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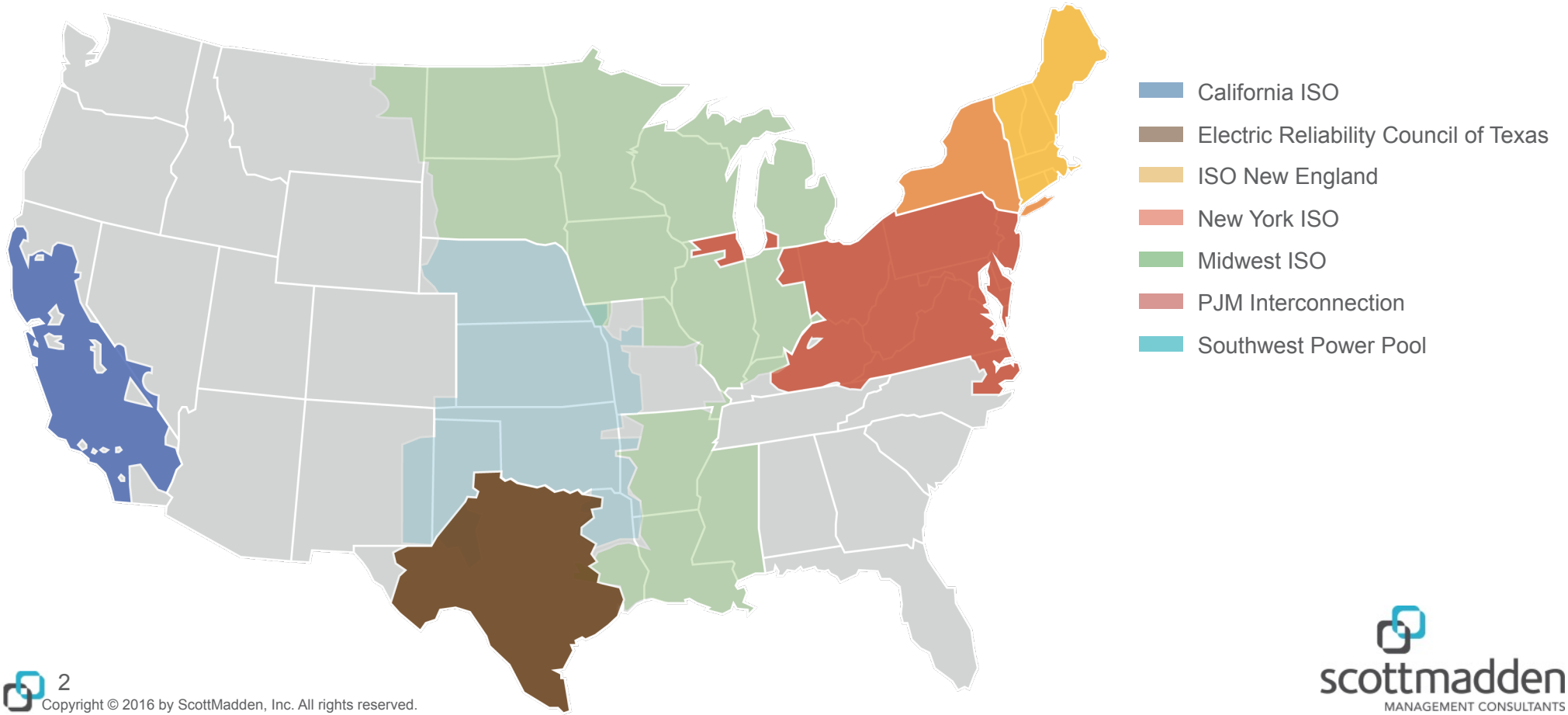
NYISO Stakeholder Forum

DER Integration into Wholesale Markets

September 22, 2016

Introduction

- Grid operators across the country are wrestling with both the challenges and opportunities of distributed energy resources (DERs)
- Unique market, regulatory, and technical infrastructures mean that each is pursuing a different approach and timeline



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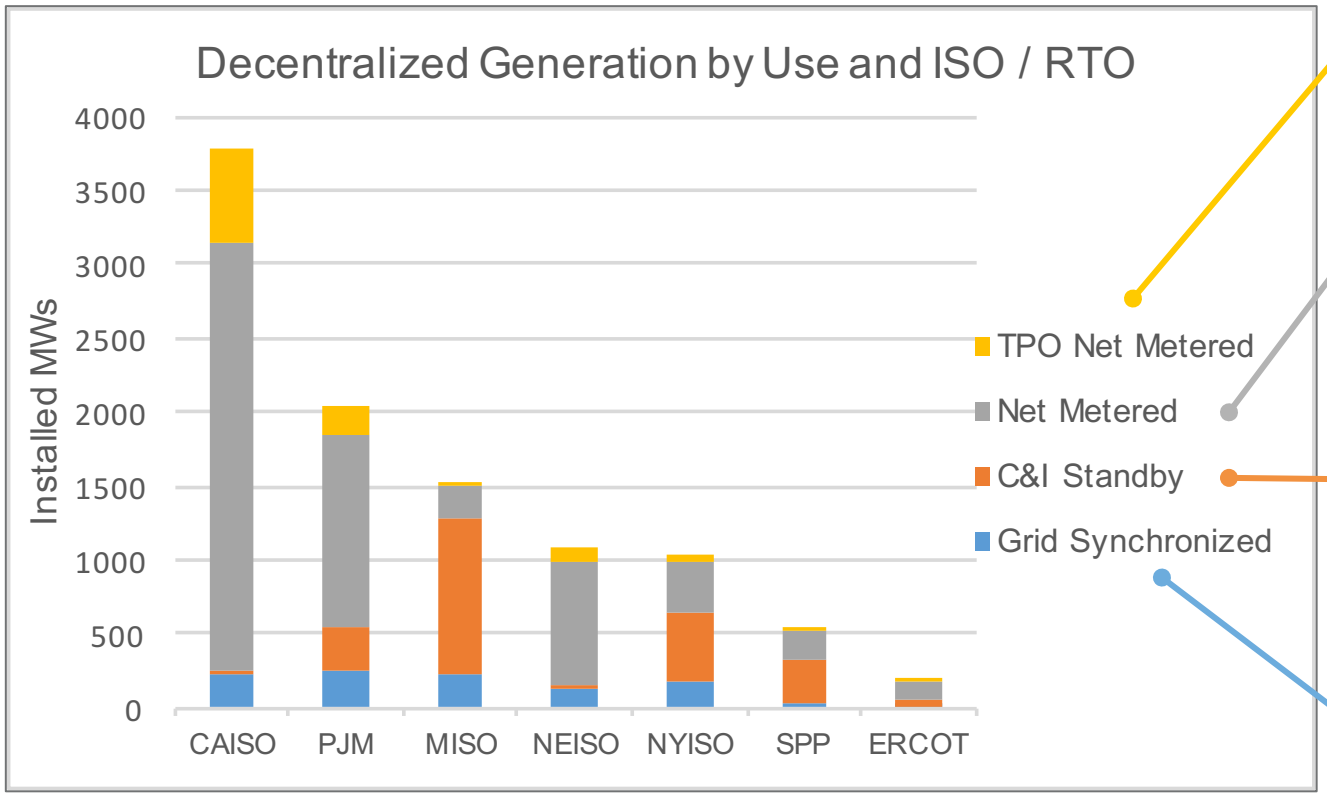
Types of Resources

Type of Resource	Wholesale (In Front of the Meter)	Behind the Meter
Energy Efficiency	■ Long history of integration into utility operations and wholesale markets	
Demand Response	■ Long history of integration into market as load modifier and capacity resource	■ Aggregation growing
DG (dispatchable)	■ Access to wholesale markets as generator	■ Dispatched in some markets; in others, load modifying only ■ Aggregation growing
DG (non-dispatchable)	■ Access to wholesale markets as generator	■ Generally serves as load modifier ■ Limited aggregation
Storage	■ May participate in various markets (capacity, reserve, etc.) ■ Myriad pilots	■ May be resource or load modifier ■ Aggregation growing

Decentralized Generation by Region



Third-party owned net metered systems

Refers to generators that are less than 2 MW in capacity with a net metering agreement

Commercial and industrial generators (< 1 MW) not connected or synchronized to the grid

Includes all commercial and industrial generators (< 1 MW) that are grid connected and grid synchronized

*Figures are from 2014 (Form 861), the most recent data available. ISO data is calculated by adding data from participating states and is illustrative of the 2014 DG totals.

 Sources: EIA, ScottMadden Analysis

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Challenges In Integrating Behind-the-Meter Resources

- Metering infrastructure (or lack thereof)
- Visibility of assets
- Verification of performance
- Dispatchability (reliability and economic)
- Availability for wholesale and retail needs (economic and reliability)
- Accounted for as load modifying resource, capacity, or energy resource?

While these challenges are not insurmountable, they need to be considered as we integrate BTM resources into wholesale markets.

Load Forecasting → ***Load Modifying Resource*** → ***Demand Resource*** → ***Aggregated Resource*** → ***Demand and Supply Resources***

DER Integration Status

ISO new england

Background

- Has pursued integration of demand response into wholesale markets for many years
- Has 600 MW of active DR and 1,900 MW of EE through capacity market in 2016
- Plans to integrate DR into all markets in 2018 (energy, capacity, operating reserve)

Status of DER Integration to Wholesale Markets

- Aggregation for DR; some aggregation of generators through lead market participant
- BTM PV does not participate in the wholesale market, though it is included in forecasts
- BTM storage typically doesn't participate in the wholesale market

Other Observations

- Grid modernization efforts are underway (e.g., MA), but AMI is not fully deployed
- Revised operating procedures effective 9/19/16 for generators and other resources

Resources	BTM DER
DR	Aggregated
DG – Disp.	Load modifying
DG – Non-Disp.	Incorporated into forecasting
Storage	Load modifying

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DER Integration Status

Background

- Long history of DR and EE participation in wholesale market
- More than 10,000 MW of DR and 1,500 MW of EE resources cleared in 2019/2020 Base Residual Auction

Status of DER Integration to Wholesale Markets

- Aggregation of demand resources enabled by Curtailment Service Provider
- BTM distributed solar amounts to roughly 3 GW (2016); incorporated into forecasting
- Tariff allows storage to serve as a capacity resource, but it requires more rule clarity related to injection rights
  - Behind-the-meter injections are not allowed
- Retail BTM generation can participate as a load modifying resource, if dispatchable by PJM

Other Observations

- Recently set new rules regarding capacity performance to push for enhanced integration of these resources

Resources	BTM DER
DR	Aggregated (CSP)
DG – Disp.	Load modifying (if dispatchable by PJM)
DG – Non-Disp.	Incorporated into forecasting
Storage	Load modifying, demand resource

DER Integration Status

California ISO

Background

- Combination of high DER penetration, active state policy making, and proactive regulatory mandates
- Multiple DERs and DR pilots completed or underway and retail DR programs well established

Status of DER Integration to Wholesale Markets

- Two auctions completed to date under Demand Response Auction Mechanism (DRAM)
- Bifurcation of load modifying and supply side DR expected in 2018

Other Observations

- DER is defined as “any resource with a first point of interconnection to a Utility Distribution Company or a Metered Subsystem”

Resources	BTM DER
DR	Aggregated by Scheduling Coordinator
DG – Disp.	Aggregated by Scheduling Coordinator
DG – Non-Disp.	Aggregated by Scheduling Coordinator
Storage	Aggregated by Scheduling Coordinator

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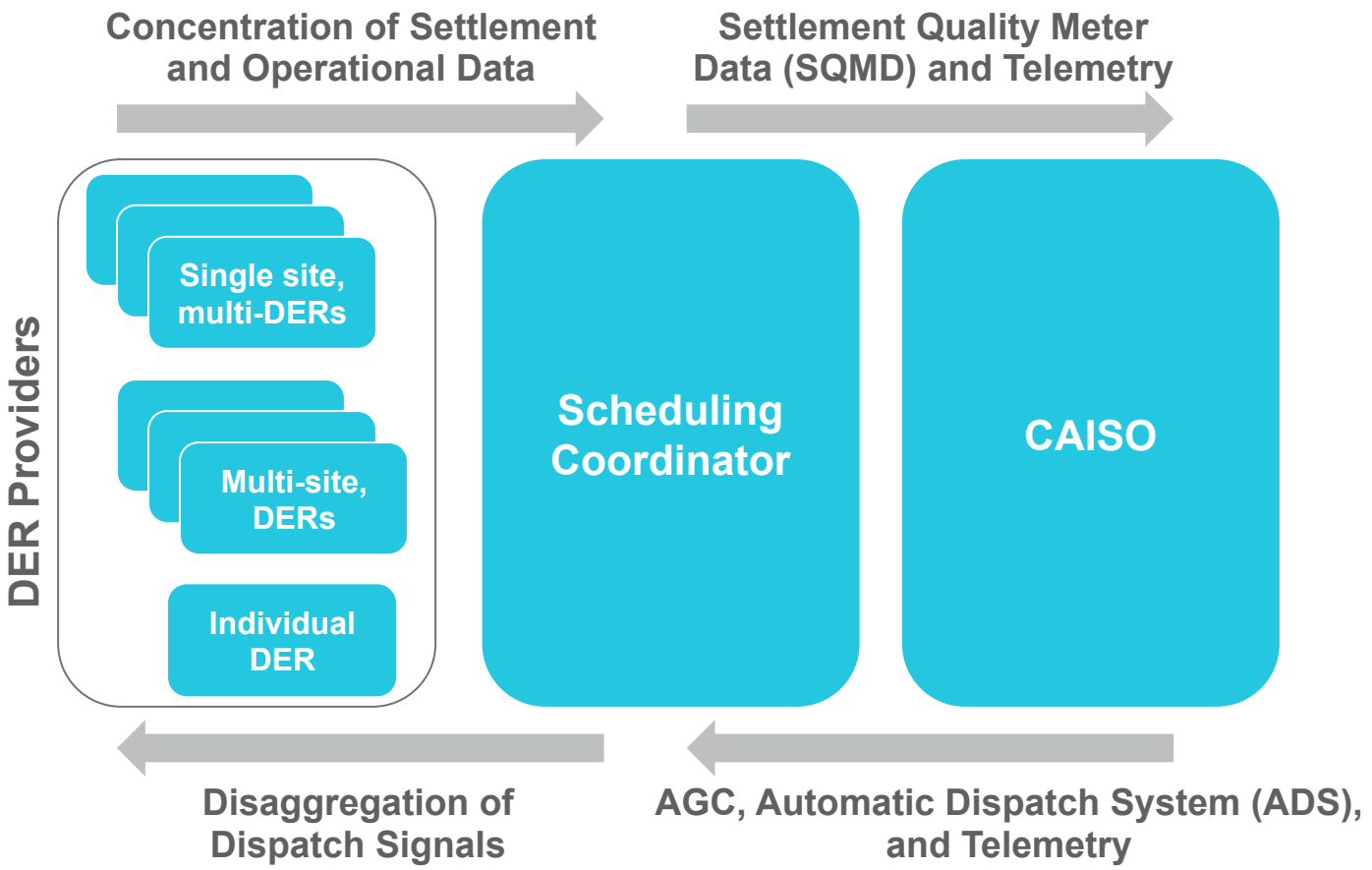
CAISO Approach to Market Bidding of Aggregated DERs

CAISO has proposed and FERC has approved the aggregation of BTM DERs by a third party for bidding into wholesale markets.

Interaction Between Aggregated DERs and CAISO



This approach enables a third party to aggregate BTM DERs and bid them into the ISO.

 Source: Expanded Metering and Telemetry Options Phase 2: Distributed Energy Resource Provider, 6/10/15, pg. 24.

In Summary

Integration Into Wholesale Markets

DER penetration, public policy mandates, technical infrastructure, and the regulatory environment all contribute to the degree of BTM DER integration in each RTO/ISO.

	ISONE	PJM	NYISO*	CAISO
DR	Aggregation	Aggregation (CSP)	Aggregation	Aggregation (SC)
DG – Disp.	Load modifying	Load modifying (if dispatchable)	Aggregation	Aggregation (SC)
DG – Non-Disp.	Incorporated into forecasting	Incorporated into forecasting	Load modifier	Aggregation (SC)
Storage	Load modifying	Load modifying (DR)	Aggregation	Aggregation (SC)

* Draft roadmap

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Cristin Lyons

Partner and Practice Lead, Grid Transformation

ScottMadden, Inc.
2626 Glenwood Avenue Suite 480
Raleigh, NC 27608
cmlyons@scottmadden.com
C: 919-247-1031

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