Markets—Overview and Impacts to Operations

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Agenda

• What is driving the industry move to Markets in the West
• What does this mean for WAPA
• Overview - Regional Transmission Organization (RTO)
• What does an RTO mean for generator Operations
• Q&A
What’s driving the industry move?
Change drivers

The industry is replacing coal as a primary generating fuel with natural gas, wind, and solar.

✓ Low natural gas prices
✓ Coal industry financial challenges
✓ Improved performance of wind and solar
✓ Environmental requirements and incentives

"If you don’t like change, you’re going to like irrelevance even less."

General Erick Shinseki, Secretary of Veterans Affairs
Generation Mix Forecast

What does this mean to WAPA?
Implications for WAPA

• Changes in the generation mix are motivating the development of regional markets.

• Power marketing:
  • Regional market expansion reduces WAPA’s access to bilateral trading partners.
  • WAPA purchases significant amounts of wholesale electricity. Per unit costs and price volatility are risks.

• System operations:
  • The location and type of replacement generation affects transmission sales, operations, and planning.
  • WAPA’s Balancing Authorities (BA) will be affected by a system that is increasingly dynamic.
WAPA’s Position on Markets

• Each region is unique and there will not be a ‘one size fits all’ solution.

• We are staying strategic, proactive, and in alignment with our mission.

• Goal: Create the best possible outcome for our customers and our organization.
WAPA Regional Activities
Upper Great Plains Region
Loveland Area Projects and the Colorado River Storage Project
Sierra Nevada Region
Desert Southwest Region
Overview - Regional Transmission Organizations (RTOs)
What is an RTO?

• An independent operator of the transmission system and generation resources.
  - RTOs do not own transmission and generation.
  - RTOs operate the system on behalf of utilities.

• The Reliability Coordinator (RC) for the operating footprint.
  - Wide-area overview of the entire footprint.

• Facilitates transmission planning.

• Performs Market Monitoring.

• Operates and oversees a centralized market for energy and ancillary services.
North American Independent System Operators (ISO) and Regional Transmission Organizations (RTO)
The West is Unique

- 38 Balancing Authorities
- 50 transmission operators
- The fragmented system is not well-positioned for change
What are the benefits of an RTO?

- More efficient generation commitment and dispatching
- Improved system reliability
- More efficient renewable energy integration
## Electric Industry Market Structures: Bilateral vs. Centralized Markets in RTOs

<table>
<thead>
<tr>
<th>Bilateral Markets</th>
<th>RTO Centralized Markets</th>
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<tr>
<td>One party sells to another party (like buying a car)</td>
<td>Electricity products cleared by a centralized market operator (like the stock market)</td>
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<td>Hourly transactions - poorly matched to increasing amounts of renewable generation</td>
<td>5 minute transactions - much more responsive to changing system conditions</td>
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<td>Fragmented operating footprints result in operating inefficiencies</td>
<td>Larger operating footprints with diverse resources are more efficient and more reliable</td>
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<td>Limited visibility to conditions on neighboring systems can create reliability issues</td>
<td>Wide area situational awareness and control of the system has reliability benefits</td>
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A closer look – How do RTOs manage it all?

Maintain reliability
+ 
Meet energy demand
+ 
Manage congestion
+ 
Lowest-cost resources
=
???
Understanding SCED

One large component RTOs use is:

**SCED** = Security Constrained Economic Dispatch

- Minimizes cost to serve customer load, while maintaining reliability of the electrical system.
Day-Ahead Market

Day before Operating Day

**OCTOBER 7**

**By 0930:**
Market Participant (MP) Activity

- **Offers** to sell energy
- **Bids** to buy energy

**Between 0930 – 1400:**
RTO runs day-ahead (DA) market

- Matches up offers and bids
- Reduces total energy costs, while maintaining **reliable** operations
- Computes and publishes **DA prices**
- Is **financially binding**

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Real-time Balancing Market

Operating Day

OCTOBER 8

24 hours

**All Day: MP activity**

- Resources committed from DA come online per schedules
- Resources follow all market instructions

**All Day: RTO runs RTBM**

- Balances generation and load in RT while maintaining reliability
- Sends Dispatch Instructions (from SCED)
- Sends Set point Instructions
- Computes and publishes prices every five (5) minutes

*Helps RTO/Market Operator fulfill Balancing Authority (BA) responsibilities*
How does SCED work?

• Security Constrained Economic Dispatch (SCED)
  • Goal: Minimize Generation cost while also respecting transmission constraints.

• Inputs
  • Generation to be Dispatched-What units are available- “The Menu” of Resources need to serve “The Load”
  • Generator Offer Curves-$ Costs-Start Up-Min Run Time
  • Generator Limits- 500Mw might only be good for 490Mw
  • Generator Current Output-Currently producing 350Mw
  • Active Transmission Constraints-Limitations or Congestion
Results of SCED

- A solution that contains:
  - Recommended changes to dispatch rate
  - A list of all active constraints on the system
  - A list of all units to be used for constraint control
  - Individual generation set points and dispatch rates for all units
  - Real-time market Alternative solutions for the RTO Generation Dispatcher
The Big Question...

• What does this mean for your operations?
  • Strong and efficient coordination with WAPA/PMAs
    • Even more crucial that outages, maintenance and differences in release rates are known ahead of time
    • Coordination across projects – not just generation
  • Might expect less hour to hour generator movements are likely
Unit Selection

SCED Determines 400 mw of Load needs to be met

- Generation Offers of $43 - higher
  Doesn't get picked up because load was met

- Generation offers of $20 - $40
  Gets selected and sets the price because load is met

- Generation offers of $20 and less
Q&A

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