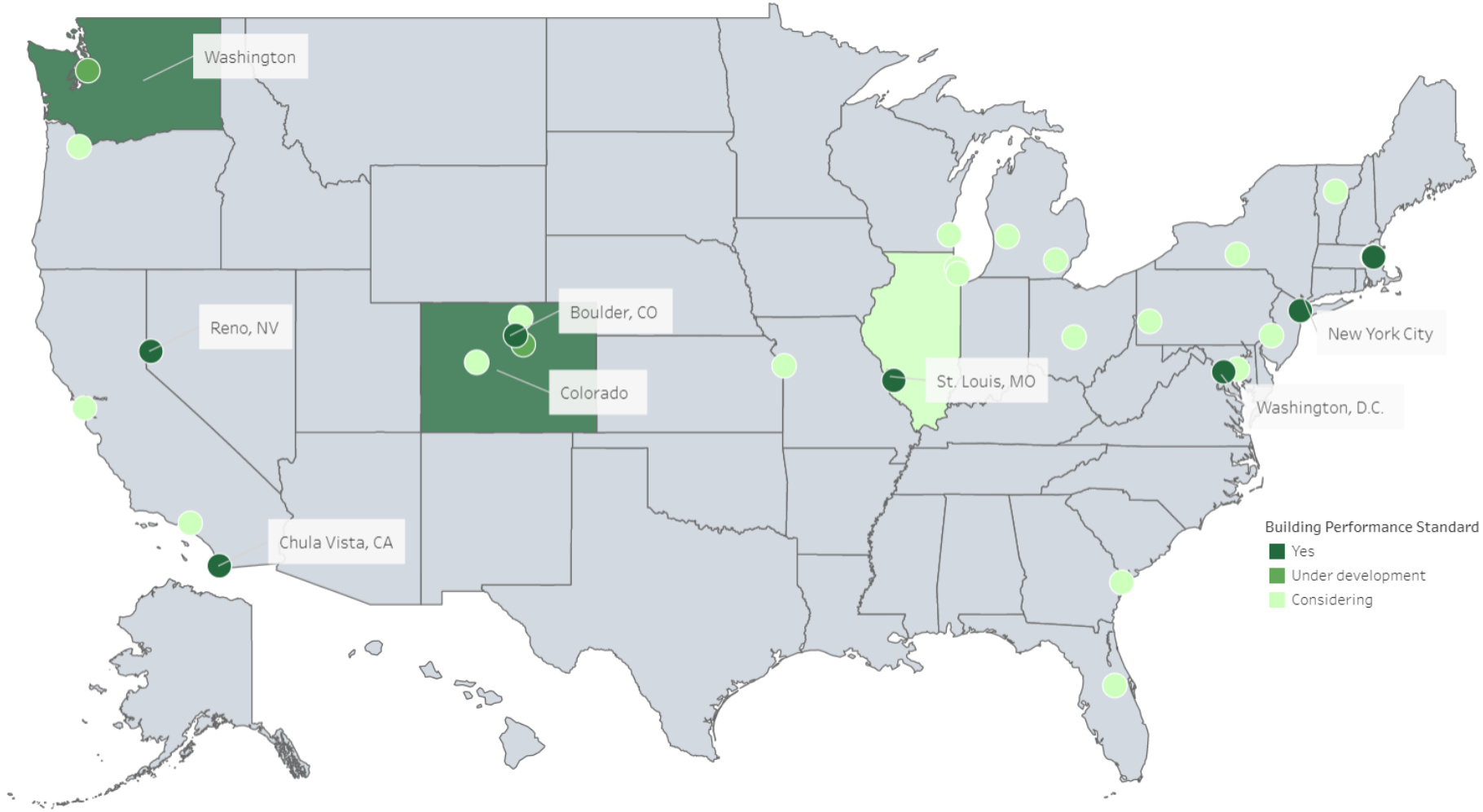
https://www.swinter.com/party-walls/the-making-of-the-2021-international-energy-conservation-code-iecc/; ashraeregion1.org/index.php/2018/08/16/ashrae-region-1-crc-is-in-full-swing/

DOE GEB-related Energy Codes Proposals

Proposal name	Description
Demand Response	Thermostats and water heaters required to include demand response capability
PV Required	On-site solar photovoltaic requirements
EV Charging	Requirements for electric vehicle installed, ready, and/or capable infrastructure
Electric Readiness	Requires electric outlets installed near fossil fuel water heaters, dryers, and cooking equipment
Energy Credits	List of additional energy efficiency and grid-interactivity measures that go beyond the prescriptive code

www.energycodes.gov/stretch-codes

Building Performance Standards

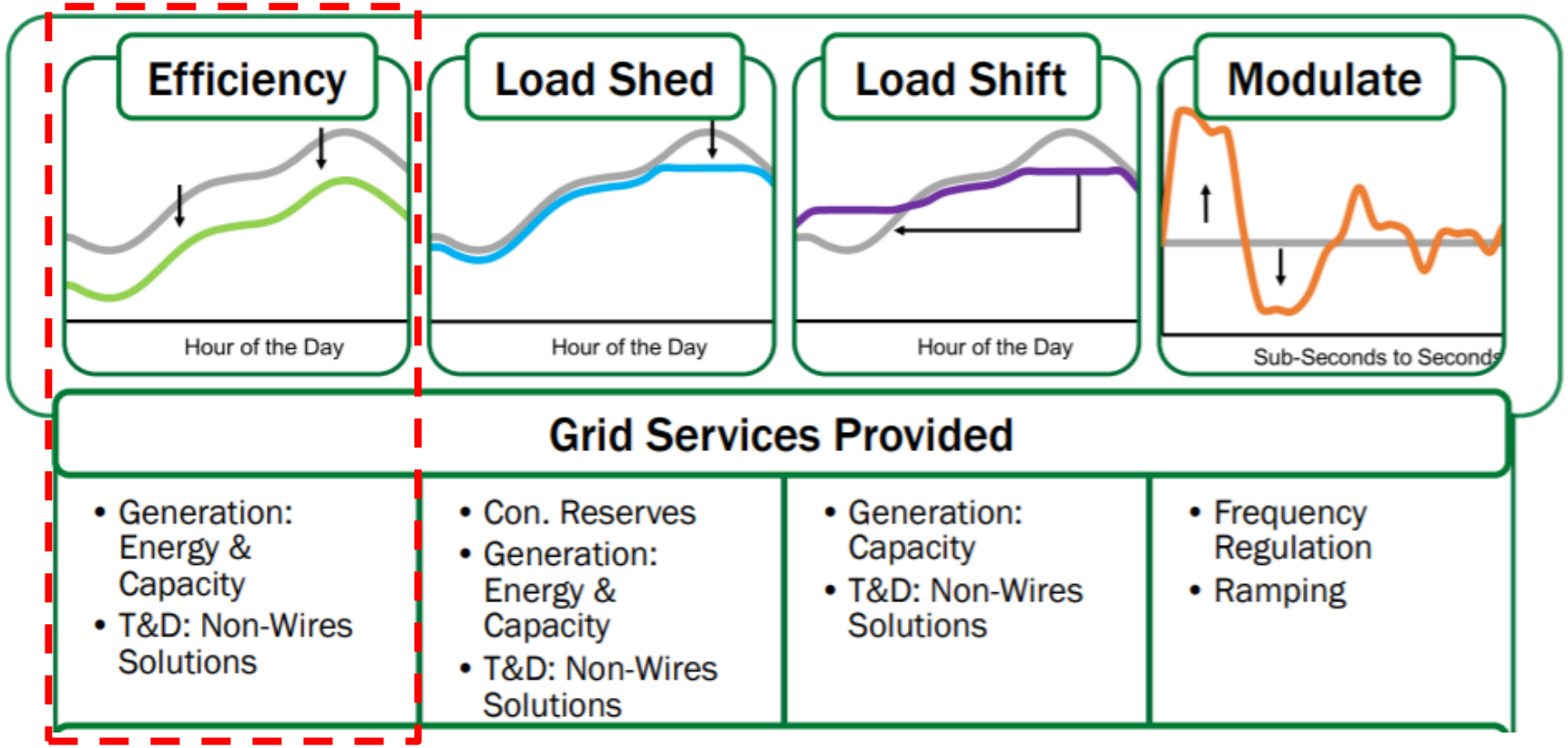


> **Trend:** States and local governments are adopting building performance standards (BPS) to complement their codes and better regulate energy use in existing buildings

Valuing Demand Flexibility in Energy Codes

The development of energy code has historically focused on efficiency with cost effectiveness based on a flat $/kWh cost.

GEBs can provide added value beyond efficiency



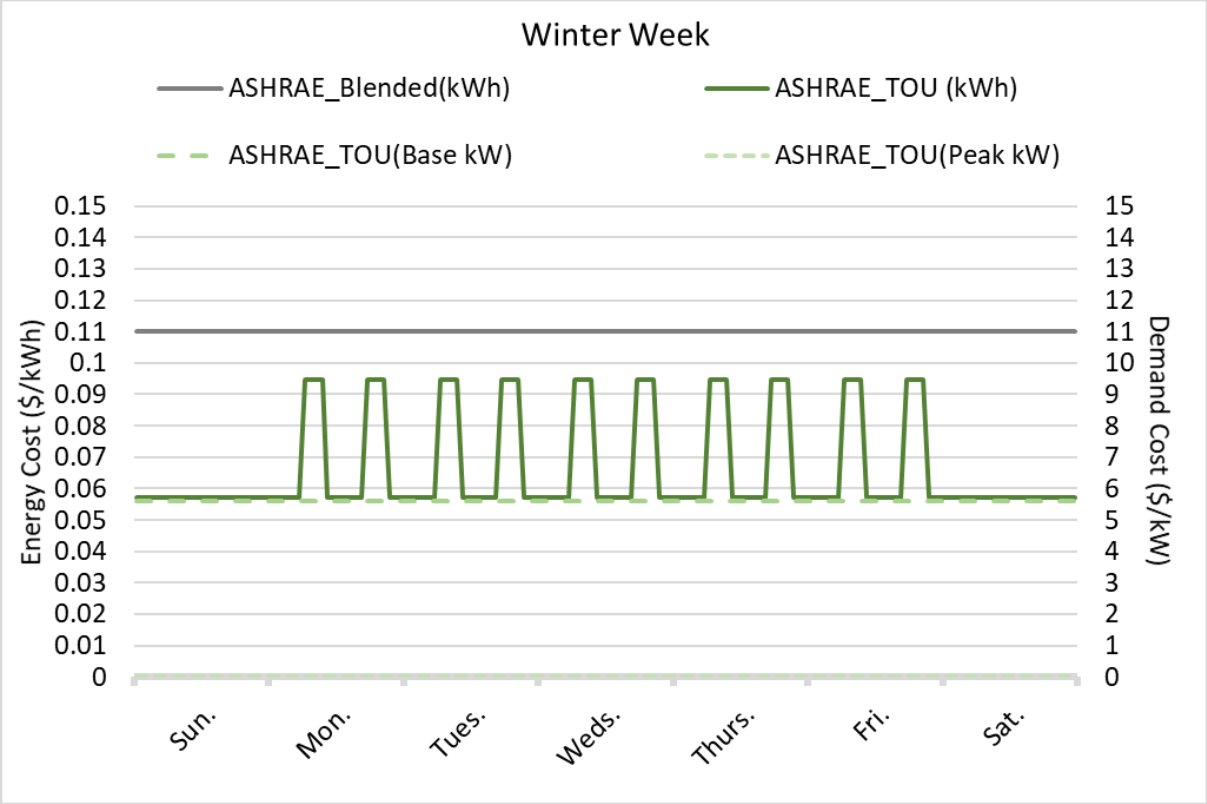
Source: DOE BTO 2019 PEER Review, Grid-Interactive Efficient Buildings Portfolio (Lighting GEB Technical Report)

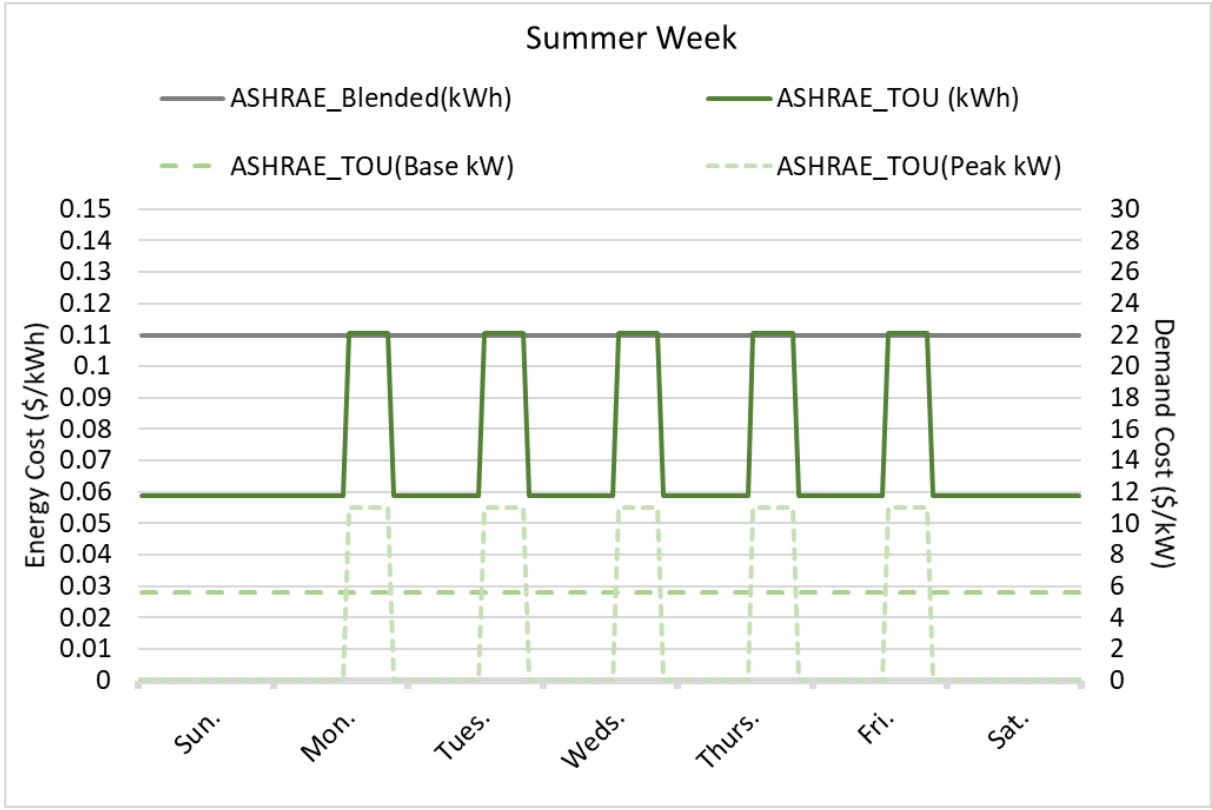
Activities in Support of Improved GEB Valuation

New Feature	Impacts	Details
Development of a representative U.S. time-of-use (TOU) rate	Prescriptive code change proposals	Available as an alternative to the blended rate
Inclusion of load management measures in Energy Credits	Prescriptive code requirements	Load reduction/shifting measure cost savings are based on the U.S. TOU rate
Consideration of regional differences in electricity demand costs	Prescriptive measures for stretch codes	Tech brief to be published in late 2022 that provides code language for GEB strategies as jurisdictional option

Representative U.S. TOU Rate

- Accepted as part of the ASHRAE 90.1-2022 Work Plan is a TOU rate that can be used as an optional alternative to the flat blended energy rate applied to demonstrate the cost effectiveness of new code change proposals
- Rate developed from tariffs data published in the OpenEI utility rate database and utility survey data
- Rate checked and refined using energy code prototype building simulation analysis





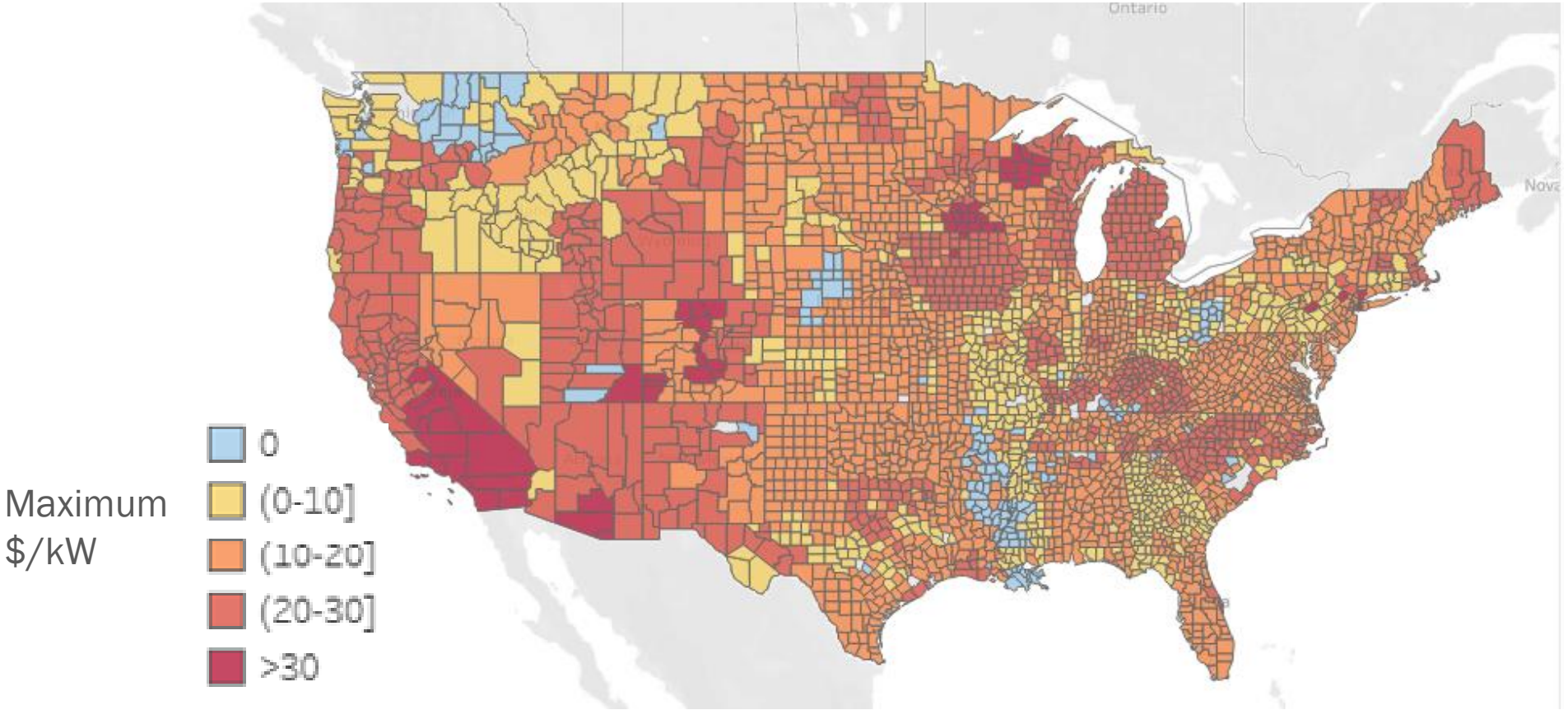
U.S. TOU Rate Use to Determine Load Management Energy Credits

ID	Energy Credit Abbreviated Title	Multifamily	Health Care	Hotel/ Motel	Office	Restau-rant	Retail	School/ Education	Ware-house	Other
R01	Renewable energy	YES	YES	YES	YES	YES	YES	YES	YES	YES
G01	Lighting load management	NA	NA	NA	YES	NA	YES	YES	YES	YES
G02	HVAC load management	NA	NA	NA	YES	NA	YES	YES	NA	YES
G03	Shading load management	YES	YES	YES	YES	YES	YES	YES	NA	YES
G04	Electric storage	YES	YES	YES	YES	YES	YES	YES	YES	YES
G05	Cooling storage	YES	YES	YES	YES	YES	YES	YES	YES	YES

Source: Hart et al. 2022. 90.1 Energy Credits Analysis Documentation. PNNL-32516. Pacific Northwest National Laboratory, Richland, Washington.

GEB Stretch Code Language for States and Local Jurisdictions

- Tech brief being developed by PNNL to better account for regional variations in demand charges and/or its importance to policy objectives



GEB Stretch Code Language for States and Local Jurisdictions

GEB Commercial Code Tech Brief Under Development

- Cost effectiveness analysis based on 400 TOU rates published in the OpenEI Utility Rate Database
- Example code language for load management measures
- Jurisdictional guidance for amending code based on regional demand charges

Example Table for Multifamily Buildings GEB Cost Effectiveness:
Regional TOU rate maximum demand charge ($/kW) needed to demonstrate code cost effectiveness*

GEB Measure	Climate Zone														
	0A	0B	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	6	7	8
Lighting Load Management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HVAC Load Management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shading Load Management	8	8	8	8	8	8	10	10	10	10	12	12	25	30	35
Electric Storage	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Cooling storage	25	25	25	25	25	25	30	30	40	40	40	45	50	60	60
SHW Storage	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Building mass w/ night flush	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

*Table mock-up for GEB commercial stretch code tech brief (do not cite)

Conclusions

- The DOE Building Energy Codes Program is available to help states with technical assistance to support energy code implementation
- Grid flexibility measures are more recently being integrated into energy codes
- DOE/PNNL and others have developed a set of proposals that promote grid flexibility capability in the energy codes
- Improved methods for assessing GEB cost effectiveness can help support their inclusion in energy codes
- New GEB valuation methods for code development include the use of:
  1. a representative U.S. TOU rate, and
  2. an assessment of TOU demand thresholds for cost effectiveness based on published rate tariffs, for use at the state and local level.

Don't forget to respond to our RFI for Resilient and Efficient Codes Implementation by May 20, 2022 here:
www.energycodes.gov/RECI-codes-workshop

ENERGY CODES | 2022

2022 NATIONAL ENERGY CODES CONFERENCE

HOSTED BY THE U.S. DEPARTMENT OF ENERGY

July 19-21 | Virtual

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Building Energy Codes
U.S. DEPARTMENT OF ENERGY

- A three-day collection of interactive discussions, training, and the latest on all things energy codes!
- Will emphasize $225M in New Support for Efficient and Resilient Energy Code Implementation
- Additional topics include the intersection of codes and building performance standards, distributed energy resources in the codes, and more

> Check out the website here!

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

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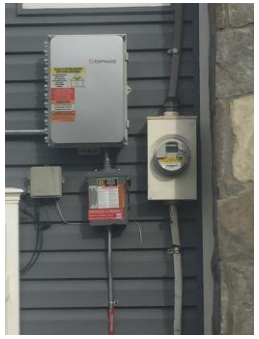

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