Sandia National Laboratories

Policy "Deep Dives"

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DOEE Energy Storage Webinar Series

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Topics I will cover in this presentation.

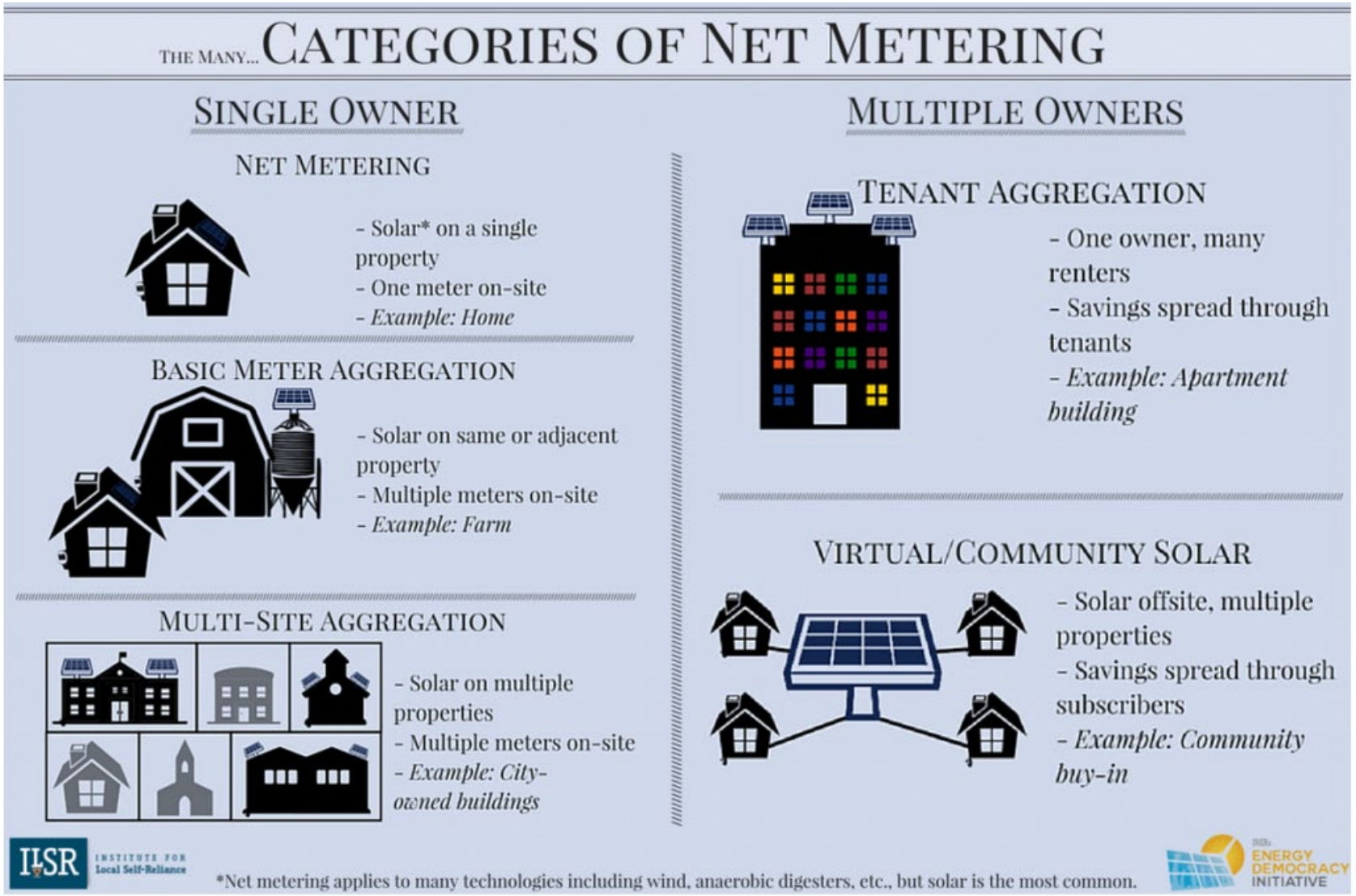
- Policy “Deep Dives” into these two topics:
  1. Net Metering
  2. Ownership Models
- Q&A Session

Net Metering

What is Net Metering?

- A regulatory construct.
  - ✓ Net metering refers to an agreement between a utility and an end-use customer who owns a distributed energy resource (DERs) and sells back power from that resource to the utility.
  - ✓ A regulatory construct meaning the NEM program is approved by a utility commission.
  - ✓ Many variations across states and utilities.
  - ✓ Most typically associated with solar panels installed on a home or commercial business.
  - ✓ Customer can be compensated either with a payment or a bill credit, with specific levels of compensation being one of the most contentious aspects.

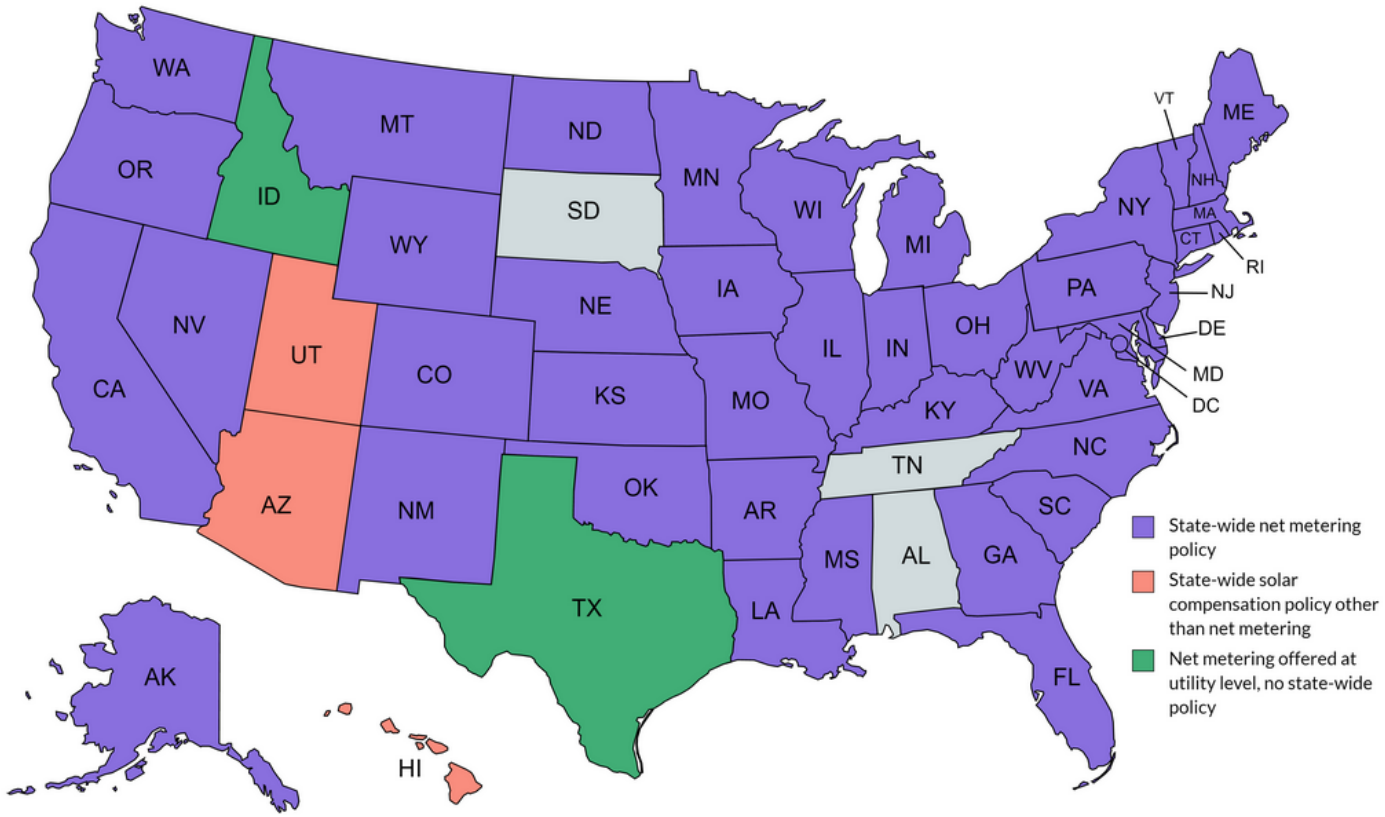
What is Net Metering?



Source: Institute for Local Self Reliance.

Where is Net Metering Available?

As of October 2022….



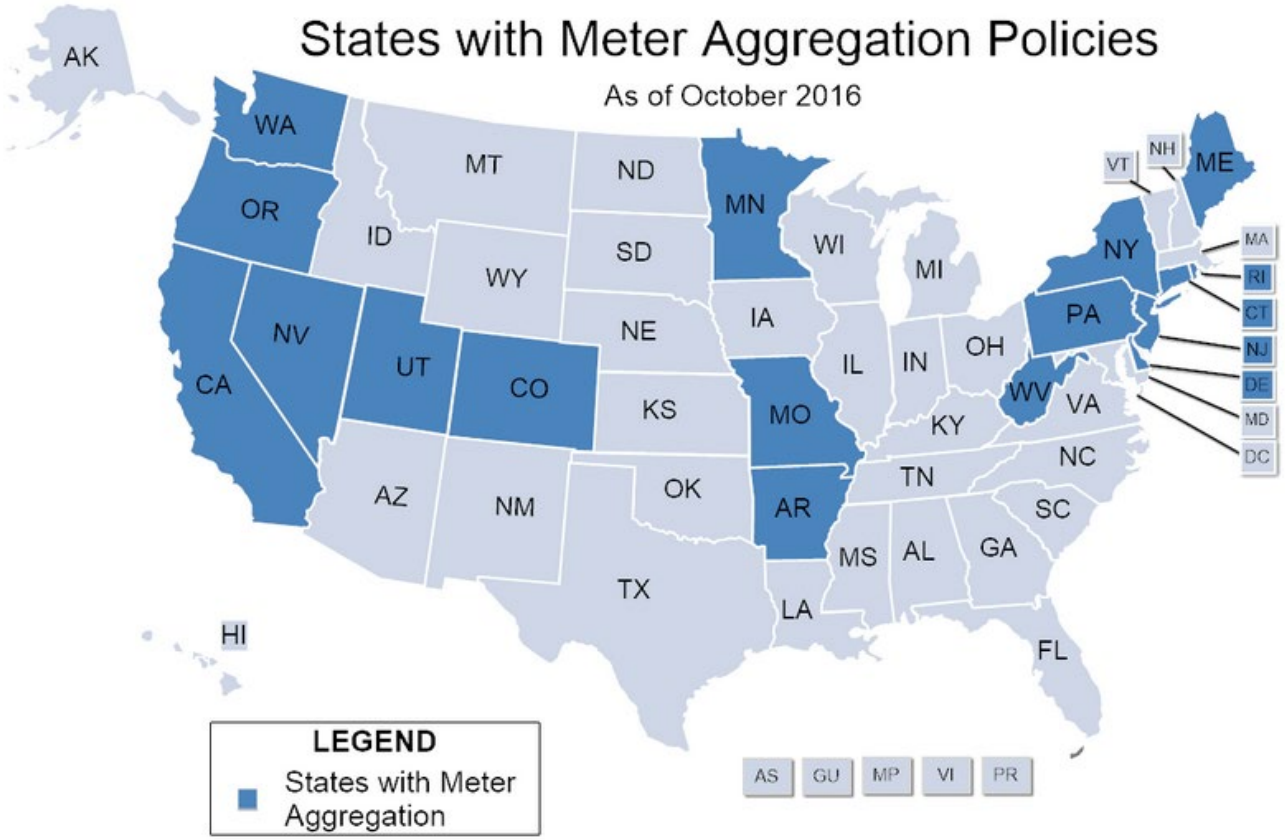
Source: Solar.com

KEY FACTS:

- 38 states, Washington, D.C., and four territories offer net metering, if defined as including retail rate compensation.
- 7 states—Arizona, Georgia, Hawaii, Indiana, Nevada, Maine and Mississippi—have statewide distributed generation compensation rules other than net metering.
- Although Minnesota offers conventional net metering, the state has also created a value of solar rate, or tariff, as an alternative to net metering.

Aggregated Net Metering

- Allows a single customer to offset electrical use from **multiple meters** on their property, **using a single renewable energy generating system** also located on the owner's property.



KEY FACTS:

- Note that Aggregated Net Metering is distinct from Virtual Net Metering, which allows multiple customers to offset their energy use from one or several shared distributed generation systems
- Certain states have placed specific requirements on aggregated net metering systems based on customer type, technology type. or the distance between meters and the renewable energy system.

Net metering compensation can take different forms.

Retail Net Metering	Avoided Cost Net Metering	Net Billing	Time of Use (TOU) Net Metering
Excess power sold back to the utility is compensated at the current **retail rate**. Most Common.	Excess power sold back to the utility is compensated at the **price the utility saved by not having to provide the customer with electricity**, which typically is lower than the retail rate.	More common for commercial than residential customers. Customer sells excess power to utility at retail price, but unlike net metering **cannot bank credits** for future billing cycles.	The value of excess power sold back to the utility **will vary based on energy demand and the current TOU rate**. TOU rates will vary during on-peak and off-peak hours, with power being more valuable and expensive during peak hours.

The "best" and most predictable NEM policy (in terms of economic compensation) is full-retail net metering because it does not fluctuate based on Time-of-Use rates or other outside factors.

State	Full-retail net metering	Avoided cost net metering	Alternative program
Maryland	Yes	No	No
Virginia	Yes	No	No

Net Metering in DC.

- Available since 2000.
- Available to C&I, R, Low Income Residential customers with systems powered by renewable-energy sources, combined heat and power (CHP), fuel cells and microturbines.
- Net excess generation is credited to customer's next bill at retail rate (including generation, transmission and distribution) for systems 100 kW or less, and at generation rate for larger systems up to 1MW.
- **Virtual NEM (2013)** allows homeowners and renters to purchase locally produced renewable power from authorized community renewable energy facilities (CREFs).
- Subscribers to CREFs can have up to 120% of their historical total monthly electric demand credited towards their electric bill via the net-metering of newly created “CREF credits.”

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Customer Location	State Cap	Individual Cap
Maryland	1,500 MW or 10% of peak demand in 2014	2 MW and cannot exceed meeting 200% of annual energy use
Disrict of Columbia	n/a	1 MW, 5 MW for community renewable energy facilities

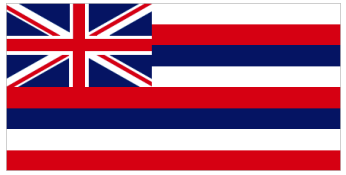
Utilities have numerous concerns about Net Metering.

- Utilities companies have been fighting to cut net metering programs.
- ***Why?***
  - ✓ Because utilities lose revenue when their generation is replaced.
  - ✓ As a result of lost revenue when their generation is replaced, utilities are reluctant to invest in infrastructure, which creates reliability concerns.
  - ✓ Thus utilities have sought to reduce residential customers' solar savings and increase the companies' profit margins.
- Utilities have succeeded in states like Nevada, Louisiana and South Carolina.

In addition, Net Metering creates Equity concerns.

- From an equity perspective, net metering has tended to benefit wealthier households and communities….they are the ones most likely to place solar panels on properties they own.
- By comparison, solar adoption in disadvantaged communities has been much lower.
- When DG owners do not pay a utility bill because their production equals their consumption, they do not cover the costs of maintaining the wires and transmission lines.
- Disadvantaged communities may still lack access to capital, financing, and home-ownership, all of which may still limit equitable adoption, but those are challenges that can (and must) be addressed outside the rate structure.

State Policy Examples.



HAWAII

- Leads the nation in leads the nation in the rate of rooftop solar adoption
- Net metering 2001-2015
- Discontinued out of concerns that infrastructure could not handle the increased amount of energy the rooftop solar

Major PUC decision 10/2022:

- New rate structure: first-in-the-nation statewide plan intended to encourage customers to shift their energy use to times that best align with Hawaii's increasingly solar-powered grid.
- Customers simply pay for the costs they impose on the system.

New rate structure with 3 components:

1) A small **fixed charge** covers utility billing and payment-collection expenses, which everyone incurs.
2) A **"grid-access charge"** that's proportional to the capacity a customer pulls from the grid in a given month.
3) But the bulk of monthly bill will be determined by a **TOU rate.**
    a) electricity in the evening peak hours costs three times more than it does in the sunny hours
    b) The middle of the night is cheaper than the peak but more expensive than the sunny hours.

State Policy Examples.

CALIFORNIA

California has more 1.3 million rooftop solar systems that collectively amount to more than 11 GW of generation capacity.

- The state spent years encouraging rooftop solar adoption and even mandated it for new home construction.
- Utilities made case of revenue erosion.
- CPUC attempted to affix a "grid-benefits charge" proposed by California's IOUs, adding $8 /kWh of solar production capacity onto bills for owners of new rooftop solar systems.
- Widespread backlash.

Current situation:

- NEM 3.0 Program remains in limbo.
- CPUC had proposed to stop paying the full retail rate for such power and instead pay a much lower "avoided cost fee." + the grid access fee.

Core policy debates:

- Every day without NEM reform imposes more cost shifting burden on non-solar customers (estimates of $1.8 billion within a four month period.)
- Current policy proposals have failed to account for the environmental and grid-resilience benefits of NEM.

Meanwhile, the increase in “Solar Batteries.”.

- Solar panels paired with an Energy Storage System (ESS), defined as a commercially available technology that is capable of:
  - ✓ Absorbing energy;
  - ✓ Storing it for a period of time; and thereafter
  - ✓ Dispatching the electricity.
- The ESS may not be any technology with the ability to produce or generate energy.
- Solar batteries do not address the Equity concerns previously mentioned.

Solar Batteries" are changing the dynamics of Net Metering

- Solar batteries have created a platform for what is being called "Battery Net Metering" or "NEM Paired Storage."
- **These batteries are connected to solar panels so that they can absorb any excess energy not used.**
- This stored energy can then be used for the times when the sun isn't shining without having to draw power from the grid.
- Many different brands and models of solar batteries to choose from, each ranging in cost from as low as $180 for a 1.2 kWh battery to $13,000 for a 16 kWh battery.
- Solar batteries are becoming more popular among homeowners, with many brands to choose from like the Tesla Powerwall, LG Chem RESU, and sonnenCore battery.

Alternatives to Net Metering.

- ✓ Value of Solar tariffs:
  - Under existing VOS program designs, solar customers continue to purchase all of their electricity from the grid at the utility's retail rate and receive credit for the solar electricity exported to the grid at the approved VOS rate.
  - **The VOS rate attempts to include the variety of costs and benefits that solar may create for the grid rather than simply paying the fixed retail rate.**
  - The VOS rate is locked in for a specified period of time—for example, at least 20 years in Minnesota—whereas net metering credits fluctuate with the retail price.
  - **By including both costs and benefits, the VOS rate addresses the concerns of cost-shifting to non-solar customers.**
  - Only Minnesota and Austin, Texas, have adopted VOS policies, however no eligible utility has chosen to implement a VOS rate.

Ownership Models

Energy Storage Ownership: What is the Policy Issue?

The Issue: Given that storage is typically classified as energy storage, should utilities be allowed to own storage assets in deregulated markets?

Arguments for Utility Ownership

- Opportunity for long-range, system-wide planning
- Opportunity to optimize the distribution system.
- Enhanced flexibility to use cost-effective resources.
- Enhanced economies of scale (i.e., prices drop with larger projects) + utilities have low cost of financing.
- Ownership through ratepayers may be most socially equitable.

Arguments Against Utility Ownership

- Market power concerns: Utility ownership may preclude third-party participation.
- Utility ownership focus limit energy storage on reliability services only, forsaking other applications for storage.
- Uncertainties about utility cost recovery and equitable rate treatment among customers.
- Non-utility ownership will do more to ensure that ES will fairly compensated for the broadest possible set of benefits.

Key Questions Within the Ownership Policy Issue.

- How will a state interpret energy storage's unique role on the grid and how best to balance emerging technologies?
- How is energy storage defined in legacy legislation or regulatory statute? (Generation asset, T&D asset, not defined?)
- How does storage fit into other goals?
- How will FTM versus BTM storage be prioritized and utilized?
- Is reaching specific customer segments (e.g., disadvantaged communities) part of defined policy goals?
- Ability for operation and management: Battery energy storage systems are complex and require 24/7 monitoring and alerting. All systems require annual maintenance, and many require quarterly or monthly maintenance.

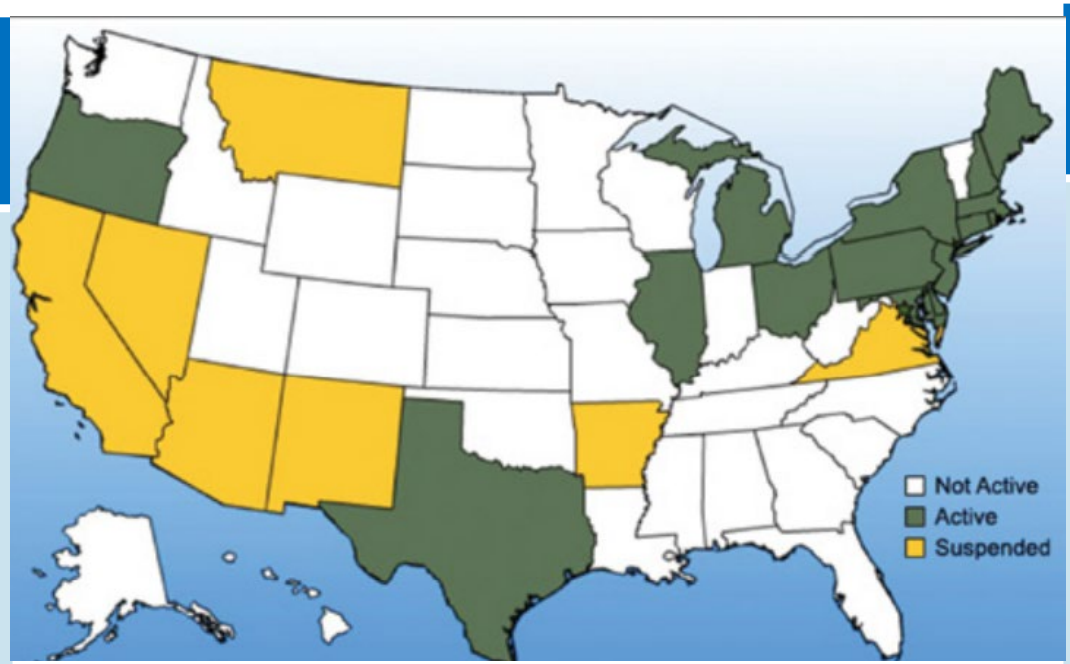
Ownership policy is driven by market status.

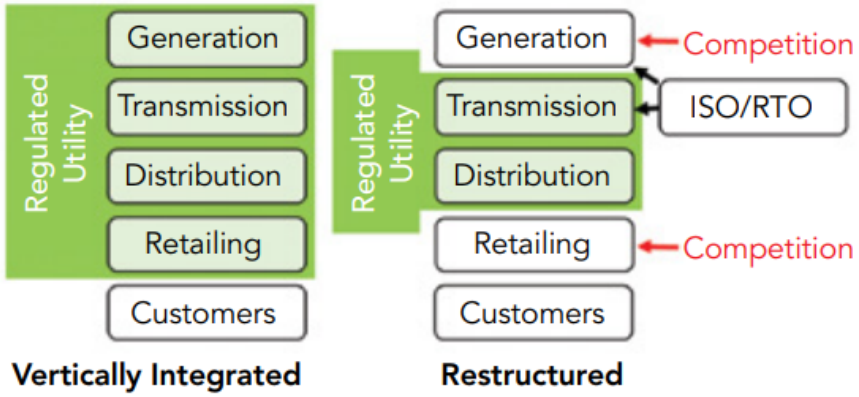
Status of Electric Restructuring by State

Regulated Markets

"Vertically integrated" utility **owns or controls** generation, transmission, and distribution

Regulated by states (public utility commissions) Cost recovery via rates charged to customers





Restructured Markets

Market is **competitive**

Utilities usually prohibited from owning G&T assets.

RTOS/ISOs responsible for inter-/intra-state T, D and O&M with oversight from FERC

Role of PUC varies state to state

Utility ownership

Key Issue:
Given that storage is typically classified as generation, should utilities be allowed to own storage assets in deregulated markets?

Various models for ownership are emerging in restructured markets:

- Utility owned
- Third party owned
- Hybrid
- Virtual power plants—aggregated DERs, owned by third parties but managed by utilities.

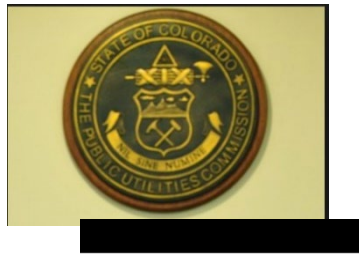
Texas has been a battleground on the issue of utility ownership. Existing law defines ESS as generation. New law allows ownership only among public power entities.

Oregon Public Utility Commission

PacifiCorp

Portland General Electric

Regulatory directive requires consideration of multiple options, including utility ownership.



Xcel Energy

Xcel Energy's plan is to replace coal-fired generating plants with utility-owned storage.

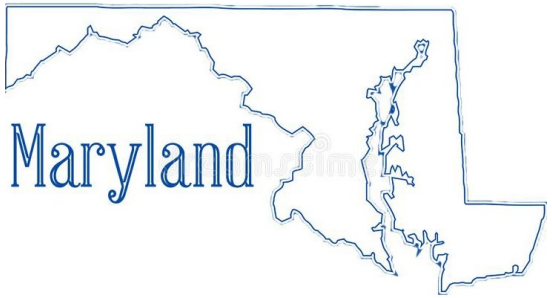
What is Community Storage?

- Not a consistent definition across jurisdictions.
- Generally, community storage **IS:**
  1. Located within a community with defined boundaries;
  2. Serves such a community; or
  3. Both of these things.
- Generally, community storage **IS NOT:**
  1. Bulk or utility-scale energy storage serving the utility and/or ratepayers as a whole;
  2. Singular, BTM systems that primarily serve the building or home to which they are connected.

- Some states may define Community Storage more explicitly:
- **CALIFORNIA:**
  1. Connected at the distribution feeder level;
  2. Associated with a cluster of customer load.
  3. Must provide specific services.

State Reference Point # 1: Maryland

- As part of this restructuring, Maryland utilities were required to divest generating assets, either by sale to a third-party entity or transfer to a non-regulated affiliate.
- But nothing in existing law explicitly prohibits utilities in Maryland from owning and operating storage assets.



Pilot Programs now being implemented to evaluate these four ownership models.

Utility-Owned	Utility/3rd Party Owned	3rd Party Ownership	Virtual Power Plants
• Utility owns and controls storage project for grid reliability. • Utility operates storage in wholesale markets when it is not needed for distribution reliability.	• Utility owns and controls project for grid reliability. • 3rd Party operates project in wholesale markets.	• Utility contracts with a storage project that is owned by a 3rd party for grid reliability. • 3rd party operates the project for wholesale markets.	• Utility aggregates, or uses a 3rd party aggregator, to receive grid services from multiple DERs projects owned by customers or a 3rd party.

State Reference Point #2: Virginia

- Utilities can own generation in this restructured / re-regulated state.
- Policy is emerging but assumption is that utilities will be allowed to own energy storage also.
  - Requires IOUs to obtain approvals to construct or acquire 3.1 GW of energy storage by 2035.
  - Additional goal of 10 percent of that capacity coming from behind-the-meter (BTM) sources.

- Virginia is in the process of establishing a ratepayer funded incentive program to accelerate energy storage deployment. Incentives will be linked to safety, reliability, environmental benefits.
- Has announced that traditional cost-of-service ratemaking will need to be revised to enable energy storage.

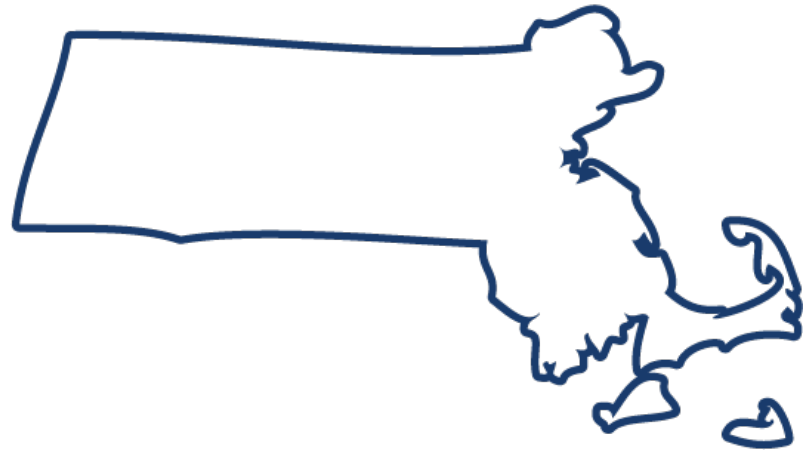
State Reference Point #3: California

- California's energy storage mandate includes both FTM storage and BTM storage.
- California restricts utility ownership of storage projects to 50 percent across all three grid domains (T, D & C). Cross-providing of services (and accompanying compensation) is restricted.
- Cost recovery is allowed for utility investments, but regulators have also encouraged third-party ownership.
- The California ISO allows aggregations of ES resources to participate in its energy and ancillary services markets.

CALIFORNIA

State Reference Point #4: Massachusetts

- Massachusetts passed legislation in 2017 to explicitly allow ownership of storage among distribution utilities—very unique for a restructured state.
- State policy requires utilities to justify the viability of storage for a variety of ownership models
- "Energy Storage Technologies" is included as one of the categories of grid modernization assets that is eligible for rate recovery if justified with a business case that includes all quantifiable and unquantifiable benefits and costs.
- Participation in the New England ISO enables compensation for services to transmission customers.



MASSACHUSETTS

State Reference Point #5: New Jersey

- Regulators in New Jersey believe it is important to provide for various ownership models, including both electric distribution company (EDC) and third-party, to realize the benefits of energy storage deployment.

- EDC ownership and operation of energy storage may be preferred to realize a broader range of storage benefits due to the EDC's knowledge and operation of the distribution system

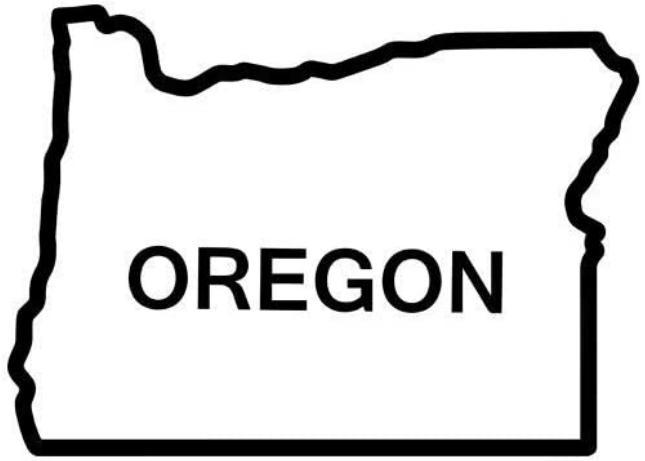
- Intervenors have argued that the state should more provide incentives to third party and customer ownership to ensure that ES can provide and be fairly compensated for the broadest possible set of benefits.

State Reference Point #6: New York

- New York PSC originally prohibited utilities from owning BTM DER, based on concerns about market power
- Competitive ownership (i.e., non-utility ownership) is a core principle of the REV policy.
- Utilities should be neutral on which DERs are connected to the grid.
- Utility ownership should not be granted unless a competitive market fails to materialize.
- Exceptions for utility ownership can be pursued in very limited circumstances (e.g., a demonstrated need to support reliability).

State Reference Point #7: Oregon

- Regulatory directive requires consideration of multiple options, including utility ownership.
- Oregon PUC directs utilities PGE and PacifiCorp to submit diverse procurement proposals, including third-party ownership models.
- Utilities may recover in rates all costs prudently incurred in the procurement of the ESS.
- PGE has argued against third-party ownership:
  - Equipment malfunction from a third-party owned asset adjunct to a PGE asset could put PGE personnel at risk.
  - PGE could be held jointly liable for environmental issues on its property.



The research included in this presentation has been funded by the Department of Energy, Office of Electricity, under the sponsorship of Dr. Imre Gyuk.

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/

Thank you!

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