Microgrids & Energy Storage for Resilience: Policy Issues

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WEBINAR SERIES

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The focus of this presentation is policy issues for Microgrids & Energy Storage.

- I will be covering the following topics:
  - Defining characteristics of Microgrids
  - How these characteristics trigger policy considerations
  - Key policy issues for Microgrids—federal and state
  - Regulatory "best practices" by state example
  - High-level summary of Energy Storage policy issues
  - Policy correlations between Microgrids & Energy Storage
  - Q&A session

Defining Characteristics of Microgrids

Setting the stage for Microgrids' (future) prominent role.

- Costs for fossil fuels remain volatile and costs for renewable energy technologies are falling.
- Regulatory policies now promote clean energy & renewable energy, and frequently preclude the development or expansion of natural gas or coal-fired generating plants.
- Decarbonization by definition includes a comprehensive move away from fossil fuels and toward renewables and clean energy.
- As a result, the industry is transitioning away from a centralized model, and toward one that relies more heavily on distributed energy resources (DERs).
- Resilience and reliability concerns are also driving a need for localized power supply.

What is a Microgrid?

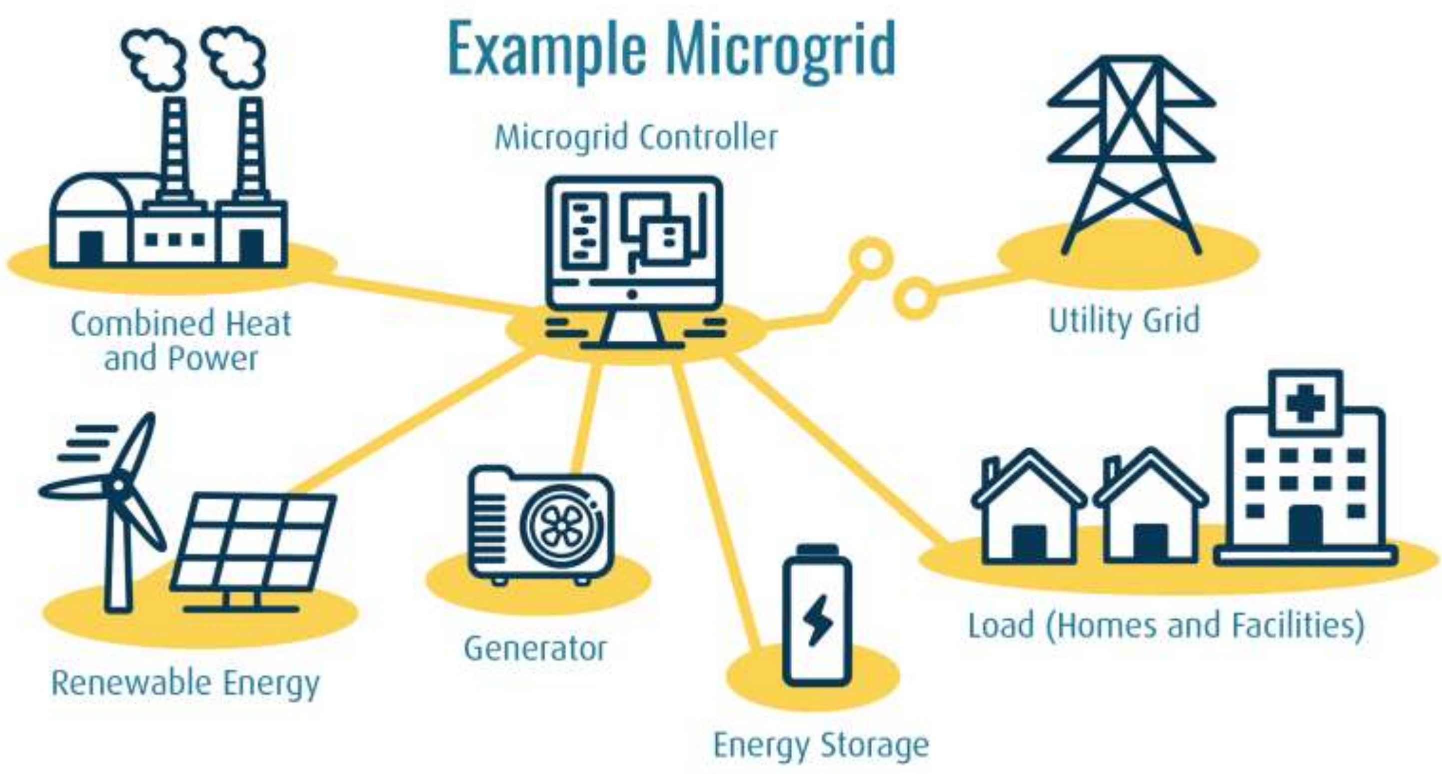
The Department of Energy's official definition:

"A Microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid.

A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode."

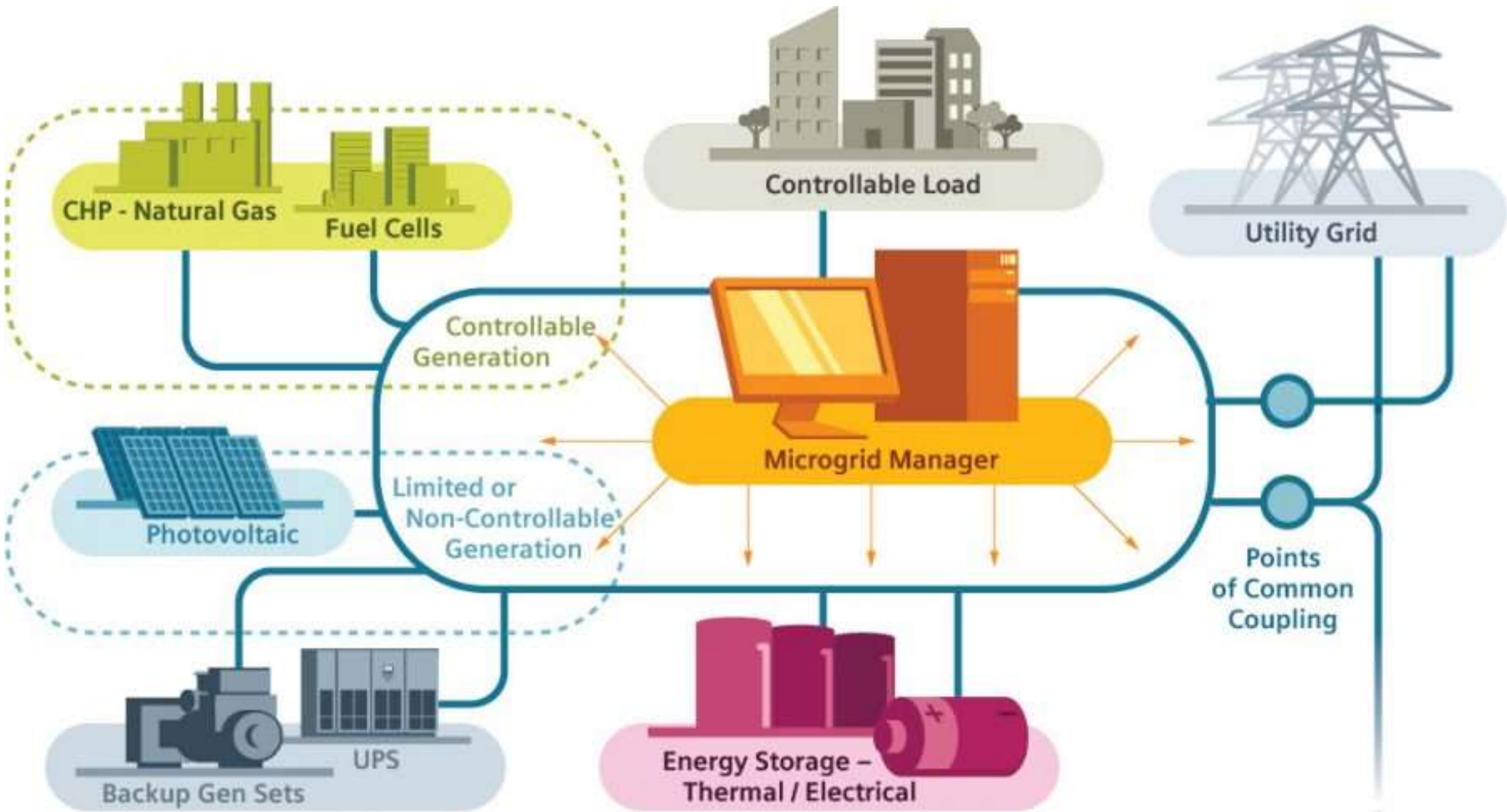
A Microgrid is defined by the services it is capable of providing (e.g., back up power) rather than the resources on which it operates.

What is a Microgrid?



Source: Department of Energy

What is a Microgrid?



Source: Department of Energy

“Real-world” examples of Microgrids

Borrego Springs Microgrid—
San Diego Gas & Electric
$4.5 million federally funded grant; 100 percent clean energy (mostly solar) with battery storage.

U.S. Marine Corp Parris Island, SC Microgrid: Natural gas and Solar PV; 5.5 MW of solar photovoltaic (PV) array, and a 4 MW battery-based energy storage system, together with an integrated control system capable of islanding and fast load shedding.

Source: Department of Energy

What is a Microgrid?

- By definition, most Microgrids can operate independently or connected to the grid. The ability to operate in both scenarios represents a key value of Microgrids.

- Whether or the Microgrid operates independently ("islanded") or is connected to the grid is the key determinant of regulatory oversight.

- Microgrids can be located in both vertically integrated and restructured states….and retail markets and wholesale markets, triggering either state or federal policy factors, respectively.

Where are Microgrids located?

There are 461 operational microgrids in the U.S. that provide a total of 3.1 GW of electricity. Most are concentrated in seven states: AK, CA, GA, MD, NY, OK, and TX. The vast majority are used for onsite reliability needs (i.e., they do not participate in markets), although this is changing, as policies evolve.

Source: https://doe.icfwebservices.com/microgrid

Most of the 461 Microgrids are located in 1) C&U facilities; 2) military bases; and 3) universities.

Microgrid locations of ***C&I facilities*** in the U.S.

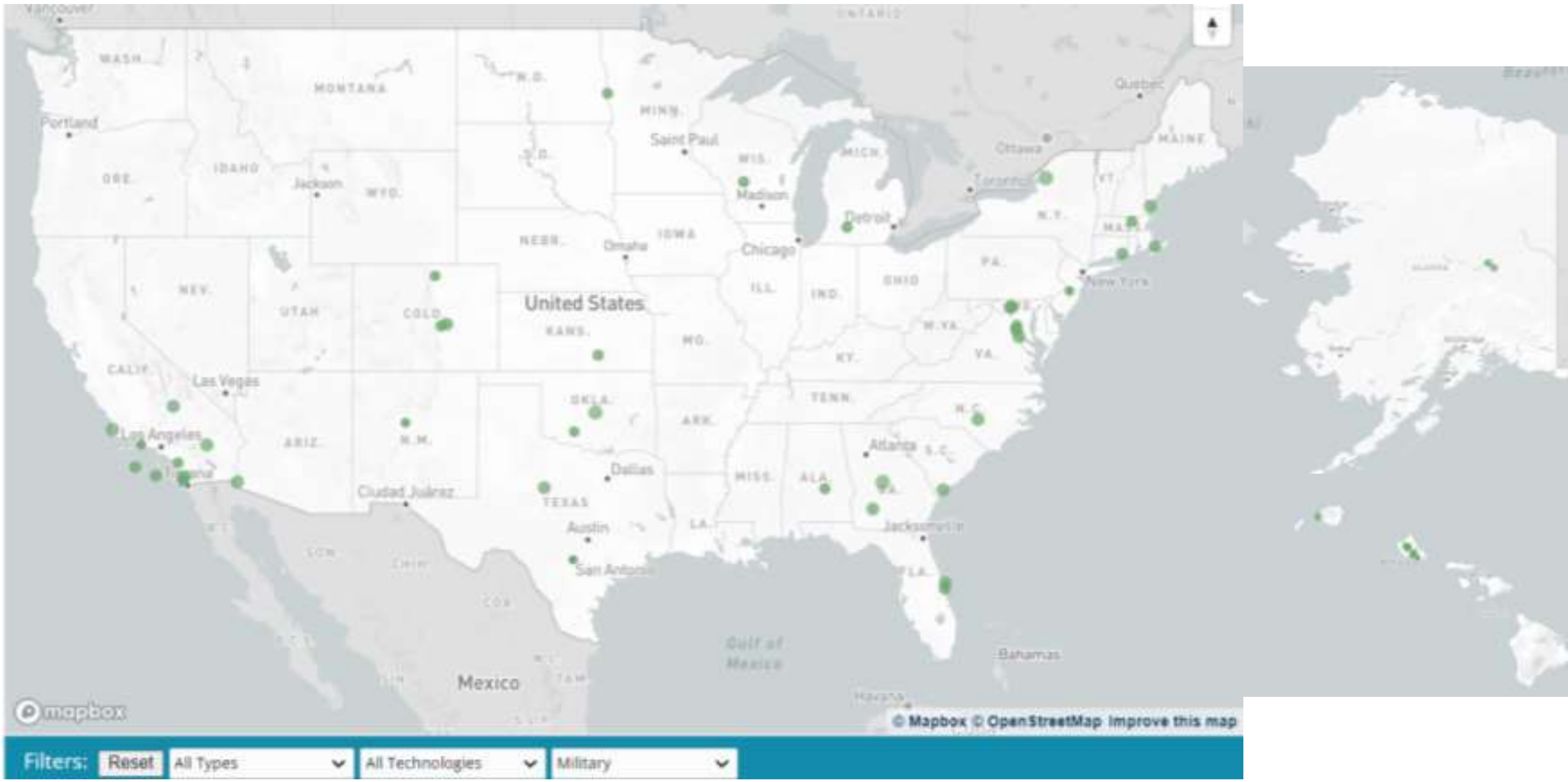
[0]

[1]

Source: https://doe.icfwebservices.com/microgrid

Most of the 461 Microgrids are located primarily in C&I, and military, sites.

Military site locations of Microgrids in the U.S.



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Source: https://doe.icfwebservices.com/microgrid

Most of the 461 Microgrids are located primarily in C&I, and military, sites.

Microgrid locations at U.S. **universities**.

[1]

[0]

Source: https://doe.icfwebservices.com/microgrid

Fuel source in the 461 Microgrids varies.

DOE data indicate that the fuel sources primarily used in the nation's Microgrids are, in descending order: Solar, natural gas, diesel, wind and fuel cells

Largest Microgrid in U.S. is at the University of Texas at Austin (135-MW, natural gas)

Many Microgrids are quite small (<100 kW)

Solar

Natural Gas

Diesel

Wind

Fuel Cells

Source: https://doe.icfwebservices.com/microgrid

Which technologies are best suited for Microgrids?

- Flywheels, liquid or compressed air, pumped hydro and hydrogen do not easily scale down for Microgrids, although they could be appropriate for utility-scale applications.

- For batteries, flow batteries can scale to Microgrid needs across a wide range. Lithium-ion batteries may still struggle to compete on cost with other resources….but nevertheless most of the Microgrids now being deployed are using Li-ion.

- There is market interest in Zinc-air, but at this time it's only interest…there are no demonstrated Zinc-air systems that offer reliability performance data (i.e., not a single commissioned project using Zinc air right now)

- Going forward, Li-ion batteries will likely be the preferred chemistry for Microgrids.

Key Policy Issues for Microgrids— Federal & State

State policy & regulatory oversight can enable or restrict Microgrid development.

- As previously mentioned, Microgrids by definition can operate independently or be connected to the grid.
- If they are connected to the grid, this is triggers regulatory oversight at the state level, particularly regarding interconnection and cost allocation.
- State policies are not uniform.
- Compliance with state policies has been a primary focus for Microgrid developers, but federal policies are becoming equally important.
- Thus, both state-level and federal-level regulations impact the opportunities for Microgrids. Inconsistencies between state and federal policies are common.

Restrictive / obsolete policies in states create barriers for Microgrid development.

- No legal definition for Microgrids: Most states have yet to define Microgrids in law – indeed, the industry as a whole grapples with its definition.

- Vertically integrated states still protect the franchises of monopoly utilities.

- If Microgrids are defined as a "utility" they may be barred from developing in competition with the incumbent utility.

- Connecticut is the only state that has defined the term to resolve barriers associated with a "utility" designation. CA, MA, MD, NY are reportedly have pending decisions.

Ownership policies also create challenges at the state level.

- Classifications are closely tied to ownership policies.

- Is it a generation resource? Is it a DER? The answer triggers many implications.

Ownership Models (can vary by state)

Utility-Owned	Landlord	Customer-Generator	Re-Seller	Co-Op
Incumbent, regulated utility owns and operates the Microgrid	A single "landlord" single landlord owns and operates the Microgrid and sells power to end-users.	A single firm owns and manages the system, serving the electric and/or heating needs of itself and its neighbors	A third-party owns and manages the Microgrid and sells power and heat to multiple customers	Multiple parties own and operate the Microgrid for their collective power & heating needs

Ownership designation triggers other requirements.

- Primary issue is how the Microgrid is classified and whether it is legally recognized.
- Most state policies to date have favored the Utility and Landlord models.
- Most Microgrids will also need to seek Qualifying Facility (QF) status, a designation created by 1978's PURPA legislation as utilities are required to purchase power from QFs at avoided costs/ wholesale value.
- QF designation also allows a Microgrid to bypass being classified as a "utility."
- However, QF designation also has constraints that confound developers: restrictions on the number of customers that can be served by the Microgrid, and limitations on the geographical scope of loads served (often a mile or less).

Net metering policies also create challenges for Microgrids.

- Net metering, which vary by state, define the price at which power from a DERS sold to the grid will be compensated (typically at the retail rate).

- Net metering can become a reason why an incumbent utility may seek to block interconnections from DERs, or eliminate net metering programs entirely (e.g., Hawaii)

- What replaces the net metering program may not be much better for Microgrid developers: In a number of states, utilities have authority to set new tariffs for DERs that may render them to be uneconomical.

Key takeaway:

There is no one regulatory framework for Microgrids at the state level; state-level policy frameworks for Microgrids are heterogeneous in nature across the 50 states.

Standardization across states is a goal but not yet a reality.

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NARUC and NASEO have formed the Microgrids State Working Group to share public- and private-sector best practices to advance beneficial microgrid development.

NARUC
National Association of Regulatory Utility Commissioners

NASEO
National Association of State Energy Officials

At the federal level, FERC's Order 2222 is directly relevant.

- Issued in September 2020, and directs RTOS & ISOS to revise their tariffs to allow energy from DERs including Microgrids to be sold into wholesale regional energy markets.

- The order removed an "opt-out" provision that had allowed grid operators to blocks offers from aggregated demand response providers in states where the practice is not allowed

- This federal rule is expected to unlock new revenue streams for Microgrids., because it will allow Microgrids primarily intended for isolated DR to aggregate with other DERs and participate in wholesale markets.

The order also benefits energy storage, electric vehicles, & energy efficiency technologies that often work in tandem with Microgrids.

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The "bottom line" on Order 2222.

- It creates the marketplace in which it will be much easier to realize benefits of assets like Microgrids.
- It will help Microgrid developers and project financers to create solutions to meet market needs, rather than design solutions simply to meet a patchwork of disparate state rules.
- Order 2222 is not just a federal issue—RTOs and ISOs will need visibility into what's happening at the distribution level — and vice versa.
- Thus state regulations need to be in sync with federal regulations.

State issues:
Ownership, interconnection, cost allocation, reliability, and safety issues

“Best Practices” for Microgrid Policymaking— State Examples

California—Policy Framework

- ***Legislation:*** SB 1339 (2018), which directed the CPUC, CA-ISO and CEC to jointly craft a microgrid policy framework.

- SB 1339 also specifically called out that ensure that the benefits of Microgrids should not extend only to wealthy customers or large corporations that can afford to pursue them.

- *Specific provisions included:*
  - Develop Microgrid service standards that meet state and local permitting requirements;
  - Reduce barriers for microgrid deployment without shifting costs among ratepayers;
  - Develop rates and tariffs to support Microgrids,; and
  - Streamline the interconnection process and lower interconnection costs for direct current microgrid applications.

California—Policy Framework

- ***Regulation:*** CPUC R.19-09-009 (2019) that initiated an evaluation whether and how Microgrids will reduce greenhouse gas emissions, protect California ratepayers, and advance California's progressive environmental goals.

- *Key provisions included:*

    - Prioritize and streamlining interconnection applications to deliver resiliency services at key sites and locations;

    - Modify existing tariffs to maximize resiliency benefits;

    - Evaluate IOU proposals for ownership

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Connecticut—Policy Framework

- ***Legislation:*** Public Act 13-298:

  - Allows Microgrids to be owned by municipalities and to cross public rights-of-way.

  - Establishes that community choice aggregation programs could allow Microgrids to operate without being subject to the same regulations as electric utilities,.

  - Microgrids can use the incumbent utility's infrastructure (under strict conditions), and develop sub-rates that apply to their customers.

  - Regulatory environments that are friendlier to networked microgrids could emerge from these efforts to reform existing regulations.

Policymaking in other states also provide good points of reference.

Hawaii	New York	Rhode Island
Legislation required PUC to establish a microgrid services tariff. Legislation required steps be taken to streamline interconnection processes for Microgrids.	The state has earmarked $11 million to be awarded for Microgrid development through competitive applications	Regulatory commission has established Microgrids as a key component of its energy transformation. It may set microgrid development requirements, similar to procurement requirements for energy storage seen elsewhere.

Technology issues have policy implications.

- There are number of technology issues that arise with Microgrid deployment that may need to be addressed through Policy:

  - Start-ups of Microgrids in “island mode” can cause a sudden intake of current which can affect the frequency of the system and voltages.

  - Microgrid balancing of generation and load in island mode needs to be constantly maintained or sudden or large change in loads can introduce instability into the island system.

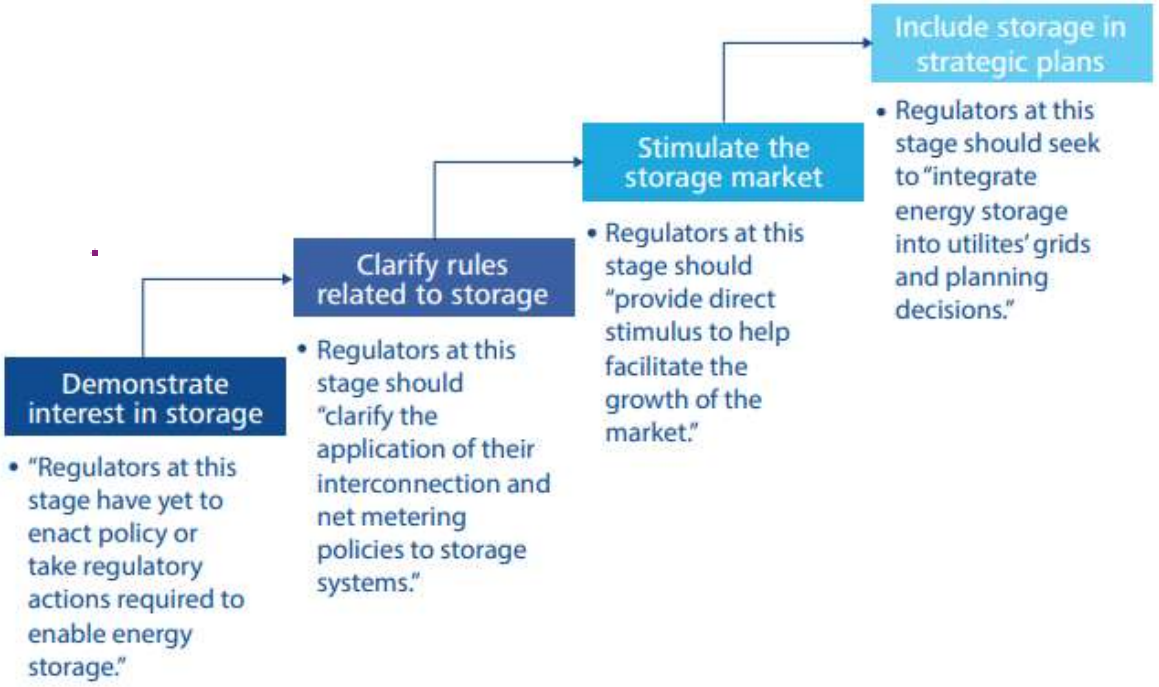
  - Feeder design: Traditional generation feeders were not generally designed with Microgrids in mind. As microgrids are gaining popularity there seems to be lack of availability in suitable feeders that go with current microgrid designs.

Where Does Energy Storage Policy "Fit In"?

The potential value streams for Microgrids run in parallel with those for Energy Storage Systems.

Resiliency	Reliability and Power Quality	Power System	Environmental	Economic
• Security and Safety • Improved energy situational awareness	• Reduced power interruptions • Critical load reliability • Elective load service • Congestion relief	• Voltage support • Loss reductions (T&D) • Black Start support • Generator efficiency	• Reduction in emissions • Renewable integration	• Savings in electric costs • Revenue generation

State-level policymaking specific to ES is still quite nascent.



Source: Interstate Renewable Energy Council

- The majority of U.S. states are still at the far left of this trajectory, and may not have even taken the first step yet.
- This becomes even more the case when LDES/SES policymaking is in question.
- Arguably less than a handful of states have reached the top level (CA, NY, HI)

Key Energy Storage Policy Issues—States

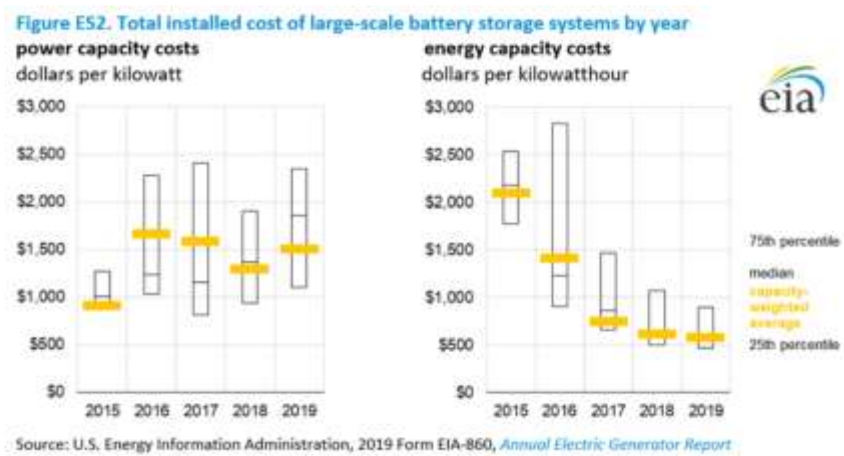
Each of the 50 U.S. states (plus territories) will need to develop policy on many energy storage issues:

1. Procurement mandates
2. Utility ownership
3. Changes to RPS mandates
4. Benefit/cost analysis
5. Distribution system modeling
6. Updates to interconnection standards
7. Multiple use applications
8. Incentives / tax credits
9. Including in utility IRPs
10. Changes to net metering programs

Energy storage policy barriers can circumvent market development.

- The #1 barrier facing energy storage development is **Cost**, which is exacerbated by the lack of policy remedies to mitigate cost impacts.
- It is true that the cost for ES technologies has fallen dramatically, (now averaging about $625/kWh), but that does not tell the full story.

- *Costs vary greatly by region and application.*
- *ESSs remain expensive and the significant upfront investment required can be difficult to overcome.*
- *Policy levers at the federal and state level can help ease the burden of these costs with subsidies, low-cost financing, etc.*
- *But the reality is that these levers are few and far between , which is a barrier that may cause many ES developments to stagnate.*



The following states have adopted clean energy / renewable goals.

These are state-level initiatives.
Utility specific initiatives are not included here.

STATE	DEADLINE	GOAL	CLEAR ROLE FOR ES & MICROGRIDS?
AZ	2070	100% carbon-free electricity	NO
CA	2045	100% carbon-free electricity by	Somewhat
CT	2040	100% carbon-free electricity by	NO
HI	2045	100% renewable energy	Somewhat
LA	2050	Net zero greenhouse gas emissions	NO
ME	2050	100% clean energy	NO
MA	2050	Net-zero greenhouse gas emissions	NO
MI	2050	Economy-wide carbon neutrality	NO
NV	2050	100% carbon-free electricity	Somewhat
NJ	2050	100% carbon-free electricity	NO

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STATE	DEADLINE	GOAL	CLEAR ROLE FOR ES & MICROGRIDS?
NM	2045	100% carbon-free electricity	NO
NY	2040	100% carbon-free electricity	Somewhat
OR	2040	Greenhouse gas emissions reduced 100 percent below baseline emissions	Somewhat
RI	2030	100% renewable energy	NO
VA	2045	100% carbon-free electricity	NO
WA	2045	100% zero-emissions electricity	Somewhat
WI	2050	100% carbon-free electricity	NO

State Activities—The Current Status

- Only about 15 U.S. states have developed substantive energy storage policy as of 3Q 2021.
- At this time, these states represent "best practices" for state-level energy storage policies.

PM	I/TC	IRPs	NEM	RPS	C/B A	DSM	IC
CA	MD	CO	CA	CA	MN	CA	AZ
MA		IN	CO	HI		NY	
NJ		NJ	HI	NJ			
NY		NM		NY			
OR				OR			
VA				VT			

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The energy storage policy landscape continues to evolve.

Sandia National Labs monitors and analyzes activity at the federal and state levels and publishes information in the Global Energy Storage Database, available at this link:

https://www.sandia.gov/ess-ssl/global-energy-storage-database/

Q&A Session

Thank you!

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