NATIONAL GOVERNORS ASSOCIATION

Governors' Energy Policy Institute

August 20 - 25, 2020

National Governors Association
Center for Best Practices

NATIONAL GOVERNORS ASSOCIATION

Welcome & Day 3 Recap

Jessica Rackley, Program Director, National Governors Association

Upcoming Opportunity: Planning for the Future Workshop

- NGA will be hosting a virtual workshop on strategies to help governor's meet their energy goals on October 27-29th
- This Workshop will provide states with policy and regulatory solutions to help meet their state energy goals, address areas for regional collaboration, and allow time for small group discussions
- Topics covered during this workshop include:
  - Enhancing energy procurement targets to meet clean energy and related goals,
  - Integrating high volumes of new technologies such as renewables on the grid, and
  - Leveraging new technologies to improve system resilience, reliability, and affordability.
- Please contact Emma, ecimino@nga.org

NATIONAL GOVERNORS ASSOCIATION

Keynote: Energy System Planning for a Modern Electric Grid

Speaker:

Lisa Schwartz, Electricity Markets and Policy Department, Lawrence Berkeley National Lab

Moderated by:

Dan Lauf, Program Director, National Governors Association

Energy System Planning for a Modern Electric Grid

Lisa Schwartz, Lawrence Berkeley National Laboratory

National Governors Association Energy Policy Institute
August 25, 2020

This work was funded by the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.

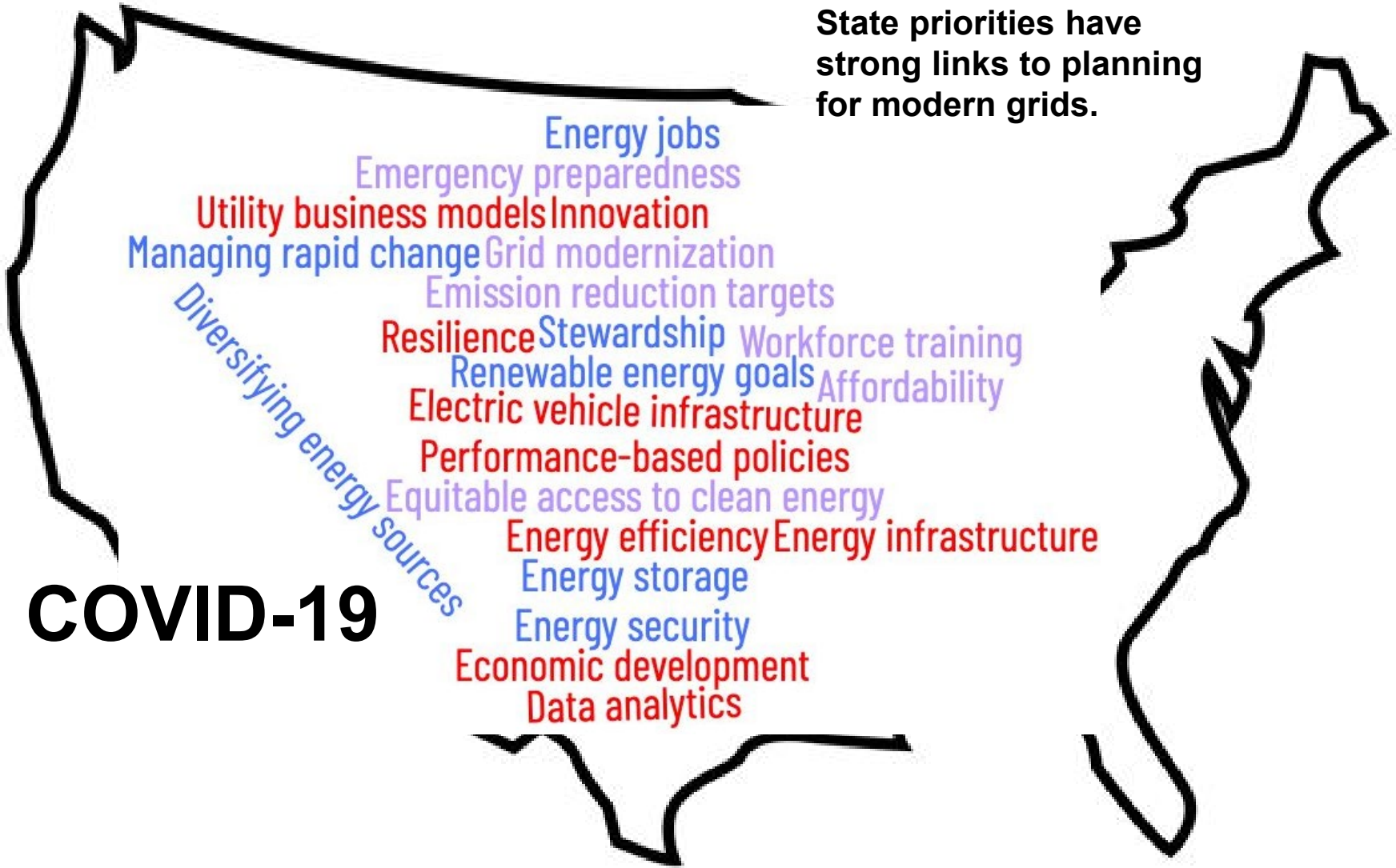
In this presentation

- Context: State energy-related priorities and potential state roles
- Electricity systems and modern grids
- State policies, grid challenges and opportunities
- Electricity system planning: activities, technologies and considerations
- Extra slides
  - Example state objectives for distribution planning
  - Example state requirements for distribution planning
  - Resources for more information

Snapshot of energy-related priorities

From Day 1 of NGA Energy Policy Institute

State priorities have strong links to planning for modern grids.

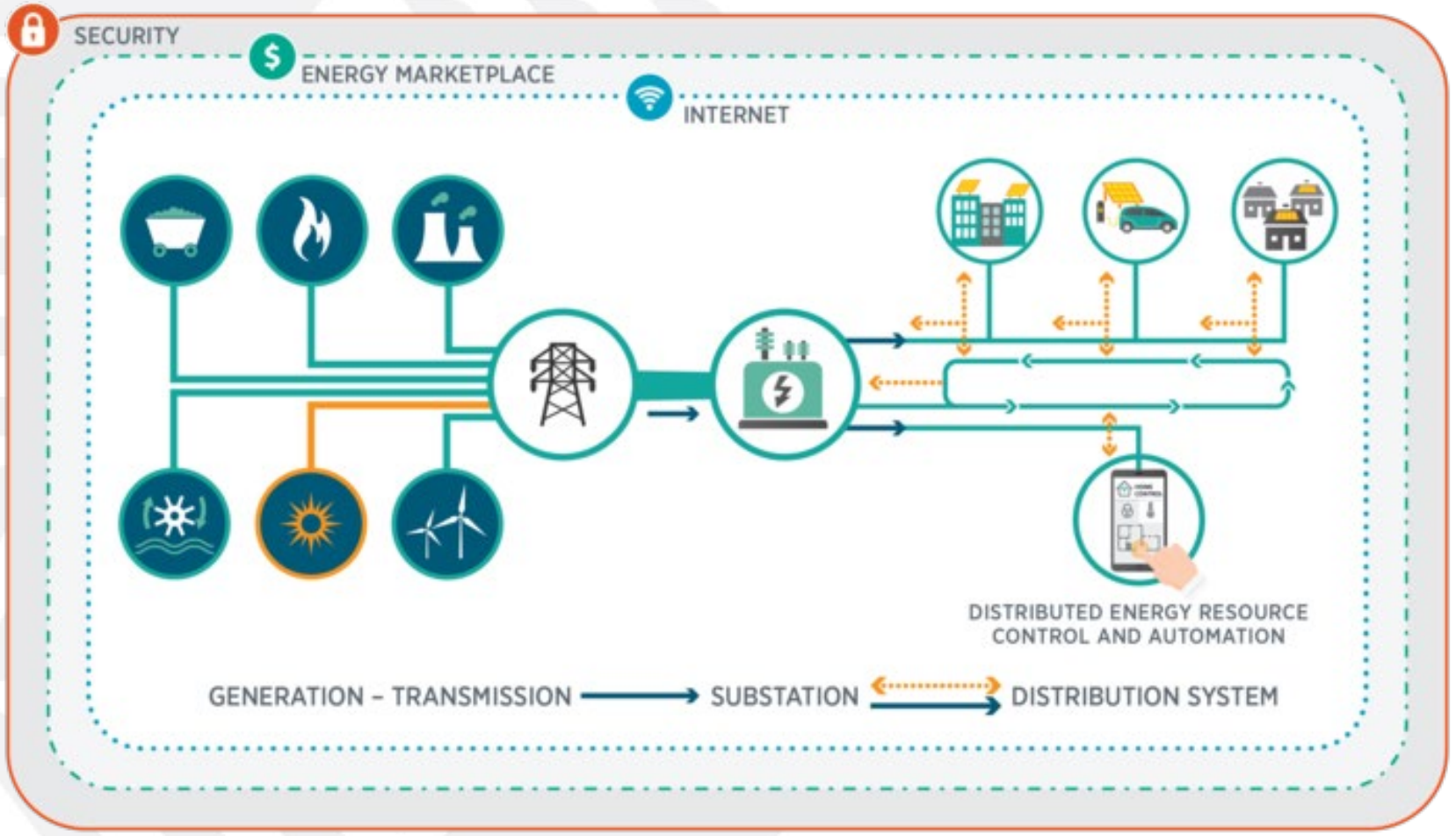


Potential state roles in planning modern grids

- Lead by example
  - Statewide energy planning
  - Studies and pilots in publicly owned buildings
- Standards and protocols
  - Data access, privacy, interoperability, cybersecurity
- Requirements or guidance for state-regulated utilities
  - Value to customers
  - Enhanced analytical methods and practices
  - Identify barriers and solutions
- Executive branch initiatives
- Legislative action

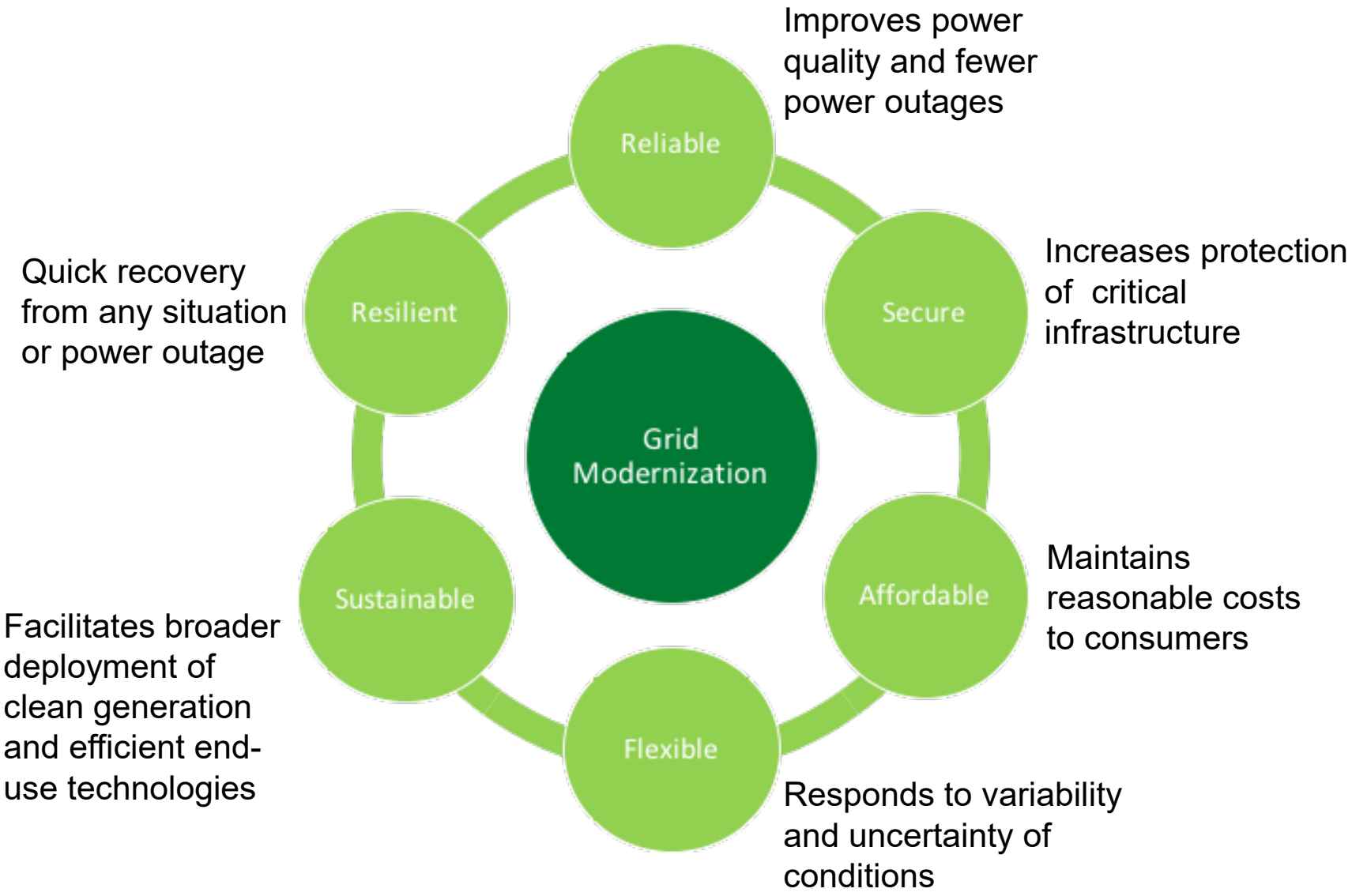
Source: National Governors Association

Electricity systems



Source: U.S. Department of Energy

What is a modern grid?



Source: U.S. Department of Energy's *Grid Modernization Multi-Year Program Plan*

Example grid modernization principles: Hawaii

HRS § 269-145.5(b) – *In advancing the public interest, the commission shall balance technical, economic, environmental, and cultural considerations associated with modernization of the electric grid, based on principles that include but are not limited to* **[emphasis added]***:*

- *Enabling a* ***diverse portfolio of renewable energy resources****;*
- ***Expanding options for customers*** *to manage their energy use;*
- ***Maximizing interconnection of distributed generation*** *to the State's electric grids on a cost-effective basis at non-discriminatory terms and at just and reasonable rates, while maintaining the reliability of the State's electric grids, and allowing such access and rates through applicable rules, orders, and tariffs as reviewed and approved by the commission;*
- ***Determining fair compensation for electric grid services*** *and other benefits provided to customers and for electric grid services and other benefits provided by distributed generation customers and other non-utility service providers; and*
- ***Maintaining or enhancing grid reliability and safety*** *through modernization of the electric grids.*

Order 32491 – The Commission adopted additional principles related to:

- **Grid platforms** for new products, services, opportunities for distributed energy resources (DERs)
- **Optimization of grid assets** and resources to minimize total system costs
- Greater **customer engagement** and options for consuming and providing energy services
- Enhancing **safety, security, reliability, and resilience** at fair and reasonable costs
- **Comprehensive, transparent and integrated distribution system planning**

State policies, grid challenges and opportunities

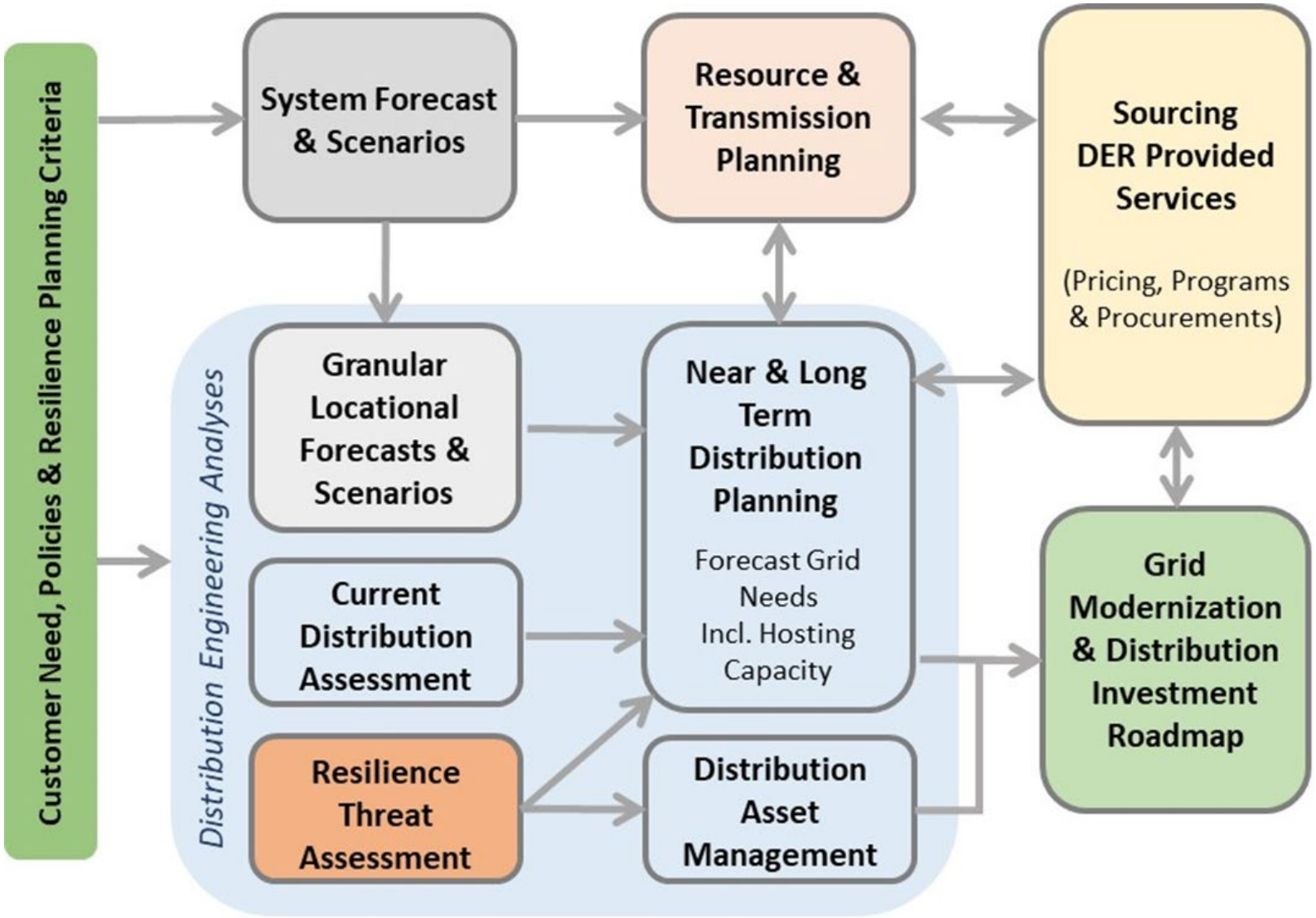
- State policies
  - Efficiency (30 states) and renewable energy targets (29 states)
  - Clean energy targets (12 states)
  - Storage policies (>15 states; also see PNNL policy database)
  - Electrification plans—e.g., CA, MA, MN, NY, VT
  - Greenhouse gas reduction goals (at least 15 states)
- Challenges
  - Growth in peak demand
  - Infrastructure constraints for transmission and distribution systems
  - Increase in variable generation—utility-scale and DERs
  - Cybersecurity
  - Maintaining affordability of essential electricity services
- Opportunities
  - Lower technology costs and improved functionality
  - Engaging consumers
  - Business practices and strategies—utilities, vendors and service providers
  - State lead by example
  - Utility, state, and local pilots and programs
  - *Improved planning processes*

Electricity planning activities

- **Distribution planning** - Assess needed physical and operational changes to local grid
  - Annual distribution planning process
    - Identify and define distribution system needs
    - Identify and assess possible solutions
    - Select projects to meet system needs
  - Long-term utility capital plan
    - Includes solutions and cost estimates, typically over a 5- to 10-year period, updated every 1 to 3 years
- **Integrated resource planning** - Identify future investments to meet bulk power system reliability and public policy objectives at a reasonable cost
  - Can consider scenarios for loads and distributed energy resources and impacts on need for, and timing of, utility resource investments
  - *For states with vertically integrated utilities*
- **Transmission planning** – Identify future transmission expansion needs and options

Also: energy efficiency, demand-side management, and electrification plans

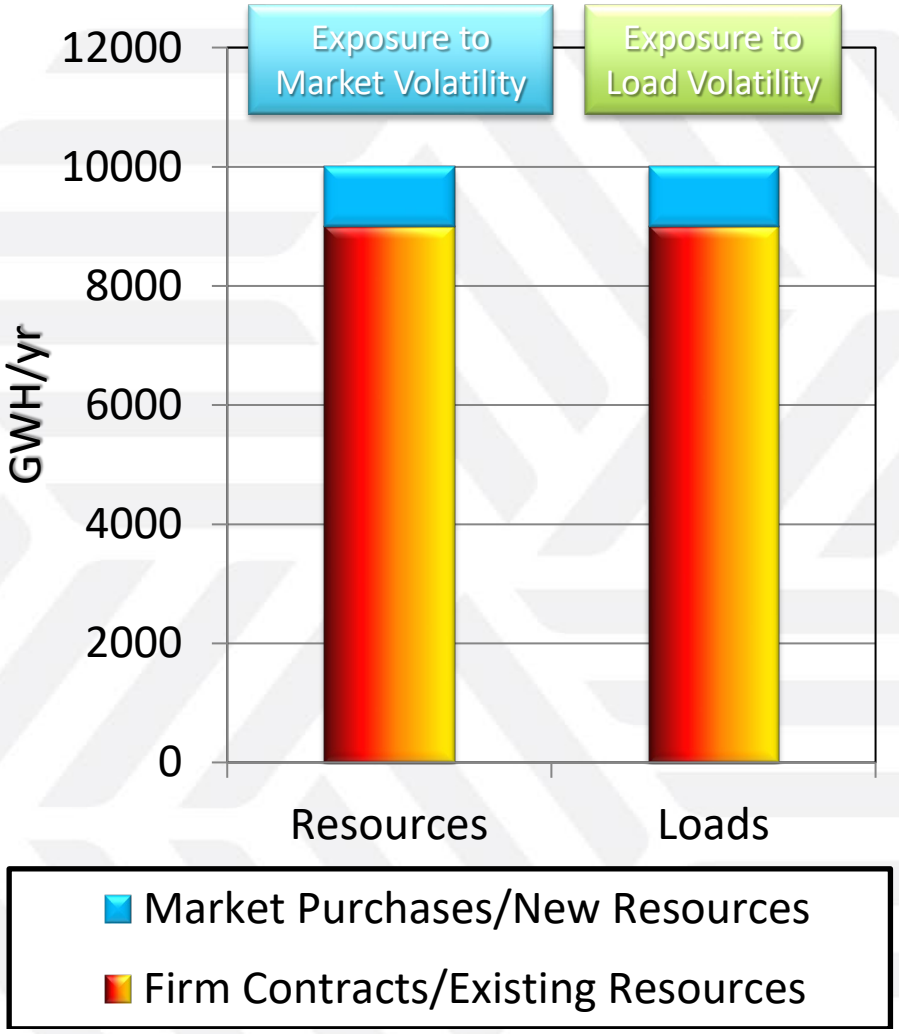
Integrated grid planning

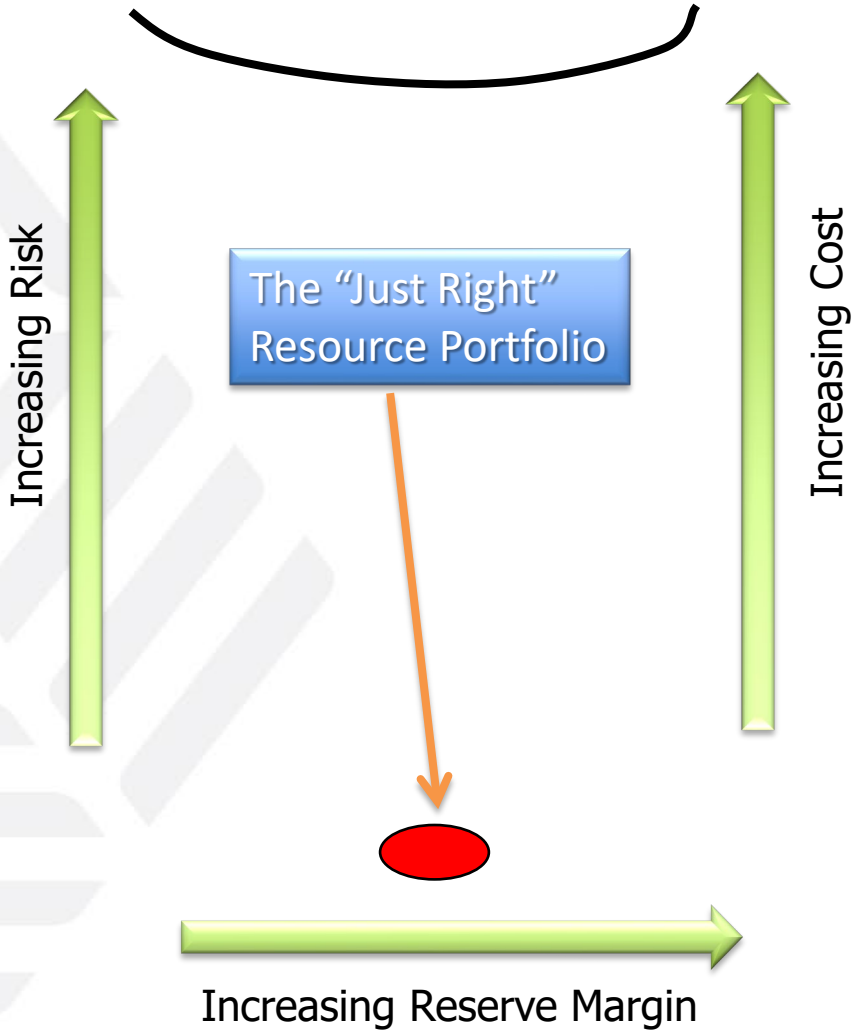


Adapted from P. De Martini, *Integrated Distribution Planning*, ICF

See [DOE's Modern Distribution Grid initiative]

Planning in the face of uncertainty

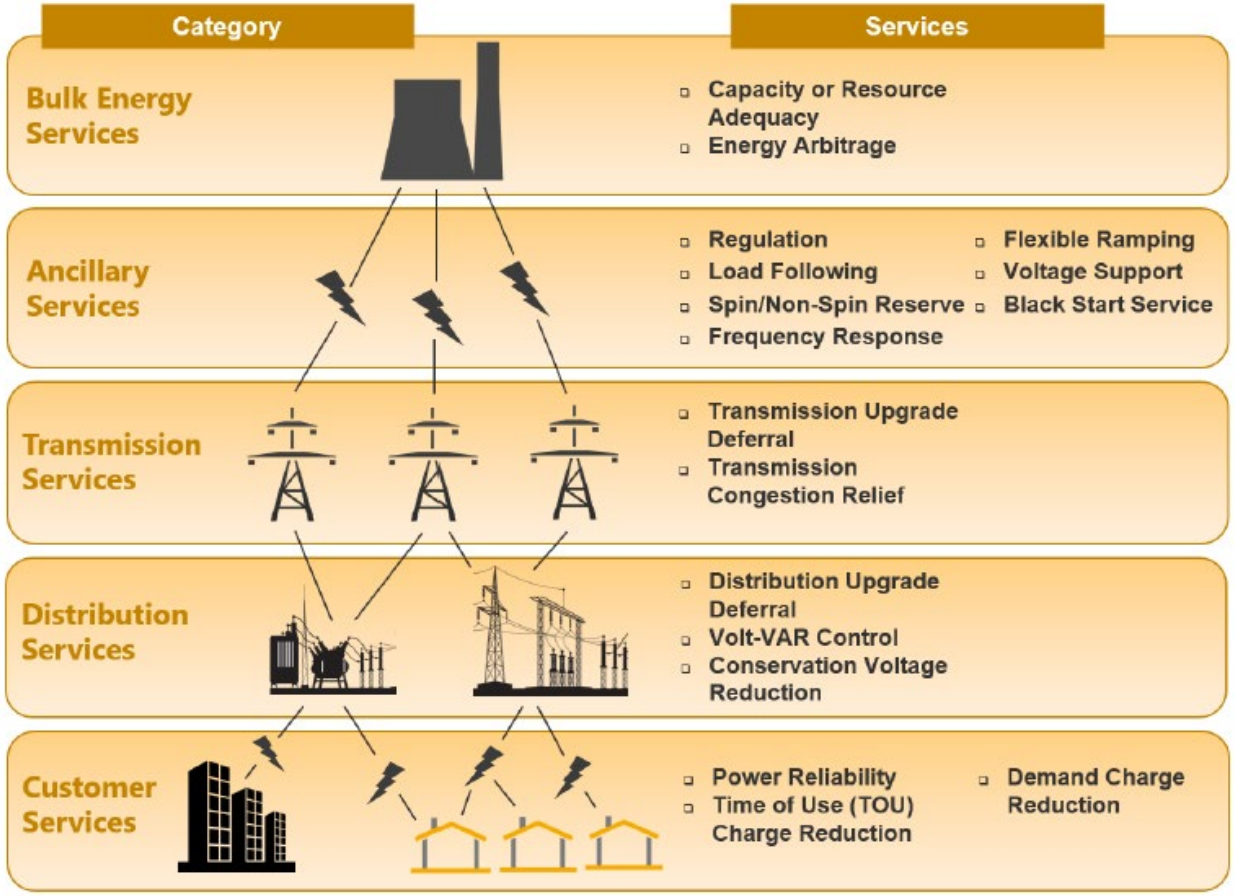




Source: Tom Eckman, Berkeley Lab

Planning with new technologies (1)

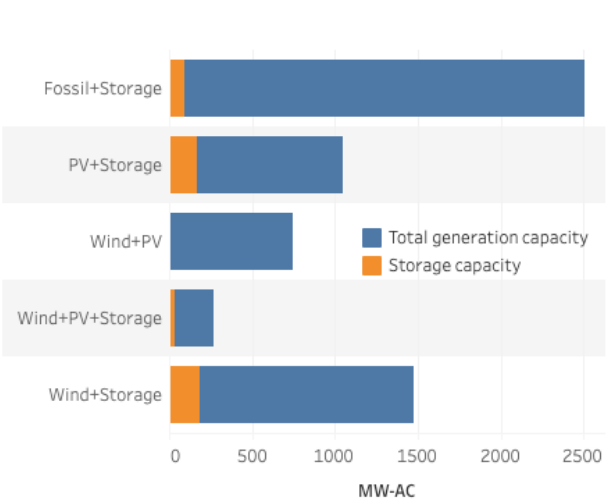
- Energy storage can provide grid services throughout the electricity system.



Source: Patrick Balducci, "Fundamentals of Energy Storage Valuation" (2020)

Planning with new technologies (2)

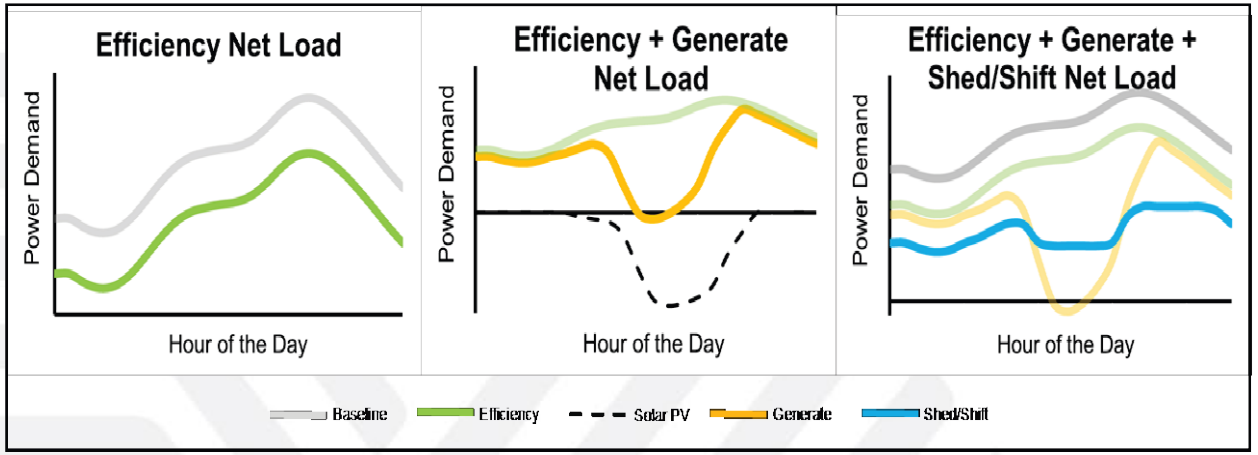
- Hybrid power plants
  - Fossil, solar, or wind *plus storage*
- Distributed energy resources
  - Resources sited close to customers that can provide some or all of their power needs; can reduce demand or provide supply to satisfy grid needs
  - Distributed generation, storage, energy efficiency and demand response



	Avg. storage duration (hours)	Storage/generation ratio (%)
Fossil+Storage	0.9	3.8%
PV+Storage	2.6	19.2%
Wind+PV		0.0%
Wind+PV+Storage	0.4	14.5%
Wind+Storage	0.6	14.2%

Source: Berkeley Lab

Planning with new technologies (3)



Source: Neukomm et al. 2019

- Grid-interactive efficient buildings use smart technologies and DERs to provide demand flexibility while co-optimizing for energy cost, grid services, and occupant needs and preferences in a continuous and integrated way
  - *Smart technologies* to manage DERs - advanced controls, sensors, models, and analytics
  - *Demand flexibility* - Capability of DERs to adjust a building's load profile across different timescales, including:
    - *Load shed*: Reduce electricity use for a short time and typically on short notice
    - *Load shift*: Change timing of electricity use
- Distribution system technologies—Geographic Information System, Outage Management System, Distribution Automation, Volt-var Optimization, and Advanced Distribution Management System that can integrate these components, plus Advanced Metering Infrastructure and DER Management Systems

Valuing demand flexibility in planning

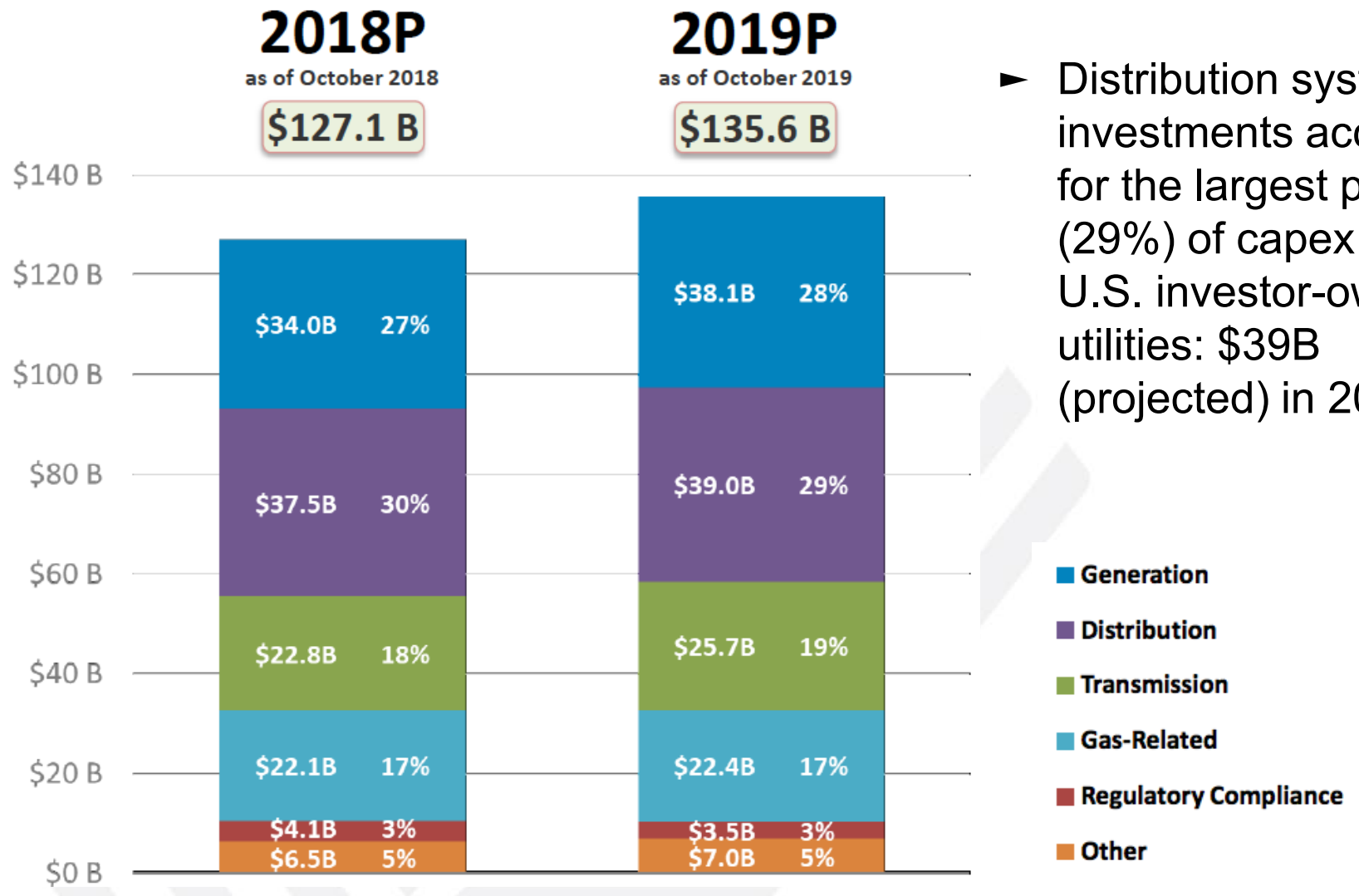
- Value of a single "unit" (e.g., kW, kWh) of grid service provided by demand flexibility is a function of:
  - *timing* of the impact on load profiles – sub-hourly, daily, monthly, and seasonally
  - *location*
  - *grid services* provided
  - *expected service life* (persistence)
  - *avoided cost of least expensive alternative* providing comparable grid service

Enhanced valuation methods to account for:	Distribution System Planning			Generation Planning		Transmission Planning	
	Hosting Capacity (for distributed generation capacity)	Energy Analysis (loss estimation)	Thermal Capacity (peak capacity)	Capacity Expansion Modeling	Market-Based Mechanisms	Capacity Expansion Modeling	Congestion Pricing Analysis
1. All electric utility system economic impacts resulting from demand flexibility	●	●	●	●	●	●	●
2. Variations in value based on when demand flexibility occurs	●	●	●	●	●	●	●
3. Impact of distribution system savings on transmission and generation system value	◔	●	◑	◑	◑	◑	◑
4. Variations in value at specific locations on the grid	●	●	◔	◔	◔	●	●
5. Variations in value due to interactions between DERs providing demand flexibility	●	◕	●	◕	◕	◕	◕
6. Benefits across the full expected useful lives of the resources	◑	◑	●	◑	◑	●	●
7. Variations in value due to interactions between DERs and other system resources	◕	◑	●	●	●	●	●

● most applicable, ◔ least applicable

[Determining Utility System Value of Demand Flexibility From Grid-interactive Efficient Buildings]

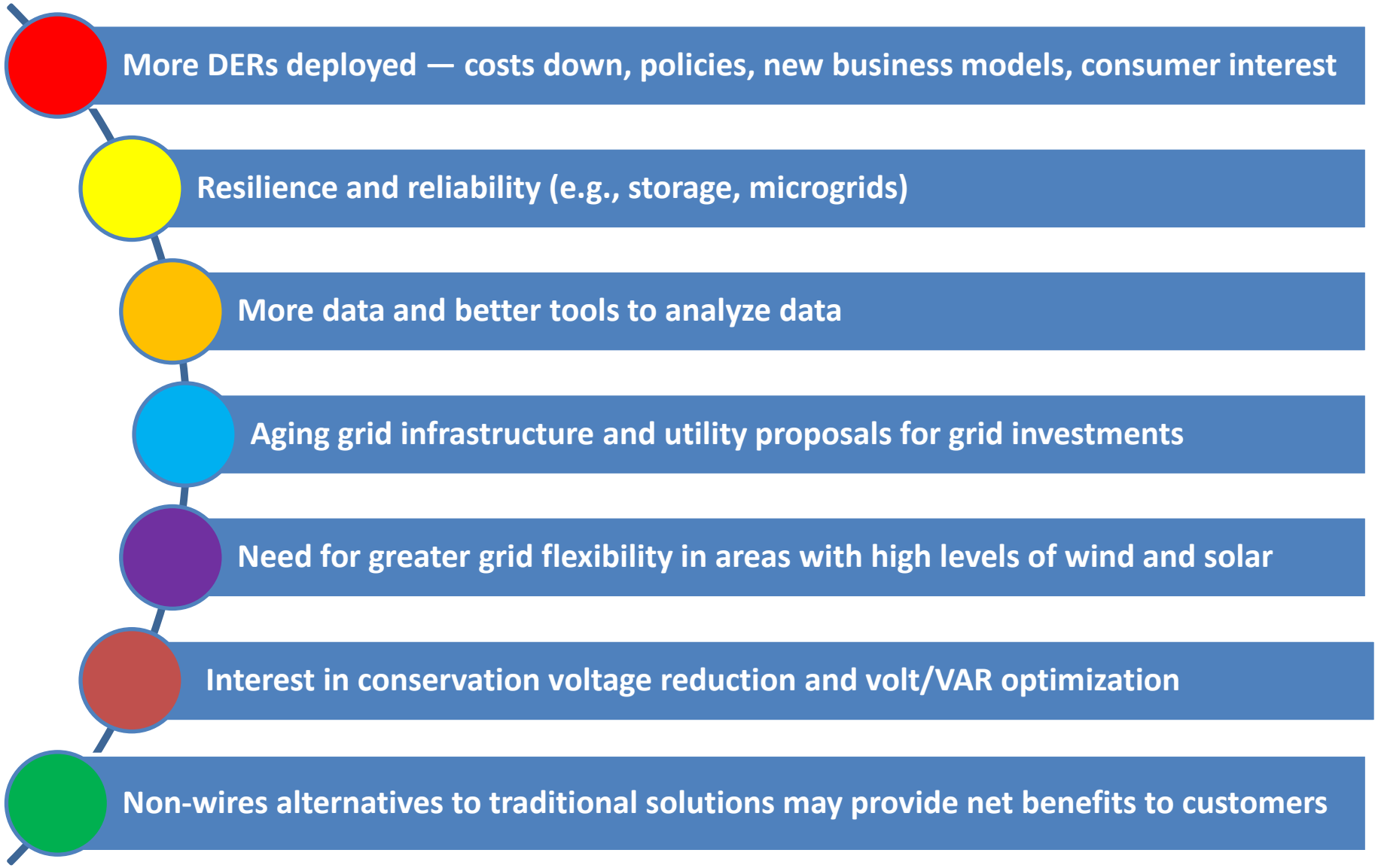
Why may states be interested in distribution planning?



- Distribution system investments account for the largest portion (29%) of capex for U.S. investor-owned utilities: $39B (projected) in 2019

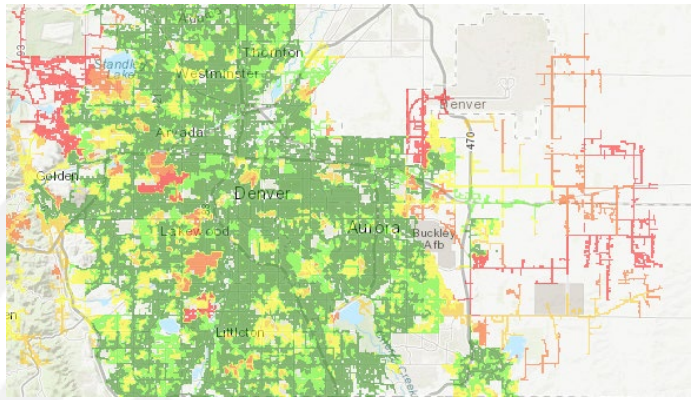
Source: Edison Electric Institute

States are responding to a variety of drivers for distribution planning.



Elements of distribution plans considering DERs

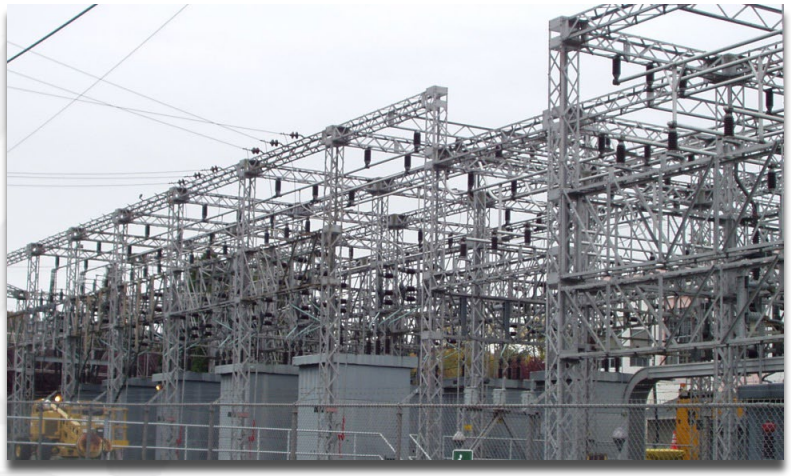
- Baseline information on current state of distribution system
  - System statistics, reliability performance, equipment condition, historical spending by category
- Description of planning process
  - Load forecast—peak demand for feeders and substations
  - Risk analysis for overloads and mitigation plans
  - Budget for planned capacity projects
- Distribution operations—vegetation and event management
- DER forecast—Types and amounts



- Hosting capacity analysis—the amount of DERs (typically solar PV) that can be interconnected to the distribution system without adversely impacting power quality or reliability under existing control and protection systems and without infrastructure upgrades
- Non-wires alternatives analysis (*next slide*)
- Grid modernization strategy—may include request for certification for major investments
- Action plan
- Additional elements may include coordination with integrated resource planning, stakeholder and customer engagement, and proposals for pilots

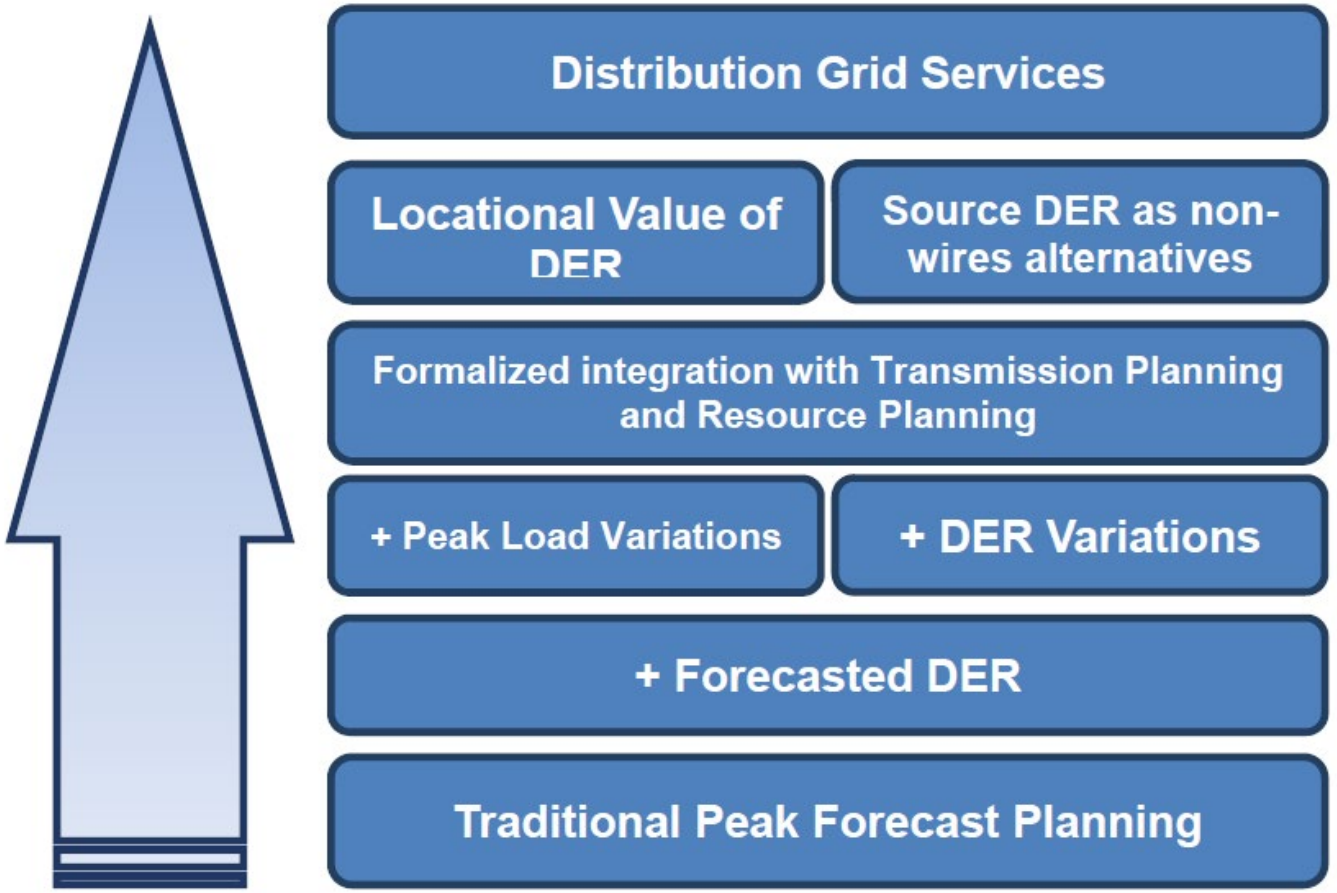
Considering non-wires alternatives

- Non-wires alternatives (NWA) are options for meeting distribution (and transmission) system needs related to load growth, reliability and resilience.
  - Single large DER (e.g., battery) or portfolio of DERs that can meet the specified need
- Objectives: Provide load relief, address voltage issues, reduce interruptions, enhance resilience, or meet generation needs
- Potential to reduce utility costs
  - Defer or avoid infrastructure upgrades
  - Implement solutions *incrementally,* offering a flexible approach to uncertainty in load growth and potentially avoiding large upfront costs for load that may not show up



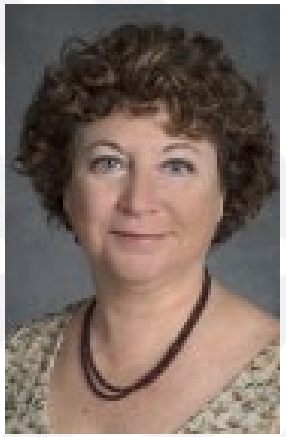
- Typically, the utility issues a competitive solicitation for NWA for specific distribution system needs and compares these bids to planned traditional grid investments (e.g., distribution substation transformer) to determine the lowest reasonable cost solution.
- DERs must be in the right place and operate at the right time to meet grid needs. The value of DERs for the distribution system depends on location.

Evolution in distribution planning practices



Source: Xcel Energy, *Integrated Distribution Plan*, Nov. 1, 2019

Contact



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Extra Slides

Example state objectives for distribution planning

- **Michigan**: Safety, reliability and resiliency, cost-effectiveness and affordability, and accessibility (order in U17990 and U-18014 dockets)
- **Nevada**: "reductions or increases in local generation capacity needs, avoided or increased investments in distribution infrastructure, safety benefits, reliability benefits and any other savings the distributed resources provide to the electricity grid for this State or costs to customers of the electric utility or utilities." (SB 146)
- **Minnesota** Stat. §216B.2425: "…enhancing reliability, improving security against cyber and physical threats, and by increasing energy conservation opportunities by facilitating communication between the utility and its customers through the use of two-way meters, control technologies, energy storage and microgrids, technologies to enable demand response, and other innovative technologies."
  - Public utility commission objectives (8/30/18 order in Docket 18-251):
    - Maintain and enhance the safety, security, reliability, and resilience of the electricity grid, at fair and reasonable costs, consistent with the state's energy policies.
    - Enable greater customer engagement, empowerment, and options for energy services.
    - Move toward the creation of efficient, cost-effective, accessible grid platforms for new products and services, with opportunities for adoption of new distributed technologies.
    - Ensure optimized use of electricity grid assets and resources to minimize total system costs.

Example state requirements*

- Distribution system plans

  California, Delaware, Indiana, Hawaii, Maine, Maryland, Michigan, Minnesota, Nevada, New York, Rhode Island, Virginia

- Grid modernization plans

  California, Hawaii, Oregon, Massachusetts, Minnesota, Ohio

  - Utilities in several other states have filed grid modernization plans even absent requirements (GA, NC, SC, TX).

- Hosting capacity analysis

  California, Minnesota, Nevada, New York

- Non-wires alternatives

  CA, CO, DC, HI, MD, ME, MN, NV, NY, RI

- Benefit-cost handbook or guidance

  Maryland, Nevada, New York, Rhode Island

*This list is growing and not all-inclusive.

Resources for more information

U.S. Department of Energy's (DOE) Modern Distribution Grid guides

Integrated Distribution Planning: Utility Practices in Hosting Capacity Analysis and Locational Value Assessment, by ICF for DOE, 2018

Alan Cooke, Juliet Homer, Lisa Schwartz, *Distribution System Planning – State Examples by Topic*, Pacific Northwest National Laboratory and Berkeley Lab, 2018

Juliet Homer, Alan Cooke, Lisa Schwartz, Greg Leventis, Francisco Flores-Espino and Michael Coddington, *State Engagement in Electric Distribution Planning*, Pacific Northwest National Laboratory, Berkeley Lab and National Renewable Energy Laboratory, 2017

Tom Eckman, Lisa Schwartz and Greg Leventis, *Determining Utility System Value of Demand Flexibility From Grid-interactive Efficient Buildings*, Berkeley Lab, 2020

T. Woolf, B. Havumaki, D. Bhandari, M. Whited and L. Schwartz. *Benefit-Cost Analysis for Utility-Facing Grid Modernization Investments: Trends, Challenges and Considerations*. Lawrence Berkeley National Laboratory (forthcoming — email me to request the draft)

Berkeley Lab's Future Electric Utility Regulation reports, including:

> *Utility Investments in Resilience of Electricity Systems*, *The Future of Transportation Electrification*, *Regulatory Incentives and Disincentives for Utility Investments in Grid Modernization*, *The Future of Electricity Resource Planning*, *Performance-Based Regulation in a High DER Future*

More from Berkeley Lab:

- Reliability and resilience
- Renewable energy
- Energy efficiency
- Time- and locational-sensitive value of DERs

NATIONAL GOVERNORS ASSOCIATION

Keynote: Energy System Planning for a Modern Electric Grid

Speaker:

Lisa Schwartz, Electricity Markets and Policy Department, Lawrence Berkeley National Lab

Moderated by:

Dan Lauf, Program Director, National Governors Association

Trivia!

- Which state receives the most rainfall on average?

Answer:

Hawaii – 63.7 inches on average

NATIONAL GOVERNORS ASSOCIATION

Improving Energy Sector Cybersecurity in Your State

Speakers:

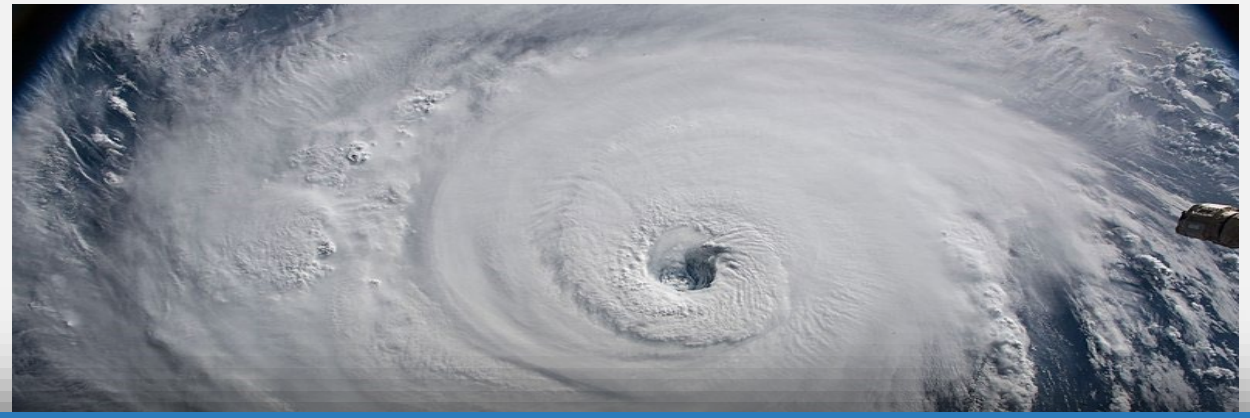
Brandi Martin, U.S. Department of Energy Office of Cybersecurity, Energy Security and Emergency Response

Chairman Gladys Brown Dutrieuille, Pennsylvania Public Utility Commission

Sean Parcel, Director, Cyber Intelligence & Defense, American Electric Power

Moderated by:

Dan Lauf, Program Director, National Governors Association

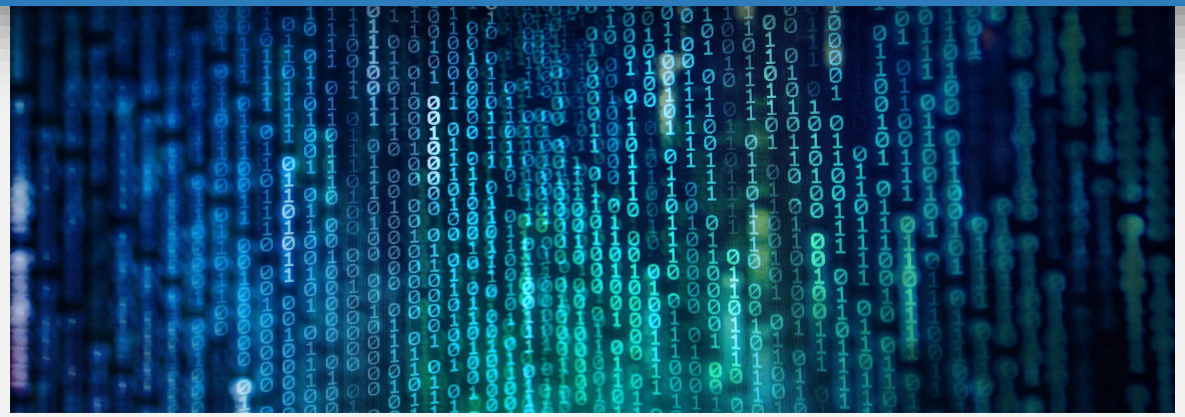


U.S. DEPARTMENT OF ENERGY | OFFICE OF Cybersecurity, Energy Security, and Emergency Response

NGA 2020 Energy Policy Institute

Brandi Martin

Cybersecurity, Energy Security and Emergency Response (CESER)

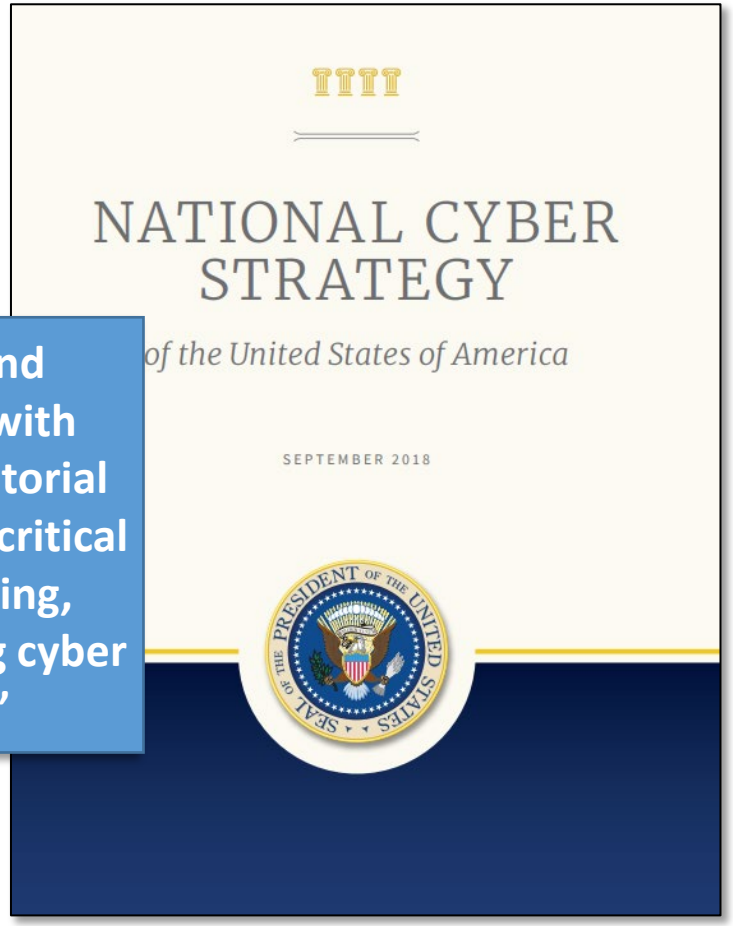


Cyber Threats and National Cyber Strategy

"China has the ability to launch cyber attacks that cause localized, temporary disruptive effects on critical infrastructure—such as disruption of a natural gas pipeline for days to weeks—in the United States."

"Federal departments and agencies, in cooperation with state, local, tribal, and territorial government entities, play a critical role in detecting, preventing, disrupting, and investigating cyber threats to our Nation."

"Russia has the ability to execute cyber attacks in the United States that generate localized, temporary disruptive effects on critical infrastructure—such as disrupting an electrical distribution network for at least a few hours—similar to those demonstrated in Ukraine in 2015 and 2016."



U.S. DEPARTMENT OF ENERGY | OFFICE OF Cybersecurity, Energy Security, and Emergency Response

Cybersecurity threats are increasing

The Hill

Officials warn of increasing cyber threats to critical infrastructure during pandemic | TheHill

Senators and other energy sector officials warned Wednesday that ... the Department of Homeland Security's Cybersecurity and Infrastructure ...

3 weeks ago

Yahoo Tech

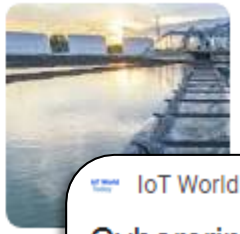
Major security vulnerability could leave critical infrastructure defenseless

... devices, home security cameras, power grids, aviation, and more. ... Most major parties insist that all the Ripple20 holes have already been ...

Infosecurity Magazine

Immediate Action Required to Protect OT Assets of Critical ...

... and the Cybersecurity and Infrastructure Security Agency (CISA) have ... "OT is foundational to absolutely everything we do – from the energy ...



IoT World Today

Cybercrime and Distributed Energy Threaten Electric Grid ...

While cybersecurity is a central concern for grid operators, renewable energy is a competing priority. Nearly half (46%) of grid operators ...

6 hours ago

NERC

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Special Report

Pandemic Preparedness and Operational Assessment: Spring 2020

Executive Summary

The global health crisis has elevated the electric reliability risk profile due to potential workforce disruptions, supply chain interruptions, and increased cybersecurity threats. The electricity industry in North America is rising to the challenge, coordinating effectively with government partners, and taking aggressive steps to confront the threat to

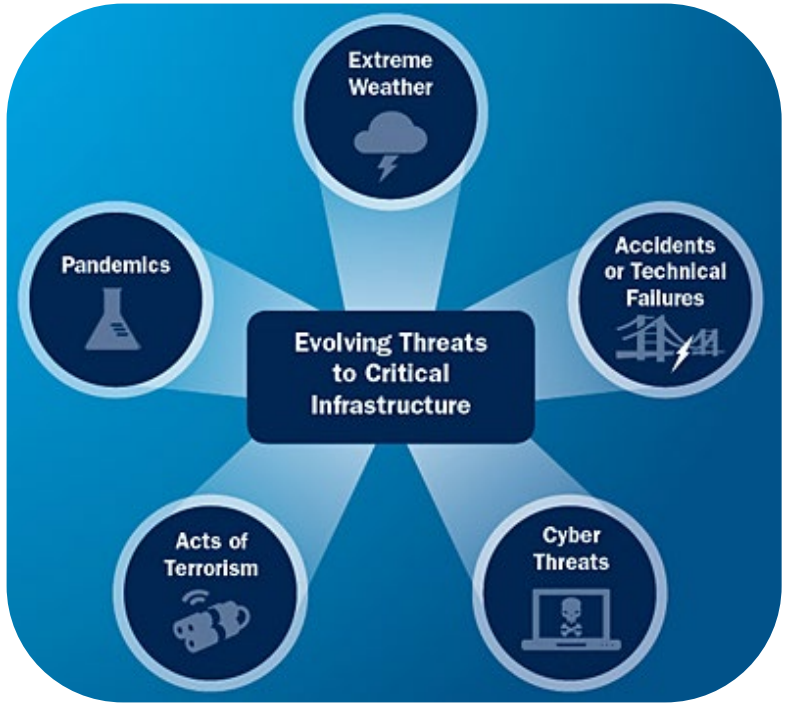
BBC News

Ransomware-hit US gas pipeline shut for two days

A ransomware attack on a US natural gas facility meant a pipeline had to be shut down for two days, the US Department of Homeland Security ...

CESER's Mission

Cybersecurity, Energy Security, and Emergency Response (CESER) leads the Department of Energy's emergency preparedness and coordinated response to disruptions to the energy sector, including physical and cyber-attacks, natural disasters, and man-made events.



U.S. DEPARTMENT OF ENERGY | OFFICE OF Cybersecurity, Energy Security, and Emergency Response

CESER Preparedness and Response

Energy Assurance

Energy Sector Situational Awareness

Emergency Response

Sector Specific Agency Responsibilities

All Hazards Preparedness

Cyber Incident Coordination

Energy Sector Exercises

Risk and Hazards Analysis

U.S. DEPARTMENT OF ENERGY | OFFICE OF Cybersecurity, Energy Security, and Emergency Response

CESER Research, Development and Demonstration

NETWORK ARCHITECTURES

Tools and technologies that design or reconfigure the way devices interconnect or communicate to enhance cybersecurity capabilities. This includes software-defined networking, wireless configurations, and altering the way information flows between EDS components.

ACCESS CONTROL

Tools and technologies that use encryption, authentication, or authorization to make information and devices indecipherable or inaccessible to unauthorized users.

ATTACK IDENTIFICATION AND RESPONSE

Tools and technologies that identify and respond to cyber attacks or intrusions to mitigate potential damage. This includes detecting and mitigating the effects of malicious software, anomalous behavior, abnormal communication, and physical tampering

SITUATIONAL AWARENESS AND OPERATOR SUPPORT

Tools and technologies that assist human operators by providing real-time information on the status of their operational networks to inform decision-making.

GUIDANCE AND PRACTICES

Guides, best practices, or reports that inform owners, operators, regulators, and/or end users of policies or practices that can improve cybersecurity. This includes identifying requirements, challenges, misconceptions, and recommendations for future action.

REDUCED EXPOSURE

Tools and technologies that preemptively identify and assess system risks and potential attack vectors to enhance cybersecurity.

U.S. DEPARTMENT OF ENERGY | OFFICE OF Cybersecurity, Energy Security, and Emergency Response

CESER Collaboration Across the Energy Sector

State, Local, Tribal and Territorial (SLTT) Program

NASEO
National Association of State Energy Officials

AMERICAN PUBLIC POWER ASSOCIATION

NCSL

NGA
NATIONAL GOVERNORS ASSOCIATION

NEMA™

ESCC
Electricity Subsector Coordinating Council

Who	• Electricity trade associations and their members
Purpose	• Coordinate efforts to prepare for, and respond to, national-level disasters or threats to critical infrastructure.
Working Groups	• Vision and Planning • Threat Information Sharing • Industry-Government Coordination • Research & Development • Cross-Sector Liaisons

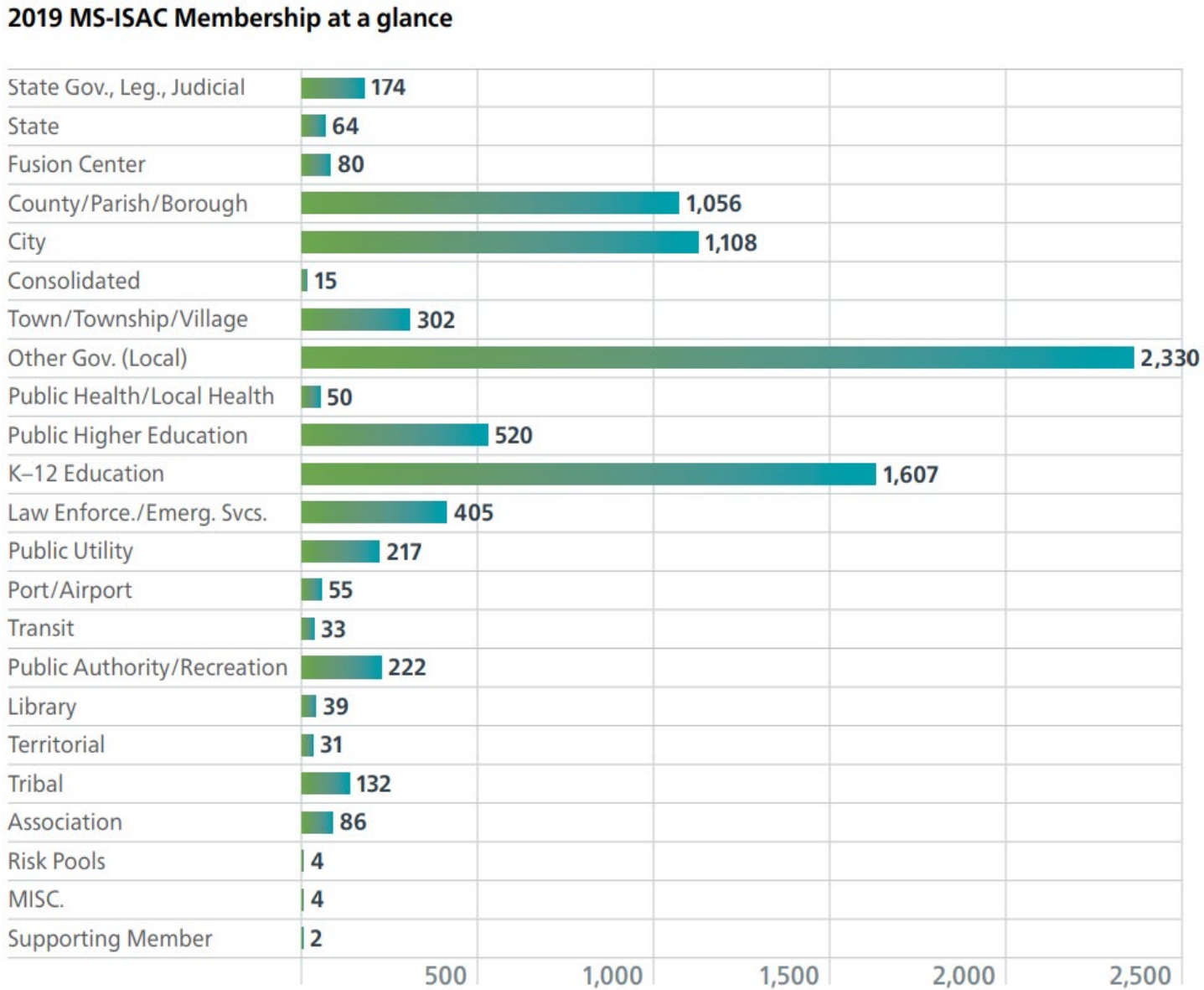
OIL AND NATURAL GAS SECTOR COORDINATING COUNCIL

Who	• Oil & natural gas trade associations and their members
Purpose	• Provide a forum to coordinate security strategies, activities, policy and communications across the sector to support the nation's security mission
Working Groups	• Cyber • Information Sharing • Regulatory Engagement • Emergency Management • Law Enforcement Engagement • Pipeline

Threat Information Sharing

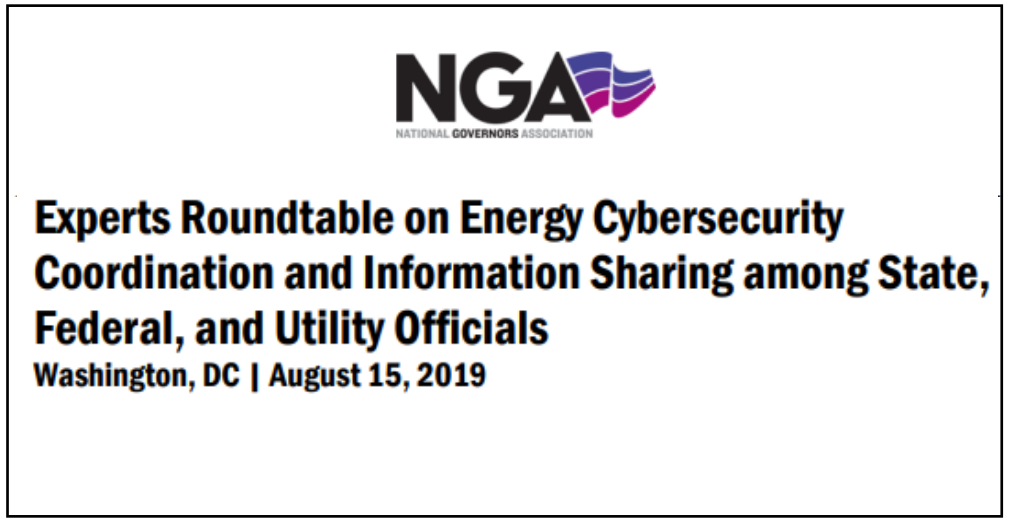
MS-ISAC®
Multi-State Information Sharing & Analysis Center®

- Bi-directional information sharing organization, focused on cyber threats
- 24-hour Watch and Warning Center
- Agreement w/ Electricity ISAC, (E-ISAC)
- SLTT representation: members from all states and territories as well as hundreds of local governments



Cybersecurity work with NGA

Completed Activities



Upcoming Activities / Resources

- **White Paper on Cybersecurity Partnerships and Information Sharing** (NGA/NASEO/NARUC)
- **NGA Threat Briefing Pilot and Memo**
- **Whitepaper on State Cybersecurity Governance Bodies**

U.S. DEPARTMENT OF ENERGY | OFFICE OF Cybersecurity, Energy Security, and Emergency Response

Cyber-focused State Tools and Resources

- Energy Emergency Assurance Coordinators (EEAC) Outreach
- Incident Calls
- Situational Awareness (EAGLE-I)
- DOE Situation Reports

- Cyber Manual Toolkit (NARUC)
- Cybersecurity Legislation (NCSL)
- Cybersecurity for SEOs (NASEO)
- Energy Security Assessment Tool
- Cybersecurity Partnerships & Information Sharing White Paper

State Energy Security Planning

GridEx state assistance (NGA)

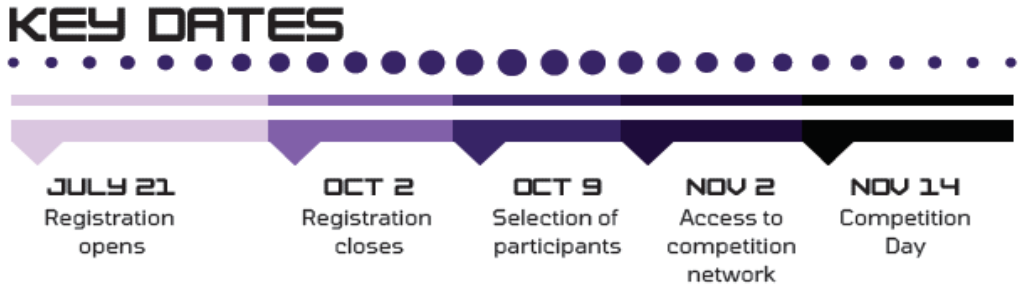
Online Cybersecurity training (NARUC)

- Regional Cybersecurity Training (NARUC)
- Cyber TTX Guidance (NARUC)
- Cyber TTX-in-a-box (APPA)
- Municipal Utility Mutual Aid Exercise (APPA)

Upcoming CESER Programs

CYBERFORCE COMPETITION

- DOE's collegiate cyber defense competition
- Students defend simulated cyber-physical infrastructure against professional red-team attackers
- Hosted in collaboration with DOE's National Labs



CyberForceCompetition@anl.gov | https://cyberforcecompetition.com

U.S. DEPARTMENT OF ENERGY CLEAR PATH VIII SALT LAKE CITY, UTAH

U.S. DEPARTMENT OF ENERGY | OFFICE OF Cybersecurity, Energy Security, and Emergency Response

Energy Security Preparedness Checklist

- ✓ Review (and update) your state's Energy Security and Assurance Plan
  - Understand your state's energy landscape
  - Evaluate risks and hazards to energy infrastructure
- ✓ Identify and maintain good working relationships with private & public energy sector contacts
- ✓ Consider cybersecurity in all-hazard energy security planning
  - Clarify state agency roles and responsibilities for cybersecurity
  - Designate a cybersecurity lead
  - Train staff to be aware of cybersecurity best practices, specifically avoiding "social engineering" cyberattacks
  - Collaborate with your State: Information Security Officer, Homeland Security Advisor and Public Utility Commissioners
- ✓ Participate in exercises
- ✓ Stay informed of threats w/ Multi-State Information Sharing & Analysis Center (MS-ISAC)

CESER Contact Information

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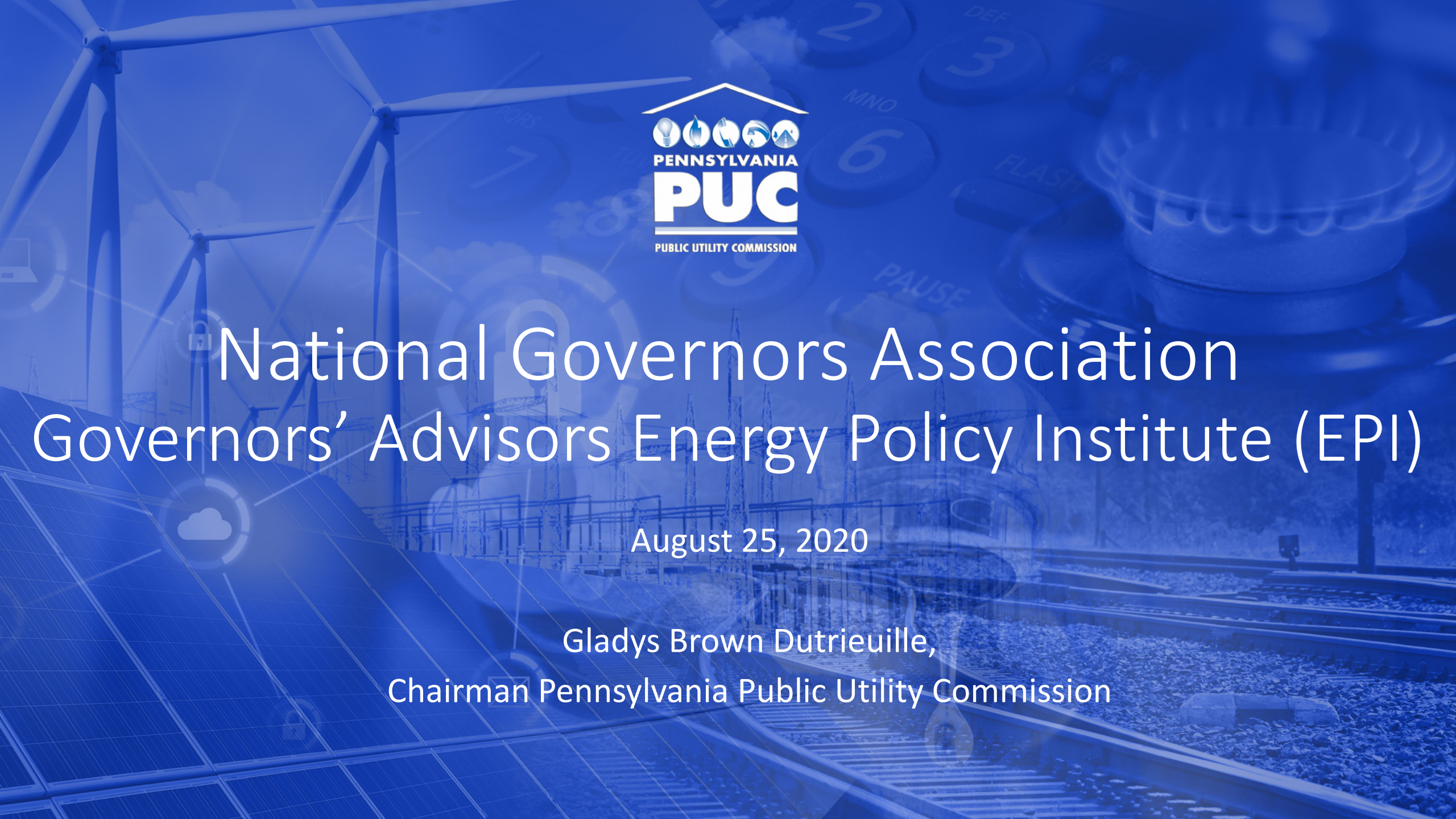
Jason Pazirandeh
Energy Sector Analyst
Jason.Pazirandeh@hq.doe.gov

U.S. DEPARTMENT OF ENERGY | OFFICE OF Cybersecurity, Energy Security, and Emergency Response

Discussion

- How can we support your cybersecurity efforts? / Are there specific resources that would be helpful?
- What are your energy security priorities and/or challenges?
- Does your state have a cybersecurity response plan? Is energy included?



National Governors Association
Governors' Advisors Energy Policy Institute (EPI)

August 25, 2020

Gladys Brown Dutrieuille,
Chairman Pennsylvania Public Utility Commission

National Association of Regulatory Utility Commissioners (NARUC) Cybersecurity Resources

- **Cybersecurity Strategy Development Guide** – This document aims to guide commissions' interactions with utilities on issues related to cybersecurity, drawing from the experiences of federal, state, and private-sector stakeholders, including state commissions themselves. https://pubs.naruc.org/pub/8C1D5CDD-A2C8-DA11-6DF8-FCC89B5A3204
- **Understanding Cybersecurity Preparedness: Questions for Utilities** – This tool provides a set of comprehensive, context-sensitive questions that commissions can ask of a utility to gain a detailed understanding of its current cybersecurity risk management program and practices. https://pubs.naruc.org/pub/3BACB84B-AA8A-0191-61FB-E9546E77F220
- **Cybersecurity Preparedness Evaluation Tool (CPET)** – CPET provides a structured approach for commissions to use in assessing the maturity of a utility's cybersecurity risk management program and gauging capability improvements over time. https://pubs.naruc.org/pub/3B93F1D2-BF62-E6BB-5107-E1A030CF09A0
- **Cybersecurity Glossary** - The glossary contains cybersecurity terms used throughout the Cybersecurity Manual, as well as "terms of art" that utilities may use during discussions with commissions. https://pubs.naruc.org/pub/7932B897-CF16-0368-BF79-EDC5C5A375EE

Utility Cybersecurity Training & Tabletop Exercises

- **U.S. Department of Homeland Security** – Cybersecurity and Infrastructure Security Agency (DHS-CISA) Training – DHS-CISA provides utilities and state regulators with cybersecurity training and tabletop exercises. The training and exercises can be in person and online. https://www.cisa.gov/cybersecurity-training-exercises

- **North American Electric Reliability Corporation (NERC) Grid Security Exercise (GridEx)** – GridEx provides NERC and state regulators with an opportunity to observe how utilities would respond to and recover from simulated cybersecurity and physical security threats to their critical infrastructure. https://www.nerc.com/pa/CI/CIPOutreach/Pages/GridEX.aspx

- **Electric Infrastructure Security (EIS) Black Sky Training** – A "Black Sky Hazard" is a catastrophic event that severely disrupts the normal functioning of our critical infrastructures in multiple regions for long durations. EIS leverages video material simulating news and emergency response operations, with interactive moderation based on evolving resilience and response recommendations from the Electric Infrastructure Protection (EPRO) Handbook Series. https://www.eiscouncil.org/

Pennsylvania Public Utility Commission Cybersecurity Regulations

- **Confidential Security Information Disclosure Protection Act (CSI Act) (35 P.S. § 2141)** – The CSI Act specifically defines Confidential Security Information (CSI) to include, among other things, vulnerability assessments, emergency response plans, and security plans. The CSI Act directs the Pennsylvania Public Utility Commission (PA PUC) to develop filing protocols and procedures for public utilities to follow when filing CSI with the Commission, and to address challenges to the designations or requests to examine records containing CSI.

- **Cybersecurity Plans and Self-Certification Regulations (52 Pa. Code § 101.1 - 7)** – These regulations require jurisdictional utilities to develop and maintain written physical, cybersecurity, emergency response, and business continuity plans. They also require utilities to submit a Public Utility Security Planning and Readiness Self-Certification Form on an annual basis.

- **Cybersecurity Incident Reporting (52 Pa. Code§ 57.11(b)(4), 59.11(b)(5) and 65.2(b)(4))** – These regulations require jurisdictional electric, natural gas, water and wastewater utilities to report an occurrence of an unusual nature that is a physical or cyber attack, including attempts against cybersecurity measures as defined in Chapter 101, which causes an interruption of service or more than $50,000 in damages.

- **Management Audits (66 Pa. Code § 516)** – The PA PUC's Bureau of Audits conducts Management Audits on the utilities' cybersecurity, emergency preparedness, physical security, and business continuity plans. Any deficiencies identified during the audit are reviewed during a post audit review with the utility, and the PA PUC follows-up with the utility to ensure that corrective action is taken to address the deficiencies.

Utility Cybersecurity Incidents

- **Security Clearances and One Day Certifications** – PA utilities and PA PUC staff have security clearances and they receive classified and secret briefings by DHS-CISA, FBI, and the PA State Police (PSP) Fusion Center. In addition to the regular security clearance process, the FBI and DHS-CISA can have a one-time meeting where they can brief C-Level employees and staff who need to be included in a briefing that includes confidential or secret information.
- **Alerts and Threat Information** – PA utilities and PA PUC staff receive classified and non-classified alerts and threat information from DHS-CISA, FBI, and PSP Fusion Center.
- **Reporting Process** – Depending on the severity of the incident, utilities can report incidents to the PA PUC, PSP Fusion Center, FBI, DHS-CISA, and/or their industry specific Information Sharing and Analysis Center (ISAC). All reports are submitted to the DHS-CISA National Cybersecurity and Communications Integration Center who ensure that all the appropriate stakeholders are notified about an incident that could impact their critical infrastructure.
- **PA PUC Cybersecurity Incident Response Team** – The PA PUC has a cybersecurity incident response team comprised of members from our offices and bureaus. These staff members have been trained to handle cybersecurity incidents and work with utility, state, and federal stakeholders.

  Note: The PA PUC adheres to the CSI Act when cybersecurity information is reported to it by a utility.
- **PA Cybersecurity Annex** – PA has a statewide cybersecurity plan that can be activated in the event there would be service outages that would take away critical utility services from utility customers. This plan identifies roles and responsibilities for the following agencies: PA PUC; Gov Office; Office of Admin; Gov Office of Homeland Security; PEMA; PSP-FUSION Center; PA National Guard; and the Commonwealth's health, safety, and welfare agencies.

Recommendations to other States and Regulators

- **Communicate with Utilities** – Bring in the utilities to get information about their cybersecurity programs.
- **Cybersecurity Program** – Establish a utility centric cybersecurity program and make sure you have clear goals and objectives to guide the program.
- **Cybersecurity Expert** – Hire a cybersecurity expert who can lead the program and train staff on the latest cybersecurity threats, industry best practices, cybersecurity standards, cybersecurity controls, incident response, etc.
- **Security Clearances** – Get security clearances for critical staff that would be called upon to assist in a cybersecurity incident involving the utilities.
- **State Utility Cybersecurity Incident Response Plan** – Meet with key stakeholders (Utilities, Emergency Management Agency, State Police, National Guard, FBI, DHS-CISA, etc.) to create statewide utility-based cybersecurity incident response process and procedures.
- **Tabletop Exercises** – Conduct regularly scheduled tabletop exercises with the stakeholders and utilities to strengthen their crisis communications relationships and provide input for lessons learned to create better incident response plans.
- **Utility Outreach Program** – Establish a utility outreach program where your staff meets regularly with the utilities to talk about cybersecurity issues and concerns.

NATIONAL GOVERNORS ASSOCIATION

Improving Energy Sector Cybersecurity in Your State

Speakers:

Brandi Martin, U.S. Department of Energy Office of Cybersecurity, Energy Security and Emergency Response

Chairman Gladys Brown Dutrieuille, Pennsylvania Public Utility Commission

Sean Parcel, Director, Cyber Intelligence & Defense, American Electric Power

Moderated by:

Dan Lauf, Program Director, National Governors Association

Trivia!

- Which state receives the most snowfall on average?

Answer:

Vermont – nearly 90 inches per year

NATIONAL GOVERNORS ASSOCIATION

The How and Why of Regional Agreements

Speakers:

Jennifer Chen, Senior Counsel, Nicholas Institute at Duke University

Eric Steltzer, Director, Renewables and Alternative Energy Division, Massachusetts Department of Energy Resources

Laura Tabor, Sustainability and Resilience Officer, New Mexico Energy, Minerals, and Natural Resources Department

Moderated by:

Matt Rogotzke, Policy Analyst, National Governors Association

Duke
NICHOLAS INSTITUTE
FOR ENVIRONMENTAL POLICY SOLUTIONS

Regional Collaborations: Lowering Costs, Reducing Emissions, Integrating Renewables

Jennie Chen

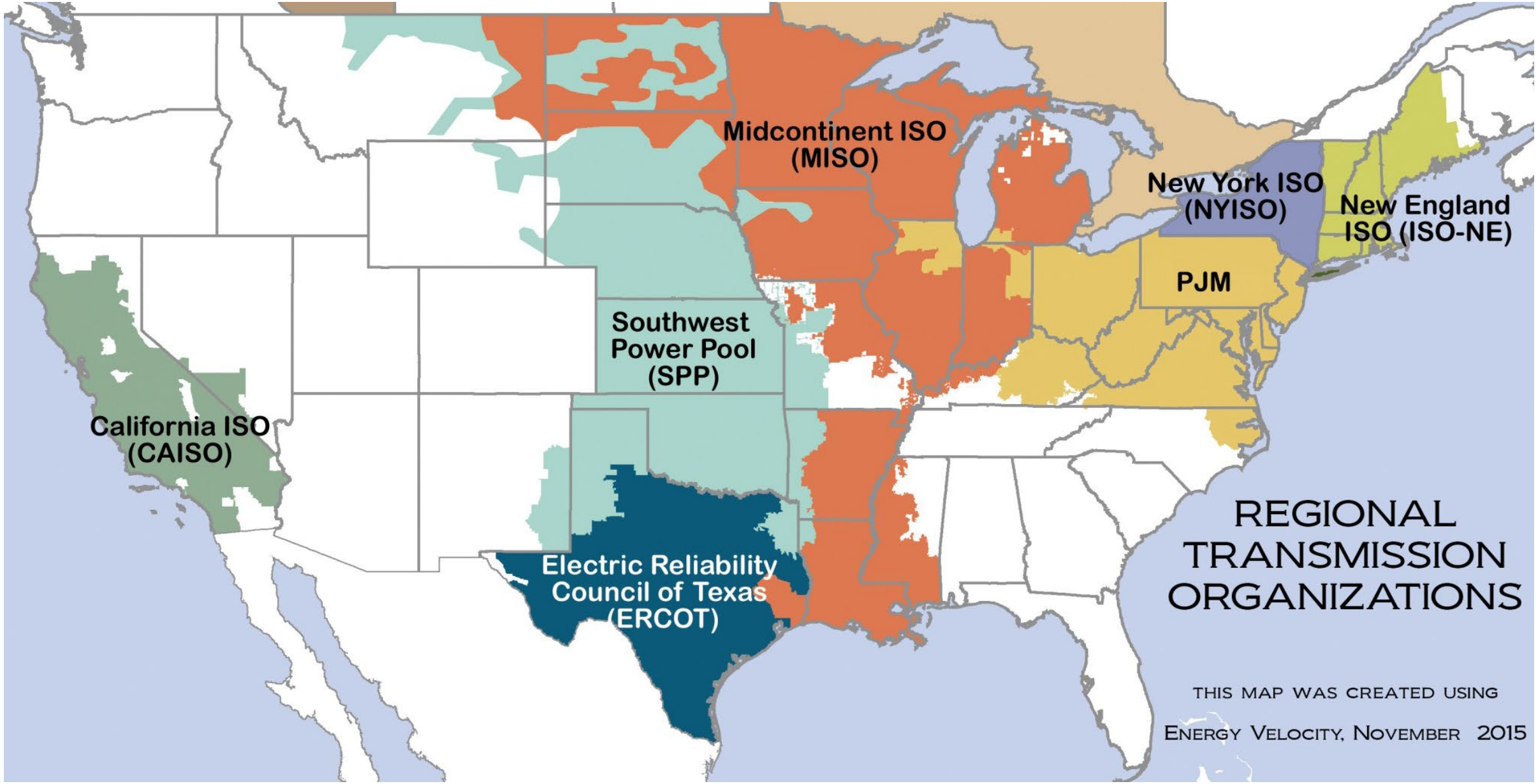
August 25, 2020

Regional collaborations for wholesale electricity—some options

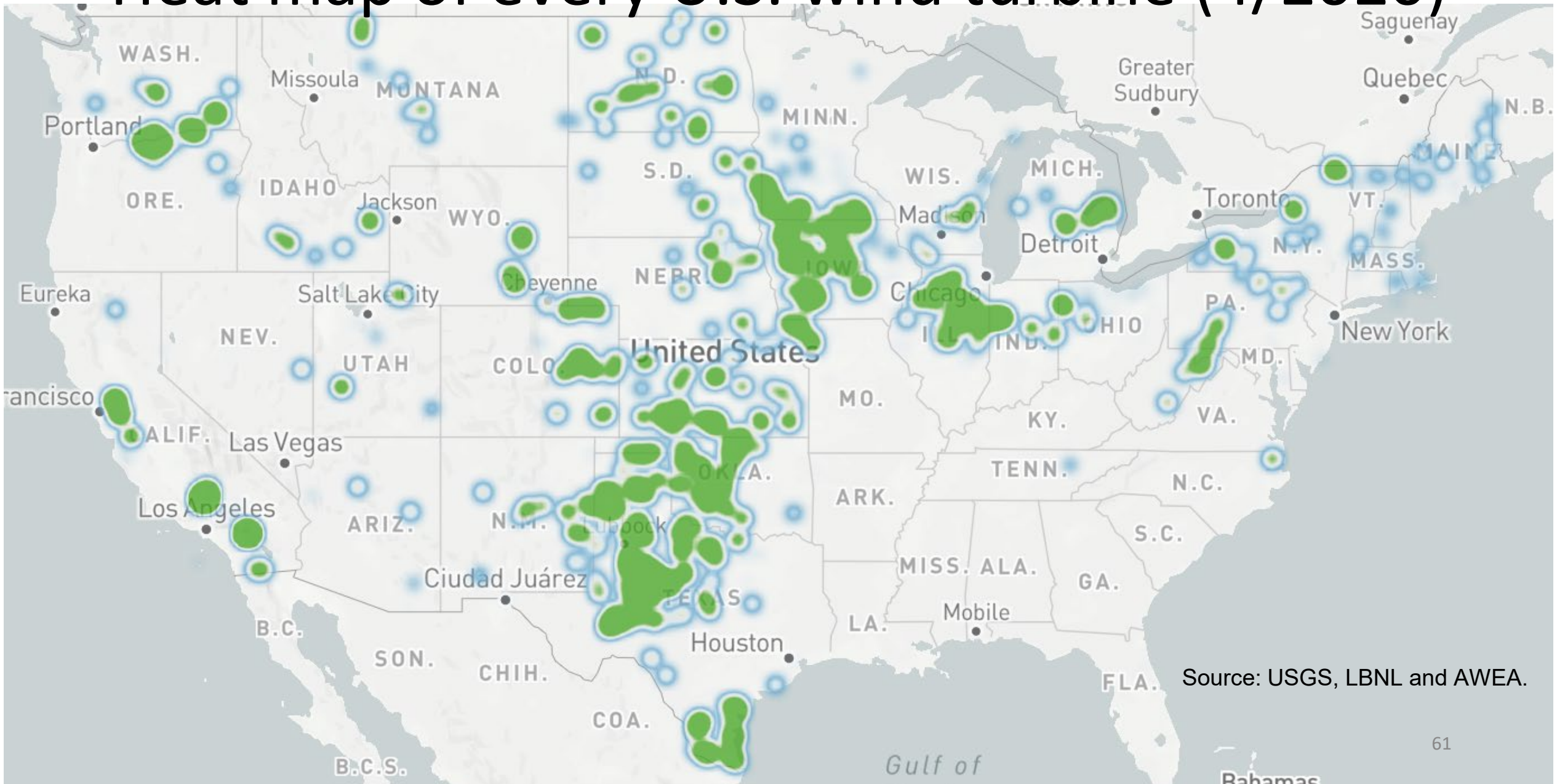
- Regional Transmission Organizations
- Energy Imbalance Markets
- Less formal voluntary trading
  - E.g., Southeast Energy Exchange Market (SEEM)?

To what extent can these options scale up renewable energy, lower wholesale costs?

- Connecting RE with customers
- RE integration/grid flexibility: size, granular timeframes
- Costs/benefits
- Price transparency
- Governance


Midcontinent ISO
(MISO)
New York ISO
(NYISO)
New England
ISO (ISO-NE)
PJM
Southwest
Power Pool
(SPP)
California ISO
(CAISO)
Electric Reliability
Council of Texas
(ERCOT)
REGIONAL
TRANSMISSION
ORGANIZATIONS
THIS MAP WAS CREATED USING
ENERGY VELOCITY, NOVEMBER 2015

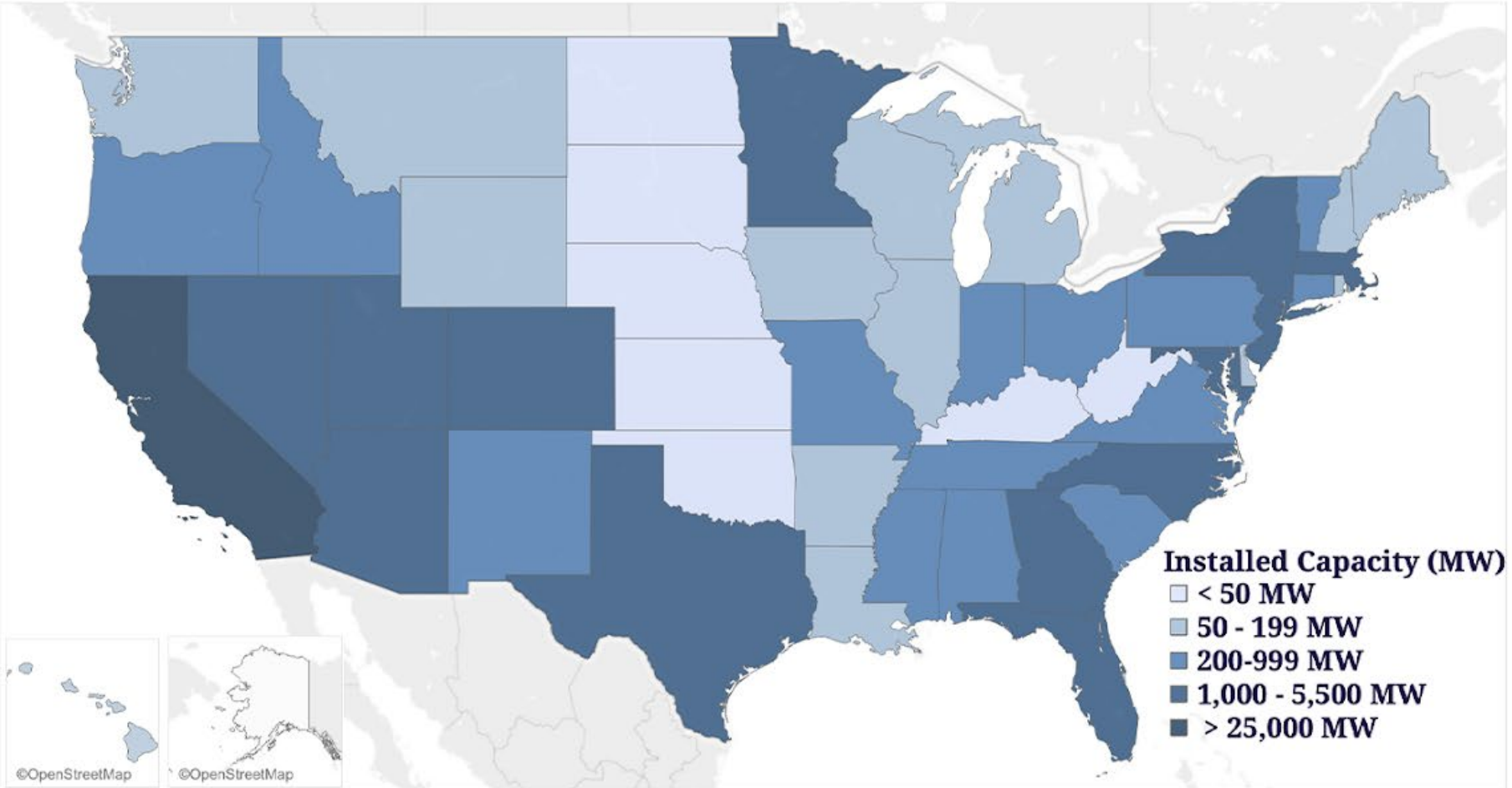
Heat map of every U.S. wind turbine (4/2020)



Source: USGS, LBNL and AWEA.

Top 10 States

California	25,016 MW
North Carolina	5,467 MW
Arizona	3,788 MW
Nevada	3,452 MW
Florida	3,156 MW
Texas	2,957 MW
New Jersey	2,829 MW
Massachusetts	2,535 MW
New York	1,718 MW
Utah	1,661 MW
Georgia	1,572 MW

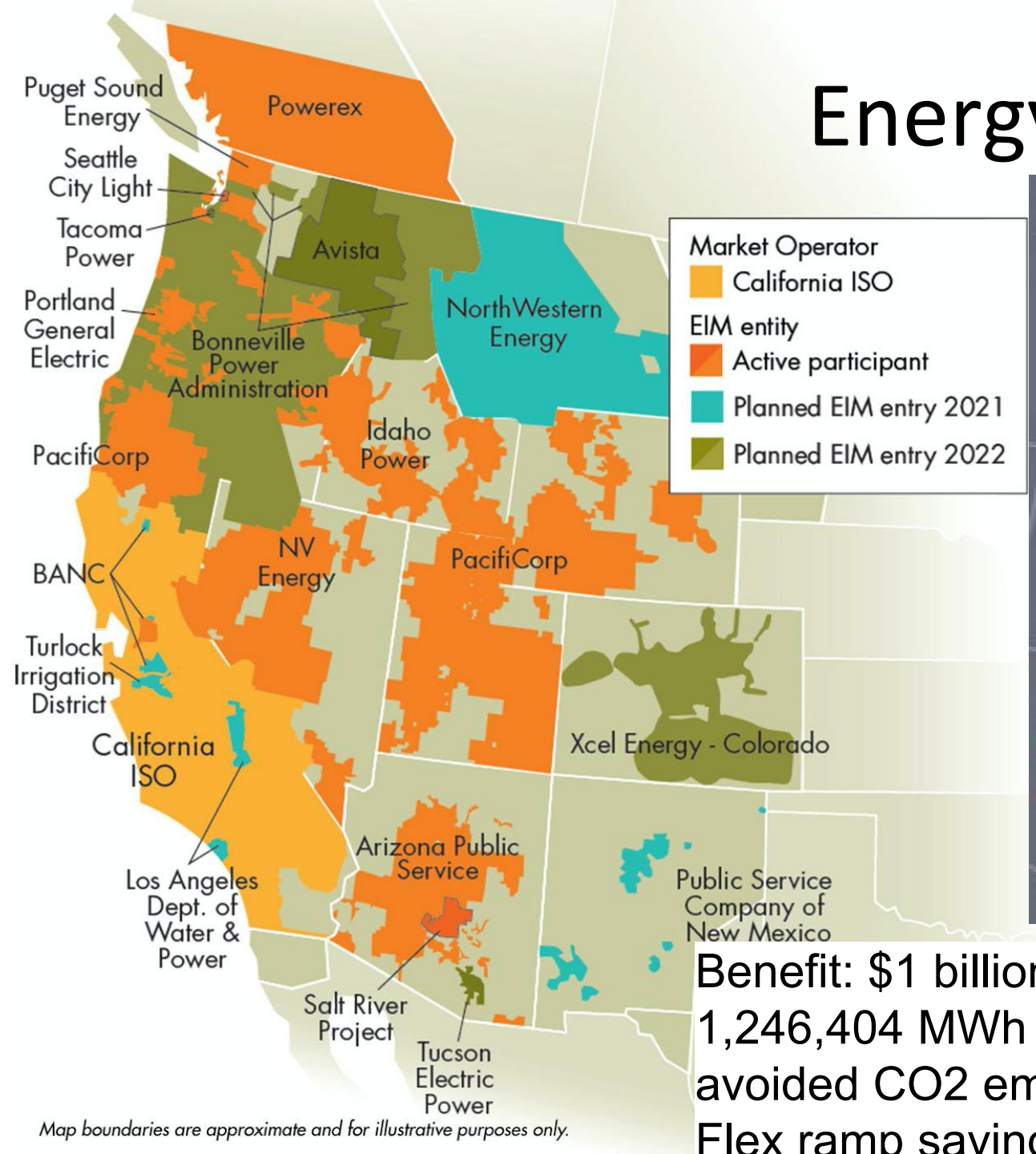


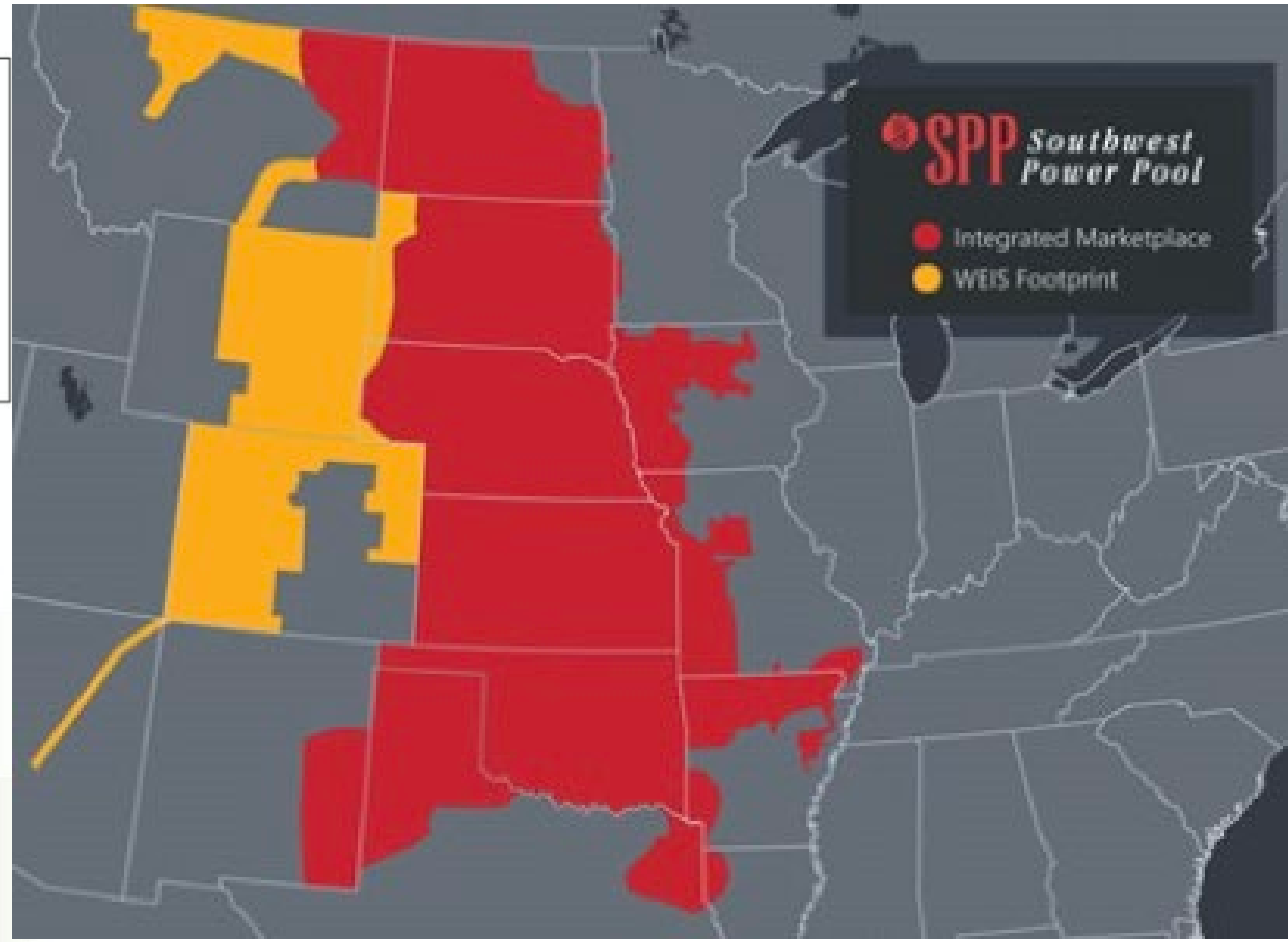
Wood Mackenzie POWER & RENEWABLES

SEIA Solar Energy Industries Association®

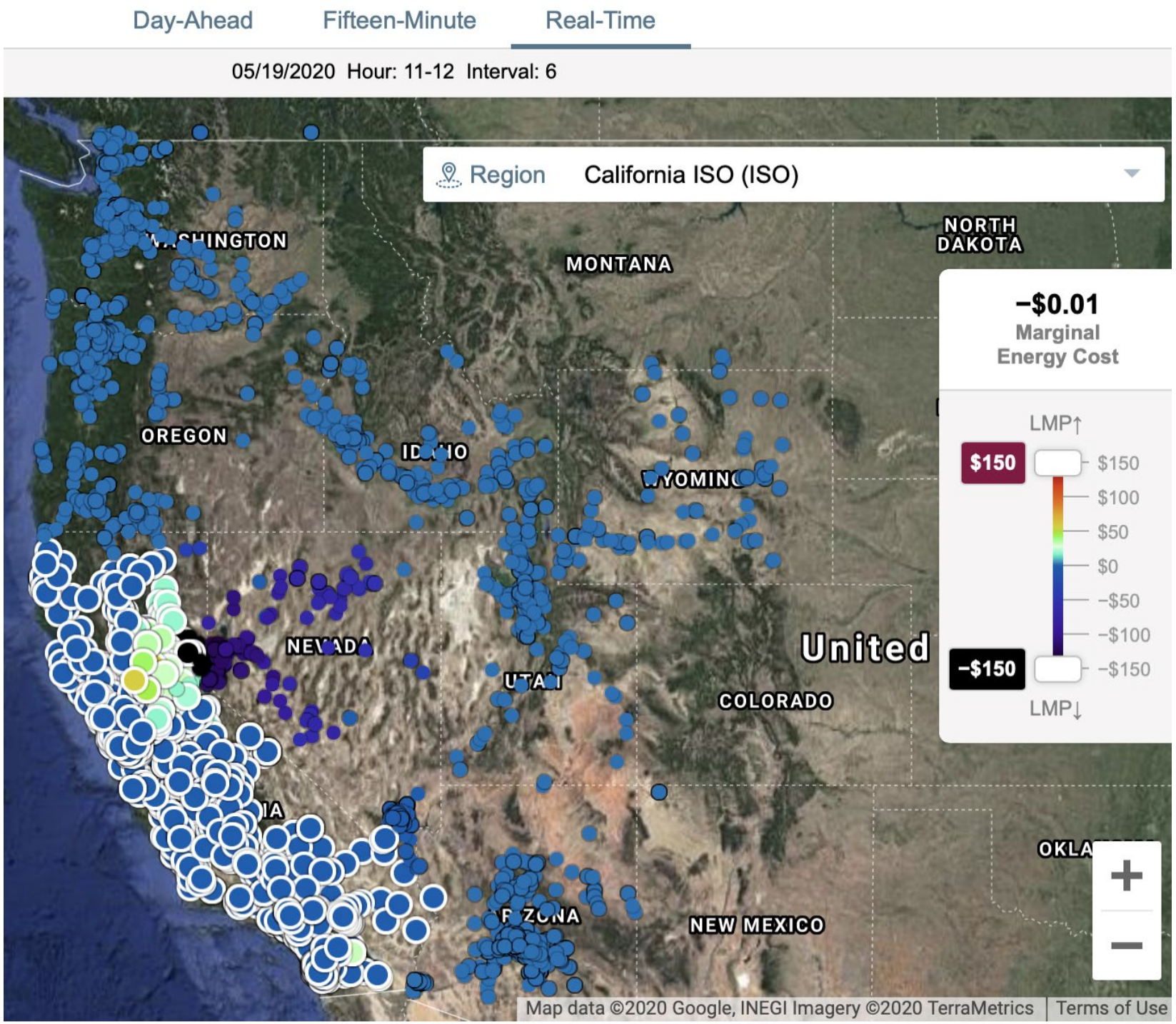
Region	2019 Renewable Capacity as Percent of Total (GW)[33]	2019 Renewable Generation as Percent of Total[34]
WECC-CA	30.5% (22.6 GW)	33.6%
ERCOT	28.6% (29.6 GW)	20.7%
SPP	25.8% (22.3 GW)	27.0%
WECC (excl. CA)	16.7% (23.4 GW)	12.0%
MISO	14.8% (25.2 GW)	10.7%
ISO-NE	10.8% (3.7 GW)	11.2%
PJM	7.0% (13.7 GW)	4.1%
NYISO	6.9% (2.9 GW)	5.2%
FRCC	4.8% (2.7 GW)	2.6%
SERC	4.3% (7.1 GW)	2.1%

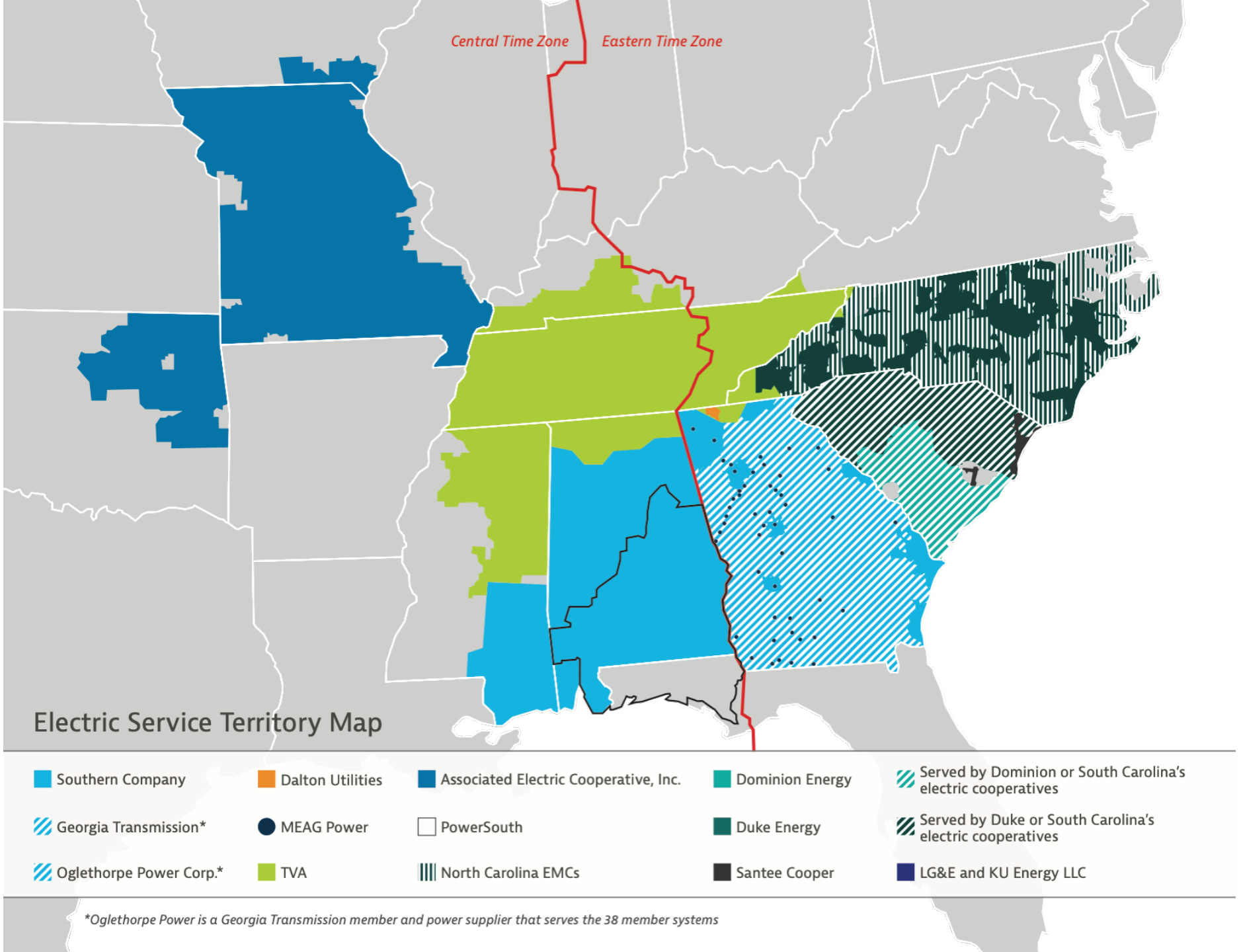
Energy Imbalance Markets





Benefit: $1 billion – from November 2014 to July 3, 2020
1,246,404 MWh avoided curtailment, 533,381 tons avoided CO2 emissions through 2Q 2020
Flex ramp savings ~ 50%


Day-Ahead
Fifteen-Minute
Real-Time
05/19/2020 Hour: 11-12 Interval: 6
Region
California ISO (ISO)
NORTH DAKOTA
MONTANA
OREGON
COLORADO
NEW MEXICO
−$0.01
Marginal Energy Cost
LMP↑
$150
$150
$100
$50
$0
−$50
−$100
−$150
−$150
LMP↓
Map data ©2020 Google, INEGI Imagery ©2020 TerraMetrics
Terms of Use


Central Time Zone
Eastern Time Zone
Electric Service Territory Map
Southern Company
Dalton Utilities
Associated Electric Cooperative, Inc.
Dominion Energy
Served by Dominion or South Carolina's electric cooperatives
Georgia Transmission*
MEAG Power
PowerSouth
Duke Energy
Served by Duke or South Carolina's electric cooperatives
Oglethorpe Power Corp.*
TVA
North Carolina EMCs
Santee Cooper
LG&E and KU Energy LLC
*Oglethorpe Power is a Georgia Transmission member and power supplier that serves the 38 member systems

Costs/Benefits

Example: APS joining WEIM*

- Size ~7 GW
- Startup cost ~$13-$19 M: metering upgrades, communications software, business process changes and tariff changes
- Ongoing cost ~$4 M annually
- $42 M/year actual benefits
- ~**$5.45 M/yr/GW** net benefits after initial costs paid

SPP projected **EIM** trade net benefits 2005 ~$37M/yr / 40 GW

=> ~ **$0.93M/yr/GW**

SEEM

- ~170 GW size?
- ~$37-55 M/yr saving (base case)
- ~$117-146 M/yr savings for region in 2037 (carbon constrained)
- ~$5 M startup, then ~$0.75-3 M/year for region
- ~45M/yr/170 GW => **~ $0.26M/yr/GW (base case)**
- ~**$0.78 M/yr/GW** net benefits after initial costs paid in 2037 (carbon constrained)

*Caveat: This is not a rigorous analysis, just a back-of-envelope estimate of potential net benefits compared to costs scaled to size using available

- Connecting RE with customers — RTO
- RE integration/grid flexibility — RTO, EIM
- Costs/benefits — RTO, EIM
- Price transparency — RTO, EIM

- Governance:
  - State input / approvals
  - Stakeholder input
  - Market monitoring
  - Independent operator
  - Transparency in prices, decision making

Thank you!

- Evaluating Options for Enhancing Wholesale Competition and Implications for the Southeastern United States https://nicholasinstitute.duke.edu/publications/evaluating-options-enhancing-wholesale-competition-and-implications-southeastern
- +2 briefs: Voluntary wholesale electricity trading mechanisms and RTOs (R Street, with Mike Bardee, forthcoming)
- State Participation in Resource Adequacy Decisions in Multistate Regional Transmission Organizations https://nicholasinstitute.duke.edu/publications/state-participation-resource-adequacy-decisions-multistate-regional-transmission

NATIONAL GOVERNORS ASSOCIATION

The How and Why of Regional Agreements

Speaker:

Eric Steltzer, Director, Renewables and Alternative Energy Division, Massachusetts Department of Energy Resources

Creating A Cleaner Energy Future For the Commonwealth

Massachusetts Department of Energy Resources

COMMONWEALTH OF MASSACHUSETTS

Charles D. Baker, Governor
Karyn E. Polito, Lt. Governor
Kathleen Theoharides, Secretary
Patrick Woodcock, Commissioner

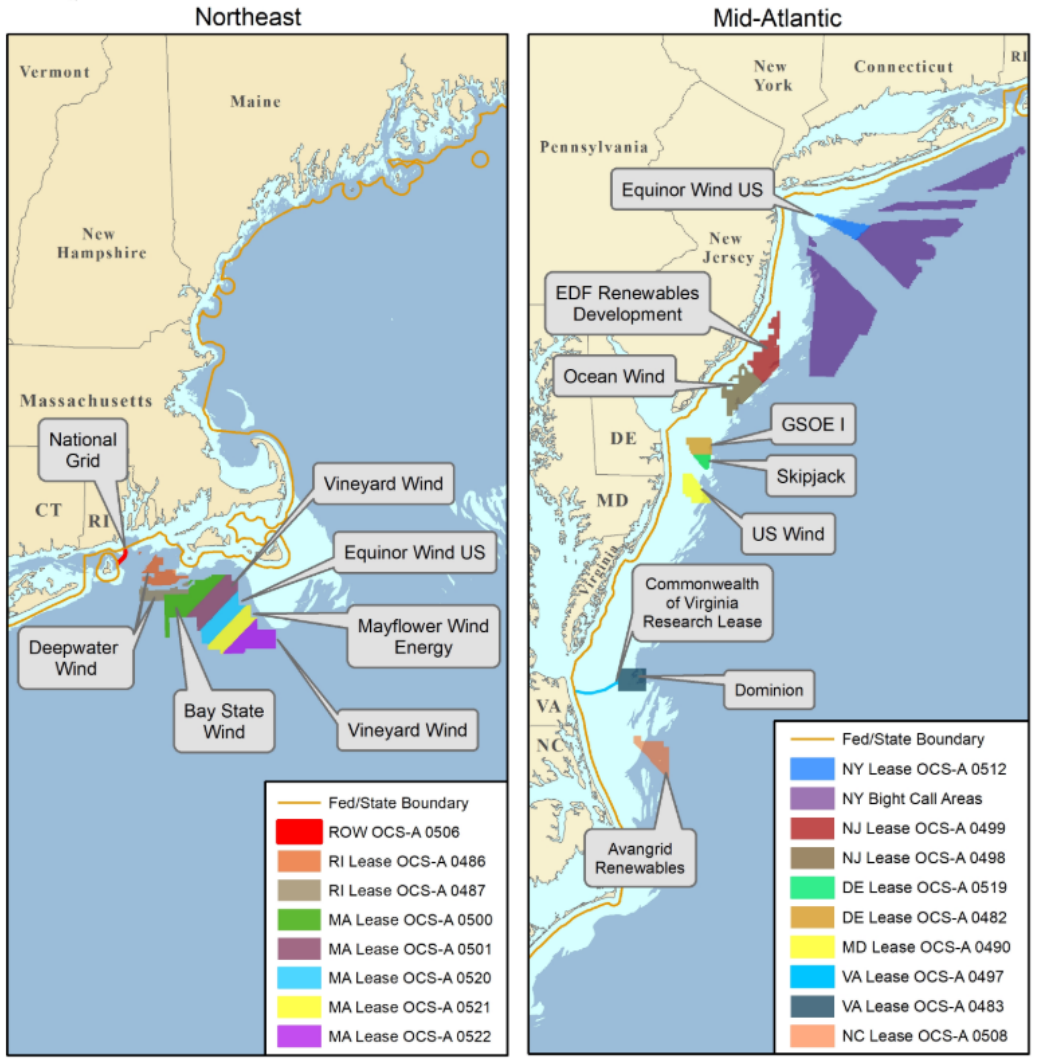
Regional Collaboration for Offshore Wind in Northeast

Presentation to NGA August 25, 2020

Eric Steltzer
Director- Renewable Energy Division

Drivers for Offshore Wind Deployment

- Clean and Diverse Energy Goals
  - Net Zero by 2050
- Massive Opportunity
  - +10GW potential
  - Pipeline Constraints
  - Winter Price Spikes
  - Significant GHG Reductions

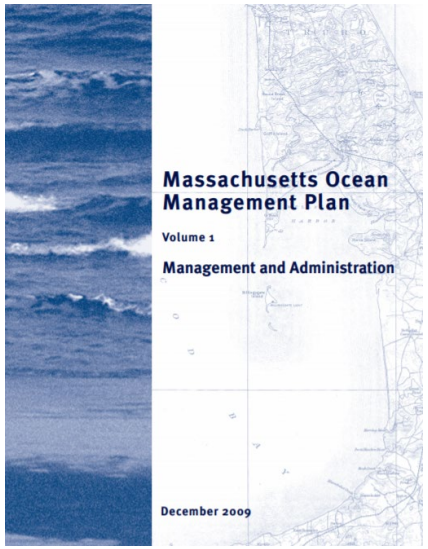


Need for regional collaboration

- Proximity of states to one another
- Resources are not limited to state boundaries
  - Environmental
  - Fisheries
  - Recreational
  - Wind Resource

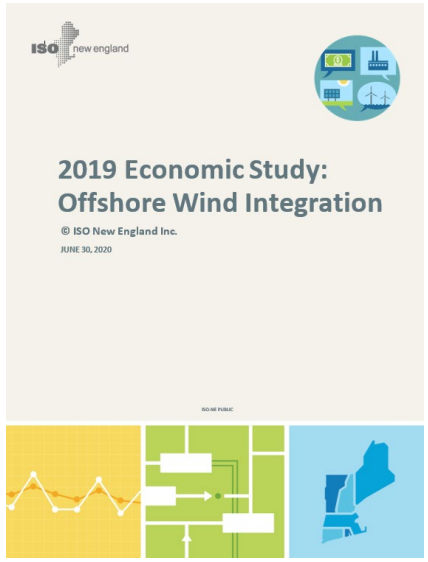
Regional Collaboration Efforts for Offshore Wind

Ocean Management Plan- 2009



Regional Offshore Wind Reports- 2017

Economic Assessment of Transmission- 2020



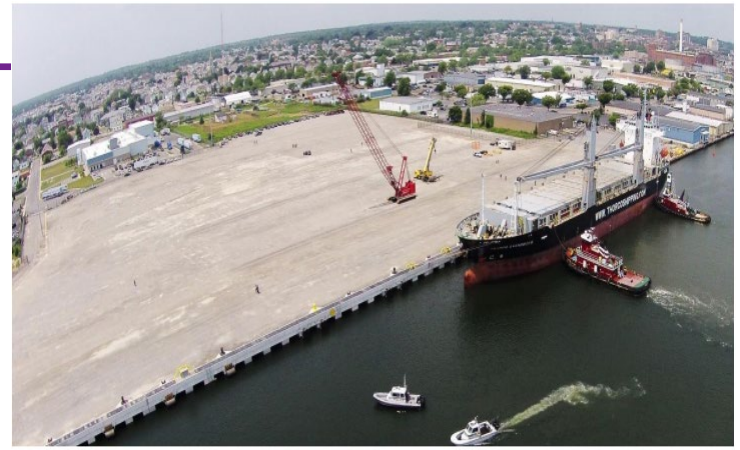
Challenges and Opportunities

Transmission

Gulf of Maine Taskforce

Fisheries and Environment

Economic Development



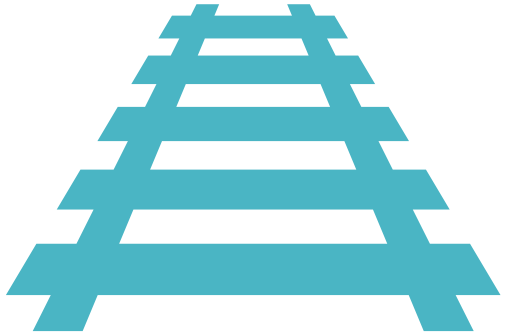
NATIONAL GOVERNORS ASSOCIATION

The How and Why of Regional Agreements

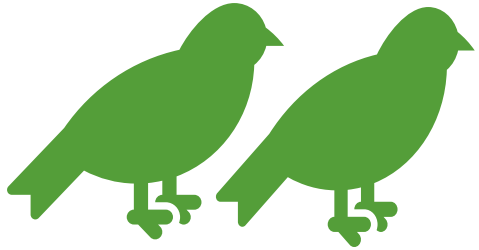
Speakers:

Laura Tabor, Sustainability and Resilience Officer, New Mexico Energy, Minerals, and Natural Resources Department

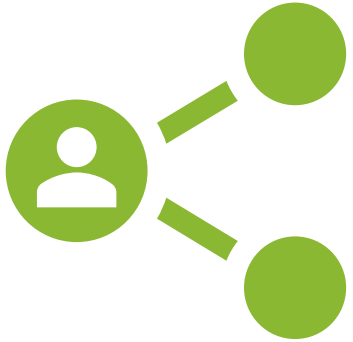
Regional Collaboration Benefits



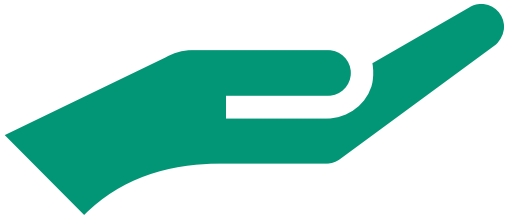
Goals, Accountability, and Momentum



Efficiency and Efficacy



Information Sharing & Learning



External Organizational Resources

NATIONAL GOVERNORS ASSOCIATION

Energy Policy Institute Wrap-Up

Speakers:

Jennifer Chen, Senior Counsel, Nicholas Institute at Duke University

Eric Steltzer, Director, Renewables and Alternative Energy Division, Massachusetts Department of Energy Resources

Laura Tabor, Sustainability and Resilience Officer, New Mexico Energy, Minerals, and Natural Resources Department

Moderated by:

Matt Rogotzke, Policy Analyst, National Governors Association

Conference Wrap Up
Recap of Key Ideas and Insights

Please share:

1. One thing you heard at this year's EPI that resonated

2. One remaining question or challenge that NGA can help address

Conference Wrap Up
Recap of Key Ideas and Insights

Following this event:

- NGA will post slides to the website and send to the full audience
- Keep an eye out for the meeting evaluation form
- NGA remains available for quick turnaround technical assistance on any of these topics and more

Save the Dates!

ResCon International 2020	Sept. 8-10
Electric Vehicle Grid Integration Workshop	Sept. 16-18
Offshore Wind Summit	Sept. 25, 30 Oct. 7
State Role in National Defense: Installation Resilience Workshop	Wk. of Oct. 5
Planning for the Future Workshop: Strategies to Meet Governors' Energy Goals	Oct. 27-29

Coming Soon:

Governor Strategies to Expand Affordable Broadband Access
Electric Vehicle Grid Integration Whitepaper
Governor's Leading on Energy Transitions: State Energy Goals and Strategies to Meet Them
State Resilience Assessment and Planning Tool
State Critical Infrastructure Cybersecurity Governance Bodies
State, Federal and Industry Energy Cybersecurity Information Sharing (with NARUC and NASEO)

NATIONAL GOVERNORS ASSOCIATION

THANK YOU!