



UNS Energy Corporation
A Fortis Company

Western Market Exploration

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Energy Markets 101



Energy Markets 101

Markets for delivering power to consumers in the United States are split into two systems: traditionally regulated bilateral markets, and those run by RTO/ISOs

Traditional wholesale electricity markets exist primarily in the Southeast U.S. and the West outside of California

- Utilities are responsible for system operations and for providing power to retail consumers

Two-thirds of the population of the United States is served by electricity markets run by Regional Transmission Organizations or Independent System Operators (RTO/ISOs or organized markets)

RTO/ISO markets optimize electricity through structured market design/mechanisms



Day Ahead & Real Time Optimization

Day Ahead: Run Generation Optimization for next 7 days

Create Day Ahead Plan and submit to the market

- Generation Base Schedules, Intertie Base Schedules, & Ancillary Services

Create Bids and submit to the market

Input all Generation & Transmission Outage

Day Ahead: Run Generation Optimization for next 7 days



Real Time: Run Generation Optimization for next open hour through balance of day

Ensure generation follows real-time (5 minute) Dispatch Instructions from market

Manage Unit Startup/Shutdown

Monitor load and renewable forecasts & update Generation/Transmission Outages

Congestion management via Security-Constrained Economic Dispatch (SCED)



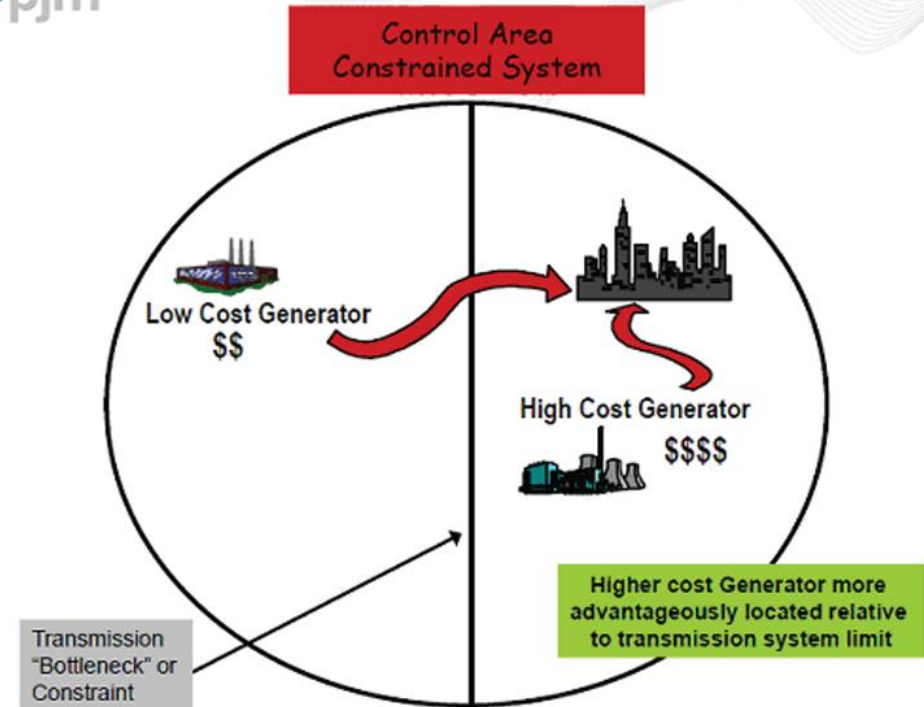
Security-Constrained Economic Dispatch (SCED)

- Optimizes generation to the extent the transmission system can support it
- Identifies and encourages addition of transmission investments needed to alleviate congestion

Security Constrained Re-Dispatch

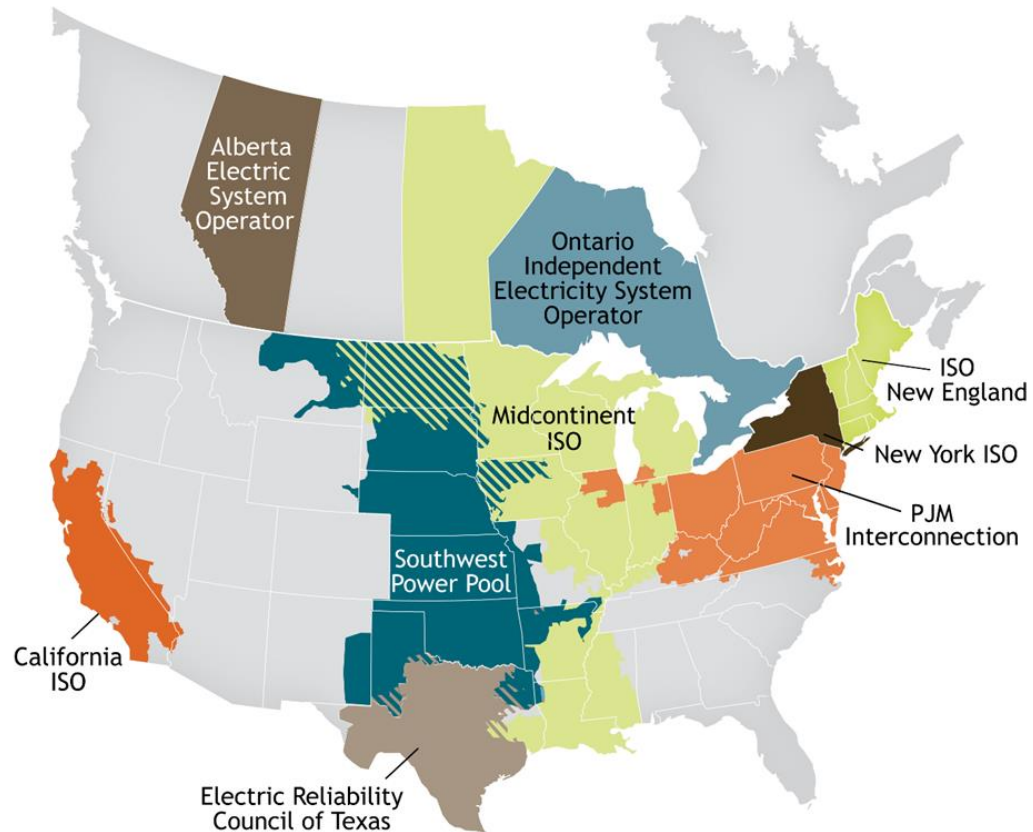


Security Constrained Re-Dispatch





Existing Structured Markets



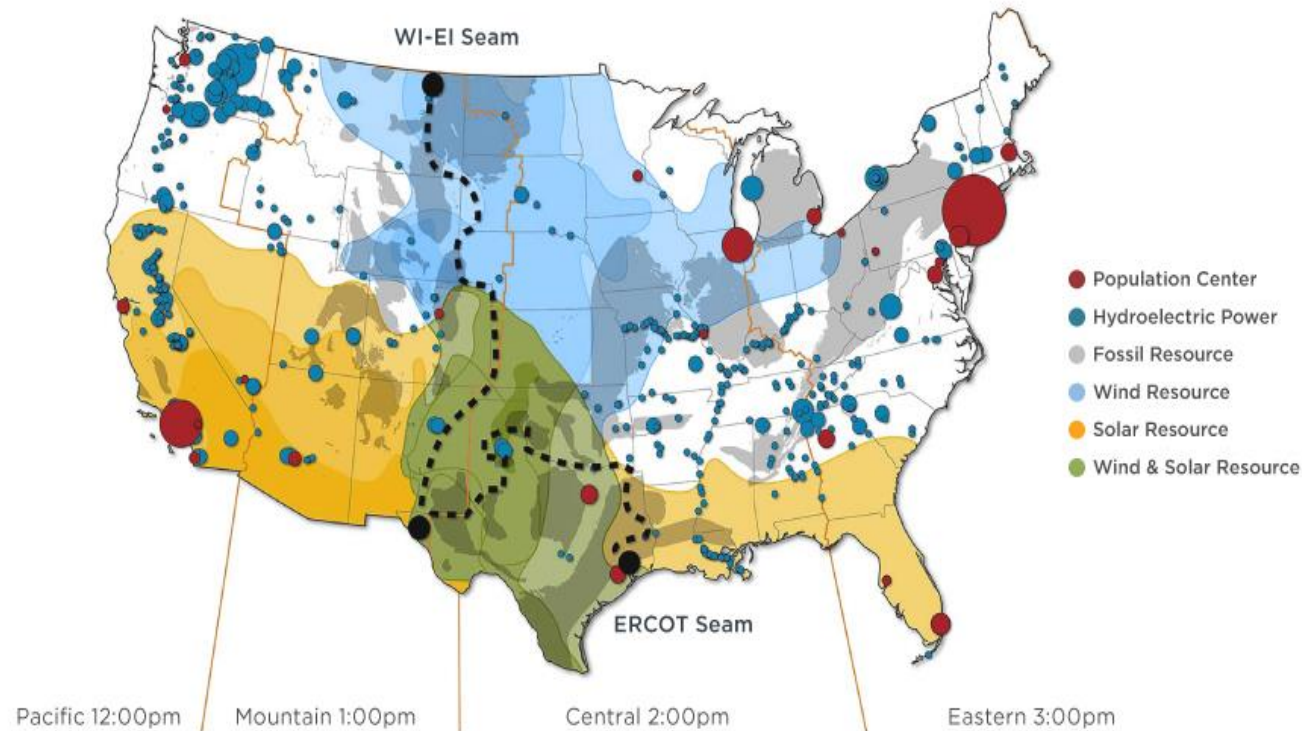
Current organized markets in North America



Market Evolution



Drivers: Geographic Diversity



Resource Diversity

- Southwest utilities have access to northwest hydro capacity in summer
- Northwest utilities have access to southwest gas and renewable capacity in winter

Peak Diversity

- Utilities peak at different times of day and year
- Allows for resource optimization, especially renewables



Drivers: Resource Adequacy

Members must ensure their own resource adequacy

- Supports reliability of entire region

Resource optimization/efficient dispatch

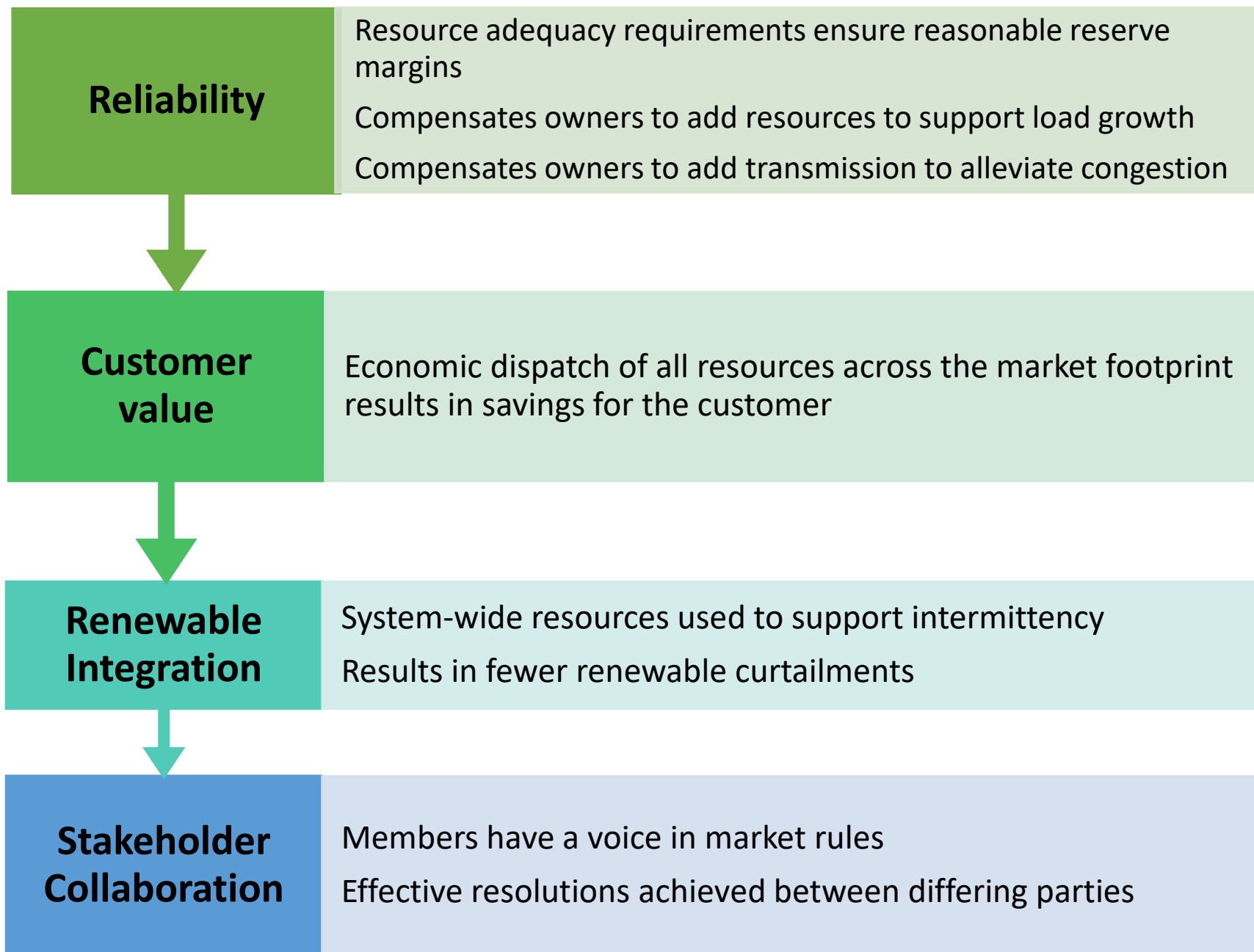
- Carried out across entire footprint instead of individual utilities

Liquid Market

- Improves reliability
- Efficient, low-cost transactions



Benefits





Market Evolution

Most organized markets in North America evolved by forming collective reliability organizations responsible for different aspects of operations:

Transmission Operations

Generation Dispatch

Reliability Coordinator



Over time, they added additional functions:

Tariff consolidation

Transmission Planning

Imbalance Markets



Until they eventually launched full markets for participants



Most began organizing shortly after FERC Order 888 (1998)



Market Features

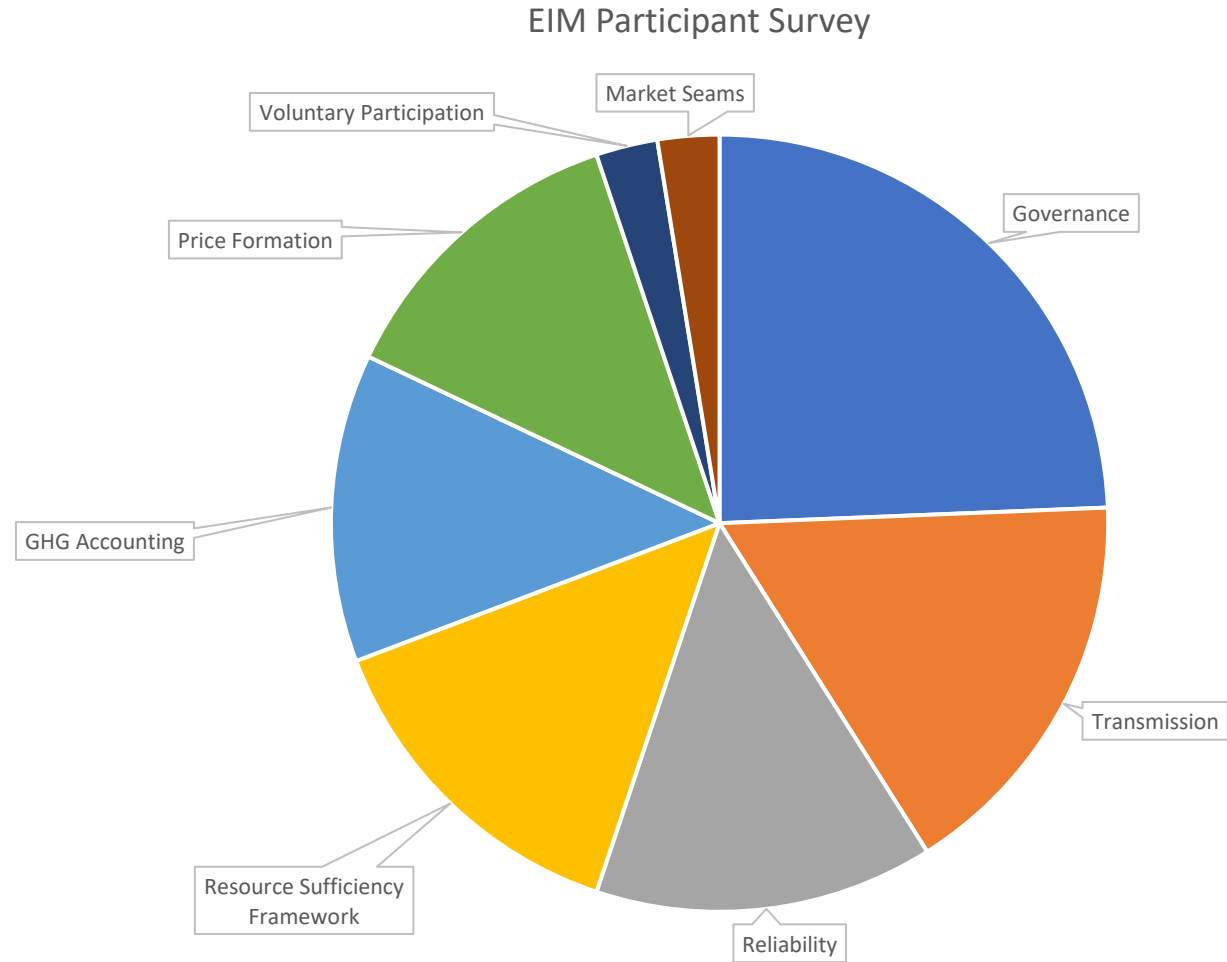
Bi-Lateral Market	Real-Time Market	Day Ahead Market	Regional Transmission Organization
Balancing Authority	Balancing Authority	Balancing Authority	Balancing Authority
Resource Adequacy	Resource Adequacy	Resource Adequacy	Resource Adequacy
Trans Planning	Trans Planning	Trans Planning	Trans Planning
Trans Service Provider	Trans Service Provider	Trans Service Provider	Trans Service Provider
Bi-Lateral Market	Bi-Lateral Market	Bi-Lateral Market	Bi-Lateral Market
<i>Real-Time Market</i>	Real-Time Market	Real-Time Market	Real-Time Market
<i>Day-Ahead Market</i>	<i>Day-Ahead Market</i>	Day-Ahead Market	Day-Ahead Market
RC Services	RC Services	RC Services	RC Services

<i>Not Offered</i>	Self-provided or procured	Market feature
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Day Ahead Market Priorities

- Governance
- Transmission
- Reliability
- Resource Adequacy Framework
- GHG Accounting
- Price Formation
- Voluntary Participation
- Market Seams





Western Market Efforts

EDAM	Develop an approach to extend participation in the day-ahead market to the Western Energy Imbalance Market (EIM) entities in a framework like the existing EIM approach for the real-time market, rather than requiring full integration into the California ISO balancing area. A bill is moving through the CA legislator, AB 538, that potentially creates a pathway for CAISO to form an RTO with entities outside of the state.
SPP Markets+	It's a conceptual bundle of services proposed by SPP that would centralize day-ahead and real-time unit commitment and dispatch, provide service across its footprint and pave the way for the reliable integration of a rapidly growing fleet of renewable generation.
WMEG	Utility executives are exploring the potential for a staged approach to new market services, including day-ahead energy sales, transmission system expansion, and other power supply and grid solutions consistent with existing state regulations.