PJM Capacity Market Workshop Session 3
Market Design Proposals
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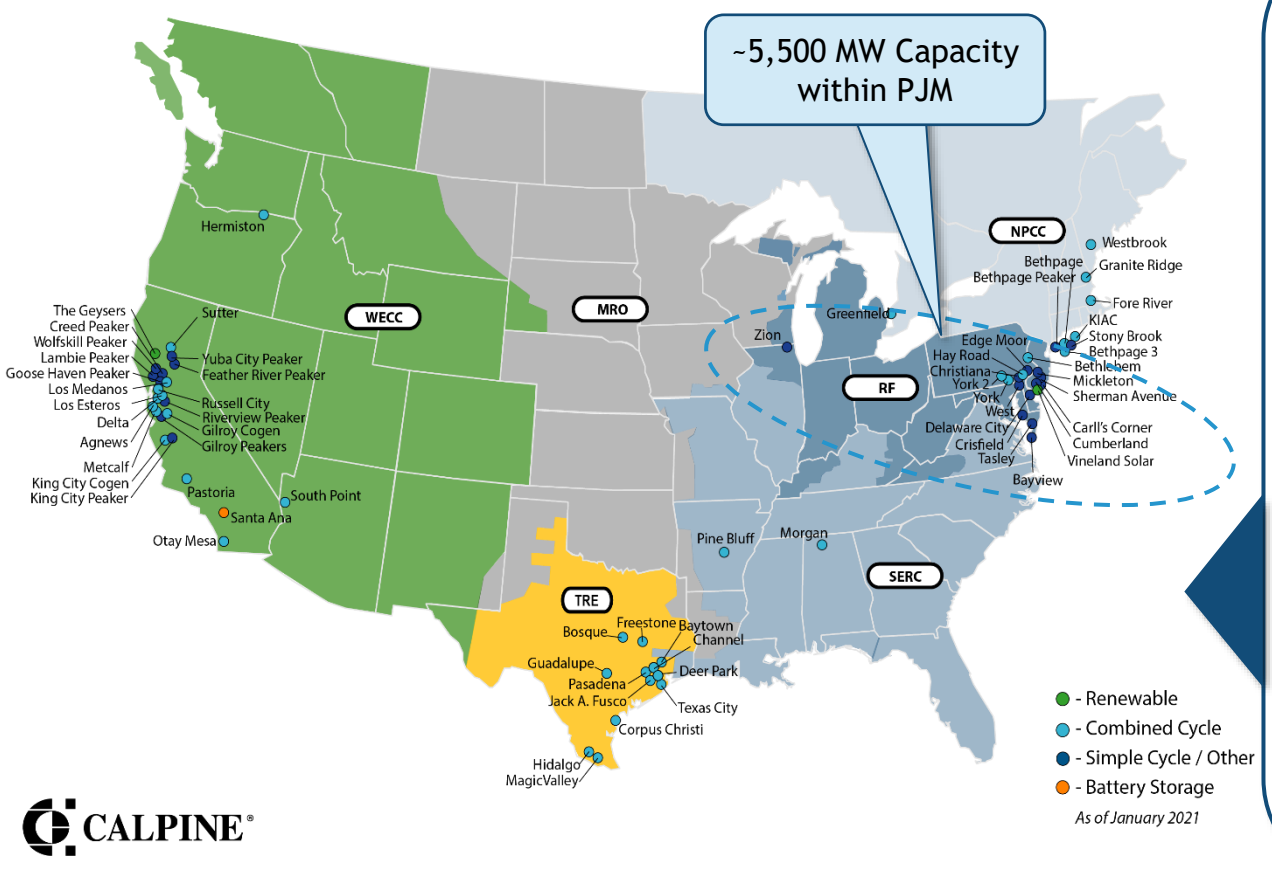
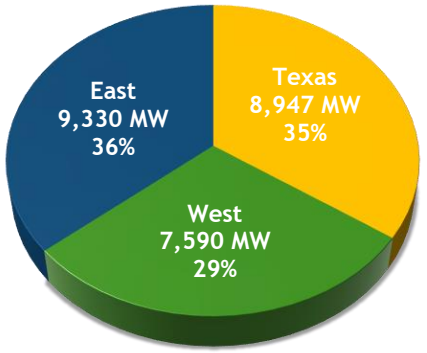
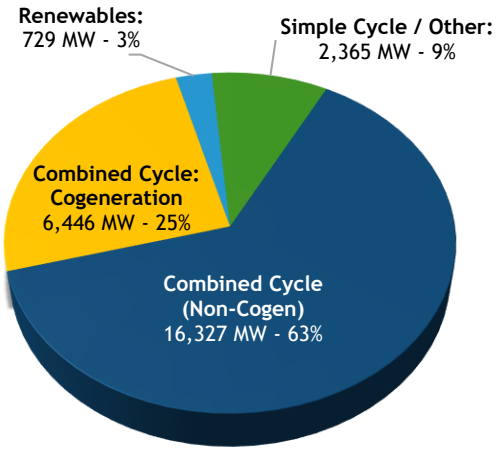
National Portfolio of Approximately 26,000 MW



Geographic Diversity



Dispatch Technology



Figures reflect 2021 MW

- Geographically diversified portfolio: Scale in America's most competitive power markets
- More than 2,300 employees
- Serve wholesale and retail customers in 22 states, Canada and Mexico
- Largest geothermal power producer in America
- Largest operator of combined heat and power (cogeneration) in America

Participation in Industry Growth Segments

Geothermal

- Own and operate the largest geothermal facility in the world
- 725 around-the-clock MW's at The Geysers in northern California

Carbon Capture

- Pilot Projects underway in CA
- Exploring further opportunities

Battery Storage

- Currently advancing on several BESS development projects
- Nearly 1GW of storage capacity within PJM queue alone

Calpine has long supported climate change policies that support both environmental stewardship and fair competitive markets

Transparent and fair markets that place a clear price on carbon emissions will ensure the U.S. can meet net-zero targets by incentivizing the environmentally efficient dispatch of power generation facilities

Consideration for Capacity Market Interim Redesign Discussions

Must Haves by the States:

- No double payment – renewables get credit in the capacity market
- States are free to procure those resources they wish in whatever fashion they desire

Must Haves by Suppliers:

- Retain capacity market structure
- Ability to earn sufficient revenue to allow return of and on capital for needed resources
- Robust reliability requirements and accurate resource counting

Considerations for Possible Solutions

a. **Economically Efficient** – leads to optimal entry and exit
b. **Equitable** – Allows suppliers a reasonable opportunity to recover their costs, especially those units critical for reliability
c. **Politically Feasible**
d. **Ensures Reliability**

Enhanced CP

- Restrict MOPR to instances of buyer side market power
- Dispatchable resources must have 16 hours of guaranteed run time for 3 days through onsite, backup fuel or contracted LNG
- Expand the definition of Performance Assessment Hours (PAH) to increase instances of events
- Increase CP penalties to $9,000/ MWh
- Ability to offer up to Net CONE * B
- No excuses (except possibly due to transmission outages that are totally out of control of the generator)
- Increase annual stop-loss to 3 times Net CONE
- Intermittent and storage resource counting capped at their ELCC and exposed to same performance penalties as other resources
- Resources increased/improved for more frequent outlier events

How Can PJM Reliably Add Intermittent Renewable Resources?

- ELCC helps with procuring for "average" single peak but is NOT adequate in & of itself for extreme or common mode events
- Higher performance responsive, fuel secure resources need to be procured to balance the increased penetration of intermittent resources
  - Ensure reliability not just for RTO average peak, but all reliability events:

    1. Extreme events
    2. Intermittent being intermittent
    3. Transmission events beyond resource adequacy
    4. Common mode fuel supply events (ex. lack of sunlight during winter peak and gas supply)
    5. Extended extreme events

  - Current capacity market does NOT recognize susceptibility to common-mode outages
  - Availability of grid resources not captured in traditional probability planning nor assumed normal distributions
  - Need Grid Reliability for events that stretch for extended periods, not just the peak hour

Reliably Adapting to Additional Dispatch Uncertainty

Responsive, Fuel Secure Product

- Renewables are allowed to participate as appropriately counted by ELCC
- Thermal resources (traditional generation) must have 16 hours of guaranteed run time for 3 days through onsite, backup fuel or contracted LNG

Restrict MOPR to Instances of Buyer Side Market Power

- Prevent building of excess generation for purpose of suppressing capacity prices paid in short term by load (Goal)

Expand Situations to Which CP Penalties Apply

- Need price signal that incents reliability during ALL periods of conservative operations
- Expand the definition of Performance Assessment Hours (PAH) to increase instances of events
- Maintain “No performance excuses” provision (except possibly due to transmission outages that are totally out of control of the generator)

Reliably Adapting to Additional Dispatch Uncertainty (cont.)

Increase CP Penalties to $9,000/MWH

- The Capacity Performance Product does not mandate how resource availability is ensured
- Need price signal that truly risks capacity revenues
- This higher penalty rate is consistent with RPM design, and the current Market Seller Offer Cap will be maintained

Resources Increased/Improved for More Frequent Outlier Events

- What used to be outlier events are becoming more common - Need interim fix
- Increase requirements for amount of additional resources to meet more frequent outlier events