

Energy Storage in the U.S: Trends and Insights

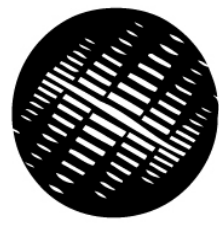
Sara Baldwin Auck
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January 15, 2018

York University, The Sustainable Energy Initiative &
Ontario Climate Consortium

“Energy Storage in the EU, UK and US”





IREC



Regulatory Reform



Quality Workforce

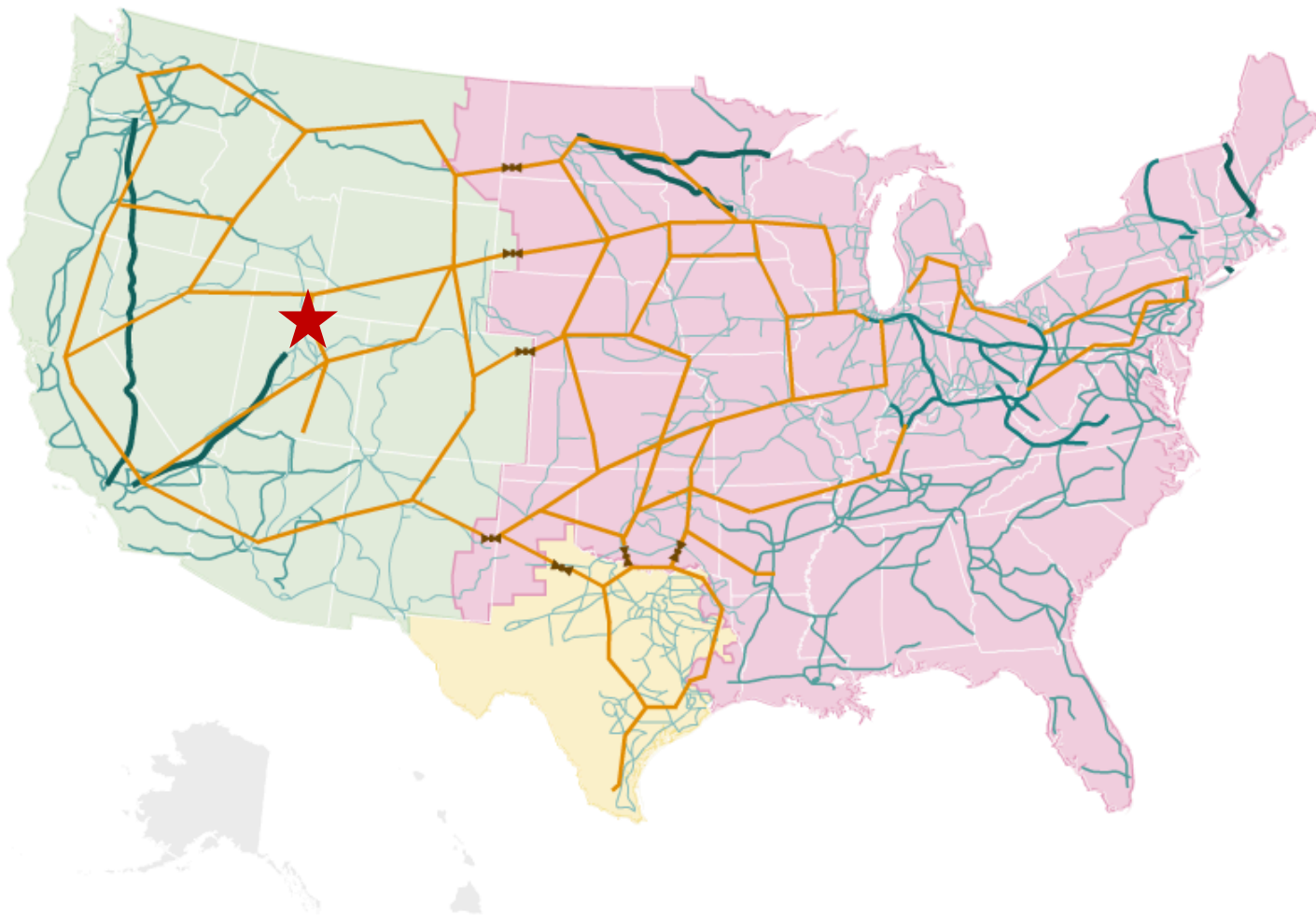


Consumer
Empowerment

Today's discussion...

- Overview of U.S. Electricity Markets
- U.S. Energy Storage Market Trends
- Policy Actions on Energy Storage

Overview of the U.S. Electricity Market



U.S. Energy Market – Layers of the Onion

Policy

- Federal
- State
- Local Government

Market Structures

- Regulated
- Deregulated or Restructured

Utility Type

- Investor-Owned Utility
- Municipal Utility
- Rural Electric Cooperative
- Federal Power Administrations (BPA, TVA, WAPA)



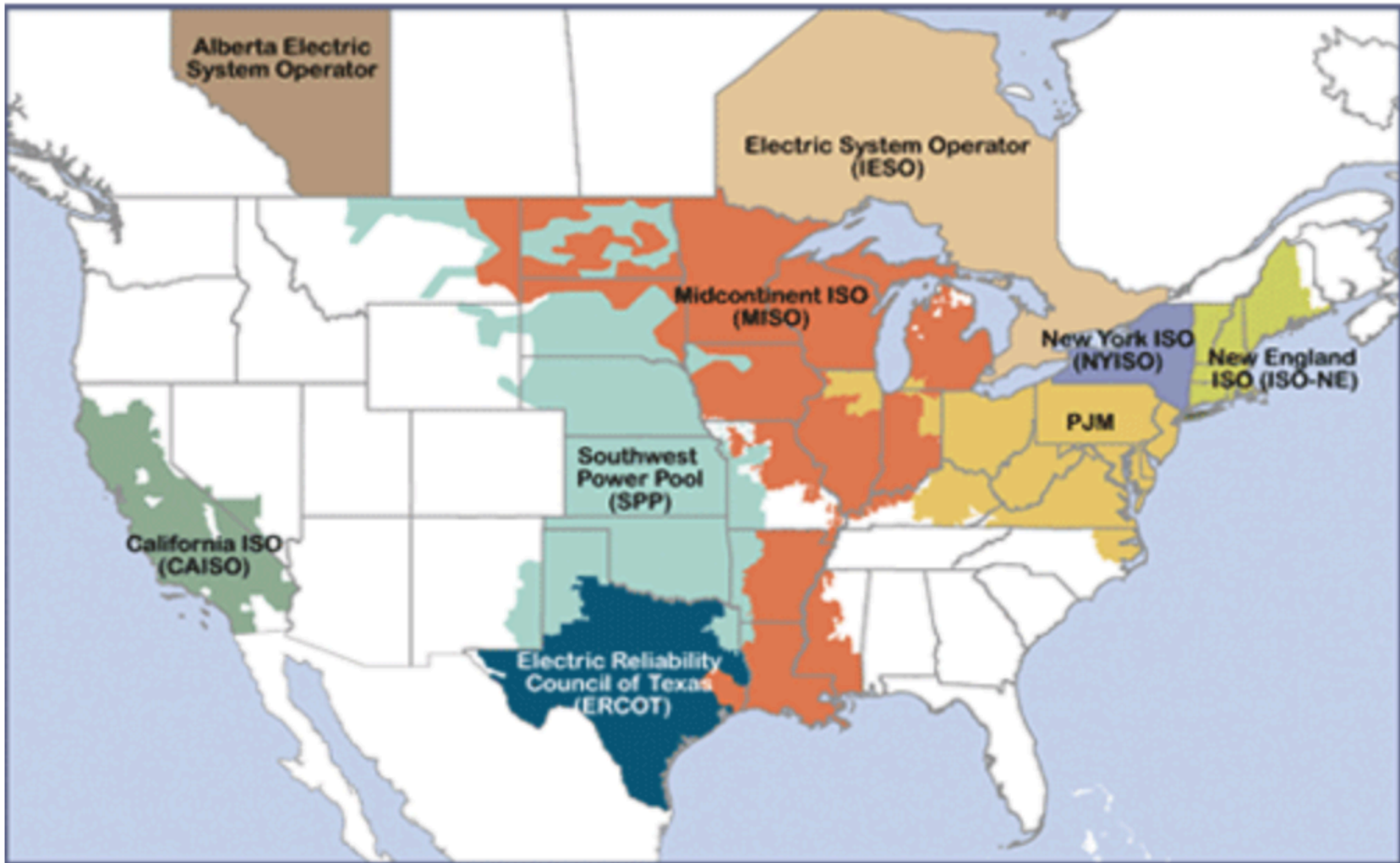
Transactions

- Wholesale
- Retail

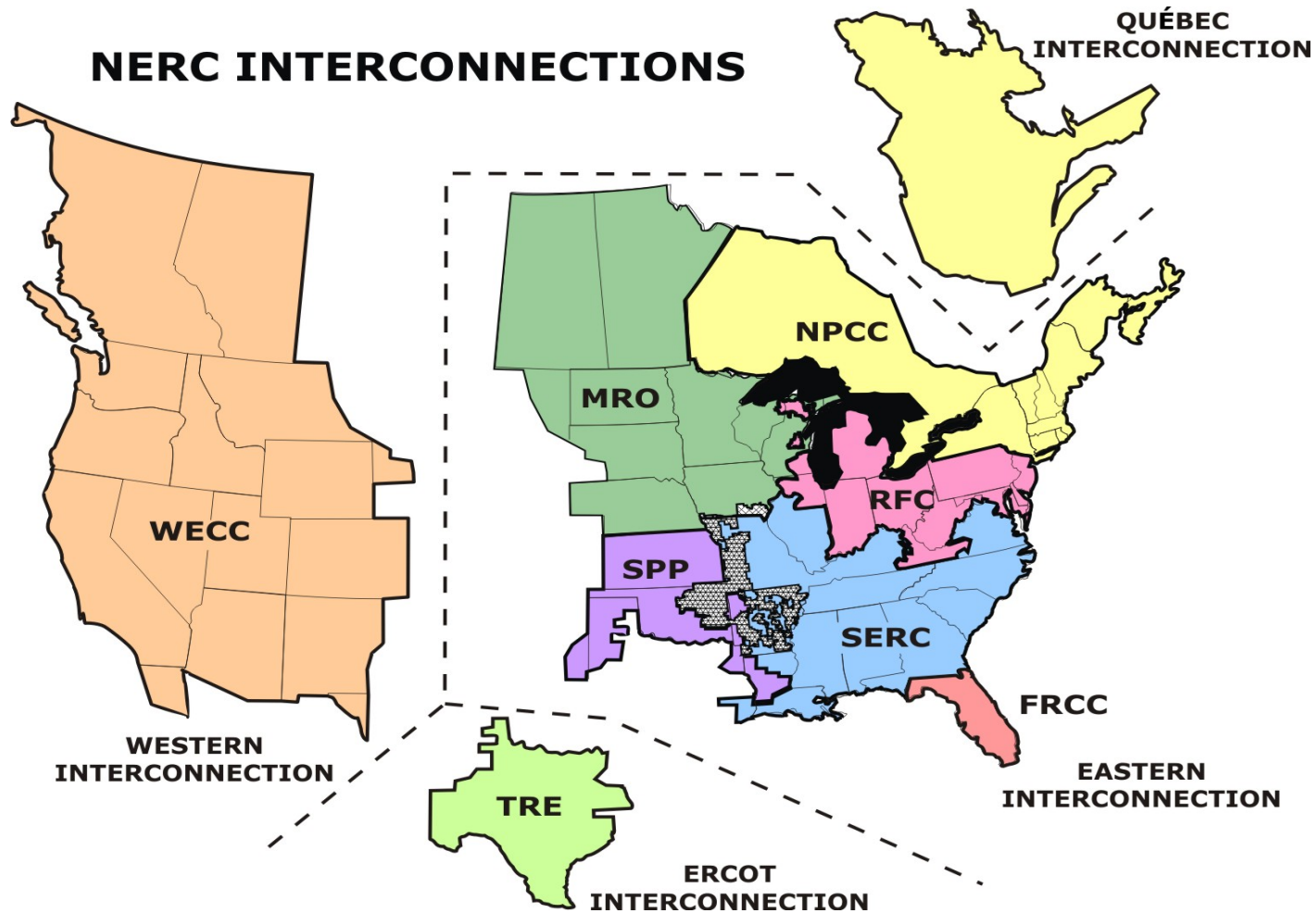
Grid Location

- Transmission System or “Front-of-Meter”
- Distribution System or “Behind-the-Meter”

Wholesale Electricity Markets

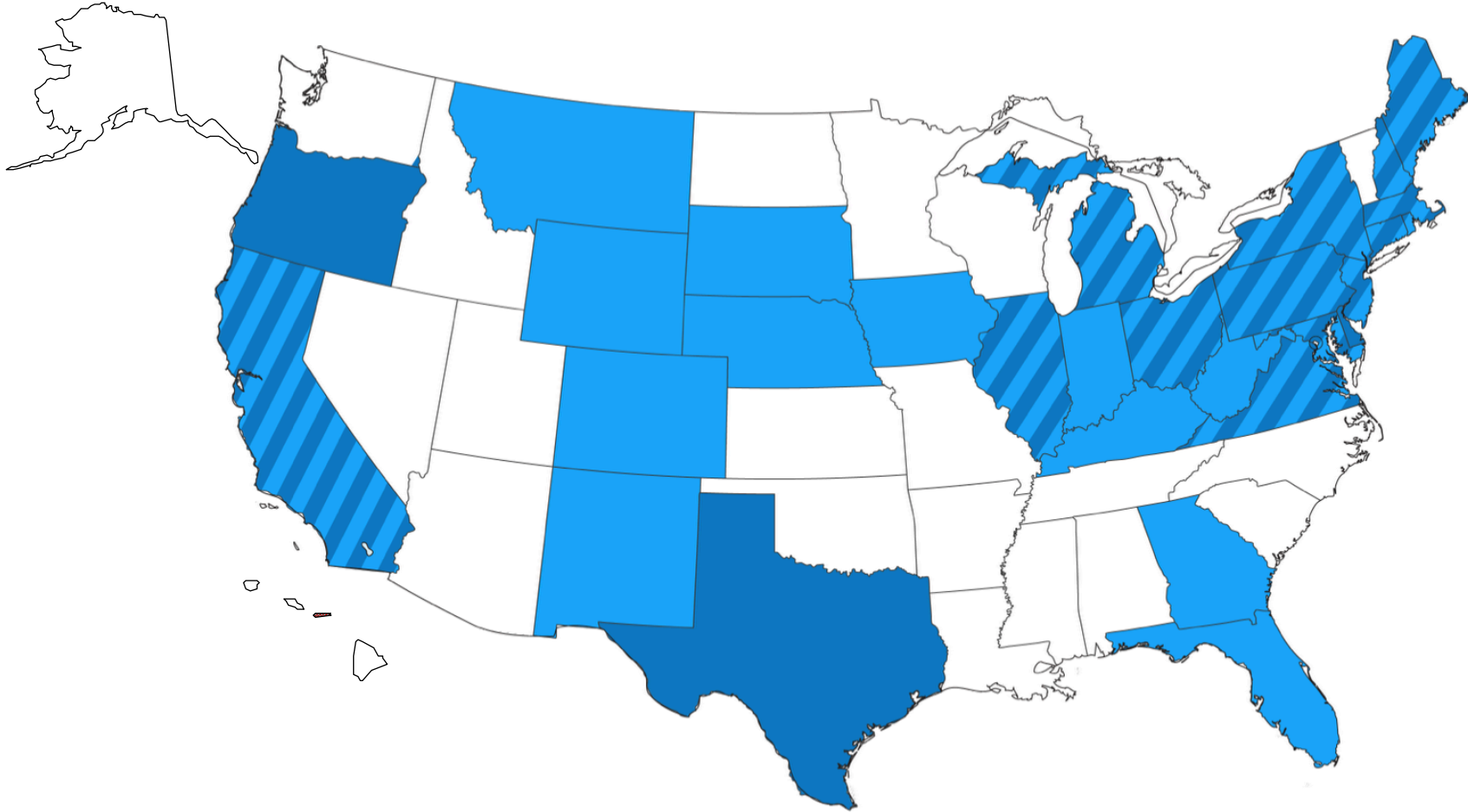


North American Electric Reliability Entities & Interconnections



Source: North American Electric Reliability Corporation,
http://www.nerc.com/AboutNERC/keyplayers/Documents/NERC_Interconnections_Color_072512.jpg

State Market Structures



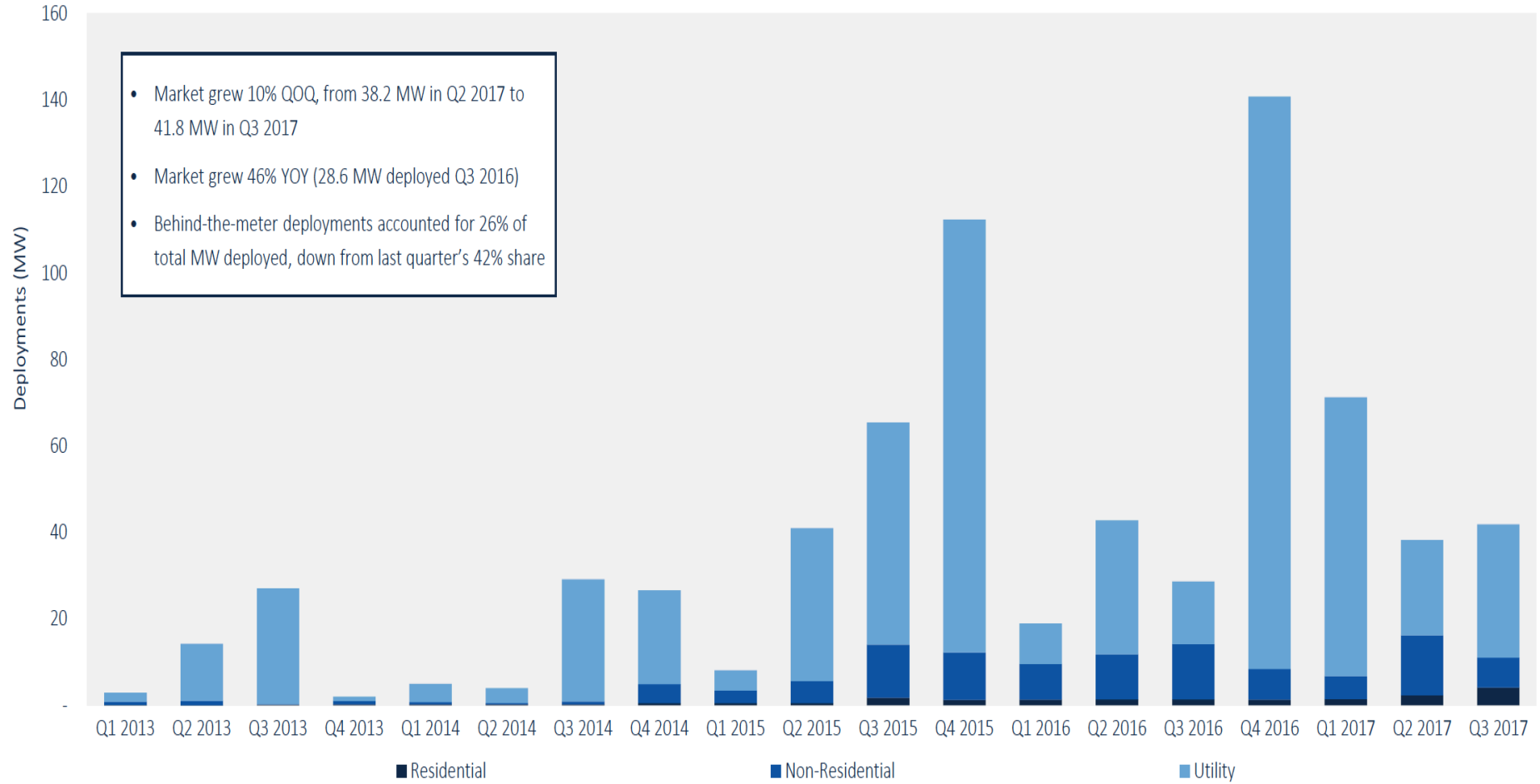
Source: <https://www.electricchoice.com/map-deregulated-energy-markets/>

U.S. Energy Storage Market Trends



U.S. Energy Storage Market Growth (MW)

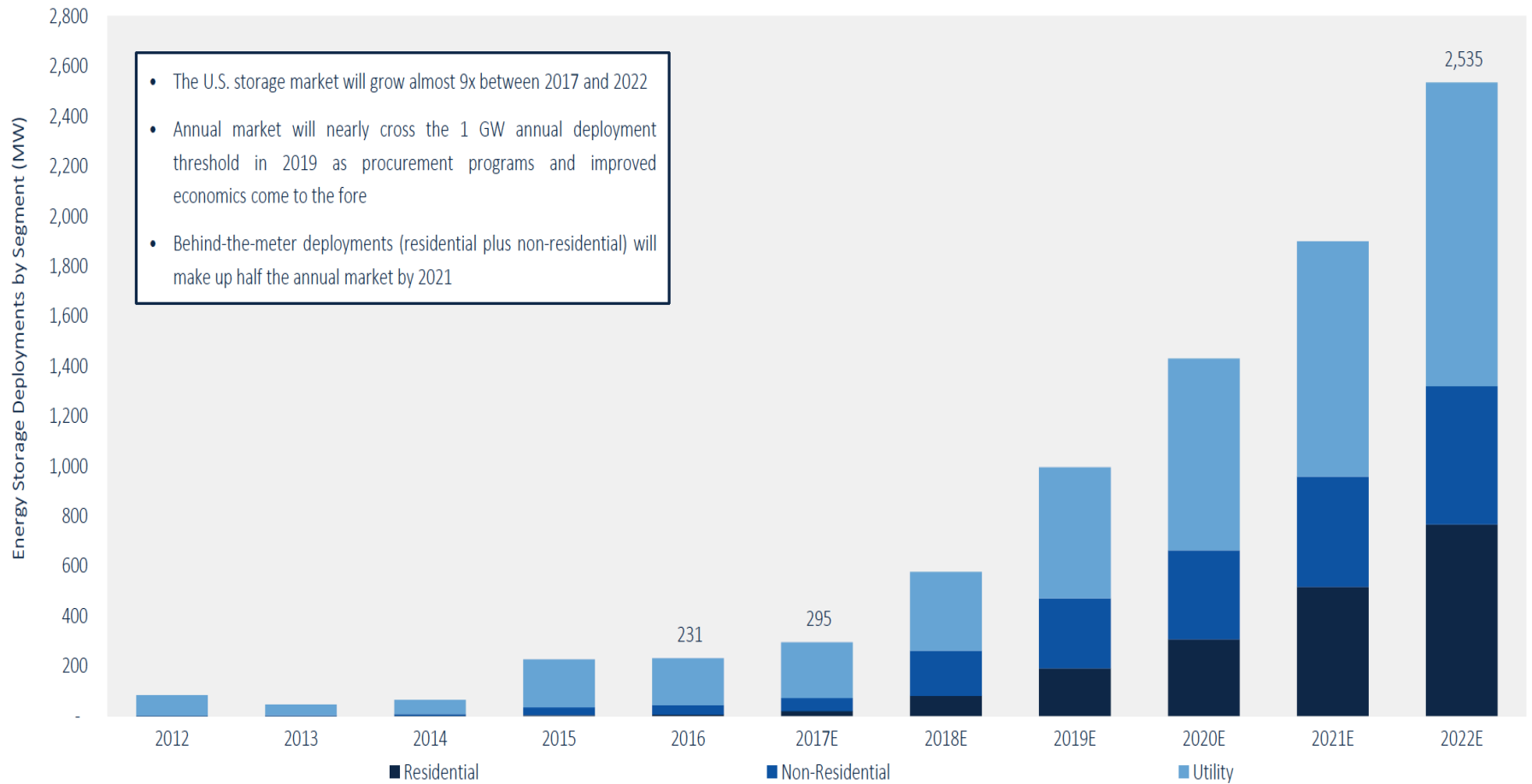
U.S. Quarterly Energy Storage Deployments by Segment (MW)



Source: U.S. Energy Storage Monitor, Q4 2017, GTM Research and Energy Storage Association (April 2017)

U.S. Energy Storage Market Forecasts

U.S. Annual Energy Storage Deployment Forecast, 2012-2022E (MW)



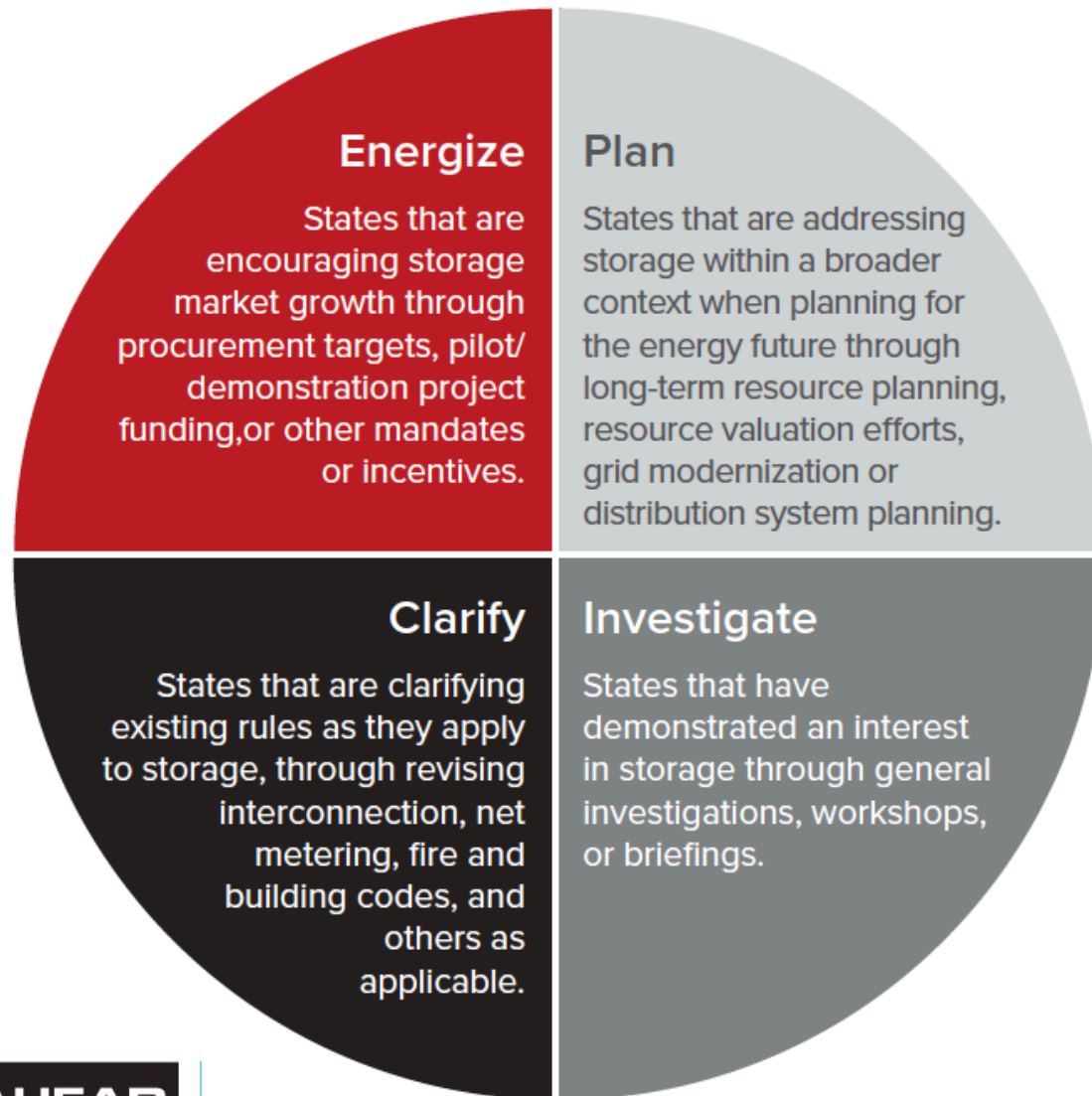
Policy Actions on Energy Storage



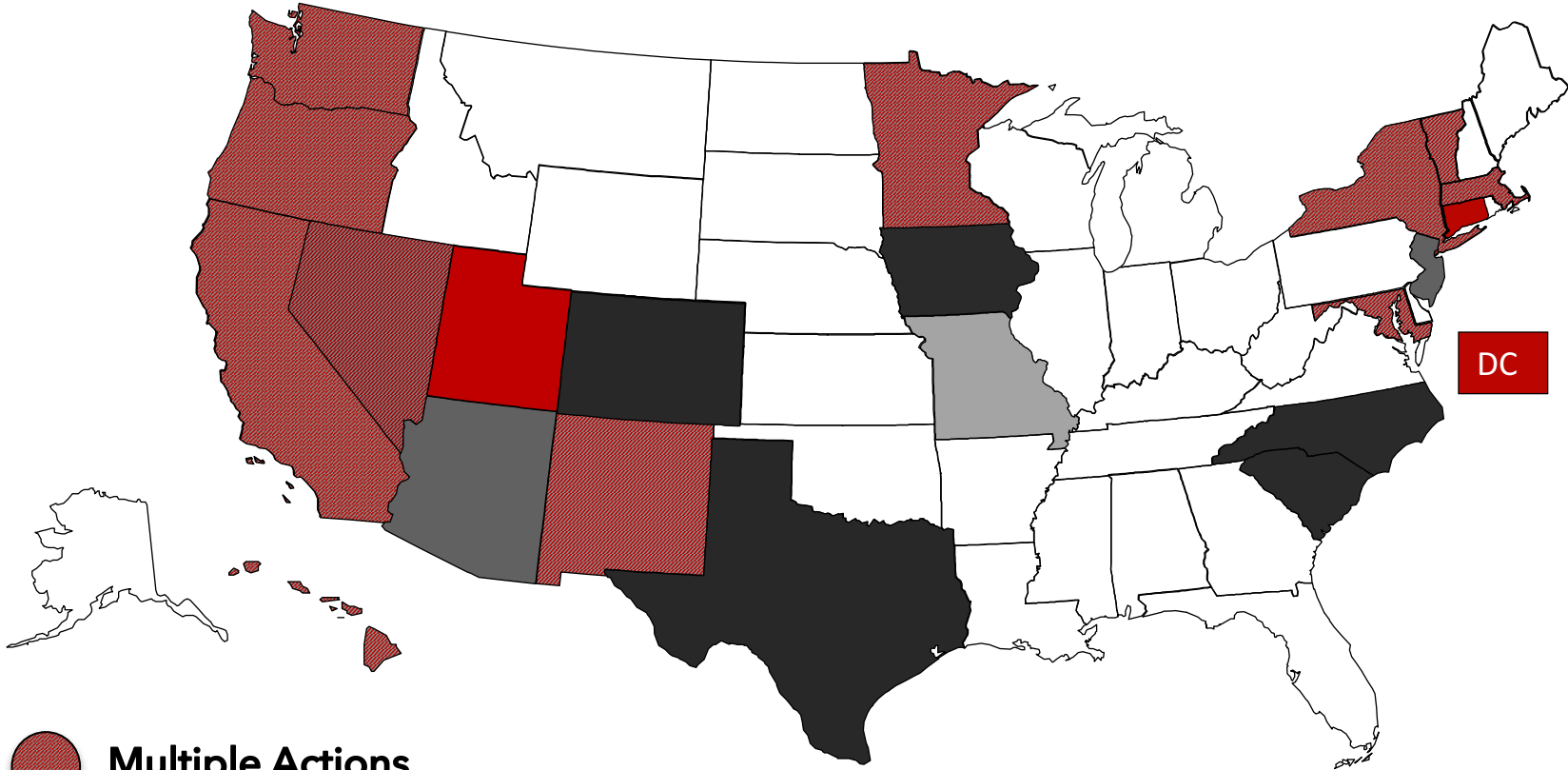
Federal Policy Actions on Energy Storage

- FERC Notice of Proposed Rulemaking on Energy Storage and Distributed Energy Resources (RM16-23-000)
- FERC Small Generator Interconnection Agreements and Procedures (RM13-2-000; Order No. 792)
- 2017 Tax Reform Bill

Categories of State Policy Actions on Energy Storage



State Actions on Energy Storage



 **Multiple Actions**

 **Energize the Market**

 **Plan for Storage**

 **Clarify Existing Rules**

 **Investigate Storage**

CHARGING AHEAD
An Energy Storage Guide for Policymakers

Note: Map is not reflective of all state activities on energy storage. Certain early stage policy/regulatory efforts, grant programs and/or pilot projects may not be reflected herein.

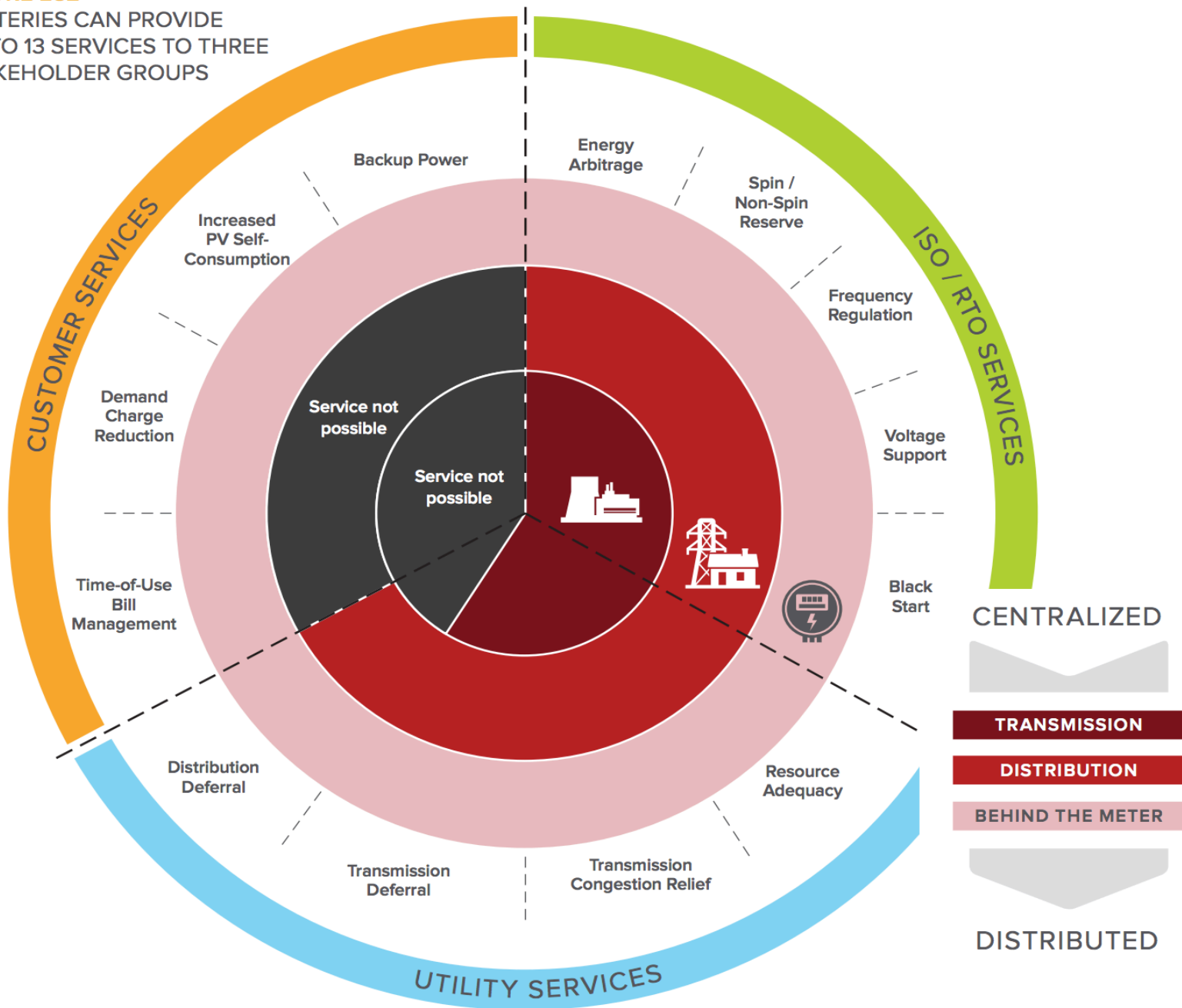


Top States for Energy Storage Policy

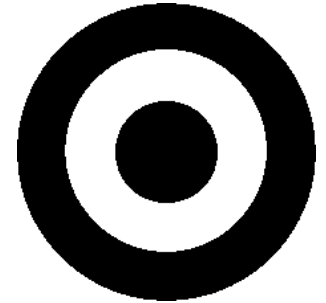
	Incentives	Procurement Target	Rate Design	Interconnection Standards	Distribution Planning	Cost-Benefit Study	IRP
California	●	●	●	●	●		●
New York		●			●		
Oregon		●				●	●
Nevada	●	●		●		●	●
Maryland	●		●	●		●	
Massachusetts	●					●	
Hawaii		●	●	●	●		●
Arizona			●				
Washington							●

FIGURE ES2

BATTERIES CAN PROVIDE UP TO 13 SERVICES TO THREE STAKEHOLDER GROUPS



Procurement Targets



- **California:** First-in-the-nation 1.325 GW procurement target for storage by 2020; later increased by 500 MWs
- **Oregon:** 2015 legislation (HB 2193) directed the Public Service Commission to set 2020 procurement targets for investor-owned utilities, up to 1% of peak load; currently being implemented
- **Massachusetts:** State legislature considering 2030 targets and Department of Energy Resources just released target for 200 MWh by Jan 1, 2020
- **New York:** Regulator ordered initial procurements (2 projects per utility) and legislature passed SB 5190 / A 6571 to create 2030 procurement targets
- **Nevada:** Legislature passed SB 204 calling on a study to inform biennial increasing procurement targets in 2017

Value Streams and Competition



- **Maryland:** PC 44 Energy Storage Workgroup is considering how to deal with energy storage ownership in its deregulated market.
- **California:** Revised net metering rules to take into account solar+storage projects; adopted mandatory Time-of-Use pricing for residential customers, starting 2019.
- **Hawaii:** Adopted rate structures for customers that have solar paired with energy storage

Incentives



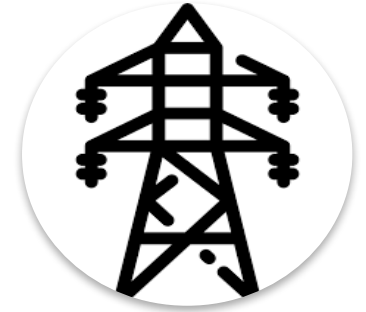
- **California:** Small generator incentive program modified in 2016 to focus on storage, and more incentives under consideration
- **Maryland:** Legislature passed first-of-its-kind energy storage tax incentive bill (SB 758) in 2017 session
- **Massachusetts:** SMART incentive program includes adder for systems with storage
- **Nevada:** Legislature passed AB 145 for storage in the solar incentive program (SESIP)
- **New Jersey:** Renewable Energy Storage Incentive Program for customer-sited storage at critical facilities

Utility Planning



- **Washington:** Commission's policy statement requires consideration of storage in integrated resource planning
- **New Mexico:** Consideration of storage required in resource planning
- **New York:** Utilities issuing all-source RFPs for grid needs as non-wires alternatives
- **California:** Distribution Resource Planning reform to include non-wires alternatives

Grid Access



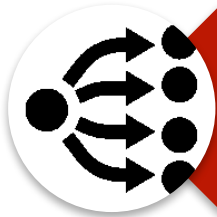
- **California** Rule 21
- **Hawaii** Rule 14H and Rule 22
- **Nevada** Rule 15 and AB 405 (establishes right to interconnect energy storage)
- **Minnesota** Interconnection Revisions underway
- **Maryland** PC 44 Interconnection Workgroup and Draft Rules
- **District of Columbia** initiated new proceeding to update interconnection procedures for storage

Promising Developments

- Bundling Energy Storage Services
- DER Aggregation
- Solar-plus-storage contracts driving prices to new lows
- Valuing Resiliency
(and high-speed deployments to resolve grid emergencies)
- Transportation Electrification



State Energy Storage Policy Foundations



CLASSIFICATION &
OWNERSHIP



PLANNING



GRID ACCESS



VALUE STREAM

Tools you can use...

CHARGING AHEAD

An Energy Storage Guide for Policymakers



IREC
Interstate Renewable Energy Council, Inc.

CHARGING AHEAD

An Energy Storage Guide for Policymakers



Key Takeaways for Policymakers and Regulators

Energy storage technologies—capable of capturing usable energy for use at another time, particularly when it is needed most and/or more valuable—provide flexible solutions to serve energy needs and address existing and emerging challenges. Energy storage technologies also provide an array of grid services and can offer multiple services interchangeably. Integrating energy storage strategically across the electricity system can result in more efficient utilization of other grid resources, defer more costly upgrades or investments, and increase the range of operational possibilities for the electric system.

Yet, the very characteristics that make energy storage valuable and attractive also make it challenging to address in policy and regulatory contexts.

Despite the game-changing potential of energy storage to transform the electricity system, energy storage is vastly underutilized in the United States' electricity sector. Its deployment remains hampered by the current features of regional, state and federal regulatory frameworks, traditional

utility planning and decision-making paradigms, electricity markets, and aspects of the technology itself.

The following summary of key takeaways from IREC's *Charging Ahead: An Energy Storage Guide for State Policymakers* (free download available at www.irecusa.org) provides a quick reference guide to accompany the full report, which provides state policymakers and regulators with systematic, foundational information on advanced energy storage as well as more specific guidance on key issues for consideration in the policymaking context. With this navigational tool and resource guide in hand, state policymakers and regulators should begin to chart a course to address energy storage in their respective markets. Beyond taking proactive steps on storage, continued policy leadership will ensure identified challenges are met with innovative, yet practical solutions that set the stage for market growth. Indeed, the policy and regulatory frameworks are the foundation upon which the US energy storage market will be built. IREC hopes this guide will serve as a valuable navigational tool and can serve all states well on their energy storage journey.

Of note, the **Additional Resources** section in the full report includes a list of other valuable sources for storage information. **Appendix A** provides a deeper dive on energy storage applications and services, and **Appendix B** contains an overview of existing modeling tools for energy storage valuation.

Energy Storage Applications & Services

BULK ELECTRIC SYSTEM APPLICATIONS

BULK ENERGY SERVICES

- Electric Time Shift
- Electric Supply Capacity
- Renewables Integration
- Firming
- Curtailement Avoidance

ANCILLARY SERVICES

- Frequency Response & Regulation
- Ramping / Load Following
- Voltage/VAR Support
- Black Start
- Spinning and Non-Spinning Reserves
- Power Quality

INFRASTRUCTURE APPLICATIONS

TRANSMISSION SERVICES

- Network Capacity
- Congestion Relief

DISTRIBUTION SERVICES

- Network Capacity
- Voltage/VAR Support

T&D UPGRADE DEFERRAL

- INCREASED HOSTING CAPACITY

AREA REGULATION

BEHIND-THE-METER APPLICATIONS

PEAK DEMAND REDUCTION

- ENERGY MANAGEMENT SERVICES
- Time-Varying Rate Management
- Demand Charge Management

RELIABILITY SERVICES

- Back-up Power

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