Pennsylvania / Ohio
Joint Hearing on Reliability

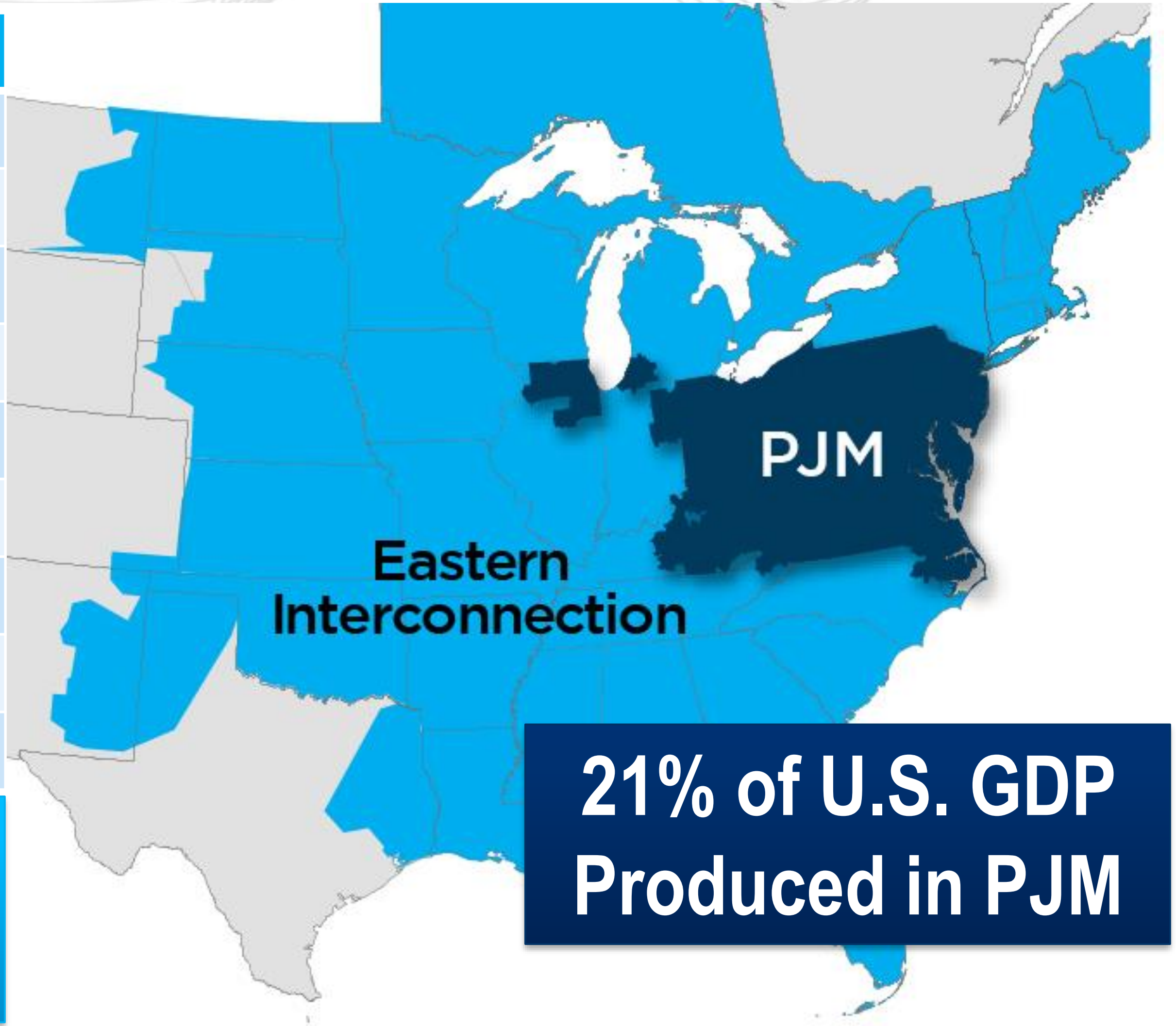
Asim Z. Haque
SVP, Governmental and Member Services

February 1, 2024

PJM as Part of the Eastern Interconnection

Key Statistics	
Member companies	1,110+
Millions of people served	65+
Peak load in megawatts	165,563
Megawatts of generating capacity	183,254
Miles of transmission lines	88,115
Gigawatt hours of annual energy	795
Generation sources	1,419
Square miles of territory	368,906
States served	13 + DC

- 26% of generation in Eastern Interconnection
- 25% of load in Eastern Interconnection
- 20% of transmission assets in Eastern Interconnection



21% of U.S. GDP Produced in PJM

As of 2/2023

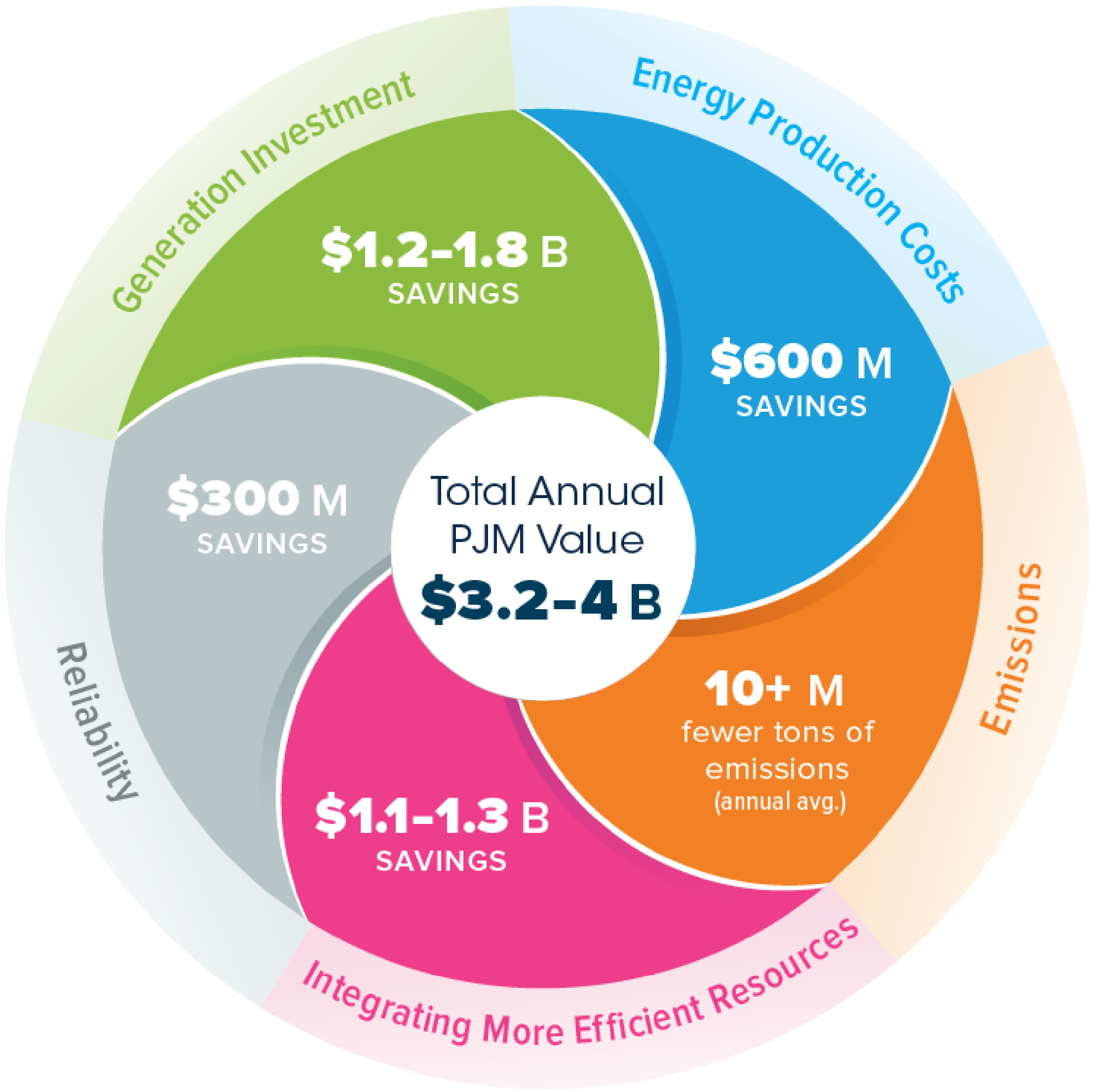
RELIABILITY

Markets
- Energy
- Capacity
- Ancillary services

Operations
- Grid operations
- Supply/demand balance
- Transmission monitoring

Regional Planning
- 15-year outlook

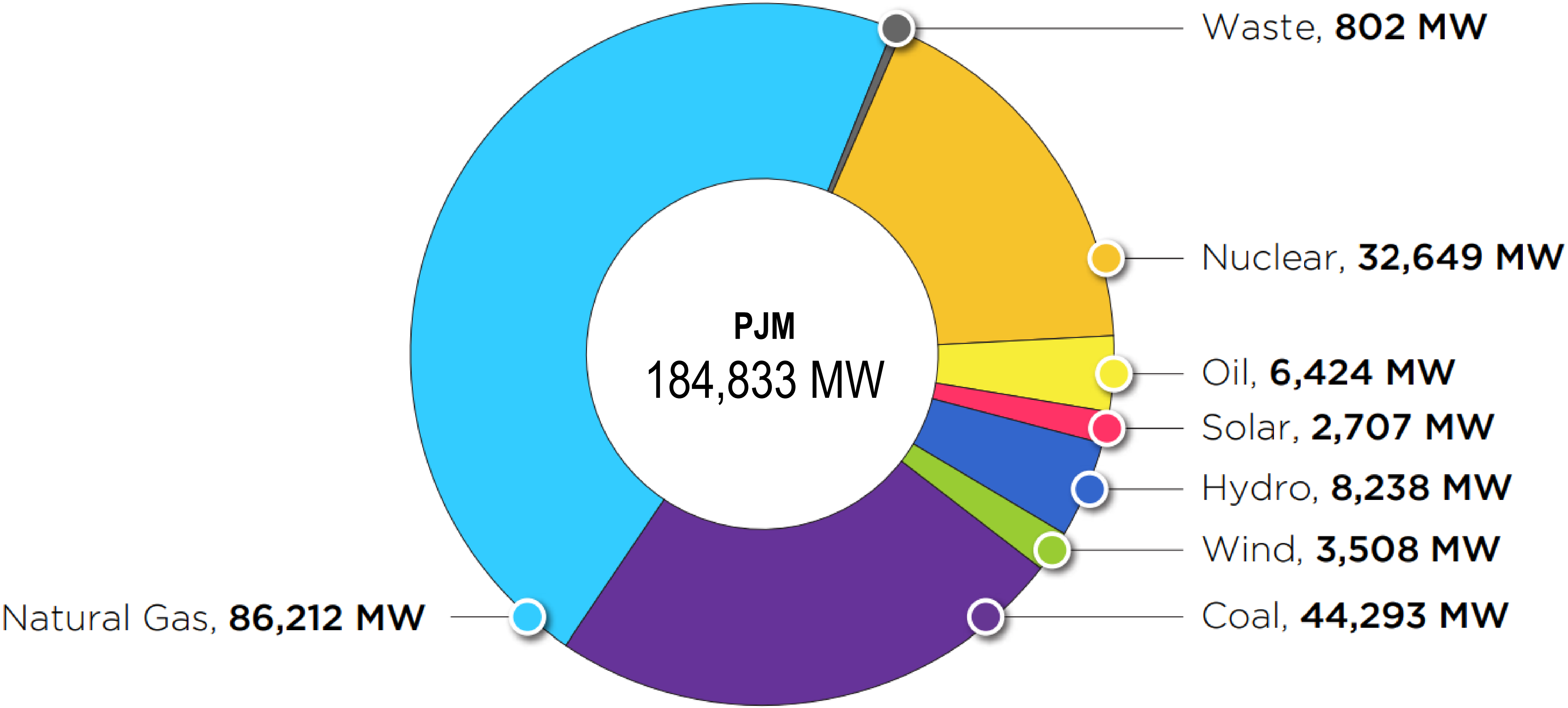
Value Proposition



All numbers are estimates.

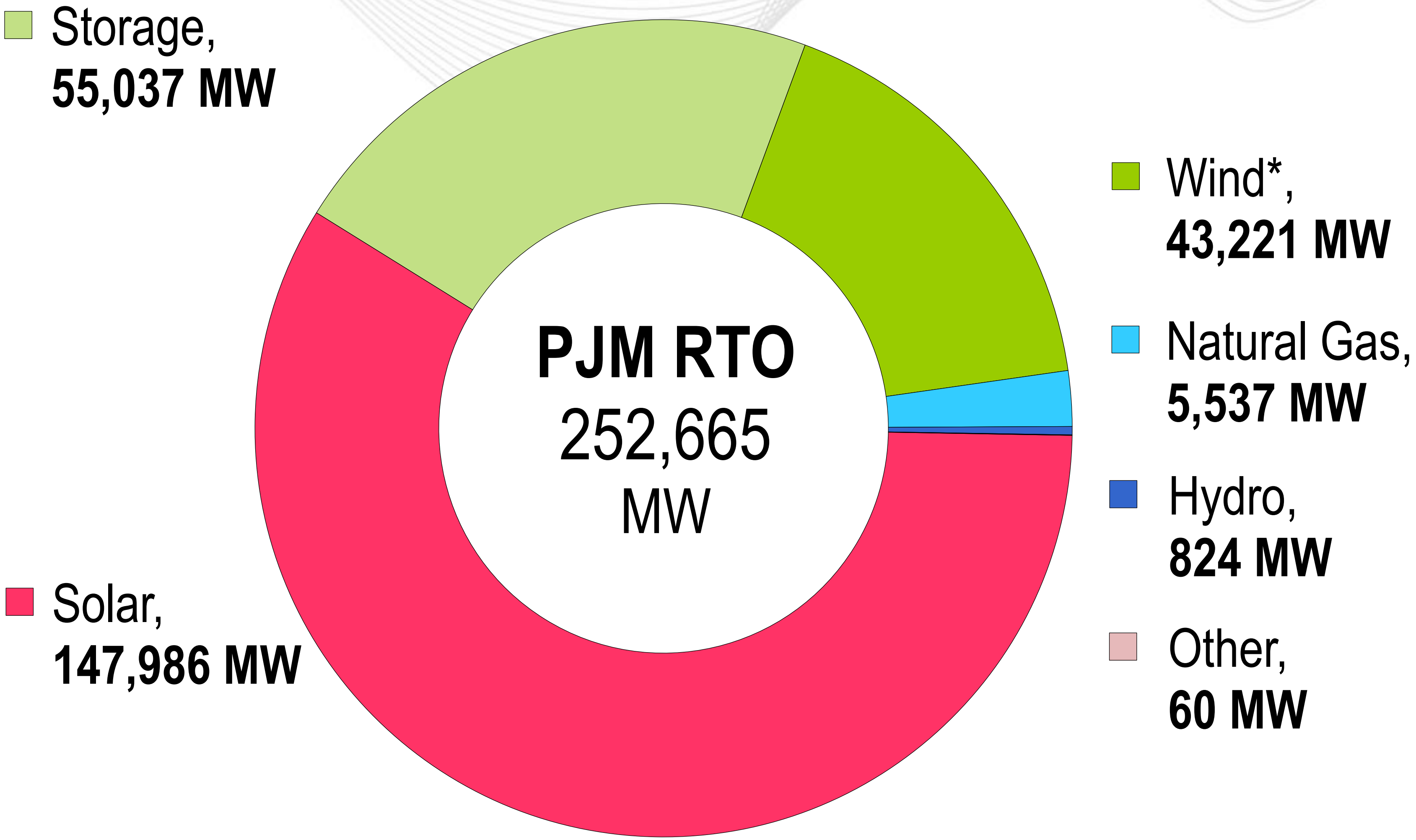
PJM – Existing Installed Capacity

(CIRs – as of Dec. 31, 2022)



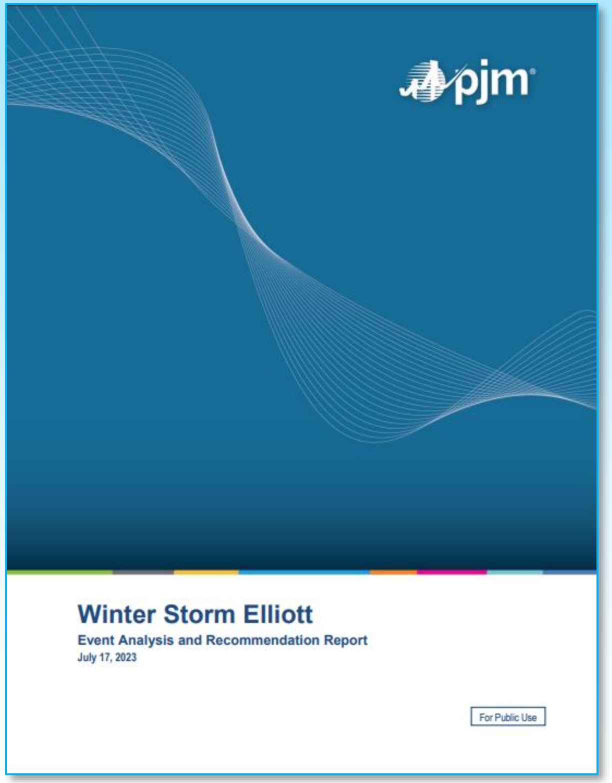
PJM Queued Capacity (Nameplate) by Fuel Type

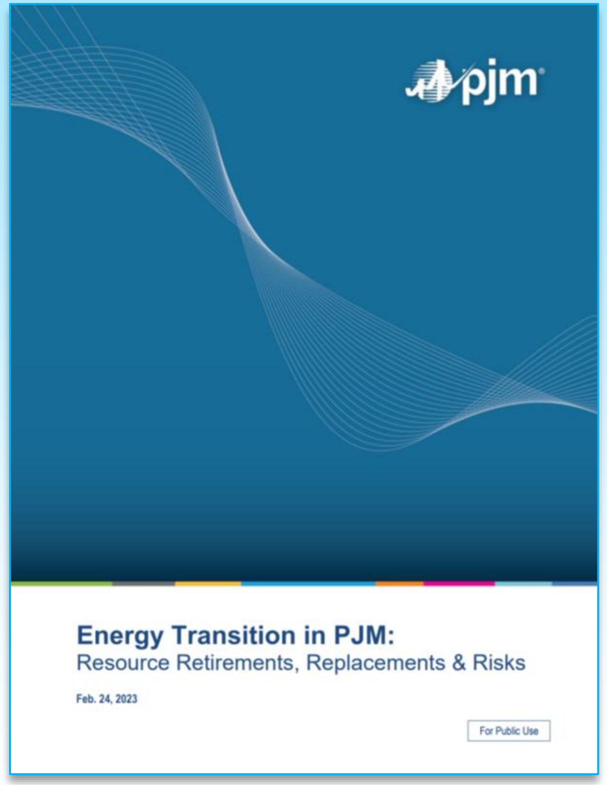
(“Active” in the PJM Queue as of April 1, 2023)

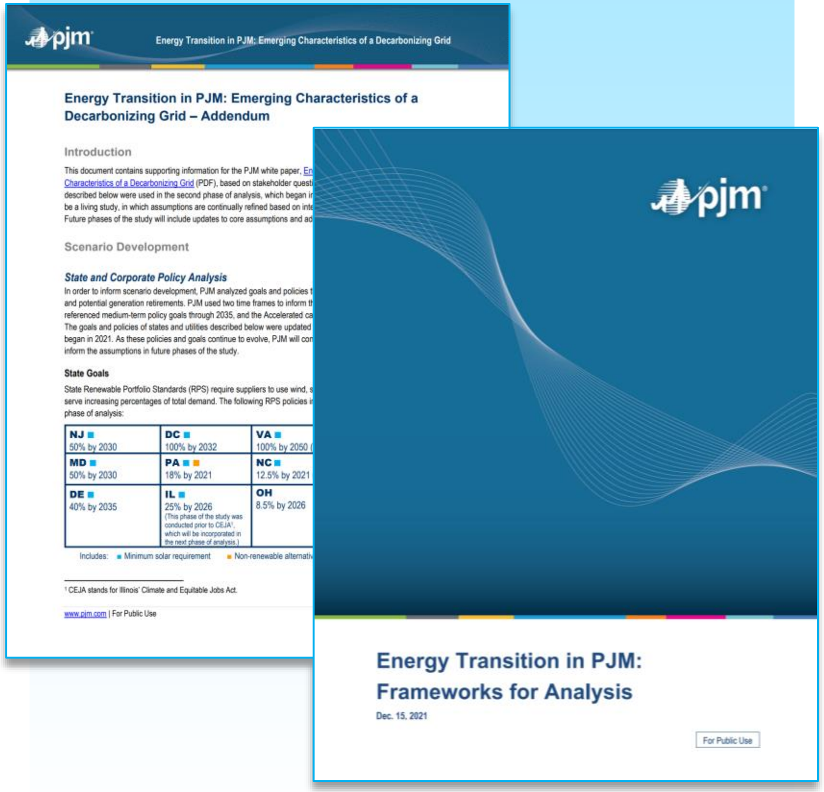


*Wind includes both onshore and offshore wind

Reliability Papers and Studies

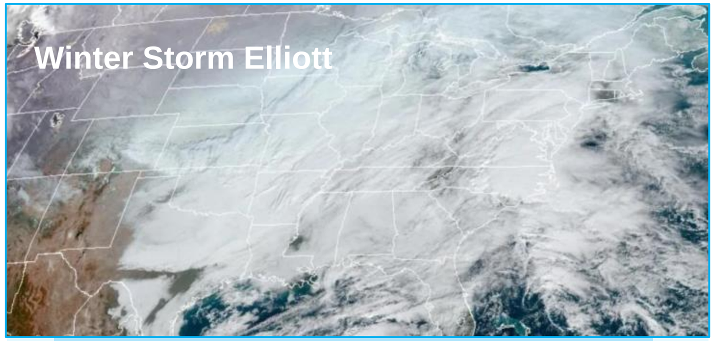




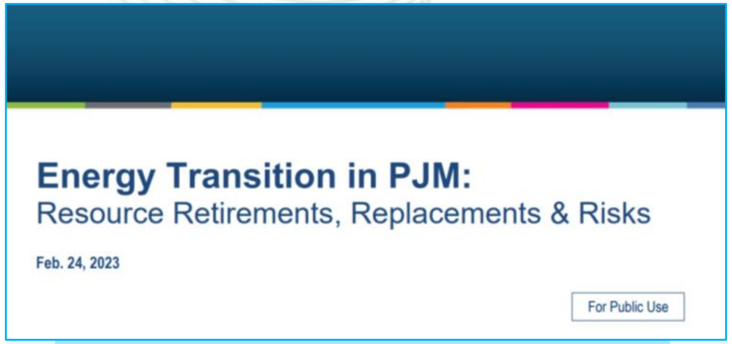


What Problem(s) Are We Solving For?

RELIABILITY



The PJM fleet has adequate resources and enough essential reliability services, but we need our generators to perform when called upon.


Energy Transition in PJM:
Resource Retirements, Replacements & Risks
Feb. 24, 2023
For Public Use

Generation retirements may outpace new entry with a simultaneous likelihood of load increasing, thereby creating resource adequacy concerns.


Energy Transition in PJM:
Frameworks for Analysis
Dec. 15, 2021
For Public Use

We will continue to need some amount of thermal generation to provide certain essential reliability services until a replacement technology is deployable at scale.

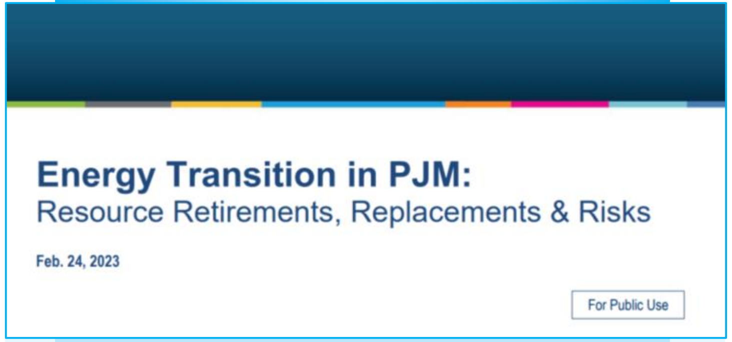
Our Reliability Concerns

The Immediate Concern

Support

Resource Performance

The Near-Term Concern


Energy Transition in PJM:
Resource Retirements, Replacements & Risks

Feb. 24, 2023

For Public Use

Ensure

Resource Adequacy

The Upcoming Concern


Energy Transition in PJM:
Frameworks for Analysis

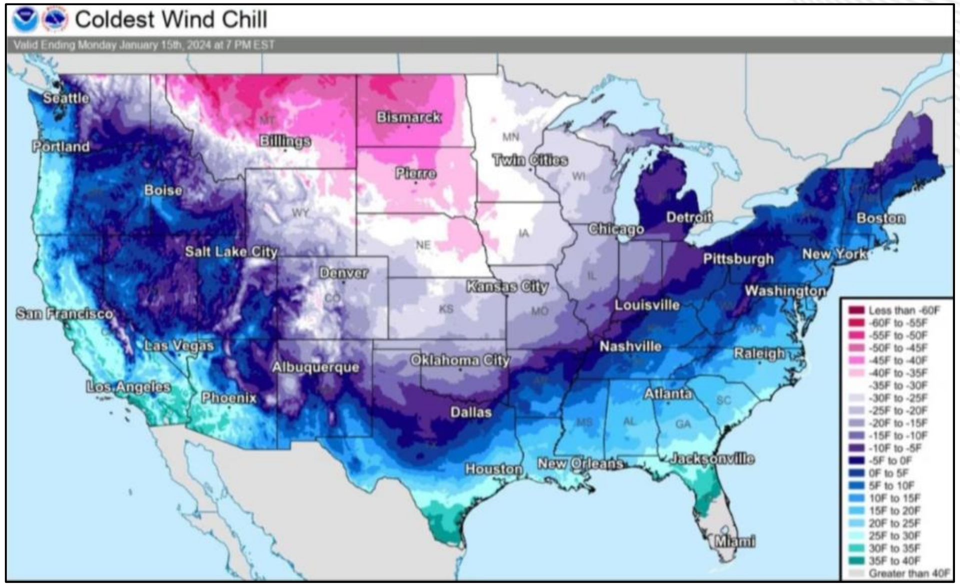
Dec. 15, 2021

For Public Use

Maintain & Attract

Essential Reliability Services

Winter Storm Gerri: Jan. 13–18, 2024



On Jan. 13: Arctic air pushed into Western Region.

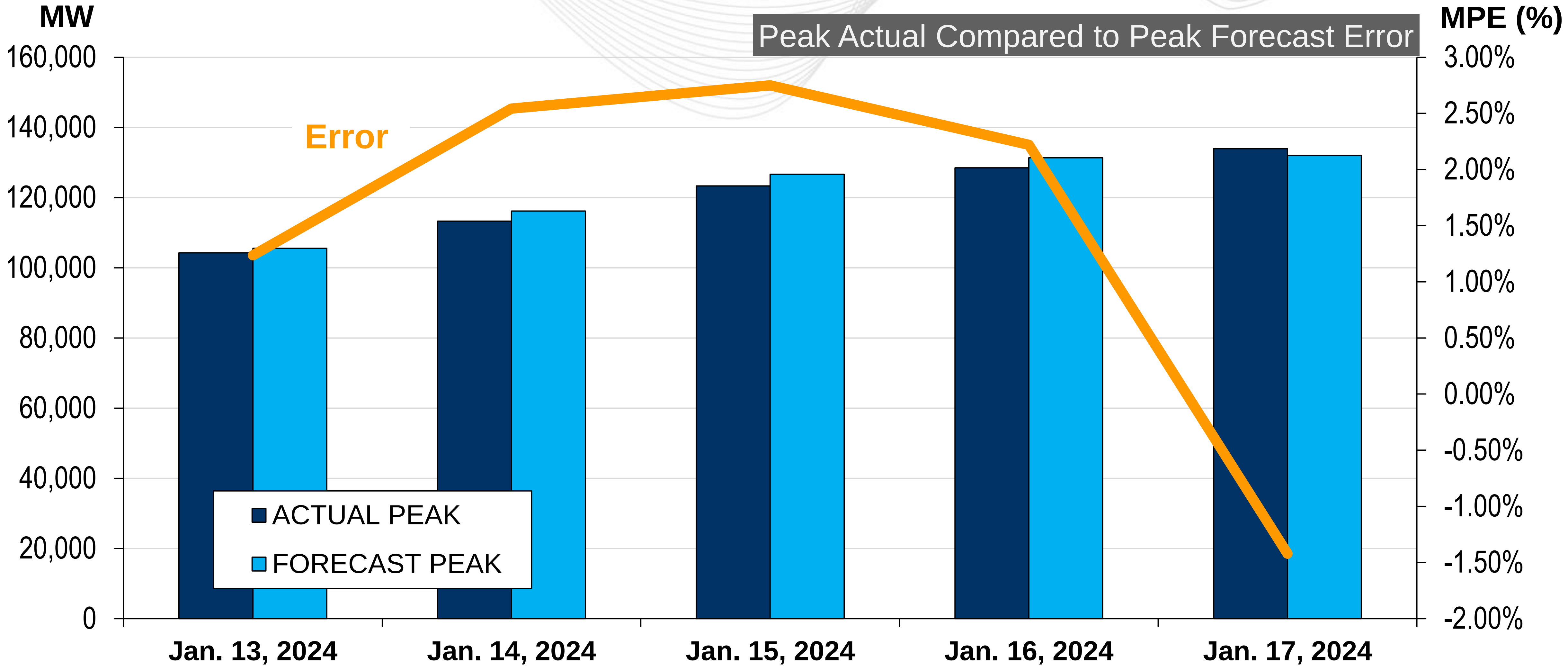
From Jan. 14–16: Air temperatures below zero degrees in COMED most hours

On Jan. 15: Coldest in Western Region

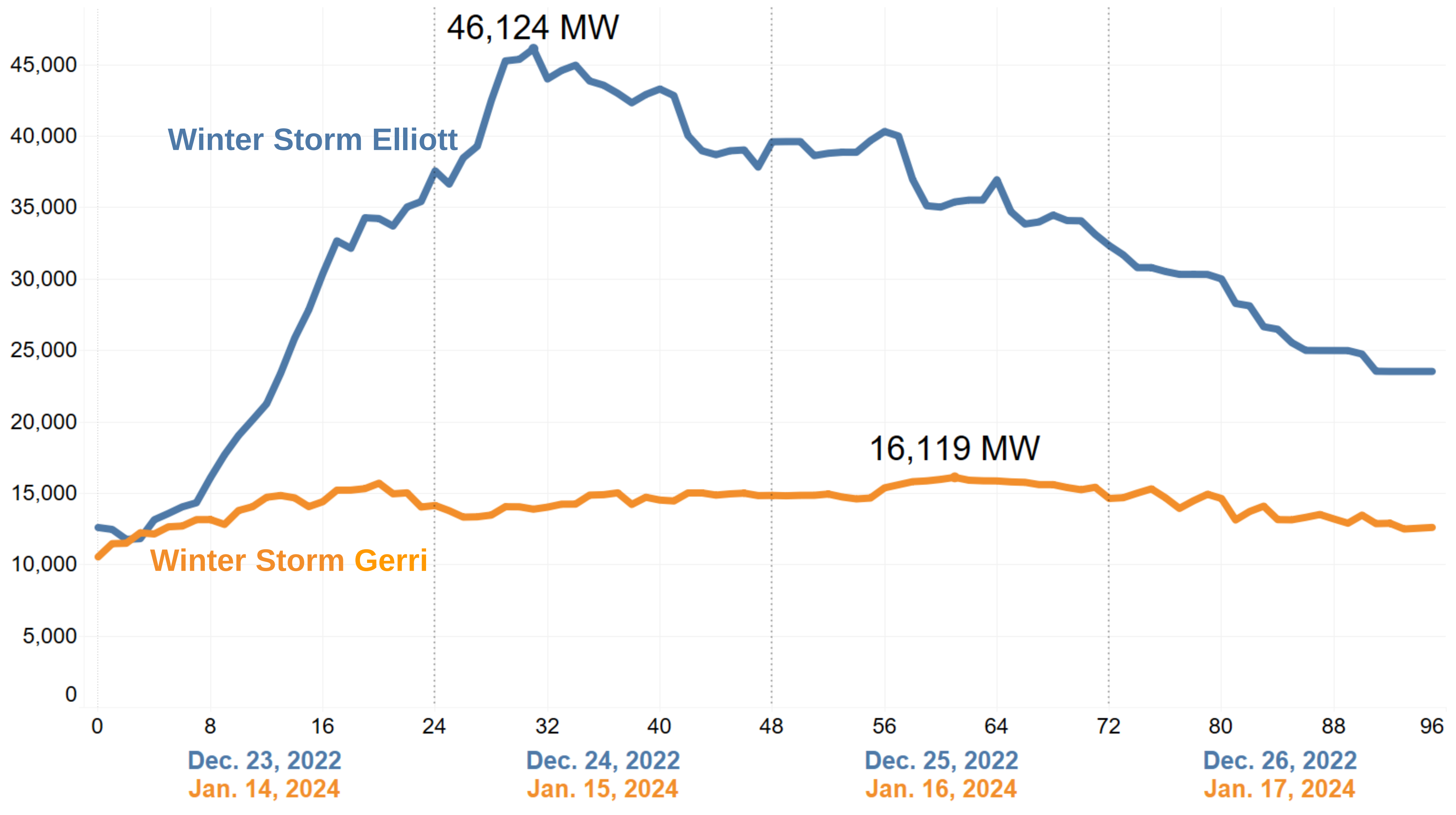
On Jan. 17: Coldest in Mid-Atlantic and Dominion regions

	Winter Storm Elliott Dec. 23–26, 2022		January 13–18, 2024 Cold Wave	
Cities	Coldest Air Temperature	Coldest Wind Chill	Coldest Air Temperature	Coldest Wind Chill
Chicago	-8°F	-35°F	-10°F	-33°F
Columbus	-7°F	-34°F	6°F	-13°F
Louisville	-5°F	-31°F	6°F	-6°F
Philadelphia	7°F	-14°F	14°F	2°F
Richmond	8°F	-11°F	14°F	9°F

Winter Storm Gerri: Forecast Error Trend



Winter Storm Gerri: Forced Outage Comparison



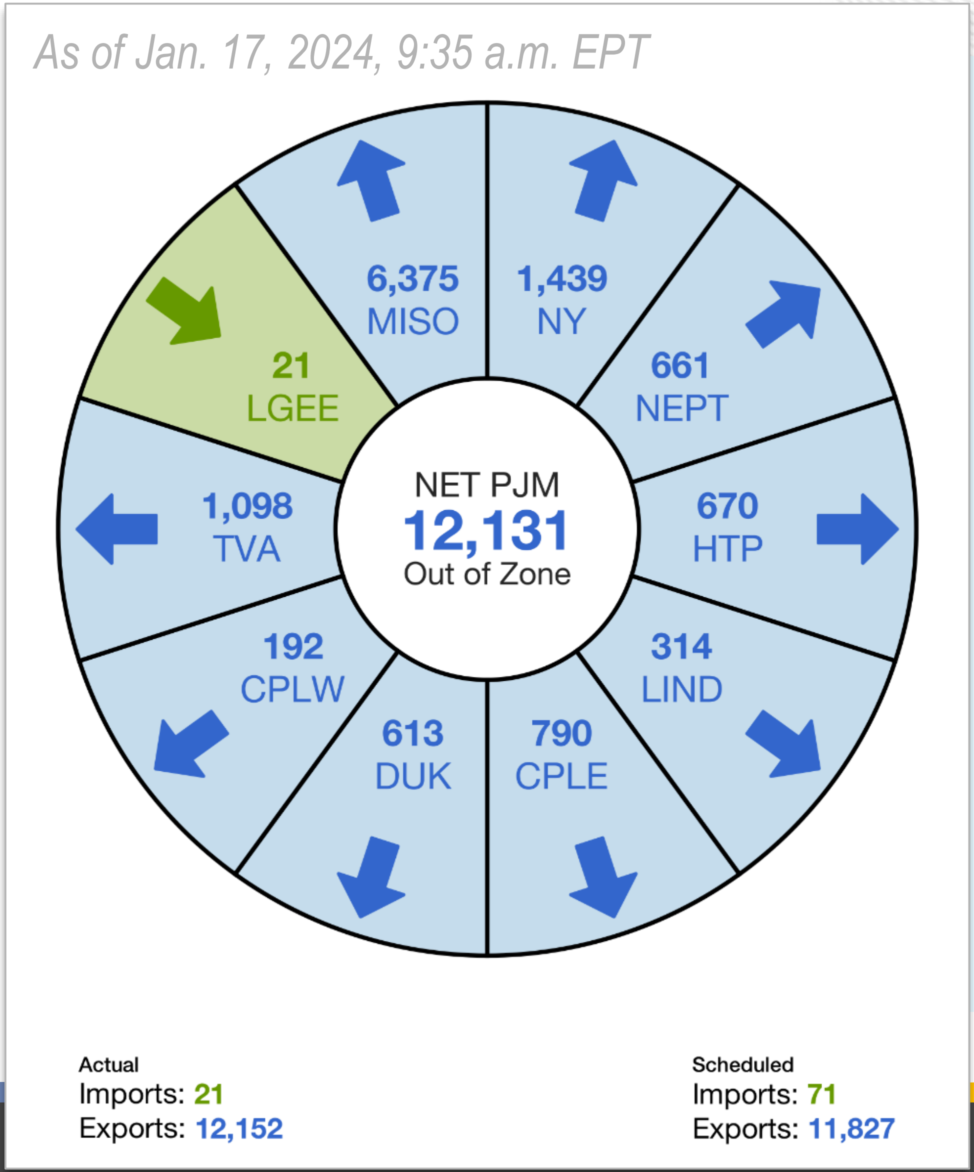
Note: 16,653 MW discrete generator outages modeled in winter OATF analysis.

Winter Storm Gerri outage data shown is collected from eDART and considered preliminary.

Winter Storm Gerri: Gas Performance

- Much better performance compared to WS Elliott
- Production well freeze-off impact greatly reduced in the Northeast.
- Strong pipeline performance with minimal capacity or pressure impacts
  - All pipelines were effectively "locked down" with various levels of daily and hourly capacity and contractual restrictions.
  - Mechanically only a couple of minor compressor station issues that were quickly rectified within a few hours with minimal impact on generation
- PJM Gas-Electric Team maintained continuous communication with the pipeline control centers to monitor and share operating conditions and forecasts.
- Spot gas prices spiked up during trading on Friday, Jan. 12, 2024, for MLK holiday weekend gas (Saturday through Tuesday) but not to the levels observed during WS Elliott.

Winter Storm Gerri: Scheduled Interchange



- Eastern Interconnection relies on mutual aid.
- PJM was able to aid neighbors at depth of cold snap, exporting nearly 10% of PJM's own needs.
- During 2014 Polar Vortex, roles were reversed, PJM imported power.

Winter Storm Gerri: Key Takeaways

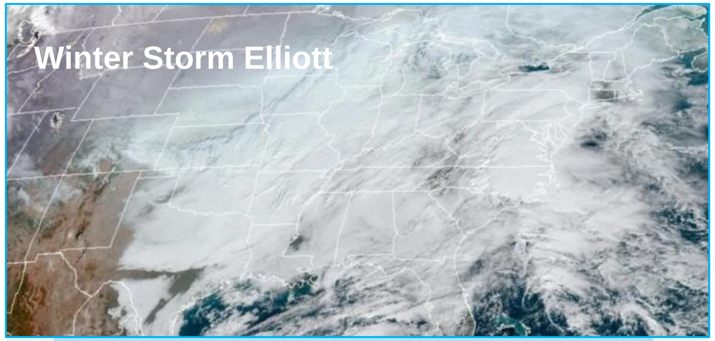
Peak Load 134,777 MW - January 17th @ 08:10

- Limited set of emergency procedures required
- Load forecast error within 3% threshold
- Significant level of exports to assist neighbors

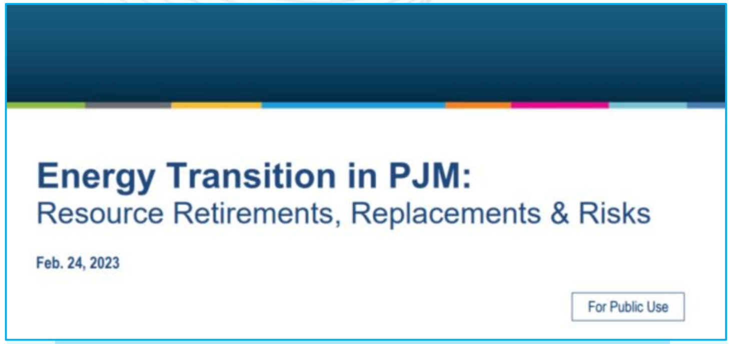
- Strong generator performance
- Much better gas performance compared to Winter Storm Elliott
- Excellent transmission performance

What Problem(s) Are We Solving For?

RELIABILITY



The PJM fleet has adequate resources and enough essential reliability services, but we need our generators to perform when called upon.


Energy Transition in PJM:
Resource Retirements, Replacements & Risks

Feb. 24, 2023

For Public Use

Generation retirements may outpace new entry with a simultaneous likelihood of load increasing, thereby creating resource adequacy concerns.

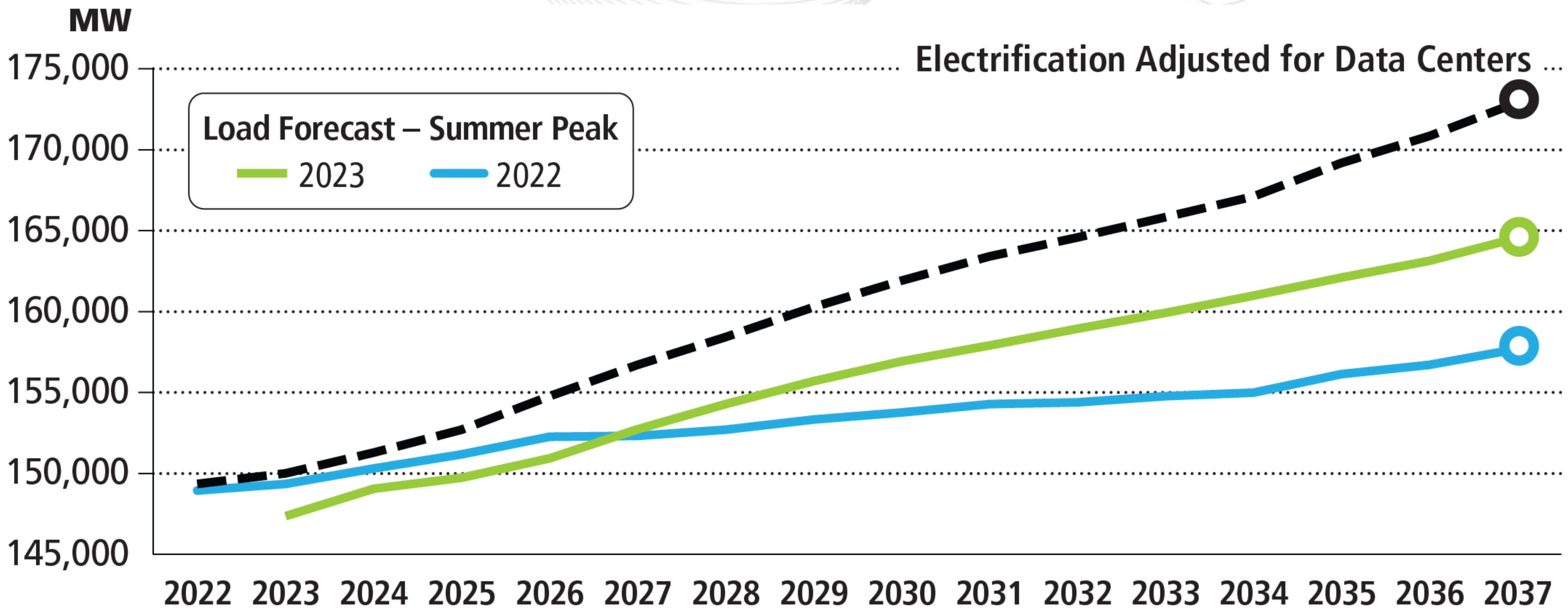

Energy Transition in PJM:
Frameworks for Analysis

Dec. 15, 2021

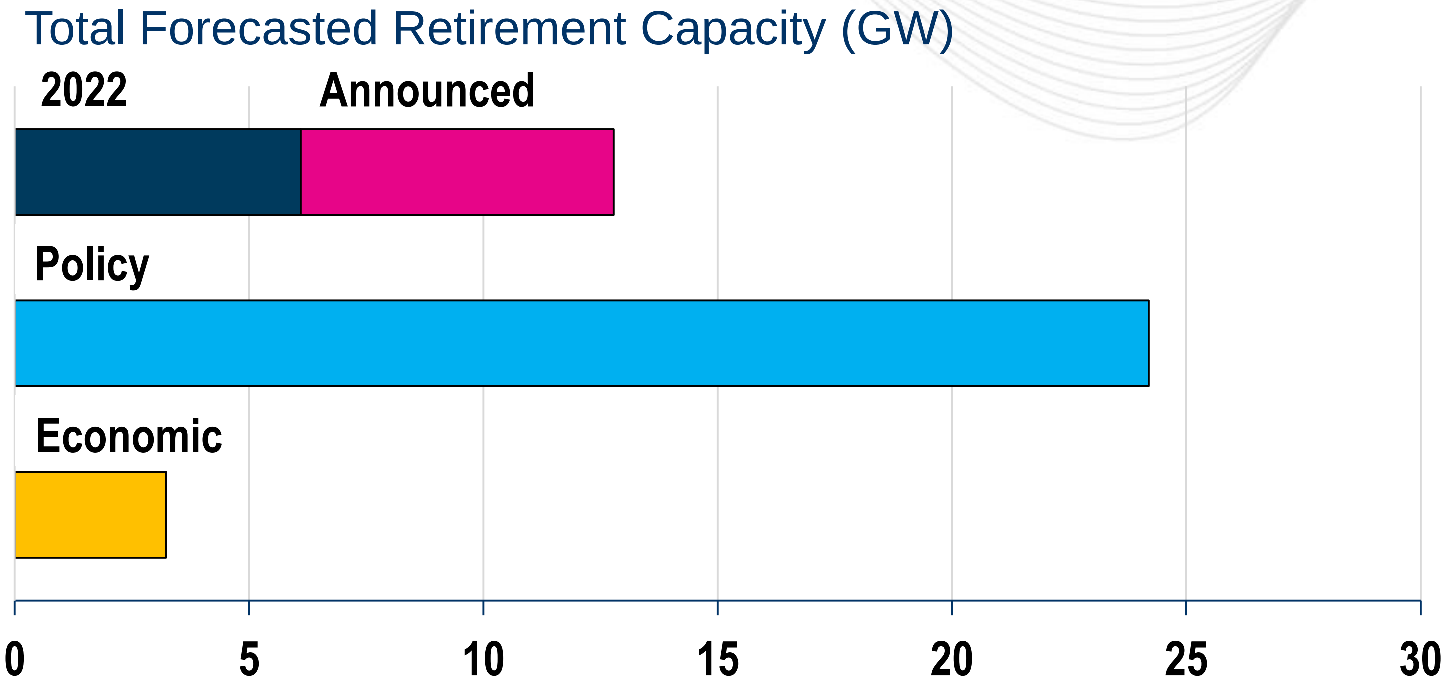
For Public Use

We will continue to need some amount of thermal generation to provide certain essential reliability services until a replacement technology is deployable at scale.

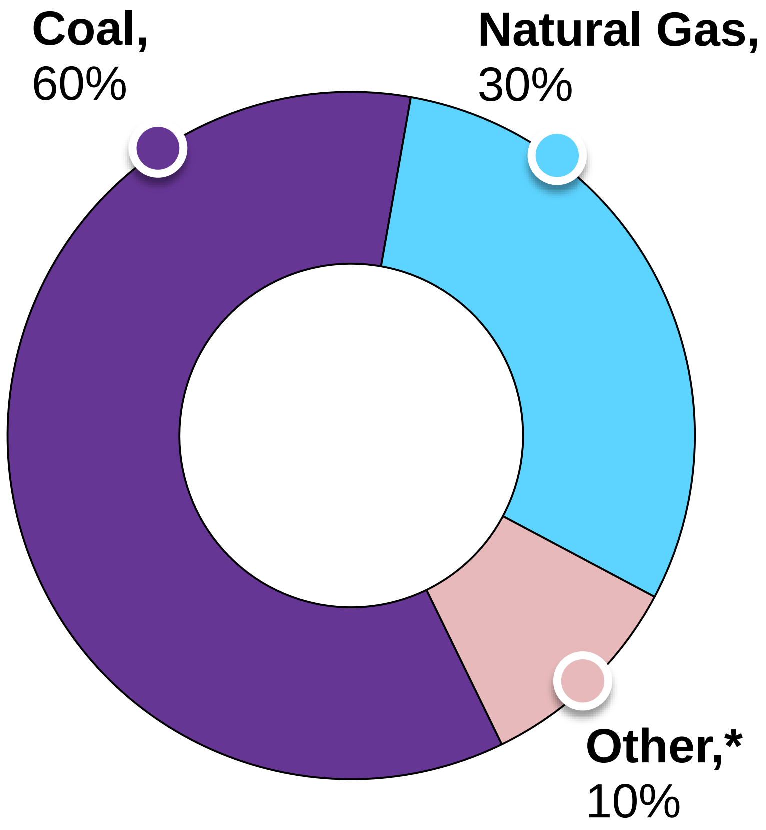
Load Growth Forecasts



Forecasted Retirements (2022–2030)

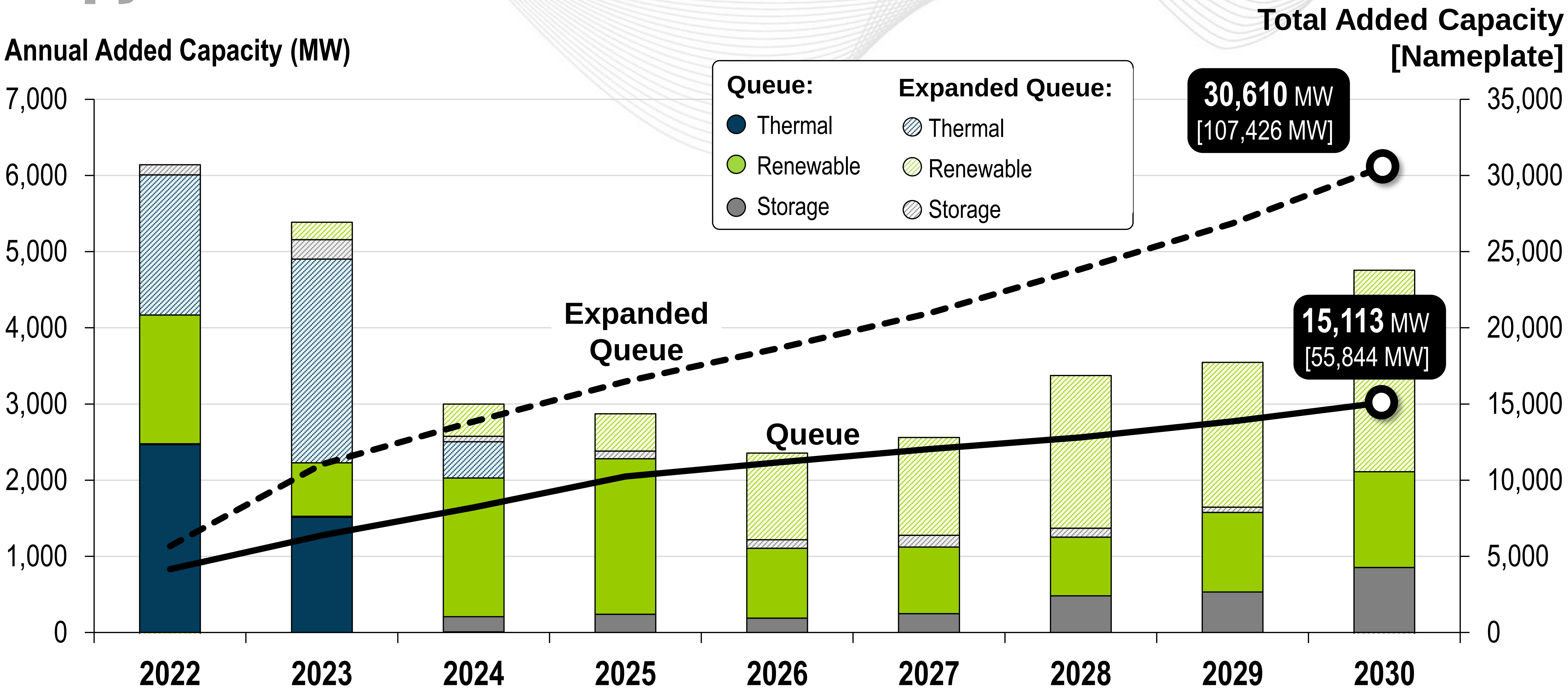


This **40 GW** represents
21% of PJM's current
192 GW of installed generation

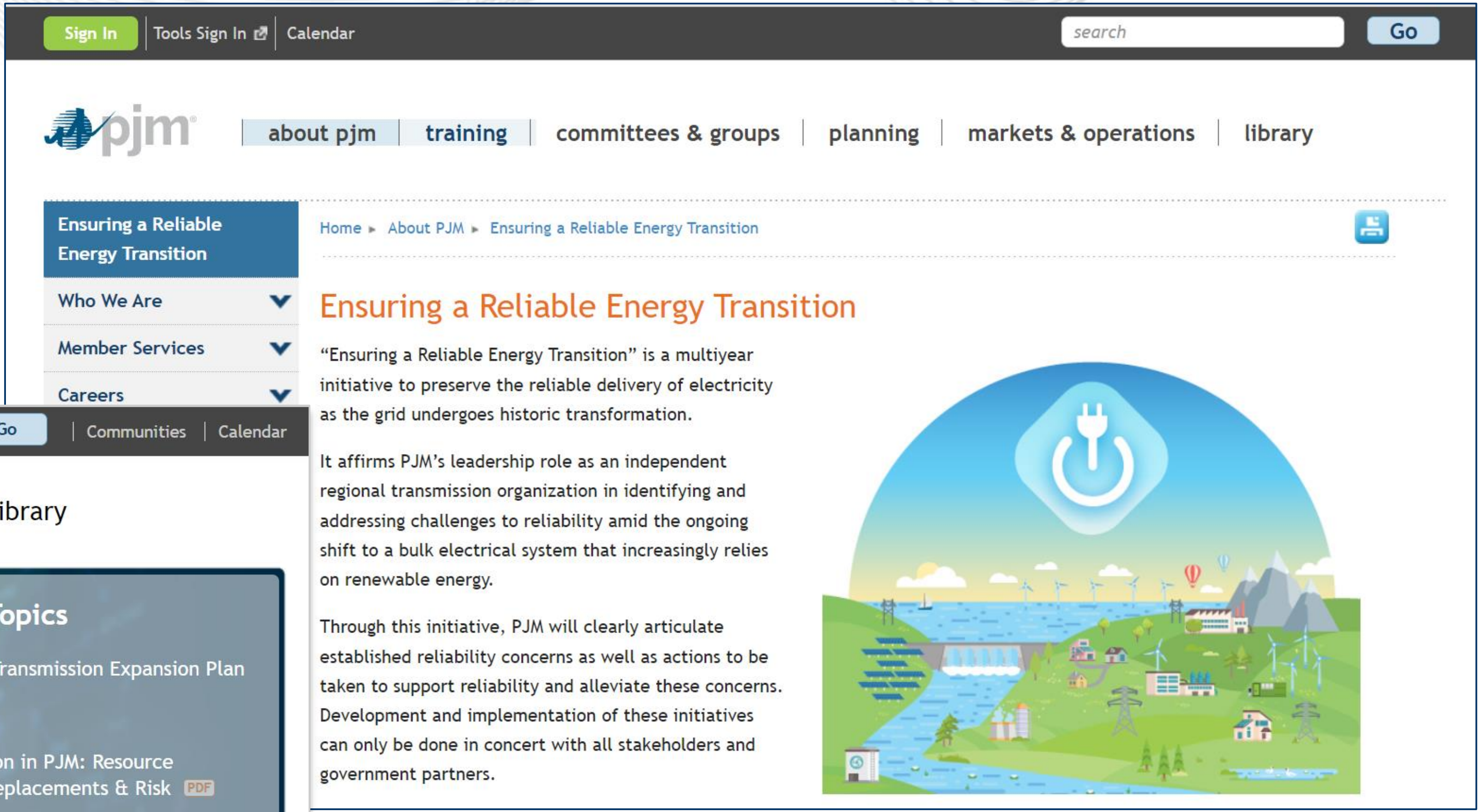


**Other includes diesel, etc.*

PJM Forecasted New Entry (2022–2030)



Ensuring a Reliable Energy Transition



Critical Actions To Support Reliability

- CIFP/RASTF Priorities
- Reserve Certainty
- Load Following/ Dispatchability
- Short-Term Forecasting
- Proactive Planning: LTRTP
- Proactive Planning: Resilience
- Proactive Planning: Interregional
- LDA Modeling
- RMR Improvements
- Policy Reliability Safety Measures
- Continued Queue Improvements
- Energy Assurance
- Gas/Electric Coordination
- Winter Storm Elliott Report

Interconnection Process Reform Timeline

2021

April 23, 2021
Stakeholder's begin queue reform through Interconnection Process Reform Task Force

May–November 2021
Stakeholders hash out issues in seven policy workshops

2022

April 8, 2022
Final meeting of Interconnection Process Reform Task Force

April 27, 2022
PJM Members Committee overwhelmingly endorses reform package

June 14, 2022
Interconnection process reform package filed with FERC

Nov. 29, 2022
FERC issues order approving reforms

2023

Jul. 10, 2023
Interconnection Process Reform Transition begins

Interconnection Queue Breakdown and Timeline

~40 GW
Through the queue but not yet constructed
Through 2023

46 GW
Transition Cycle 1
Mid-2025

61 GW
Post Transition
2026 and Beyond

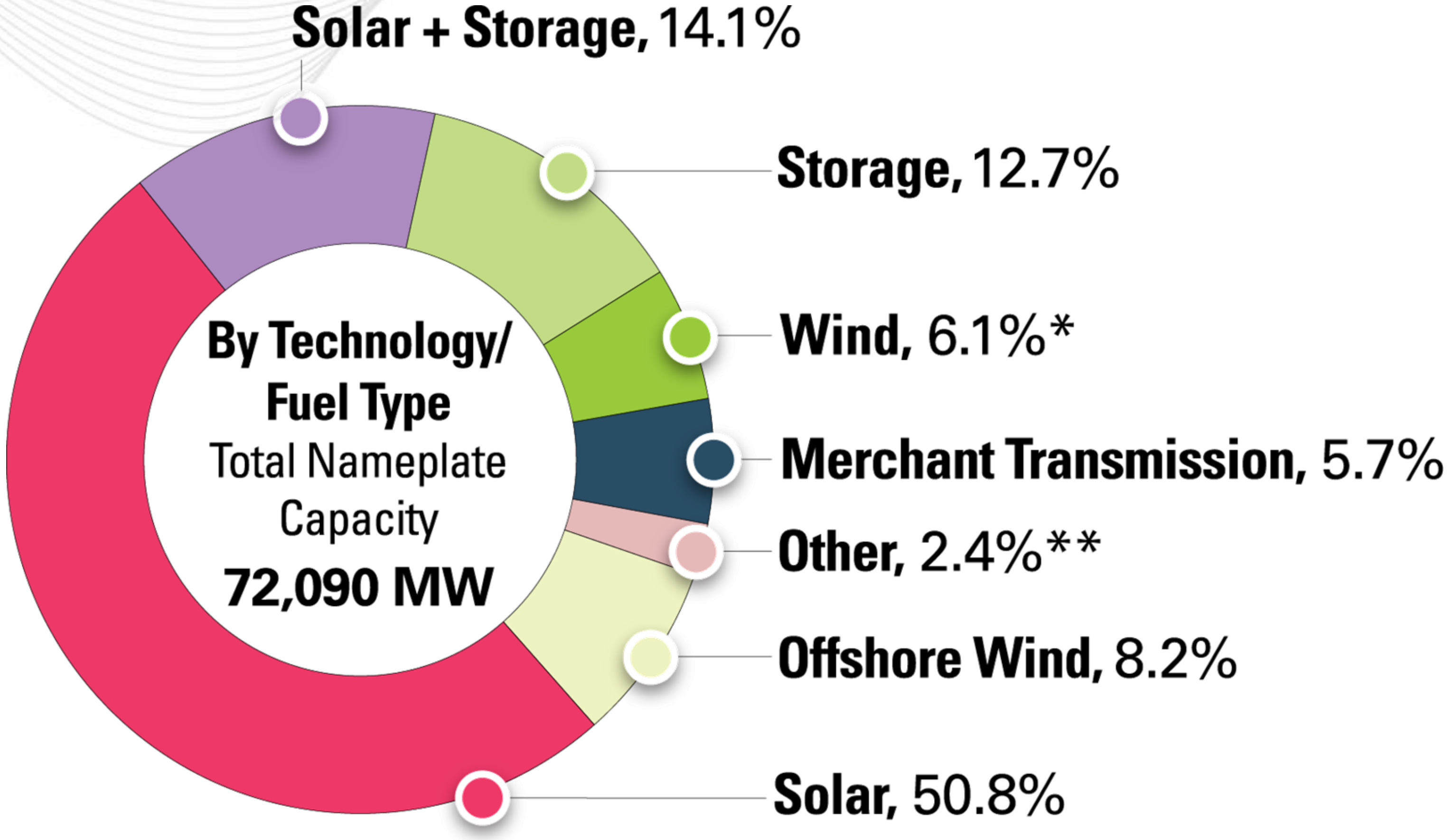
2023 | **2024** | **2025** | **2026**

26 GW
Fast Track
2024

99 GW
Transition Cycle 2
Through Q3 2026

Projects To Clear PJM Interconnection Process in 2024 and 2025 via Fast Track and Transition Cycle 1

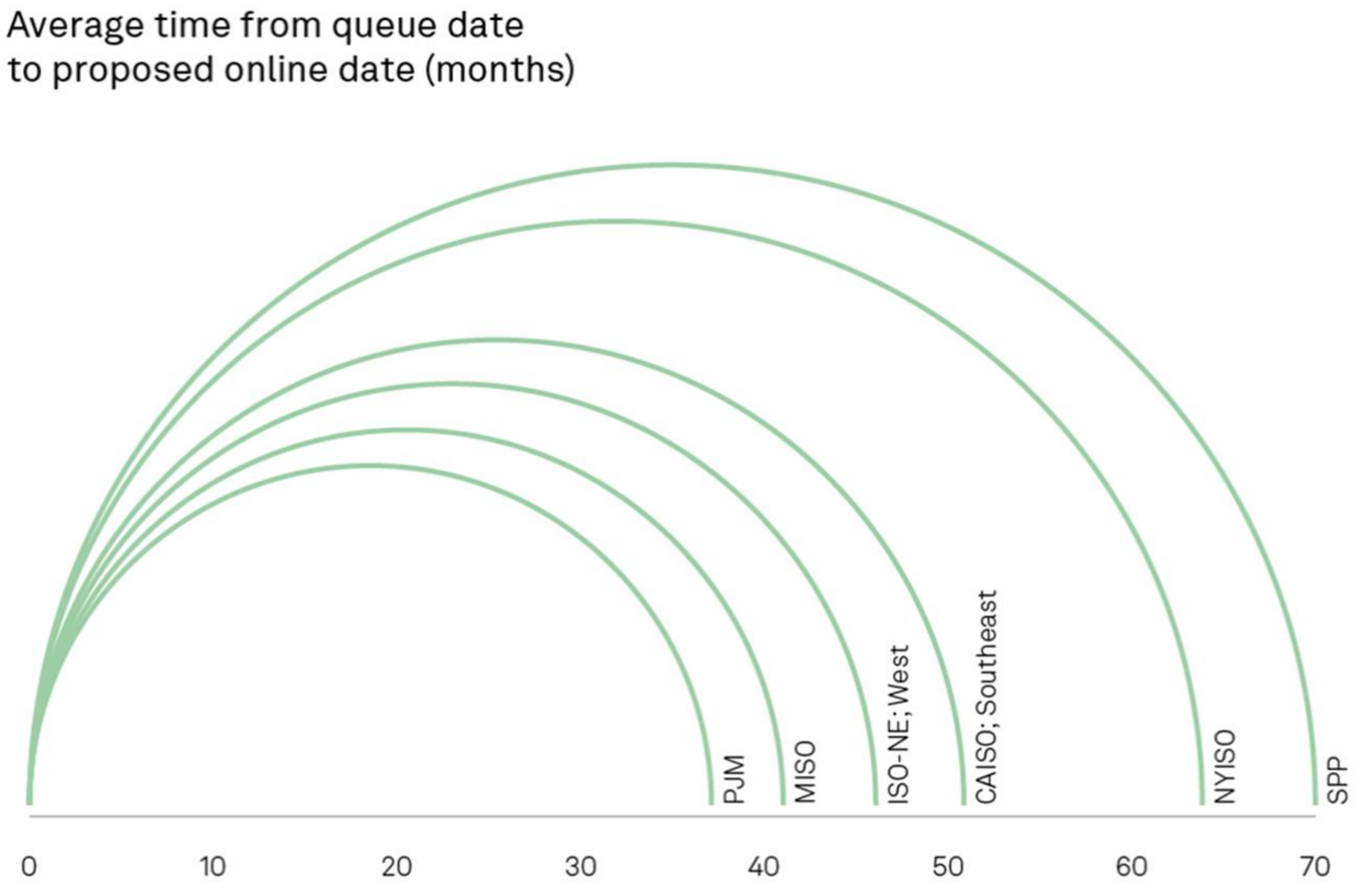
By State	Number of Projects	Total Nameplate Capacity (in MW)
DE	5	1,184
IL	82	13,798
IN	69	13,475
KY	39	4,125
MD	6	1,288
MI	8	887
NC	25	1,775
NJ	25	1,528
OH	72	8,613
PA	108	5,055
VA	162	19,012
WV	15	1,350
Total	616	72,090



*Includes one combined Wind & Solar facility of 199 MW

**Other: Natural Gas (1,647 MW, 2.3%) and Hydro (51 MW, 0.1 %)

U.S. Interconnection Queues – S&P Global



As of June 28, 2023.
Active queues only.
Only includes interconnection queues for which sufficient details were available.
Source: Public company reports (see Excel attachment for details).

Resource Adequacy Market Reform

Enhance reliability risk modeling in resource adequacy studies.

Improve capacity accreditation to reflect resources’ contribution during periods of risk.

Maintain the **capacity performance framework, but enhance** the rules and testing requirements.

Improve other areas of the market construct, including balanced **market power mitigation** rules.

ELCC Class	Preliminary 2025/26 BRA Class Rating
Onshore Wind	21%
Offshore Wind	39%
Fixed-Tilt Solar	15%
Tracking Solar	25%
Landfill	56%
Hydro Intermittent	41%
4-hr Storage	76%
6-hr Storage	85%
8-hr Storage	89%
10-hr Storage	92%
Solar 4-hr Storage Hybrid Closed Loop *^	44%
Solar 4-hr Storage Hybrid Open Loop *^	44%
Hydro NPS^	94%
DR	95%
Nuclear	96%
Coal	86%
Gas Combined Cycle **	87%
Gas Combined Cycle Dual Fuel **	88%
Gas Combustion Turbine **	74%
Gas Combustion Turbine Dual Fuel **	90%
Diesel Utility	91%
Steam	78%

Preliminary ELCC Class Ratings for the 25/26 BRA reflecting the proposed capacity market reforms filed by PJM in FERC Docket No. ER24-99

Policy Takeaways

- *Avoid* policies meant to push generation resources off of the system until an adequate quantity of replacement generation is online and has been shown to be operating

- *Analyze* your state/local challenges in the deployment of new generation resources and electricity infrastructure, and *enact* policy to facilitate greater/quicker construction

- PJM is a resource to assist in your policy discussions

Thank You and Questions