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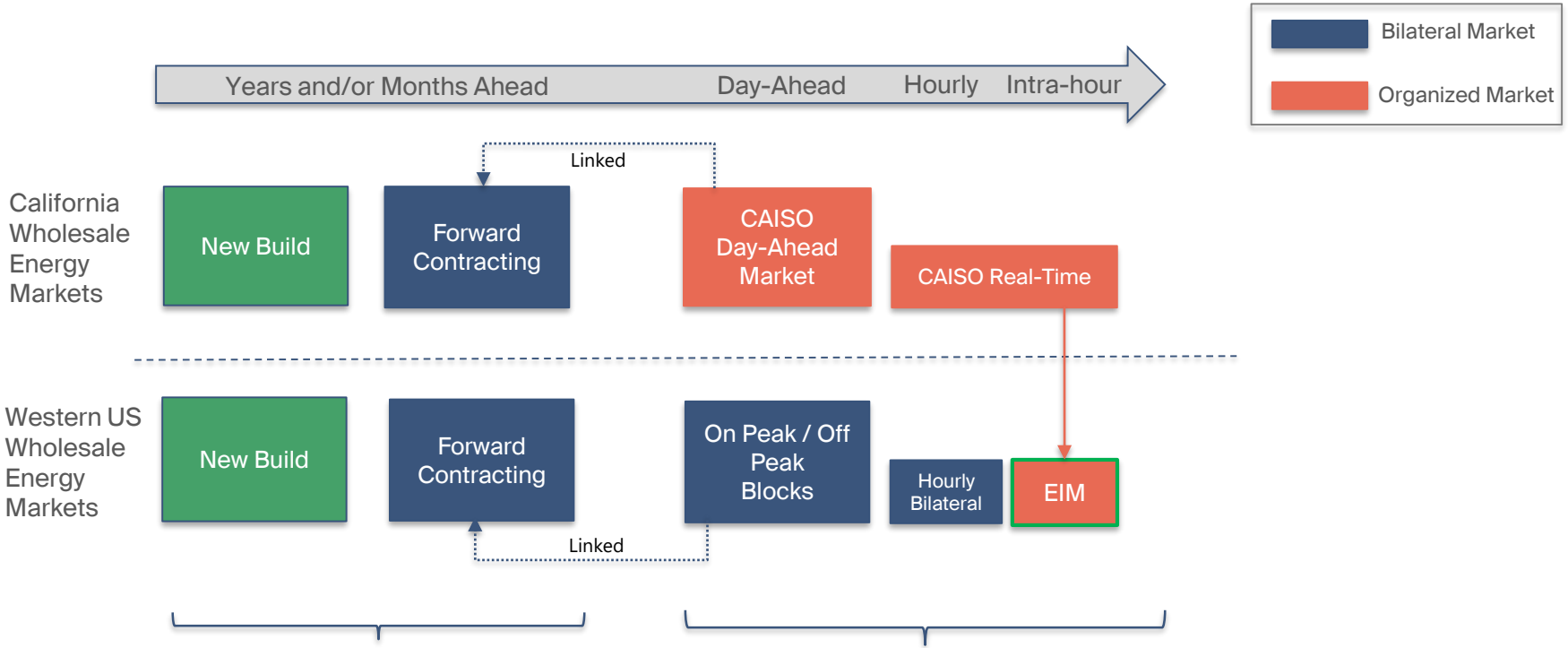
Jeff Spires
Director, Power

CETA Market Workgroup

Energy Markets Overview

Supply. Flexibility. Commitment.

Trading in Western U.S. Markets

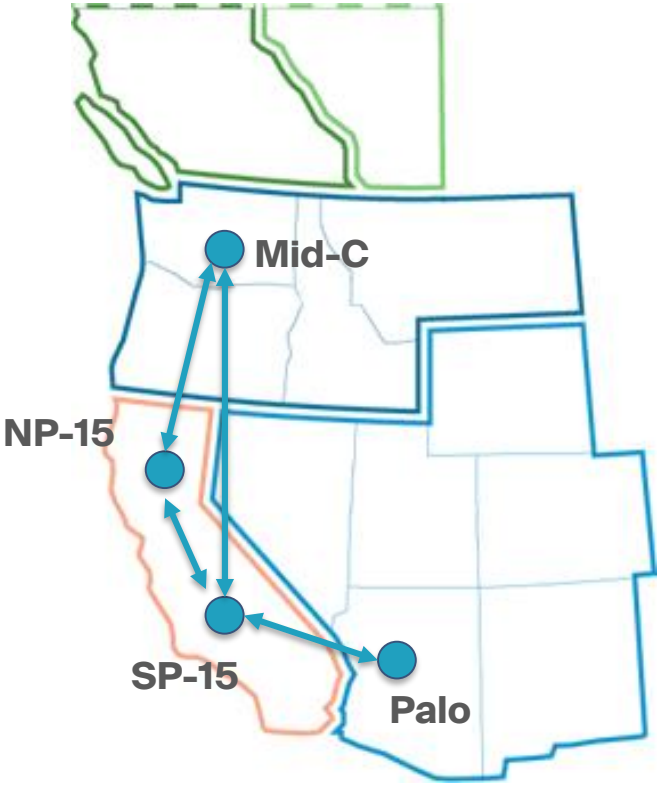


Planning Horizon:
What resources are needed?
("steel in the ground")

Operating Horizon:
Which resources should run?
(economic dispatch)

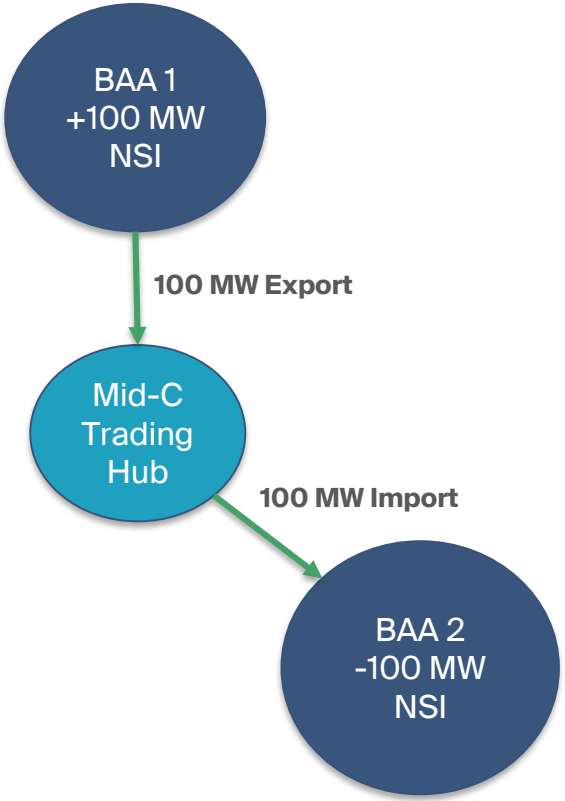
Nature of Bilateral Markets

- Multiple buyers and sellers
  - Each trade occurs between a **single buyer** and **single seller** at a **negotiated price**
  - Trades executed through electronic exchange (i.e., ICE), brokers, phone
- Standardization facilitates efficiency:
  - **Location**: Trading Hubs (e.g., Mid-C or Paloverde)
  - **Time Period**: On-Peak and Off-Peak Blocks
  - **Product Quality**: Firm, Unit Contingent, Non-Firm
  - **Contract Terms**: e.g., WSPP Schedule C
  - **Carbon**: "Unspecified" or Resource-specific
- Bilateral wholesale energy markets enable large volumes of regional trade across the West



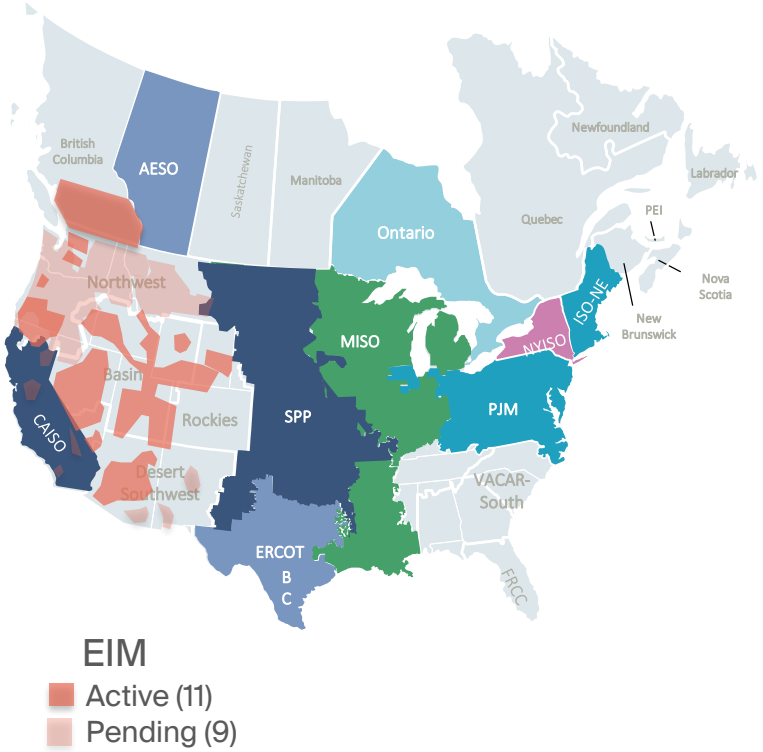
Arranging Bilateral Transactions

- OATT transmission contracts purchased to deliver to/from transaction location (e.g., trading hub)
  - Transmission contract terms can vary: multi-year → hourly
- **e-Tags** used to provide a detailed electronic schedule
  - All Parties in schedule receive copy of e-Tag (seller, purchaser, tx providers, sending and receiving balancing authority areas)
- Sum of all confirmed e-Tags is the BAA's net scheduled interchange (NSI) for the delivery hour
  - i.e., the BAA's final export or import obligation after considering all transactions
- Within the hour each BA operator balances generation with internal demand and NSI
  - Failing to balance the BAA results in Area Control Error (ACE)
  - BAs subject to NERC-defined performance criteria



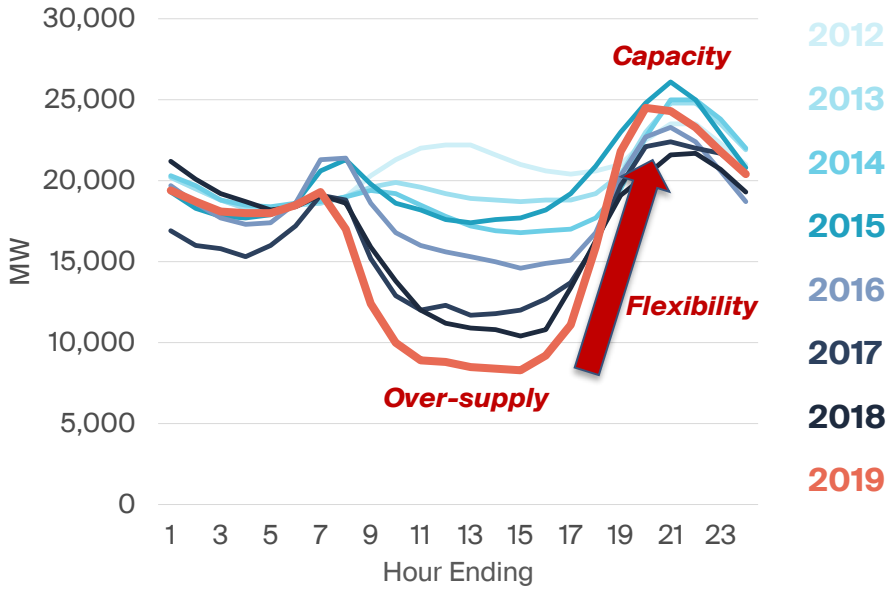
Organized Markets In North America

- Central market operator uses software to simultaneously dispatch **all** resources to meet **all** demand within a large regional footprint
  - Participants submit bids and offers
  - Market operator clears all buyers and sellers
  - No explicit link between any individual resource and any individual load
- Results in efficient “least cost” solution subject to transmission limits
  - Locational Marginal Prices (LMPs) at each location within the footprint: energy, congestion, losses
- Day-Ahead (hourly) and Real-Time (5-minute)
  - Real-Time market solution produced as often as every 5-minutes in response to changing grid conditions

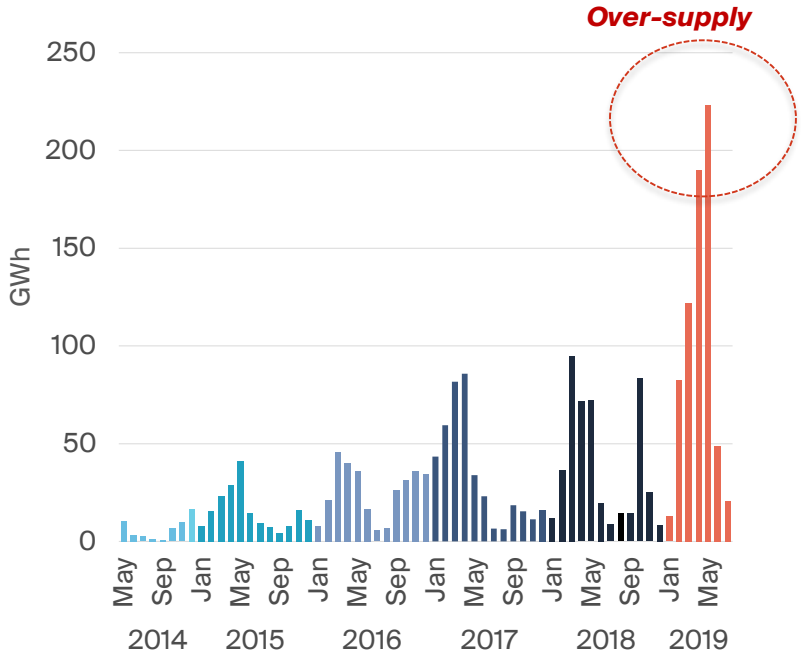


Western Grid is Evolving

California Net Load



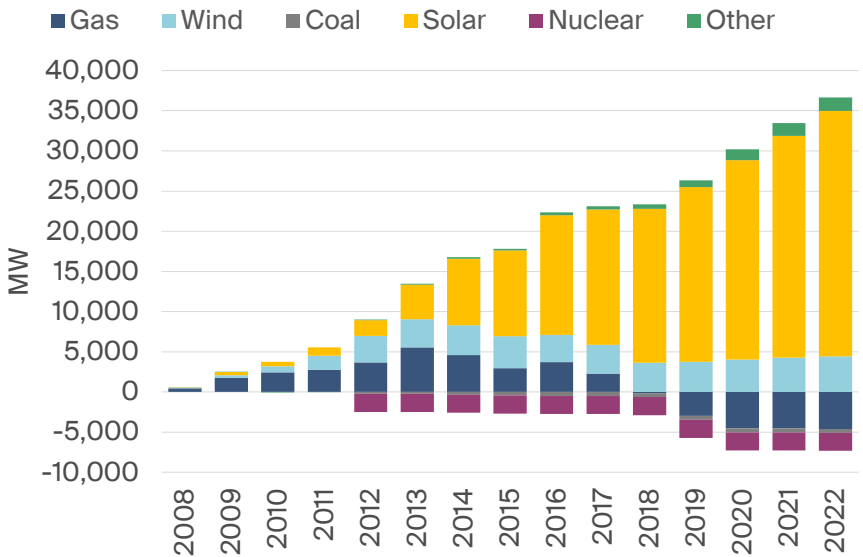
Renewable Curtailments

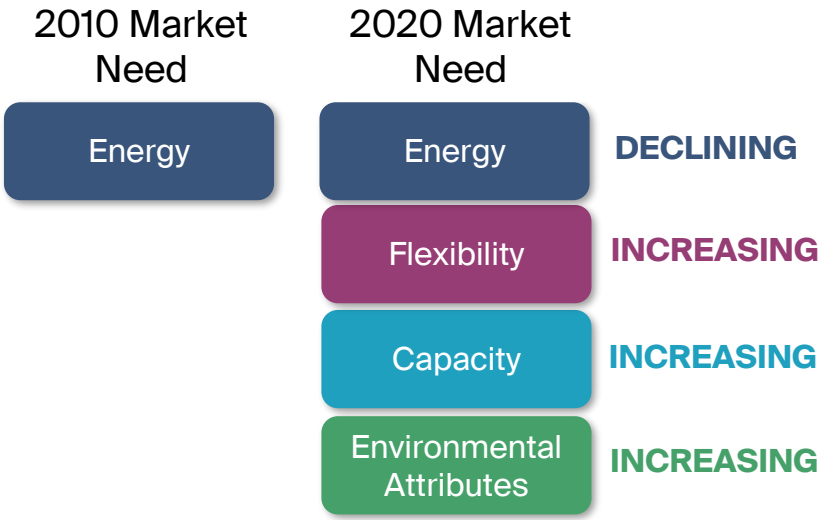


Source: CAISO Oasis – March 31st Net Load (Load – Renewable Generation)

Western Grid is Evolving

California Capacity Additions and Retirements



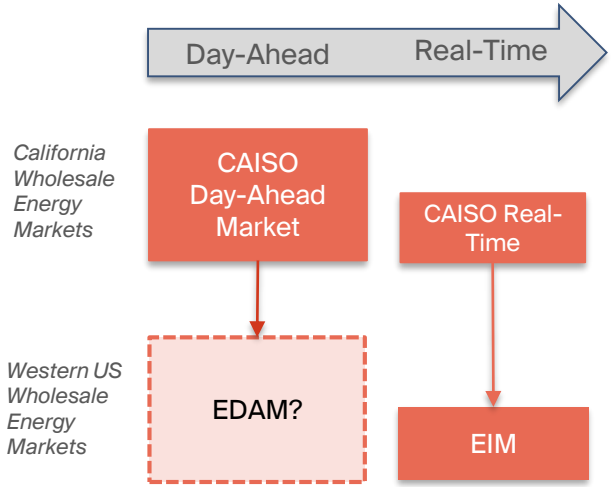


- Bilateral markets less well-suited to increasing variability and uncertainty of the grid
- Regional organized markets are critical to support efficient renewable integration, reducing GHG emissions, and maintaining affordable electricity rates

Source: California Energy Commission

Trading in Western U.S. Markets: Looking Ahead

- Stakeholders exploring an Extended Day-Ahead Market (EDAM)
  - Voluntary
  - Day-ahead trading with hourly granularity
  - Centralized unit commitment of thermal resources
  - More efficient trading and improved renewable integration
  - Potentially **much larger volume** than EIM
- Requires regional consensus in key areas
  - Governance and oversight
  - Detailed market rules and design
  - Transmission availability (and rates)
  - GHG



Efficient Wholesale Electricity Markets Support State Environmental Policy Objectives

State Environmental Policy Objectives

- Reduce greenhouse gases
- Create clean jobs
- Increase local renewable resources
- Decrease reliance on fossil fuels
- Support electrification
- Achieve objectives at acceptable cost

Efficient Wholesale Electricity Markets Support State Objectives

- Keep rates affordable through efficient trade
- Integrates renewable resources at lowest cost
- Reduces renewable curtailment
- Reduces GHG emissions

... while respecting individual state autonomy and ensuring reliability

Efficient Markets Cannot be Achieved Without Policy Coordination

- Regional organized markets are critical to efficient renewable integration, reducing GHGs, and maintaining affordable electricity rates (example Western EIM)

- Fragmented state environmental policies create challenges in achieving efficient wholesale electricity markets (both organized and bilateral markets)
  - Challenges largely limited to **interstate** electricity trade (i.e., imports and exports)
    - Example: no west-wide agreement on allocation of generation to load
  - Significant volume of interstate trade occurs EVERY hour, **and is necessary**
  - Inefficient wholesale electricity markets undermine state objectives:
    - Higher electricity rates
    - State environmental policies objectives are undermined
      - For example: GHG leakage, reduced buildout of clean / renewable resources
    - Renewable curtailment

Thank You

Powerex Corp.
1300-666 Burrard Street
Vancouver, British Columbia
Canada V6C 2X8

604 891 5000
1 800 220 4907
powerex.com

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