



# U.S. Trends and Experiences with DER Integration, with a Focus on FERC actions

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**ASOCODIS -- XV Seminar on  
Electricity Distribution Trends and Opportunities**

**Federal Energy Regulatory Commission**

*Views expressed do not necessarily represent the views of the Commission or any Commissioner.*



# Topics for Discussion

- State Distributed Energy Resources Policies
- Recent Experience with DER integration
- FERC Actions
  - Demand Response
  - Storage
  - DER Aggregation

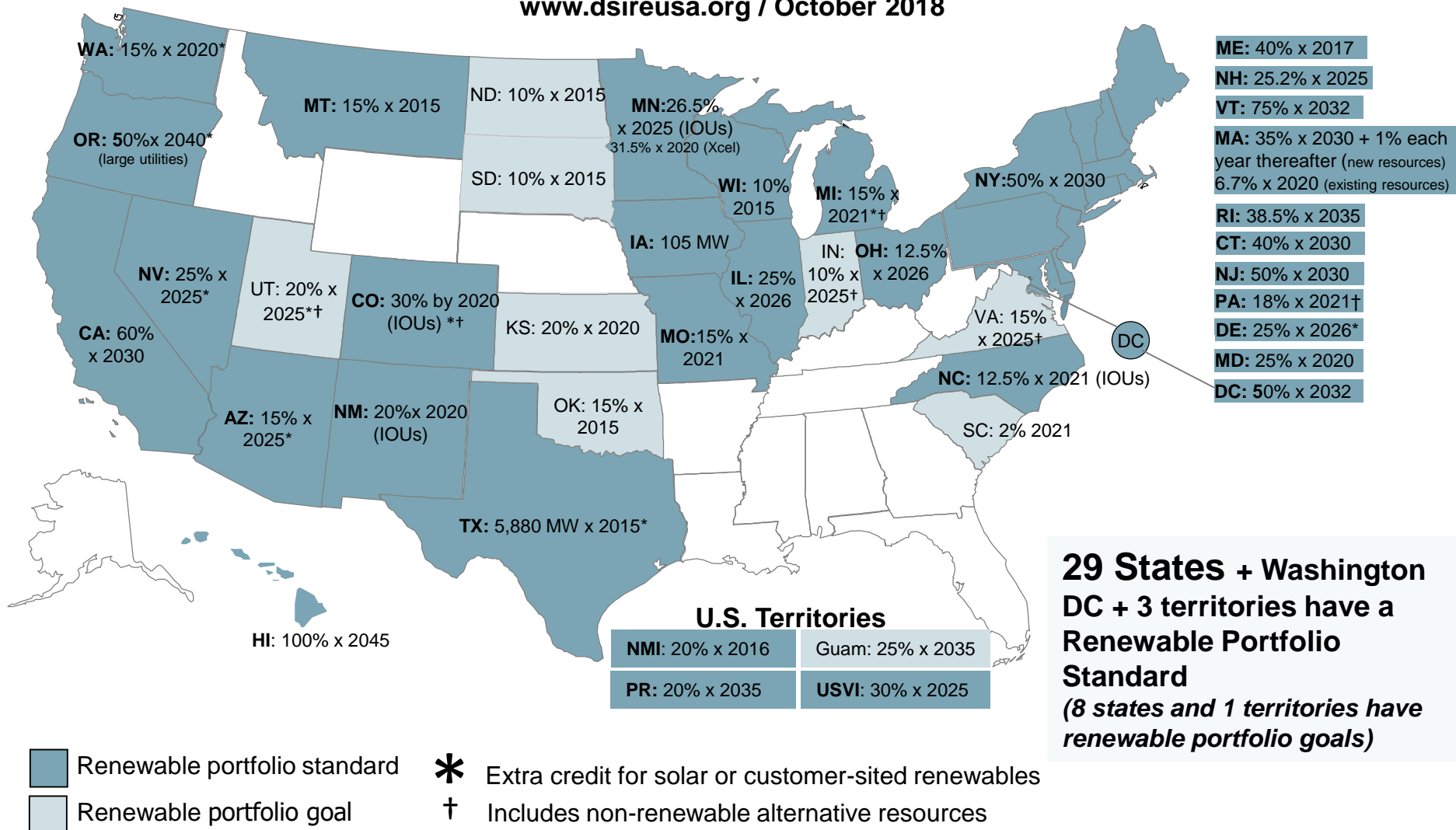


# State Actions Related to Distributed Energy Resources

- Renewable Energy
  - Renewable Portfolio Standards
    - 29 States plus District of Columbia
    - Trend is towards 50%
  - Net metering
    - 38 States plus District of Columbia allow net metering
    - Several states are reviewing and modifying these policies
- State-Level Demand Response
  - 35 GW as of 2016
  - Primarily utility load management programs
  - Time-Based Rates – growing, but still small numbers

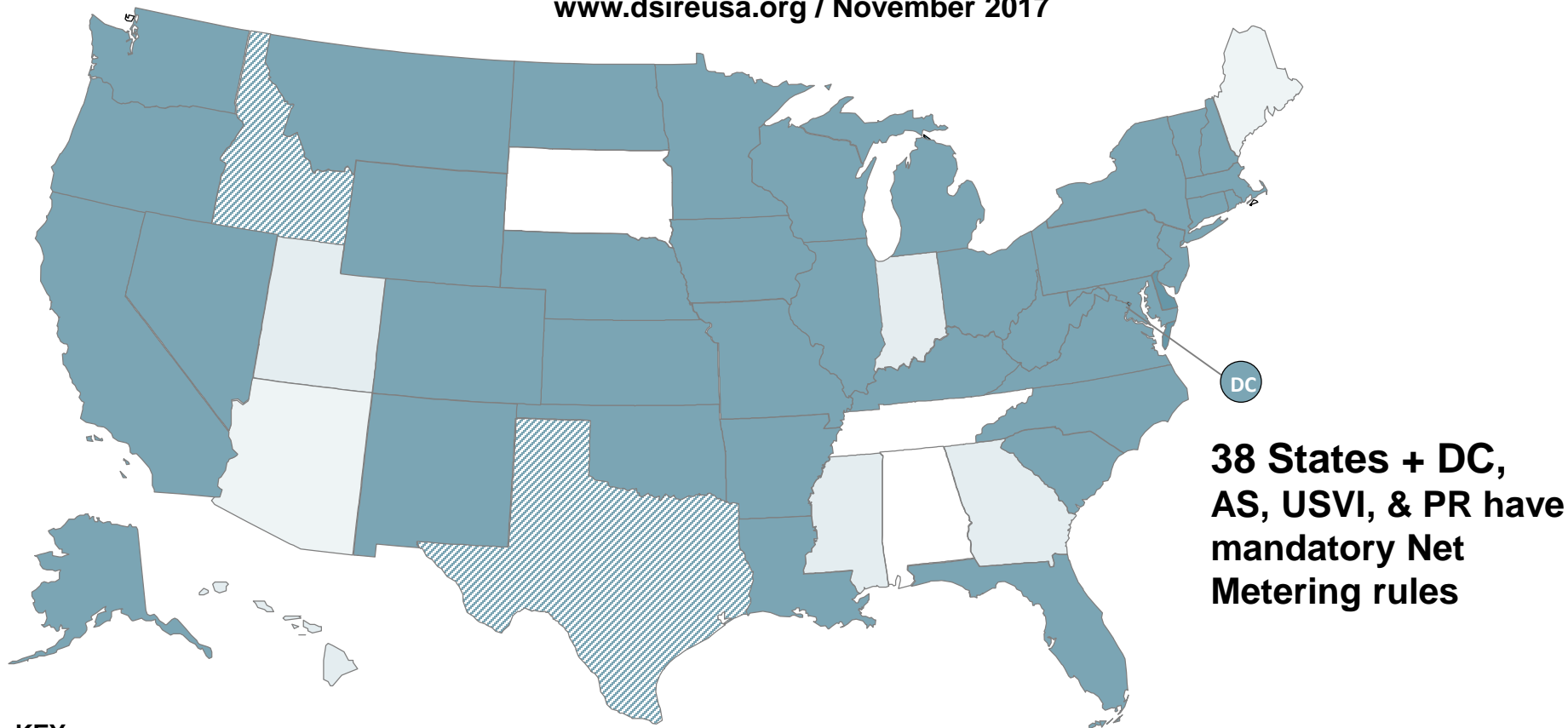
# Renewable Portfolio Standard Policies

[www.dsireusa.org](http://www.dsireusa.org) / October 2018



# Net Metering

[www.dsireusa.org](http://www.dsireusa.org) / November 2017



## KEY

State-developed mandatory rules for certain utilities (38 states + DC+ 3 territories)

No statewide mandatory rules, but some utilities allow net metering (2 states)

Statewide distributed generation compensation rules other than net metering (7 states + 1 territory)

## U.S. Territories:

AS	PR
VI	GU



# State Actions Related to Distributed Energy Resources – Grid Modernization

- Grid modernization
  - Which typically includes DER provisions
- Distribution system planning
  - Including: hosting capacity, forecasting, deferral of infrastructure
- Distribution system operators (DSOs)
  - Enhanced functionality to integrate DERs into distribution system
  - California and New York developing concept

# States are advancing distribution system planning in a variety of ways

- ▶ Requirements for utilities to file distribution system/grid modernization plans with stakeholder engagement (e.g., CA, HI, MA, MD, MI, MN, NY)
- ▶ Ad hoc directive to file a distribution system plan (e.g., MI, MD)
- ▶ Requirements to conduct hosting capacity analysis (e.g., CA, HI, MN, NY)
- ▶ Consideration of cost-effective non-wires alternatives (e.g., CA, NY, RI)
- ▶ Locational net benefits analysis for DERs (e.g., NY, CA, HI, NV)
- ▶ Investigations into DER procurement strategies (e.g., HI, NY, CA)
- ▶ Requirements for utilities to report regularly on poor-performing circuits and propose investments (e.g., FL, IL, OH, PA, RI)
- ▶ Storm hardening and undergrounding requirements (e.g., FL, MD)
- ▶ Reliability codes and annual compliance reports (e.g., OH, IL)
- ▶ Smart grid reporting (e.g., OR, WA)
- ▶ Investigation into DER markets (e.g., HI)

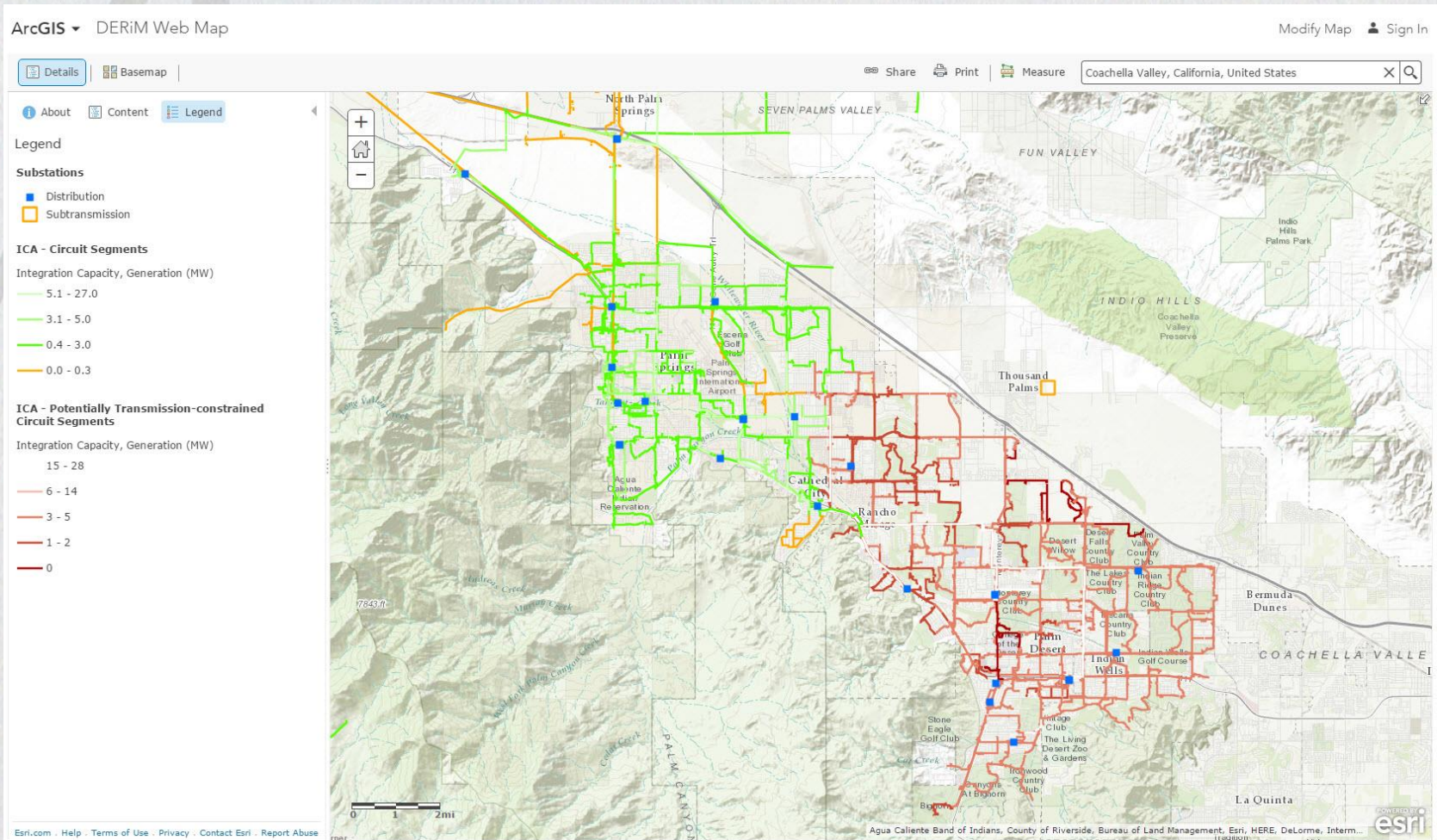


# New York Distribution Planning Policy

- Utilities are required to integrate distributed resources in their distribution planning
- Utilities have mapped their “hosting capacity”
  - Maps are available to project developers to guide them in selecting sites
- Increasing hosting capacity may be recognized in distribution system investment proposals
- More information is available in the utilities’ Distributed System Implementation Plans



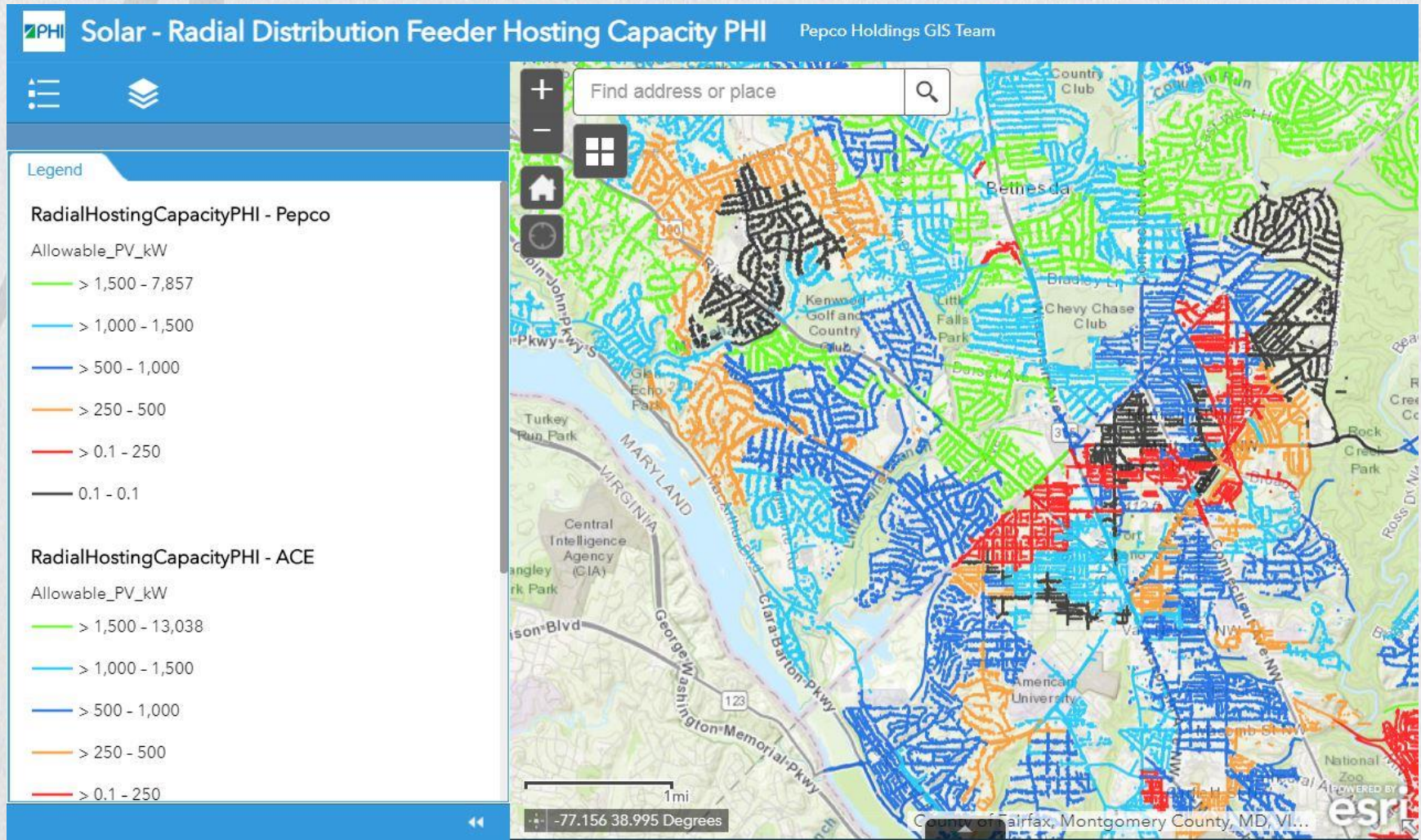
# Example Hosting Capacity Analysis: Southern California Edison



Source: Southern California Edison



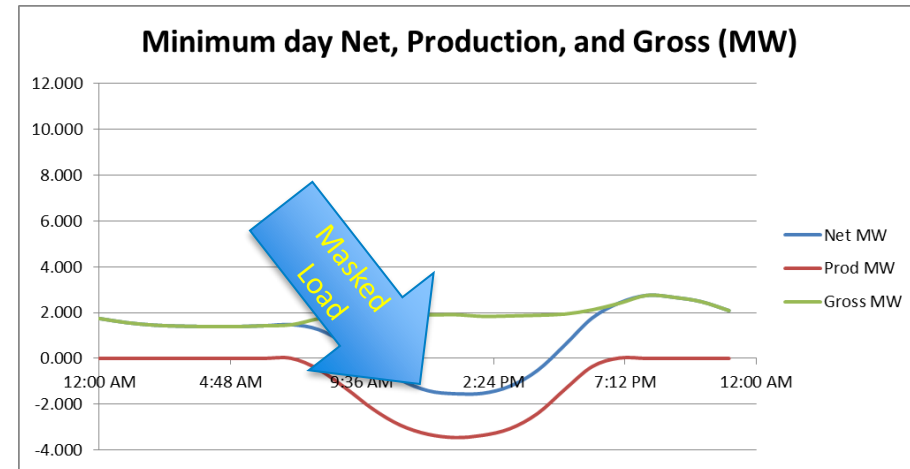
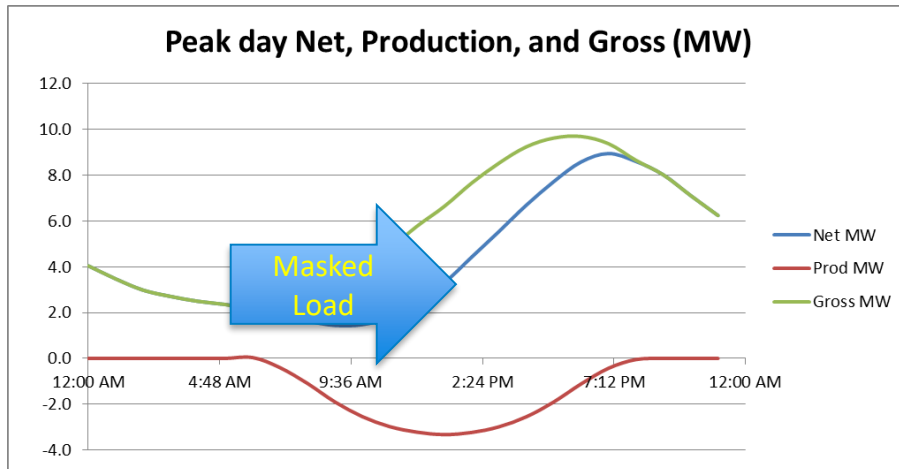
# Example Hosting Capacity Analysis: PEPCo Washington DC Area





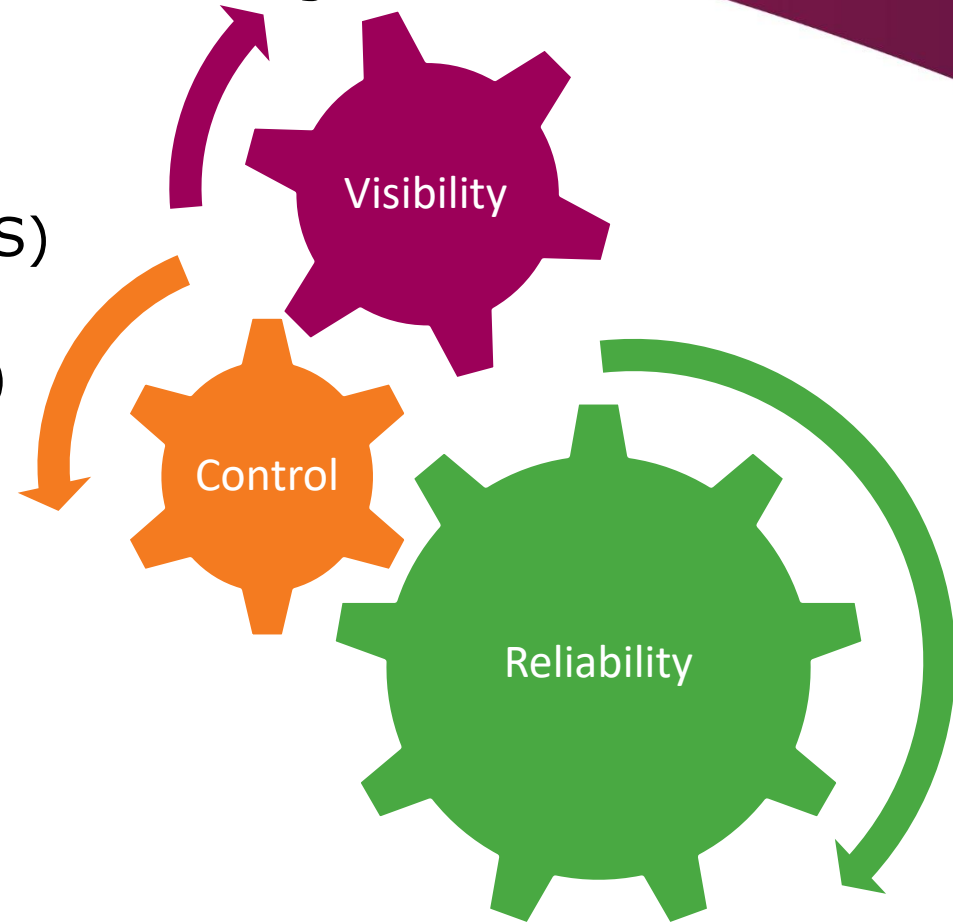
# Impact on Visibility

- Visibility
  - DERs mask load on the system
    - Operators cannot see “true” load
    - Uncertainty of masked “true” load can appear in disturbance
  - Weather dependent variability
    - PV output drop of -90% in seconds with cloud cover
  - Existing infrastructure will not provide visibility
    - New thermal, voltage, and protection coordination risks
    - Lack of visibility is a concern and must be managed



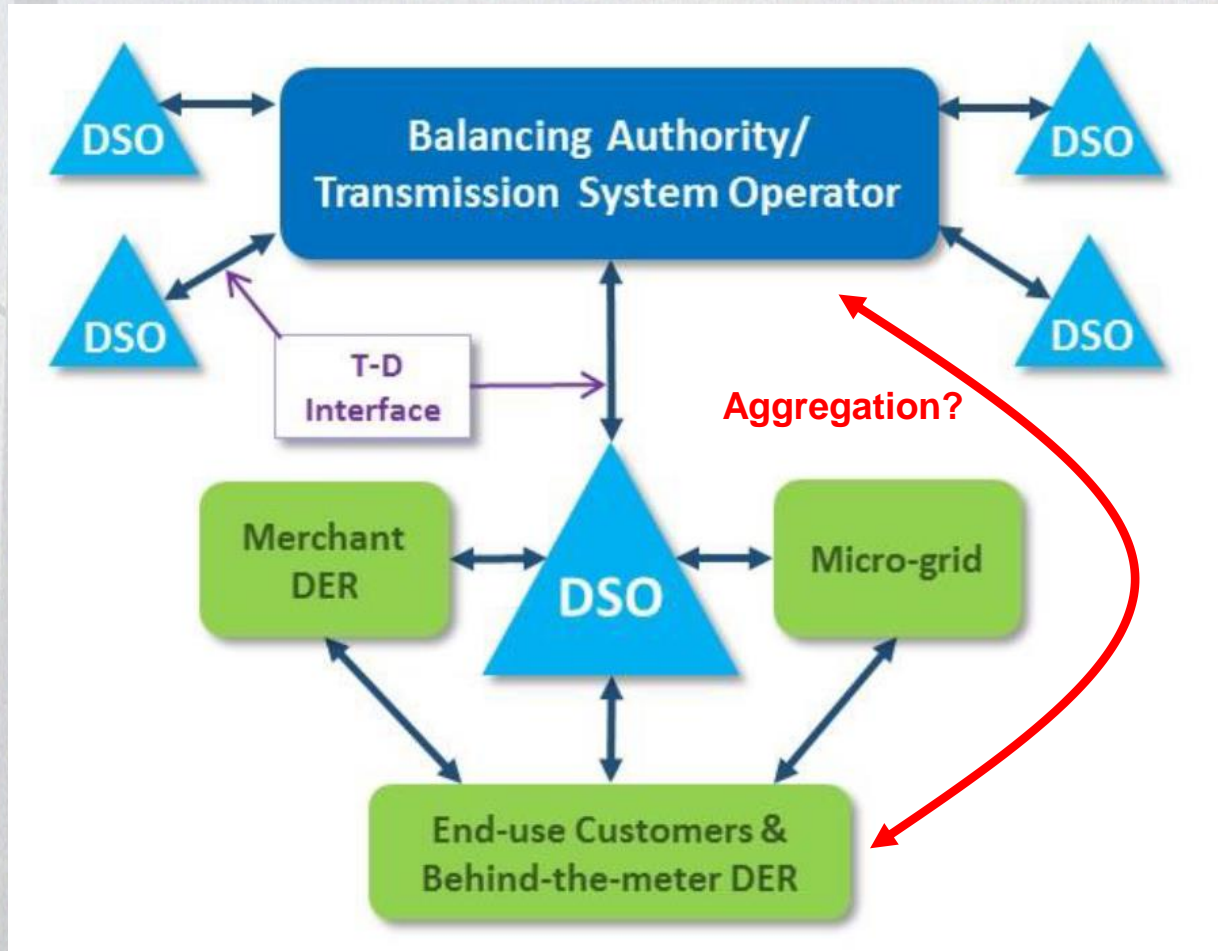
# Enabling Technologies and Projects

- Making it all fit together
  - Advanced Distribution Management System (ADMS)
  - Transmission Energy Management System (EMS)
  - Data Management
- Additional technologies
  - Battery Energy Storage Systems (BESS)
  - Residential Advanced Inverter Demonstration
  - DER technologies





# What is a DSO in the U.S.?



# U.S. Wholesale Demand Response

- Starting in 1999, FERC has approved wholesale demand response proposals developed by Regional Transmission Operators (RTOs)
  - Capacity Market
    - Demand reductions compensated as capacity resources in exchange for obligation to perform when directed
  - Ancillary Services
    - If capable, adjustments to customer demand can be compensated as ancillary services (non-spinning, spinning, and regulation response)
  - Demand Bidding (or Economic Demand Response)
    - Demand reductions are bid and dispatched in energy markets like generation resources
  - Voluntary Emergency Demand Response
    - Compensation for demand reductions during system emergencies
- Participation in RTO programs -- 32 GW in 2016



# Key FERC Rulemakings

- Order No. 719 (Wholesale Competition)
  - Changes to wholesale markets to permit demand response participation
  - Allows aggregated retail demand responses to bid into RTO and ISO markets, unless local laws or regulations do not permit a retail customer to participate
- Order No. 745 (Demand Response Compensation)
  - Requires that RTOs and ISOs pay demand response resources participating in the Day-Ahead and Real-Time Wholesale Energy Markets the Locational Marginal Price (or LMP) when
    - Demand response resources are capable of balancing supply and demand, and
    - Are cost-effective as determined by a net benefits test
    - Struck down by U.S. District Court of Appeals in 2014 (*EPSA v. FERC* decision)
    - Appealed to the U.S. Supreme Court

# FERC v. EPSA Case

- The U.S. Supreme Court issued a decision in *FERC v. EPSA*\* in January 2016 that upheld FERC's jurisdiction on wholesale demand response
- Supreme Court found that
  - FERC does possess adequate regulatory authority under the Federal Power Act; and
  - FERC's decision to compensate demand response providers at locational marginal price was not arbitrary and capricious.

\* *Elec. Power Supply Ass'n v. FERC*, 753 F.3d 216 (D.C. Cir. 2014), *rev'd sub nom. FERC v. Elec. Power Supply Ass'n*, 136 S. Ct. 760 (2016)



# Order No. 841 – Electric Storage Participation in the Organized Wholesale Electric Markets

In February 2018 the Commission required RTOs/ISOs to establish market rules that ensure:

- Electric storage resources are eligible to provide all capacity, energy, and ancillary services they are technically capable of providing.
- RTO/ISO tariffs account for physical and operational characteristics of electric storage resources.
- Electric storage resources are able to be dispatched and set the wholesale market clearing price as both a wholesale seller and wholesale buyer.
- RTO/ISO tariffs establish a minimum size requirement for electric storage resources not to exceed 100 kW.



# **NOPR on Electric Storage Participation in the Organized Wholesale Electric Markets:**

## **DER Aggregations (RM16-23-000 and RM18-9-000)**

In November 2016, the Commission made several proposals, including:

- Eligibility to participate in the organized wholesale electric markets through a distributed energy resource aggregator
- Locational requirements for distributed energy resource aggregations
- Distribution factors and bidding parameters for distributed energy resource aggregations
- Metering and telemetry requirements for distributed energy resource aggregations
- Coordination between the RTO/ISO, the distributed energy resource aggregator, and the distribution utility

On February 15, 2018, new rulemaking proceeding created to collect additional information on the DER aggregation proposals



# FERC Staff DER Report

- FERC Staff Report (February 2018) (Docket No. AD18-10-000) addressed the following:
  - Practice of netting DERs with load
  - DER Capabilities for frequency and voltage ride-through
  - Potential for improved customer level voltages
  - Potential effects on system-wide transmission line flows and generation
  - Sensitivity of voltage or power needs to different types of DER applications (e.g. energy, capacity or ancillary services)
  - Need to develop planning processes that capture more detailed models of DERs and allow for modeling of the interface between transmission and distribution systems
  - Need to enable information exchange and more accurate calculations of the DER impact on the bulk power system



# Distributed Energy Resources Technical Conference

- To collect additional information on DER aggregation, FERC conducted a technical conference on April 10 and 11, 2018 (RM18-9-000)
- Technical conference also reviewed DER impacts on the bulk power system as part of a new proceeding (AD18-10-000)
- Seven panels and over 50 panelists covered:
  - DER aggregation locational requirements
  - State and local regulator concerns
  - Double compensation for same services
  - DER data
  - DER modeling
  - Coordination

# What We Heard at the DER Technical Conference

- Variance in regional DER deployment drives activity
- Recognition that addressing DER deployment will be important
- General desire for visibility into DER operation
- DER aggregation coordination important as penetration increases
- Crucial role for distribution utilities in DER aggregation
- Means exist to address compensation for multiple services from DERs
- RTOs/ISOs vary in preferred geographic scope of DER aggregation
- Need for flexibility in implementation
- Importance of the use of grid architecture concepts

Post-Technical Conference Comments were due June 26 under separate dockets (AD18-10-000 and RM18-9-000)



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# Questions?

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