Investigation of Resource Adequacy Alternatives

Technical Conference
September 18, 2020
Opening Remarks:

Joseph Fiordaliso,

President, New Jersey BPU
Education:

Kathleen Spees

The Brattle Group
Fundamentals of Resource Adequacy

September 18, 2020

PREPARED FOR
New Jersey Board of Public Utilities
Technical Conference: Investigation of Resource Adequacy Alternatives

PREPARED BY
Kathleen Spees
Walter Graf
Fundamentals of Resource Adequacy

- What is resource adequacy?
- How do we achieve resource adequacy?
- How does the PJM capacity market work?
- How are other regions approaching resource adequacy for the 100% clean grid?
What is resource adequacy?
Resource adequacy = Enough resources to reliably serve customers

The electricity grid must have enough generation, storage & demand response resources to meet peak demand in both “normal” and “extreme weather” years

PJM Resource Adequacy Standards

**System-Wide:** No more than 1 supply shortfall event in 10 years, or “1-in-10” reliability standard

**Locational:** Transmission import-constrained regions such as New Jersey require enough transmission capability and local supply to achieve no more than 1 shortfall event in 25 years, or **1-in-25 reliability standard**

How Reliability Improves with More Capacity Resources

- **1-in-10 Reliability Standard**
- **Capacity Resources Needed to Meet Reliability Standard**

Frequency of Outages (Events per Year)

Reserve Margin
(capacity ÷ peak load)
Resource adequacy is only one part of reliability

**US Average Annual Electric Power Service Interruption Duration**

*(hours per customer)*

A rolling blackout may occur once per decade, but most customers will never be interrupted due to lack of supply.

Traditionally, excludes:
- *Operational reasons* for outages
- *Transmission* outages
- *Distribution* outages

How do we achieve resource adequacy?
There are several ways to achieve resource adequacy:

### Vertically Integrated/Planned
- Vertically integrated utilities or a government entity does resource planning to build or contract new resources
- MISO, California, SPP, Ontario

### Energy-Only Market
- Energy prices (plus “scarcity price” during tight hours) is primary mechanism to attract new investments
- ERCOT, Alberta, Australia

### Capacity Market
- Organized market for “capacity” product is primary mechanism to attract new investments
- PJM, ISO-NE, NYISO, UK, Ireland

### Market-Based Options
Energy-only and capacity markets both use competitive prices to attract new supply investments

**Energy-Only Markets**

Investments attracted through occasional high price spikes if reserve margins fall

No capacity payments

**Capacity Markets**

Energy prices are more stable and lower on average

Investments attracted through capacity market payments

See Spees & Newell discussion of alternative resource adequacy constructs.
A capacity market can be used to achieve higher reliability than market forces alone would support.

**Texas Example: Power Plant Energy Market Net Revenues**

- **Energy-Only**: Reserve margin and reliability determined by market forces (no minimum reliability standard).
- **Capacity Market**: 1-in-10 reliability standard is set by policy and guaranteed through capacity market auctions.

Capacity payments to attract more investments & achieve 1-in-10 reliability standard. In Texas we estimated 1% greater customer costs in the long run compared to energy-only.

See Brattle’s 2012 and 2014 analyses of capacity and energy-only market options in Texas.
How does the PJM capacity market work?
Capacity is procured via technology-neutral competitive auctions

- **Product:** The obligation to be online and available to produce energy during shortage conditions, denominated as unforced capacity (UCAP) MW

- **Supply:** All generation, storage, and demand response resources can offer their UCAP rating. Typical UCAP ratings as a percentage of installed capacity: 13% wind, 38% solar, 95% gas plant

- **Downward-Sloping Demand Curve:** Determined administratively to reflect system and local resource adequacy objectives

- **Three-Year Forward Auctions:** Supply and demand are brought together in auctions to clear the **lowest-cost set of resources** to serve resource adequacy
Successes and challenges with PJM’s capacity market

Successes to date:

• Consistently met system & local resource adequacy, even as 41 GW of capacity (primarily fossil) has retired since its inception
• Attracted large quantities of new entry at low prices (far below the prices available from contract solicitations)
• Proved ability to attract merchant generation entry, placing almost all risks on developers (not customers)
• Technology-neutral approach unlocked large quantities of non-traditional supply, including launching a thriving merchant demand response industry

Challenges going forward:

• Many challenges already addressed through rule refinements over time to better meet reliability needs
• Procurement in excess of reliability needs
• Need improved supply & demand accounting for the clean grid
• Minimum offer price rule (MOPR) will exclude many state-supported policy resources from clearing

Source: Brattle analysis of PJM 2021/2022 RPM Base Residual Auction Results.
Recent FERC expansion of MOPR could exclude many state policy resources from clearing the capacity market

- MOPR originally intended to address manipulative price suppression from large buyers
- Expanded MOPR applies to existing and new state-supported policy resources (existing renewable resources are grandfathered in)
- Affected resource offers are restated to higher levels in the capacity auction; many will not clear
- Likely impacts: higher capacity clearing prices, retention of fossil fuel resources beyond what is needed for capacity, and customers “paying twice” for capacity
- States and delegated entities can choose fixed resource requirement (FRR) to secure capacity for resource adequacy and avoid MOPR

MOPR Requires Policy Resources to Offer at Higher Prices

<table>
<thead>
<tr>
<th>Capacity Quantity (UCAP MW)</th>
<th>Capacity Price ($/MW-day)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demand Curve</strong></td>
<td></td>
</tr>
<tr>
<td>With-MOPR Clearing Price</td>
<td></td>
</tr>
<tr>
<td>No-MOPR Clearing Price</td>
<td></td>
</tr>
<tr>
<td>Other Supply Offers</td>
<td></td>
</tr>
</tbody>
</table>

With higher MOPR price many policy resources will not clear, producing higher prices

Contracted policy resources would offer at a zero capacity price absent MOPR
How are other regions approaching resource adequacy for the 100% clean grid?
New York: Policymakers are evaluating capacity market alternatives to eliminate MOPR

<table>
<thead>
<tr>
<th>Structure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Current Market with Status Quo MOPR</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Current Market with Expanded MOPR</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Current Capacity Market without MOPR</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Competitive Retailers Contract Bilaterally for Capacity</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Co-optimized Capacity and Clean Energy Procurement</td>
</tr>
</tbody>
</table>

See our Qualitative and Quantitative (original and updated) assessments of resource adequacy structures conducted on behalf of NYSERDA and NY DPS.
New York: MOPR will impose significant excess costs on customers

* Energy and AS prices decrease in some cases because excess capacity depresses prices in tight hours; and because higher contract payments (due to lack of capacity payments) cause energy prices to be more negative in over-generation hours.
ISO New England: Considering market-based approaches to align RTO market with state policies

Broad state-driven “Future Grid” and “Pathways” stakeholder efforts are underway to identify how wholesale power markets should change to support the states’ economy-wide 80x50 goals. Pathways track is evaluating options for states to attract clean resources in a regional competitive market:

<table>
<thead>
<tr>
<th>Integrated Resource Planning</th>
<th>State Contracting</th>
<th>Forward Clean Energy Attribute Market</th>
<th>Carbon Pricing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>More Targeted</td>
<td>More Targeted</td>
<td>More Targeted</td>
</tr>
<tr>
<td></td>
<td>Bundled contracts</td>
<td>Technology-specific or new resource</td>
<td>Electricity sector only</td>
</tr>
<tr>
<td></td>
<td>Technology-specific</td>
<td>carve-outs</td>
<td>Region-wide</td>
</tr>
<tr>
<td></td>
<td>Regionally limited</td>
<td>Regional Technology neutral</td>
<td>Technology neutral</td>
</tr>
<tr>
<td></td>
<td>More Competitive</td>
<td>More Competitive</td>
<td>More Competitive</td>
</tr>
<tr>
<td></td>
<td>Unbundled attributes</td>
<td>Region-wide</td>
<td>Region-wide</td>
</tr>
<tr>
<td></td>
<td>Regional Technology neutral</td>
<td>Technology neutral</td>
<td>Electricity sector only</td>
</tr>
</tbody>
</table>

Family of approaches that would allow each state to meet a portion of their clean electricity needs in a regional clean attribute auction.
Experience

- Dr. Spees is an expert in wholesale electricity and environmental policy design and analysis
- Her work for market operators, policymakers, utilities, and market participants focuses on:
  - Energy, capacity, and ancillary service market design
  - Carbon and environmental policy design
  - Valuation of traditional and emerging technology assets

Education

- Ph.D., Engineering and Public Policy, Carnegie Mellon University, 2008
- M.S., Electrical and Computer Engineering, Carnegie Mellon University, 2007
- B.S., Physics and Mechanical Engineering, Iowa State University, 2005
Panel 1:

- Paul Flanagan, Executive Director, New Jersey Board of Public Utilities
  - Sylwia Bialek, NYU Policy Integrity
  - Joseph Bowring, Monitoring Analytics
  - Lathrop Craig, PSEG Power Ventures
  - Rob Gramlich, Grid Strategies LLC
  - Brian Lipman, New Jersey Division of Rate Counsel
  - Glen Thomas, PJM Power Providers Group
  - Kevin Warvell, FirstEnergy
FRR options for New Jersey

Sylwia Bialek
09/18/2020
BPU Technical Conference
FRR design choice
- main dimensions

Procurement form

- Centralized
- Multi-year

Contract length
- Sub-annual
- Decentralized
FRR design choice
- main dimensions

Procurement form

Contract length

Multi-year

Sub-annual

Decentralized

Centralized

CAISO now

MISO

PJM’s RPM

NYISO’s ICAP

Sylwia Bialek
09/18/2020
FRR design choice
- main dimensions

- Multi-year
- Sub-annual
- Whole NJ
- Decentralized
- Centralized

Procurement form

FRR territory

Individual
EDCs

Procurement form

Sylwia Bialek
09/18/2020
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www.nj.gov/bpu
How **Actual** Power Markets Attract Investment

No MOPR
No mandatory capacity market
Via FRR

- Lender
  - Upfront $ → IPP Generators
  - Future $ → IPP Generators
- IPP Generators
  - Physical or financial long-term contracts
- LSEs
  - Physical or financial long-term contracts
  - End-Use Customers

Intermediary
- 7+ year PPAs

State Resource Adequacy Oversight
- Texas style: voluntary contracting, no reserve margin or mandatory obligation
- California style: State Commission capacity requirement
- Australia style: Flexible oversight to ensure annual load-generation balance
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  - Stu Bresler, PJM Interconnection, L.L.C.
  - Scott Weiner, SAW Associates
  - Katherine Hamilton, Advanced Energy Management Association
  - Jeff Dennis, Advanced Energy Economy
  - Travis Kavula, NRG Energy, Inc.
  - Katie Guerry, Enel North America
Panel 2: Resource Adequacy in New Jersey and Distributed Energy Resources

Katherine Hamilton
AEMA Executive Director
September 18, 2020
AEMA mission and members

Advanced Energy Management Alliance (AEMA) advocates for policies that empower and compensate customers appropriately—to contribute energy or energy-related services or to manage their energy usage—in a manner which contributes to a more efficient, cost-effective, resilient, reliable, and environmentally sustainable grid.

Our members are providers and supporters of distributed energy resources (DERs), including demand response (DR) and advanced energy management, united to overcome barriers to nationwide use of demand-side resources.
Demand response and distributed energy in New Jersey

AEMA members—including providers and customers—are active throughout NJ, bringing clean, efficient, resilient, and reliable resources to the state.

Current and future demand response and distributed energy resources are cost-effective, clean, resilient, and reliable resources that should be key components to New Jersey’s resource adequacy mix.

AEMA strongly urges NJ to remain in PJM in order to maximize the benefits of the regional market to customers based on cost savings, environmental benefits, and resource efficiency.
Demand Response in NJ

**PJM DR By the Numbers**

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>C&amp;I customer locations in PJM DR</td>
<td>1,444</td>
</tr>
<tr>
<td>MW in PJM DR</td>
<td>400+</td>
</tr>
<tr>
<td>Estimated $ saved for all NJ consumers from PJM DR</td>
<td>$148 M, or $50/house in 20/21</td>
</tr>
<tr>
<td>Estimated $ paid to C&amp;I customers in NJ</td>
<td>$20 M in 20/21</td>
</tr>
</tbody>
</table>

**Enablers for C&I DR**

- 95+% of revenues for C&I DR comes from PJM capacity market
- Capacity payments provide C&I customers with the predictability they need to participate in DR
- If NJ leaves PJM, DR throughout PJM would be reduced
To meet resource adequacy and climate goals, NJ should

- meet goals cost-effectively and reliably, using wholesale markets to do so;
- benefit from regional competition and ability to leverage other states’ resources;
- take steps to align capacity resource mix with state clean energy goals;
- encourage less energy intensive resources that avoid new generation procurement such as behind-the-meter customer-sited DERs.
AEMA Recommendation #1

The state should continue to support in-state energy efficiency, demand response, and distributed energy resources that contribute to NJ’s resource adequacy and offset the need to build new generation.
AEMA Recommendation #2

The state should consider key principles as it evaluates potential Resource Adequacy alternatives.

- Minimized cost and risks to ratepayers;
- Procurement mechanisms that allow free entry and exit of third-party providers through which end use customers can participate;
- Non-discriminatory treatment for capacity (and capacity attribute sellers) between utilities and third parties;
- Competitive, technology neutral (as long as clean) price signal for capacity and capacity attributes;
- Stable, low-risk environment for DERs of all types—energy efficiency, demand response, energy storage, advanced energy management; and
- Regional cooperation and competition.
AEMA Recommendation #3

The state should consider any negative impacts to the Clean Energy Act’s energy efficiency and peak demand response goals under a Fixed Resource Requirement construct.
AEMA Recommendation #4

If an alternative capacity mechanism is pursued (such as expanding Basic Generation Service), the following principles should apply:

- Allowing third party suppliers to participate;
- Allowing unbundled service procurement; and
- Ensuring capacity procurements are deliverable.
AEMA Recommendation #5

The state should consider future opportunities for additional PJM market enhancements through stakeholder processes.

- Changes to accounting for environmental externalities of emitting resources in PJM dispatches and increase MOPR floors for those resources; and
- Changes to PJM capacity market rules for self-supply options and exclusions to “state subsidy” definition under replacement rates.
Conclusion

AEMA commends the work of the BPU to properly incentivize energy efficiency, peak demand reduction, and advanced energy solutions for consumers.

AEMA urges the BPU to adopt key principles that support robust consumer participation that can in turn prevent new generation, reduce costs, and meet environmental goals.

AEMA believes that opportunities for NJ lie within PJM market participation, through regional collaboration, and in state programs and policies.
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New Jersey BPU Technical Conference on Resource Adequacy

09/18/2020

Katie Guerry

Head of Regulatory Affairs – US & Canada

Enel North America, Inc.
The Enel Group

A leader in the new energy world

1st network operator\(^1\)

World’s largest private player\(^2\) in renewables

Largest retail customer base worldwide\(^3\)

- 73 M End Users
- 46 GW Renewable capacity
- 6.3 GW Demand Response
- 33 Countries
- 69,000 Employees

1. By number of end users. Publicly owned operators not included
2. By installed capacity. Includes managed capacity for 3.4 GW
3. Including customers of free and regulated power and gas markets

Proprietary and confidential. Do not distribute.
### Enel’s Unique Market Position & Perspective

#### New Jersey 2019 Energy Master Plan Strategies

<table>
<thead>
<tr>
<th>New Jersey 2019 Energy Master Plan Strategies</th>
<th>Enel Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Reducing Energy Consumption and Emissions from the Transportation Sector</td>
<td>Leading provider of “smart” electric vehicle charging</td>
</tr>
<tr>
<td>2) Accelerating Deployment of Renewable Energy and Distributed Energy Resources</td>
<td>Developing, owning and operating utility-scale solar/wind and aggregating DERs</td>
</tr>
<tr>
<td>3) Maximizing Energy Efficiency and Conservation, and Reducing Peak Demand</td>
<td>Reducing peak demand through C/I demand response and residential/office smart EV charging</td>
</tr>
<tr>
<td>4) Reducing Energy Consumption and Emissions from the Building Sector</td>
<td>Supporting large energy user customers to develop virtual PPAs and reduce peak demand</td>
</tr>
<tr>
<td>5) Decarbonizing and Modernizing New Jersey’s Energy System</td>
<td>Providing of non-wires solutions to modernize the grid and zero carbon electricity generation</td>
</tr>
<tr>
<td>6) Supporting Community Energy Planning and Action in Underserved Communities</td>
<td>Investing in over 75 community organizations throughout USA in 2020, United Nations &amp; NGO Climate Compacts</td>
</tr>
<tr>
<td>7) Expand the Clean Energy Innovation Economy</td>
<td>U.S. Innovation Hubs - new technology opportunities &amp; access (Boston, San Francisco); Enel Foundation and U.S. Academia partnerships</td>
</tr>
</tbody>
</table>
## Market Investment Drivers

**Key Criteria Impacting Enel’s Investment Decisions**

### Market: PJM Interconnection

<table>
<thead>
<tr>
<th>Investment Criteria</th>
<th>Market Criteria Satisfied?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent &amp; Liquid Market</td>
<td>Yes</td>
</tr>
<tr>
<td>Stable Market &amp; Policy Conditions</td>
<td>Yes</td>
</tr>
<tr>
<td>Open Access in All Markets –Compensatory or Other Opportunities for Valuing All Unique Attributes or Services from Resource</td>
<td>Yes* (*most)</td>
</tr>
<tr>
<td>Competitive Market Rules -Transparent &amp; Fair</td>
<td>Yes</td>
</tr>
<tr>
<td>Access to Competitive Regional Market Efficiencies</td>
<td>Yes*</td>
</tr>
</tbody>
</table>

*Certain states and utility territories prohibit DR participation from third parties as a result of FERC Order 719
NJ Integrated Energy Plan

Access to regional markets is critical to achieving goals for least cost, clean energy

“...an increasing amount of electricity generation comes from in- and out-of-state renewable resources”
NJ’s actions have far-reaching impacts

Actions taken by NJ with respect to regional competition

Impacts costs paid by NJ consumers and the air that NJ residents breathe

Impacts development of clean resources in NJ and ALL PJM states
Recommendations to NJ BPU

Non RA-Based Wholesale Market Rule Reforms at PJM

- **Streamline the Best Practices for Interconnection Process and Rules**
- **Reduce Bottlenecks in Transmission System**, increase penetration and reduce costs for clean energy
- **Appropriate valuation of clean resources through Effective Load Carrying Capability (ELCC)**
- **New DER Participation Models and rules for Complimentary Cost Effective Retail & Wholesale programs**

Develop Principles of Alternate Regional RA to Transition from RA Attracting Clean Resources to RA Efficiently Maintains & Operates Clean Resources

- **Utilizes Regional Competition**, minimizes cost, increases penetration and reduces emissions
- **Ensure capacity market outcomes themselves reflect state policy goals** (e.g. Clean Constraints and or Co-Optimization of Clean energy & Resource Adequacy)
- **Provides pathway for development of flexible, less energy-intensive resources that may see limited benefit from carbon pricing and FCEM**

Leverage all possible State and Local Policy tools

- **Create distribution-level retail price signals for DERs services Complimentary to Wholesale services**
- **Address Siting and Interconnection Barriers at Local and State Governments and Utilities**
- **Build Clean Energy Highways for Transmission**
- **Tighten Environmental Restrictions & Reinforce Infrastructure for Emerging Technology (e.g. EV)**
Thank You!

09/18/2020

Katie Guerry
Head of Regulatory Affairs – US & Canada
Enel North America, Inc.
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Global Warming Response Act (GWRA) – 2007, Revised 2019

- **2018 GHG Emissions**
- **2020 GHG Reduction Goal**
- **2050 GHG Reduction Goal**

**Estimated Annual Statewide Emissions**

**NEW JERSEY’S EMISSIONS GOAL**
80% down from 2006 baseline by 2050
**Executive Order 100 & NJ PACT**

- EO 100 DIRECTED DEP TO ADOPT PROTECTING AGAINST CLIMATE THREATS ("PACT") REGULATIONS.
- DEP ISSUED ADMINISTRATIVE ORDER 2020-01 (NJPACT)

### Climate Pollutant Reduction Regulations
- Carbon Dioxide
- Short-Lived Climate Pollutants

### Land Use Regulations
- Incorporate Climate Change considerations into existing rules

### Reform EO 215 (1989)
- Incorporate climate change considerations into Environmental Impact Statement/Environmental Assessment

**GWRA Report**

**GHG Monitoring & Reporting Program**
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Despite reductions since 2005, PJM emission rates need to fall dramatically to meet targets

**PJM’s Published Data**

- EIA projections indicate PJM region emission reductions will level out by 2025
- Premature retirement of nuclear plants would reverse emission declines
- Backfilling generation from Illinois, New Jersey, and Ohio PJM nuclear plants with new CCGT’s would increase PJM’s rate by ~127 lbs./MWh
- Backfilling them with the marginal PJM unit would increase the rate by ~212 lbs/MWh, undoing half the progress of the last 15 years

**PJM Actual Emissions**

- Marylad, Illinois Governor goals 100% CES by 2040 (MD) or 2030 (IL)
- Virginia, New Jersey goals 100% CES by 2050
- Chicago, Philadelphia goals 80% economy-wide by 2050

Inside Lines – March 4, 2020
Non-RGGI states rely more heavily on coal-fired generation

Heavier reliance on higher emitting resources by non-RGGI states complicates the potential for a meaningful region-wide carbon price in PJM
Border adjustments or other leakage mitigation rules are needed to support state carbon pricing programs such as RGGI.

The lack of border adjustments or other leakage mitigation undermines the effectiveness of state carbon pricing mechanisms.
New Jersey has a narrow window for adopting alternative policies in response to FERC’s MOPR orders

- PJM proposes to execute the next capacity auction (2022/2023) 6.5 months after FERC acts on its MOPR compliance filing, which could result in the auction being run in January 2021 with, subsequent procurements in rapid succession every 6.5 months
- In all cases, Fixed Resource Requirement (FRR) elections and capacity plans must be provided to PJM 120 days and 30 days prior to the start of the auction, respectively

Failure to put alternative mechanisms in place quickly will result in PJM making capacity investment commitments through mid-decade under rules that penalize clean energy
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