

DER Participation in Wholesale Electricity Markets

Technical Challenges and Opportunities

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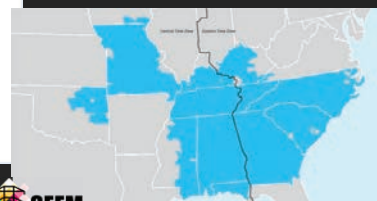
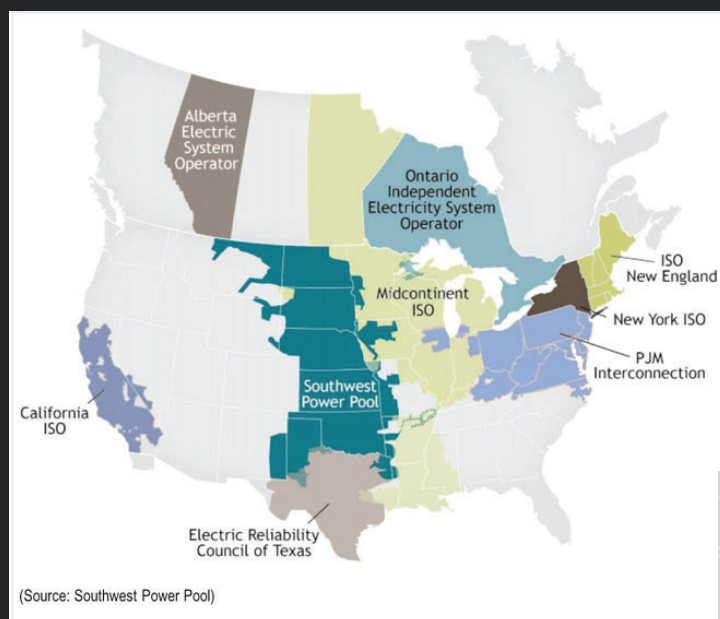
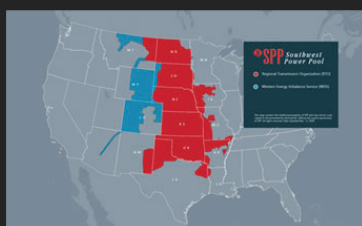
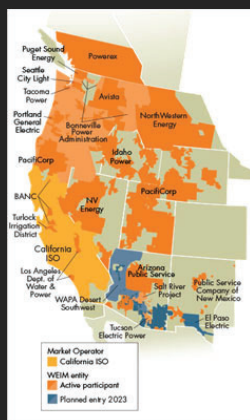
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RTO/ISO Wholesale Markets in North America



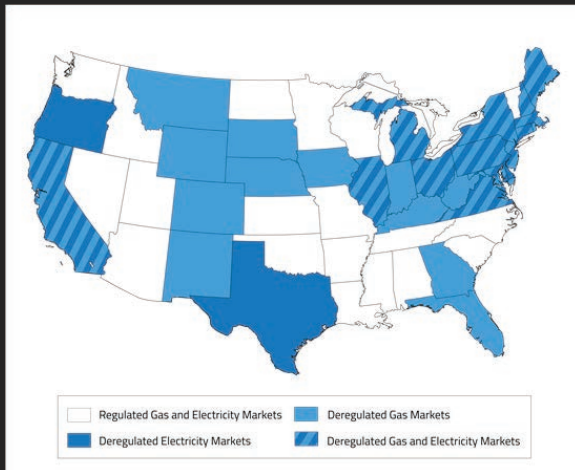
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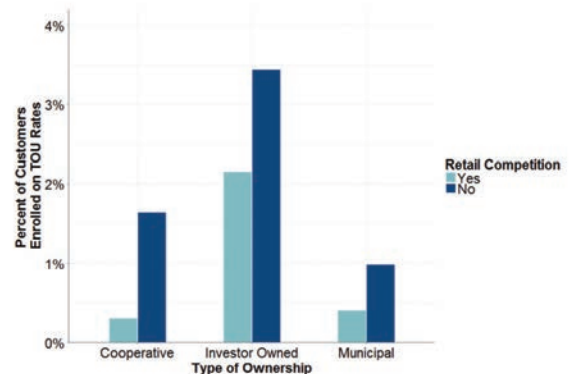
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U.S. Retail Electricity Markets



Retail rates are regulated by **state** utility commissions or other local retail regulatory authorities

Share of Customers Enrolled in TOU Where Available



https://www.brattle.com/wp-content/uploads/2021/05/17904_a_survey_of_residential_time-of-use_tou_rates.pdf
 Note: Prior to California launch of TOU as default Province of Ontario: 90% enrolled

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North American ISO and RTO Characteristics

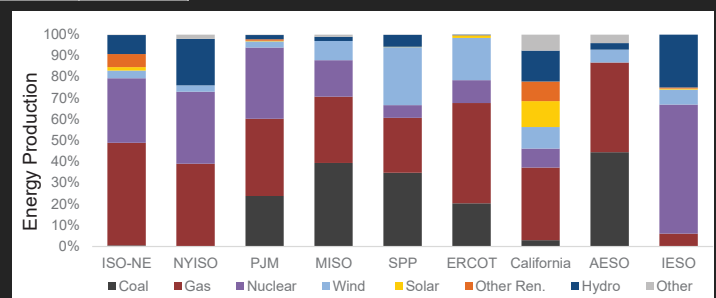
	Total Market Volume (\$B)	All-in-Price (\$/MWh)	Energy (\$B)	Ancillary Services Markets (\$M)	Uplift (\$M)	Financial Transmission Rights (\$M)	Capacity Market (\$M)
AESO (CAD\$)	5.7	46.72	3.9	148	0.75	N/A	N/A
CAISO	8.9	42.41	8.77	199	126	70	N/A
ERCOT	11	27.70	10	382	370	726	N/A
IESO (CAD\$)	18	13.9	1.8	71.5	148.1	36.3	N/A
ISO-NE	8.1	69	3.0	103	25.7	(0.8)	2,700
MISO	22	24.50	15	47	96	609	179
NYISO	6.1	38	3.5	125	41	244	2,040
PJM	33.64	44.57	16.171	544	90	681.4	7,023
SPP	16.16	20.05	10.7	84.7	104	705	N/A

Wholesale Electricity Market Design in North America: 2021 Review. EPRI, Palo Alto, CA: 2022. 3002021813.

Older, public version:
<https://www.epri.com/#/pages/product/000000003002009273/?lang=en>

	PJM	ISO-NE	NYISO	MISO	SPP	ERCOT	CAISO	AESO	IESO
Wholesale Market Regulator	FERC	FERC	FERC	FERC	FERC	TX PUC	FERC	AUC	OEB, CA NEB
Resource Adequacy	FERC	FERC	NYSRC, FERC	FERC/ states	FERC/ States		CPUC, FERC		OEB
Organization representing state interests	OPSI	NESCOE	NY PSC	OMS	SPP RSC		CPUC		

FERC: Federal Energy Regulatory Commission. TX PUC: Texas Public Utility Commission. AUC: Alberta Utilities Commission. OEB: Ontario Energy Board. CA NEB Canada National Electricity Board. NYSRC: New York State Reliability Council. CPUC: California Public Utility Commission. OPSI: Organization of PJM States Incorporated. NESCOE: New England States Committee on Electricity. NY PSC: New York Public Service Committee. OMS: Organization of MISO States. SPP RSC: SPP Regional States Committee.



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FERC ORDER 2222

A High Level Overview



What is a DER? What is a DER Aggregator?

DER: any resource located on the distribution system, any subsystem thereof or behind a customer meter

DERA: Entity that aggregates one or more DER for purposes of participation in RTO and ISO markets

What are the Key Implementation Challenges?

Operational Coordination

Aggregator Management

Metering and Telemetry

Market Design

How Does 2222 Enable DER to Participate in ISO/RTO Markets?

Key Eligibility Requirements

- All DER technologies can **heterogeneously** aggregate to meet RTO/ISO requirements, if aggregation is at least **100 kW** in size
- Existing and/or new **participation models**
- Aggregation as **geographically broad as technically feasible**
- Data, bidding, metering, and telemetry for **DERAs** **balanced** with existing requirements, but reduce burden on **DERs**
- Limit compensation for the **same service** in other programs

What is the Timeline?

ISO tariff modifications due 7/19/21, All have been submitted, 2 have received FERC compliance orders.

ORDER 2222 enables DER participation in ISO/RTO Markets

Who does this impact?

Customers
DER
Aggregators
Distribution Utilities
RTOs/ISOs
Regulators

How Will Market Participation Be Coordinated?

• **Main market interface:** RTO/ISO ↔ AGGREGATOR

• Key Elements of Coordination

- Distribution utility **preclears** DER to join an aggregator
- Distribution utility may **override** DERA schedule to ensure distribution system safety and reliability
- **Data sharing** practices between all parties
- **Retail rate authorities** involved in coordination
- Allow regional **flexibility**, no explicit **coordination framework**

Relevant Research Areas



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EPRI FERC O2222 Collaborative Forum



650+ individual participants from 32 companies
4,000+ cumulative attendees



Over 45 unique webcasts



Summary, history and gap assessment



11 workstream guides



DERA Use Case Survey Tool



Final Implementation Roadmap Report



Participation



■ ISOs ■ Utilities ■ Other



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Also available as part of the eCourse

[2023 Renewable Energy Law eConference](#)

First appeared as part of the conference materials for the

18th Annual Renewable Energy Law Institute session

"Distributed Energy and Virtual Power Plants: Regulatory Challenges and Opportunities to Leverage Consumer-Driven Electrification "