Resource Adequacy & Natural Gas-Electric Coordination

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Executive Summary

- Resource Adequacy: A PJM Case Study
  - Recent high prices are a window into different causes of fundamental tightening of supply/demand
  - Things don't quite add up. Economics and public policies are driving generation retirements and withdrawal of demand response. New supply is slow to come online. Meanwhile, demand is expected to grow rapidly
  - The next several years will surface market and regulatory models that do (and don't) work to accommodate this significant change in fundamentals

- Gas-Electric Coordination
  - Numerous initiatives have helped define the problems, but few 'solutions' have been adopted, so far (except in Texas). The authority to adopt such solutions is highly balkanized
  - It's likelier that electric markets will change to match gas industry practices, than *vice versa*
  - Collaborative information-sharing between industries seems to have significant support, with some regulatory urging necessary

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Resource Adequacy: A PJM Case Study

NERC Finds Broad Reliability Risk

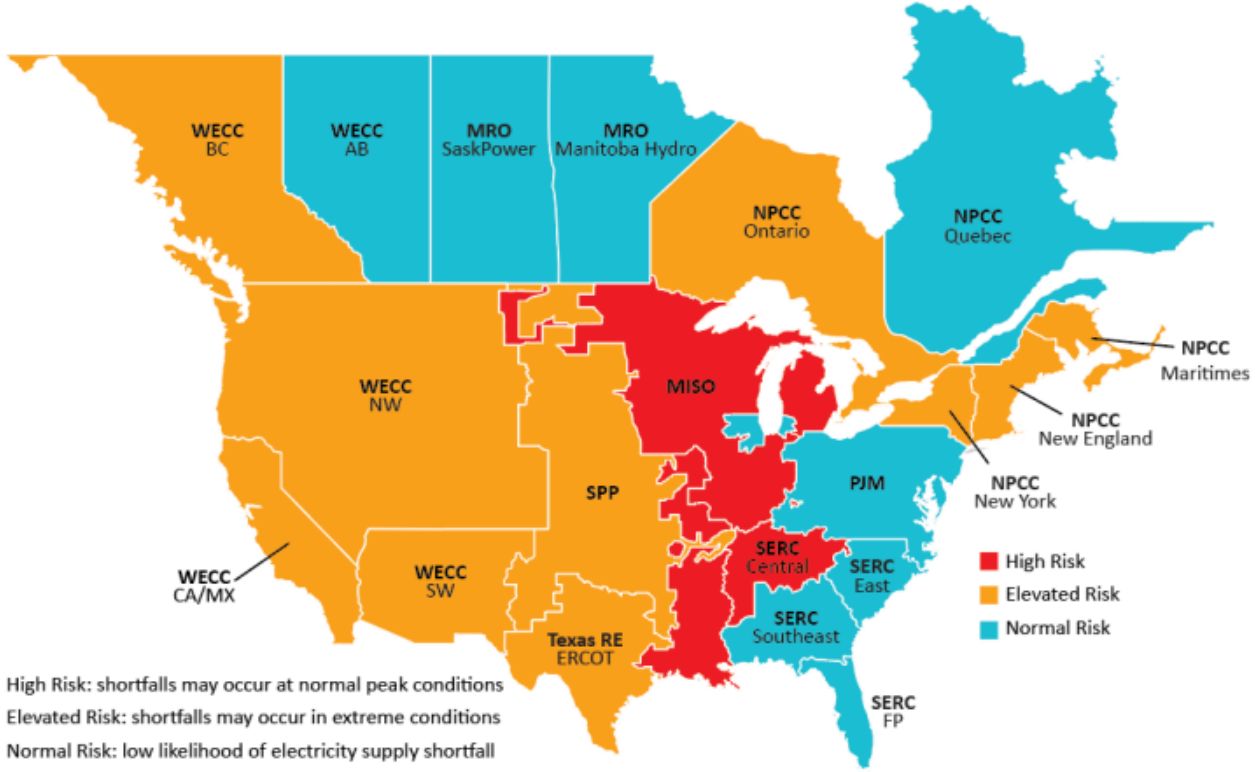

Figure 1: Risk Area Summary 2024–2028[8]

Published December 2023. Be on the lookout for an update later this year.

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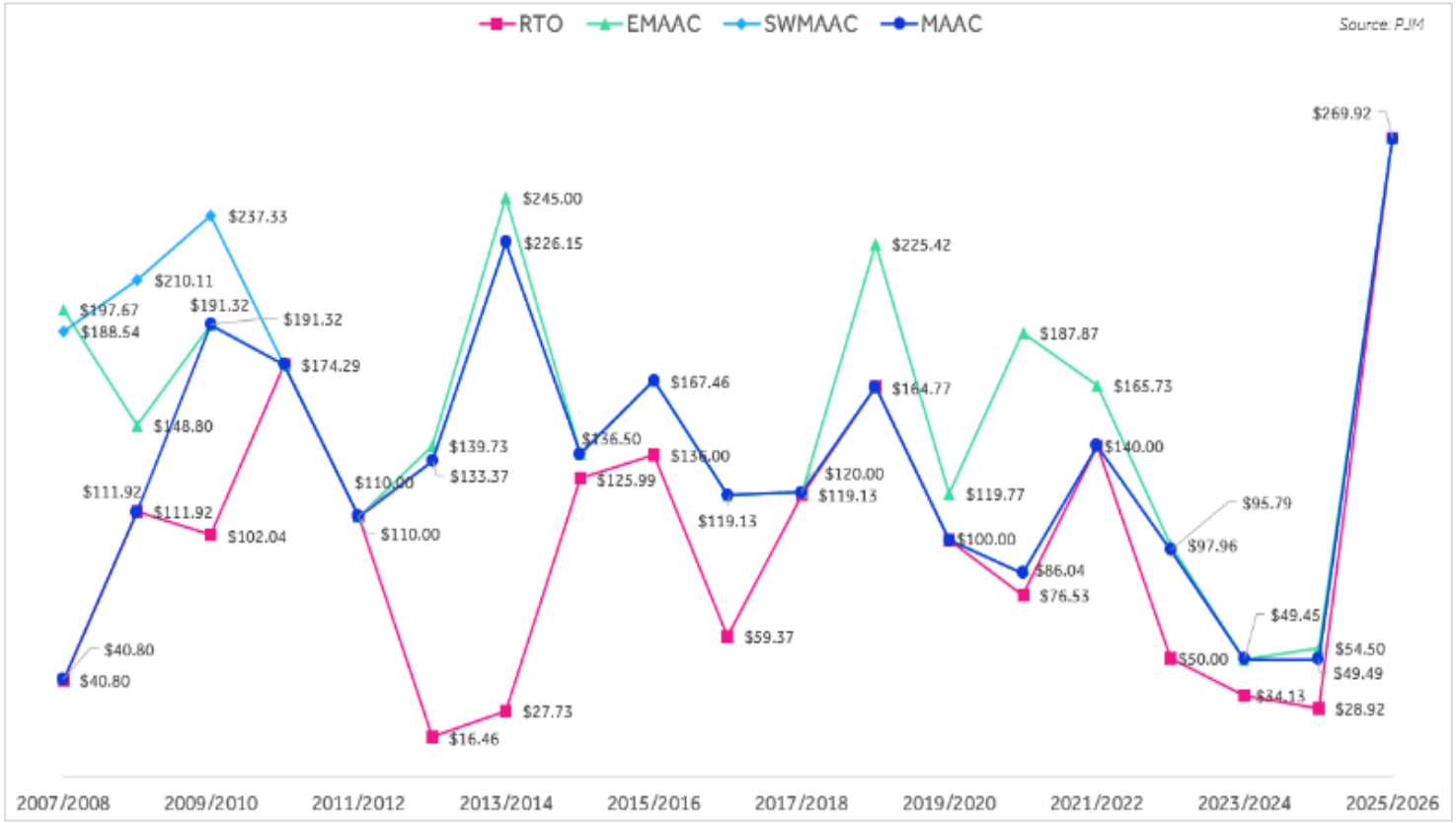
Capacity Pricing: A Signal that PJM is (nearly) “Resource Inadequate’



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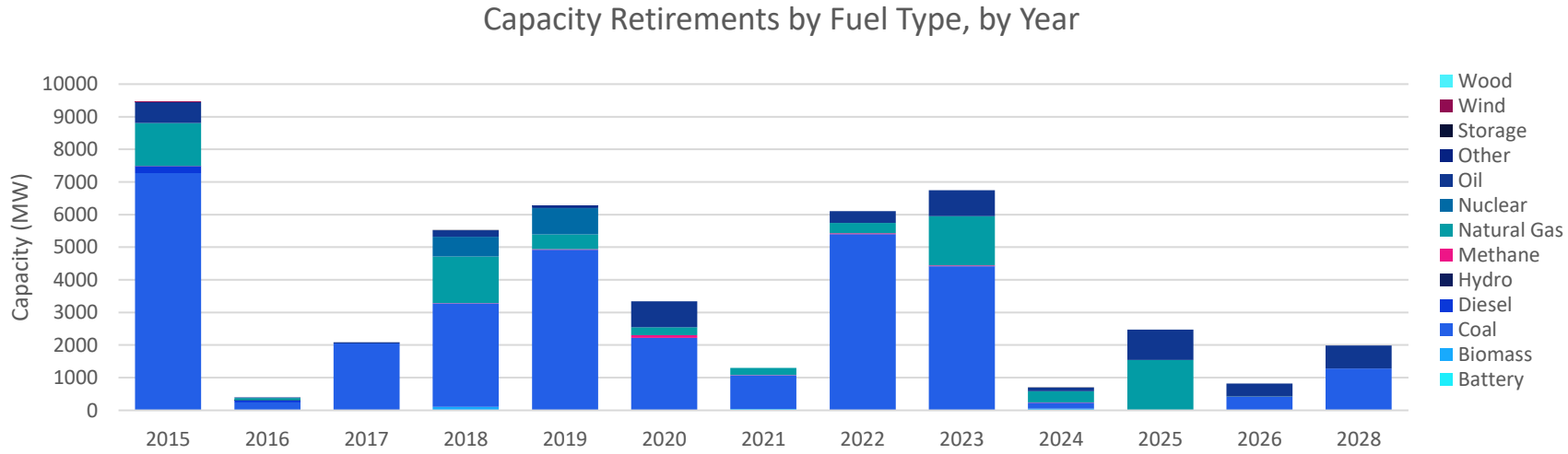
Coal, Gas, & Oil Power Plants Retiring at a Quick Pace 2018-2023

Economic Drivers:

- Three previous auctions closed at low-capacity prices, driving generators to exit that need cap-ex or are capacity-price-dependent
- Newly realized risk of performance penalties in winter storms

Policy Drivers:

- State law & regulation, including IL CEJA (coal & gas retirement by date certain), NJ DEP CO2 (emissions standard), utility IRPs
- Federal environmental regulations, including coal ash, effluent, NOx



Source: PJM, https://www.pjm.com/planning/service-requests/gen-deactivations.

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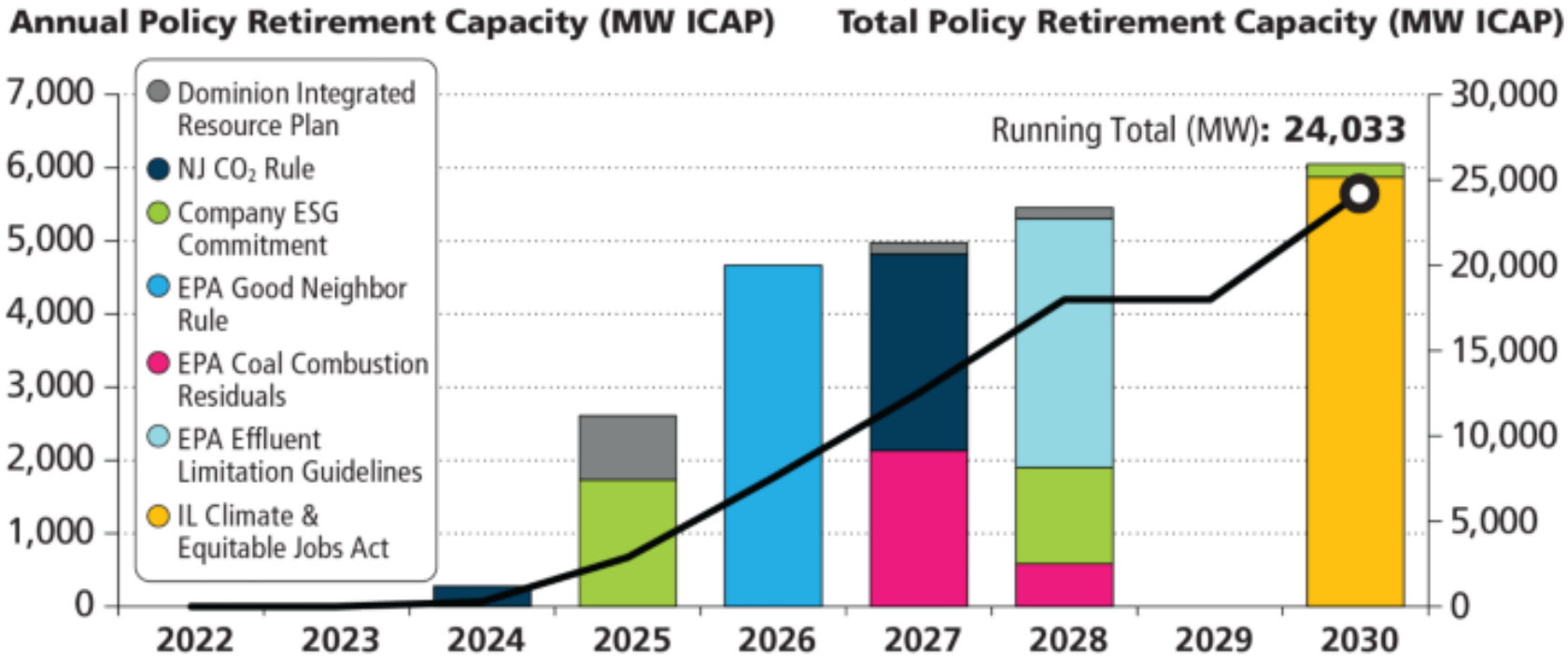
PJM's Forecast of Policy Retirements



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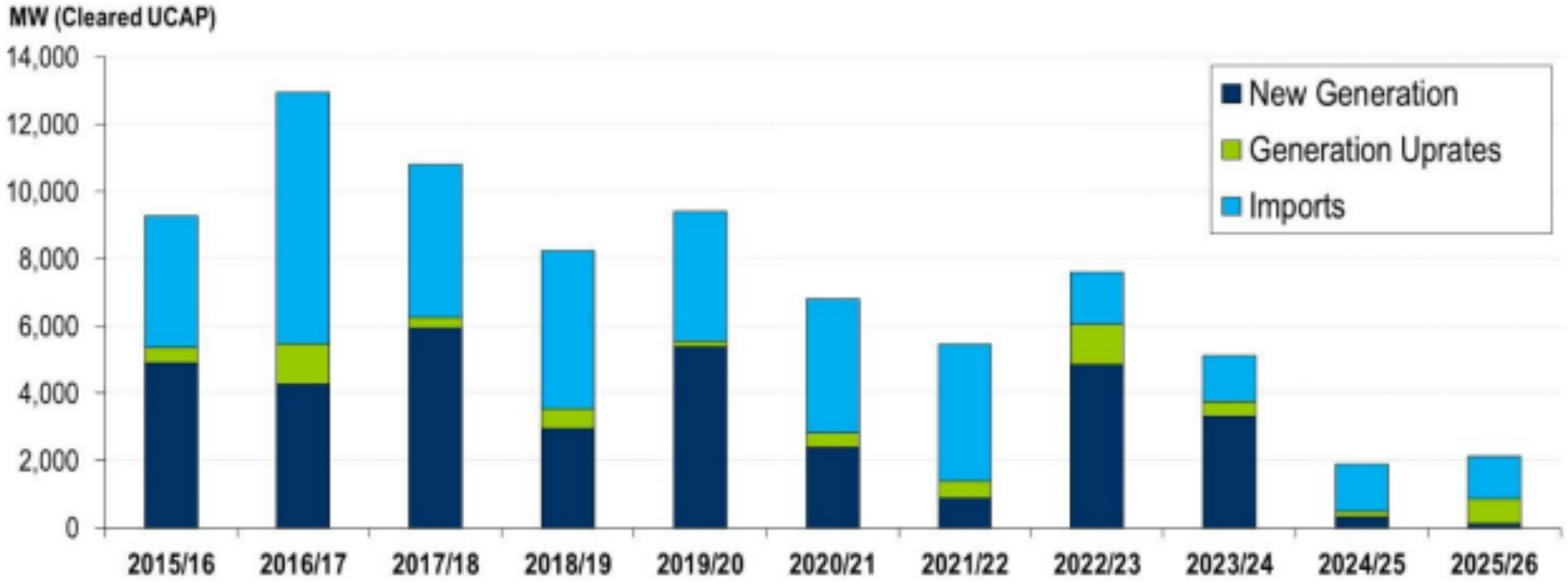
The Rate of New Entry Has Been Slowing

Figure 2. Cleared MWs (UCAP) by New Generation/Uprates/Imports by Delivery Year



Source: PJM, *2025/2026 Base Residual Auction Report*, July 30, 2024, p. 7, Figure 2. https://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2025-2026/2025-2026-base-residual-auction-report.ashx.

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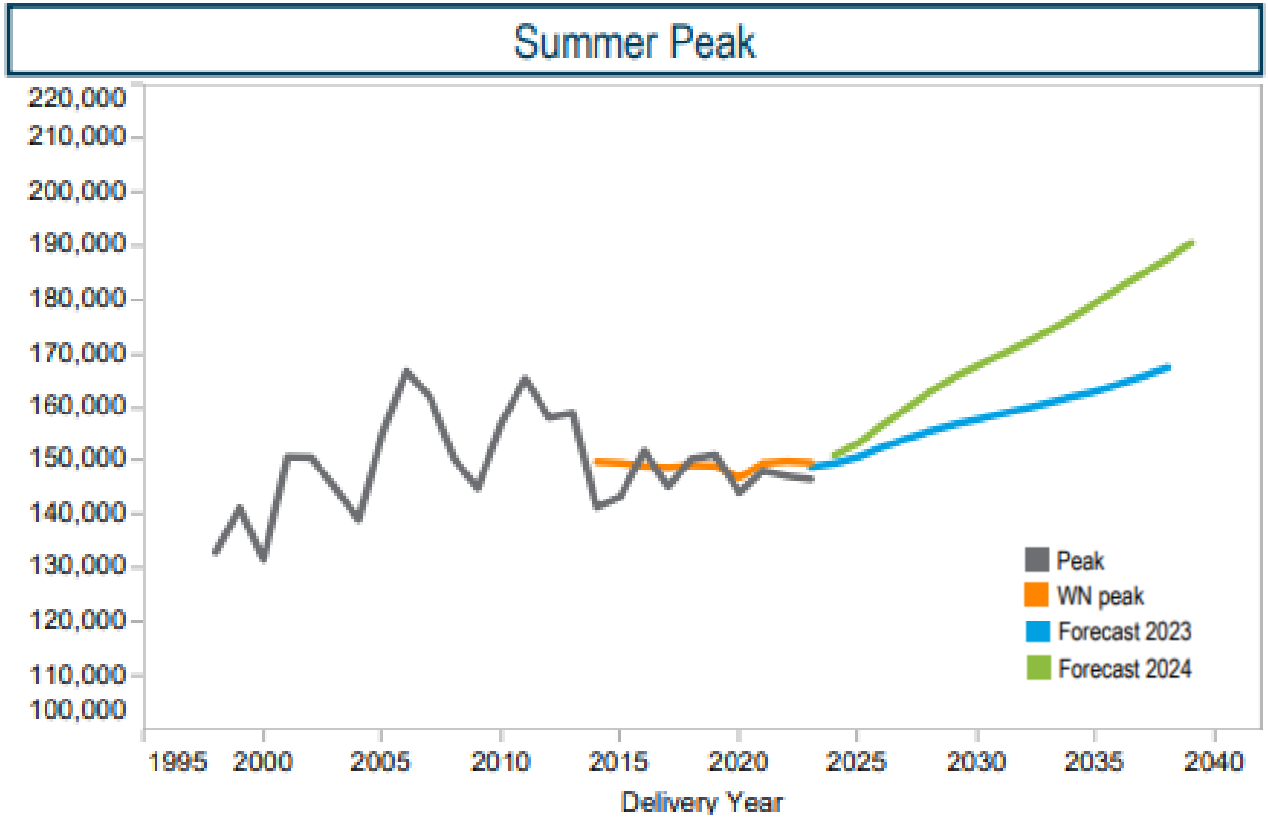
Load Growth Projected to Accelerate



Source: PJM, PJM Load Forecast Report January 2024, p. 9. https://www.pjm.com/-/media/library/reports-notices/load-forecast/2024-load-report.ashx

A New View of Capacity Accreditation

- Regulators and RTOs are also getting more serious about the expected availability of capacity resources, adopting Effective Load Carrying Capability (ELCC)
- The latest PJM auction, for 2025-26, was the first in which ELCC was used to accredit capacity. Significant haircuts were assigned to certain renewables (like utility-scale solar), but also for gas technologies (due to common failure mode of winter storm events)
- These haircuts meant that less supply was available in the market—and, somewhat paradoxically, it also made the supply that got the haircut more valuable on a unit basis

Select ELCC Classes	Before[1]	2025/26 BRA[2]
Onshore Wind	10%	34%
Offshore Wind	21%	61%
Fixed-Tilt Solar	30%	8%
Tracking Solar	50%	13%
4-hr Storage	80%	57%
Nuclear	99%	95%
Coal	87%	84%
Gas Combined Cycle	96%	78%
Gas Combined Cycle Dual Fuel	96%	79%
Gas Combustion Turbine	90%	68%
Gas Combustion Turbine Dual Fuel	90%	79%

1. "Before" is the Equivalent Forced Outage Rate, based on historical data of plant availability.
2. 2026/27 BRA ELCC Class Ratings from: https://www.pjm.com/-/media/planning/res-adeq/elcc/2026-27-bra-elcc-class-ratings.ashx.

Demand Response Exits

- Significant Demand Response exited, resulting in less DR offered and cleared in 2025/26
- DR providers exit for the same reason that generators have – low-capacity prices and high risk
- ELCC also reduced DR accreditation

Table 6. Offered and Cleared MWs by Type for RPM and Committed FRR for Previous BRAs

	Offered and Cleared UCAP							
	2022/23		2023/24		2024/25		2025/26 (Reflects ELCC Accreditation)	
Type	Offered	Cleared	Offered	Cleared	Offered	Cleared	Offered	Cleared
Coal	45,754	39,230	37,164	31,811	35,114	31,532	30,081	30,081
Distillate Oil (No.2)	3,178	2,897	2,894	2,855	2,776	2,674	2,408	2,408
Gas	85,562	79,329	85,217	81,643	85,469	83,258	66,354	66,354
Nuclear	31,944	26,140	31,960	31,960	31,835	31,629	30,549	30,549
Oil	2,674	2,527	2,350	2,269	2,493	2,220	578	578
Solar	2,633	2,096	2,945	2,935	4,234	4,232	1,337	1,337
Water	6,917	6,749	6,375	6,375	6,137	6,137	5,365	5,361
Wind	2,595	1,839	1,608	1,416	1,396	1,396	2,618	1,676
Battery/Hybrid	-	-	16	16	36	36	14	14
Other	1,205	1,168	1,185	1,185	1,153	1,153	911	911
Demand Response	10,604	8,903	10,652	8,631	10,334	8,180	6,363	6,342
Aggregate Resource	484	386	511	511	503	503	327	273
Total (without EE)	**193,551**	**171,263**	**182,875**	**171,605**	**181,481**	**172,951**	**146,905**	**145,883**
Energy Efficiency	5,057	4,811	5,471	5,471	8,417	7,669	1,460	1,460
Total (with EE)	198,608	176,073	188,346	177,076	189,898	180,620	148,364	147,343

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A Highly Managed Market—Except for Certain Resources

- PJM is a very highly managed auction with competitive features (not a ‘free market’)
  - The demand curve is administratively defined, and its slope based on RTO’s guess of appropriate proxy unit (e.g., CT vs CCCT). In current design, it only takes ~3,700 MWs to go from a $0/MW-day to ~$700/MW-day price.
  - Most resources are subject to a ‘must offer obligation’
  - Those offers are price-capped, allowing the Independent Market Monitor to effectively set the offer price for the vast majority of resources
  - This has typically resulted in auction outcomes where the clearing price is a function of that mitigation
- However, a couple of resources – demand response and new entrant renewables – are unmitigated
- When these unmitigated resources are on the margin, prices can quickly escalate

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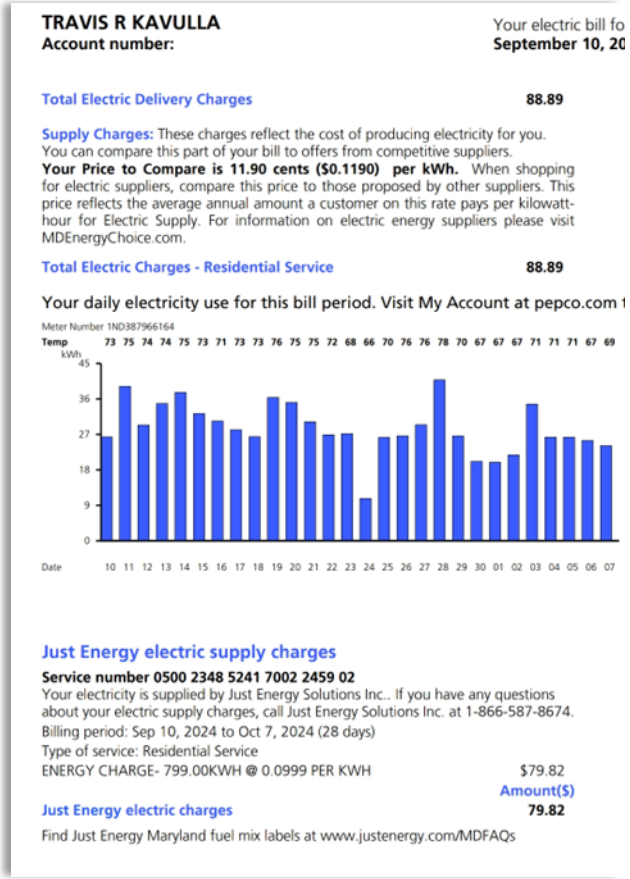
Retail Competition Provides Hedge Against Wholesale Volatility

- The majority of PJM states have retail competition policies that can provide a useful shield to wholesale volatility
- Policymakers can do more to educate consumers about the opportunity to sign long-term, fixed-price contracts to obtain price certainty, despite uncertainty in market energy & capacity prices, and regulated utility tariffs (transmission)
- My own price of 9.99 cents/kwh for energy supply, including transmission and capacity costs, is secure through mid-2029



TRAVIS R KAVULLA
Account number:

Your electric bill fo
September 10, 20

Total Electric Delivery Charges **88.89**

Supply Charges: These charges reflect the cost of producing electricity for you. You can compare this part of your bill to offers from competitive suppliers.
Your Price to Compare is 11.90 cents ($0.1190) per kWh. When shopping for electric suppliers, compare this price to those proposed by other suppliers. This price reflects the average annual amount a customer on this rate pays per kilowatt-hour for Electric Supply. For information on electric energy suppliers please visit MDEnergyChoice.com.

Total Electric Charges - Residential Service **88.89**

Your daily electricity use for this bill period. Visit My Account at pepco.com

Meter Number 1ND387966164

Temp 73 75 74 74 75 73 71 73 73 76 75 75 72 68 66 70 76 76 78 70 67 67 67 71 71 71 67 69

kWh 45 36 27 18 9 0

Date 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 01 02 03 04 05 06 07

Just Energy electric supply charges

Service number 0500 2348 5241 7002 2459 02
Your electricity is supplied by Just Energy Solutions Inc.. If you have any questions about your electric supply charges, call Just Energy Solutions Inc. at 1-866-587-8674.
Billing period: Sep 10, 2024 to Oct 7, 2024 (28 days)
Type of service: Residential Service
ENERGY CHARGE- 799.00KWH @ 0.0999 PER KWH $79.82

Amount($)
Just Energy electric charges **79.82**

Find Just Energy Maryland fuel mix labels at www.justenergy.com/MDFAQs

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Takeaways

1. The electric grid is more dependent than ever on a single fuel for reliability. Moreover, it is becoming more and not less essential, at least as measured by its market value. As certain capacity retires or is re-accredited at a lower value due to what we might call “electric-gas coordination risks,” prices rise in presence of near-shortage conditions.

2. Nothing appears to be replacing gas – even California at its most ambitious, deploying batteries, is contemplating no gas retirements until 2045. Increasingly clear that remaining gas capacity, although seen less throughout decarbonization scenarios, is still necessary. This leads to the amplification of another issue: paying more on a unit basis for rarely utilized capacity, both in plants & pipelines. Thus, the importance of capacity markets (or something like them)

3. These two things also make the electric-gas coordination issues more pressing

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Gas-Electric Coordination

Forums and Reports on Gas-Electric Coordination

- NAESB Gas Electric Harmonization Forum (GEH)
  - Final Report 7/28/23
  - 20 recommendations, mostly directed at FERC and state regulators
- NARUC Gas-Electric Alignment for Reliability (GEAR)
  - Bring together state regulators and industry representatives
  - Task Force chartered 11/23 through 2/25*
- FERC/NERC
  - Winter Storm Uri Report – 11/16/21
  - Joint letter to NAESB – 7/29/22
  - Winter Storm Elliott Report – 11/7/23
  - Joint Task Force with NARUC (kicking off at NARUC Annual Meeting in Nov. 2024)
- RTOs
  - SPP, MISO, PJM, ISONE publish “Strategies for Enhanced Gas-Electric Coordination” 2/21/24
  - Proposed a suite of Market enhancements; Operational improvements; and regulatory changes

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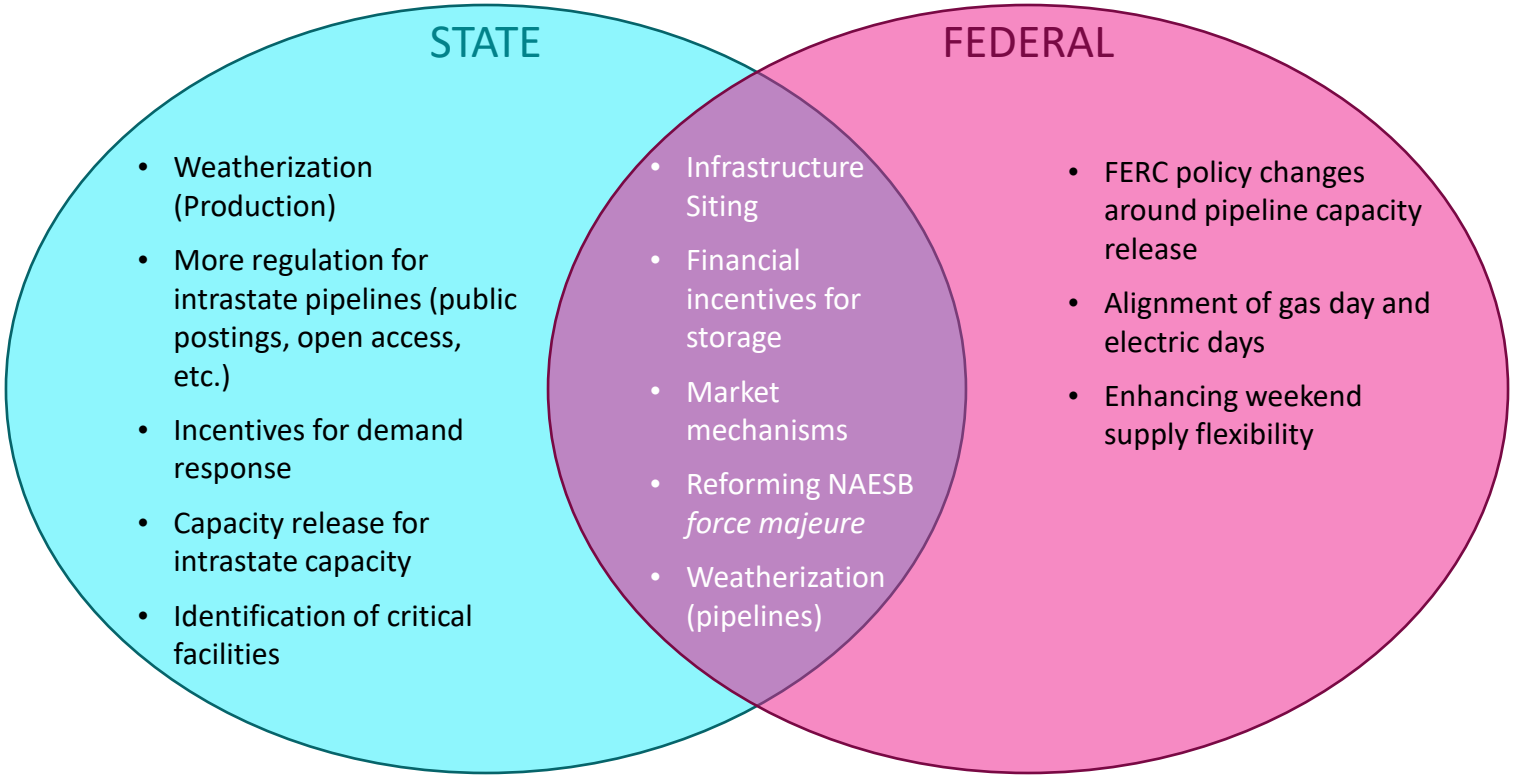
Issues Around Gas-Electric Coordination Cross Jurisdictional Borders



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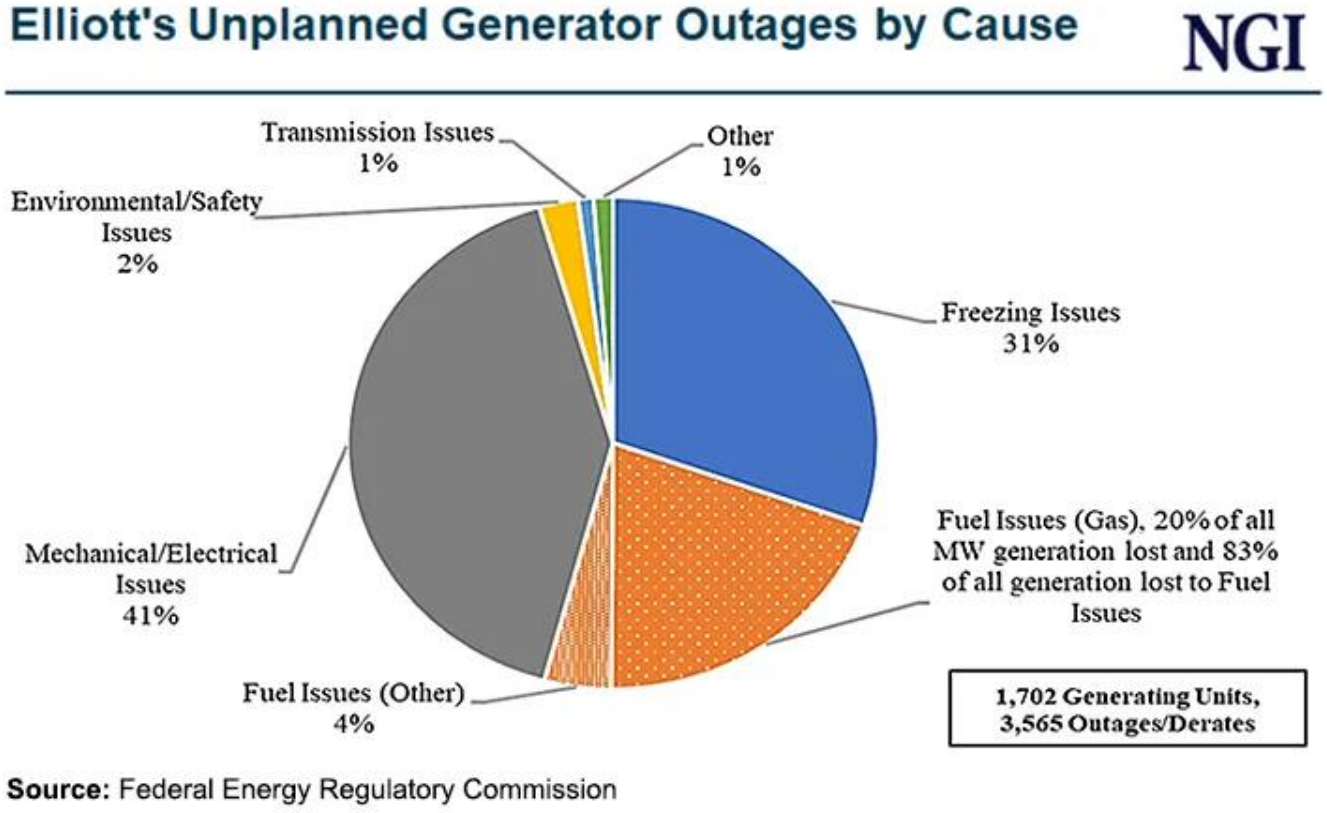
Numerous Causes of Gas Plant Challenges



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Gas Infrastructure Weatherization

- Gas infrastructure weatherization is the process of preparing natural gas facilities to operate during extreme weather events
  - The failure to identify and protect critical gas infrastructure exacerbated power outages
  - In the wake of Winter Storm Uri, Texas took steps to identify and require weatherization of critical infrastructure
- The “Texas approach” post-W.S. Uri
  - “Electricity supply chain map” identified facilities and methods used for producing, treating, processing, pressurizing, storing, or transporting natural gas for delivery to electric generation facilities (including roads)
  - Elements within the supply chain are designated as “critical” based on their characteristics (size, location, etc.)
  - Critical elements are required to be weatherized
  - Annual “Weather Emergency Readiness Attestation” is submitted to the Commission by Dec. 1st each year
  - If a major weather-related stoppage was caused by a facility's failure to adhere to weatherization requirements, can be fined $1 million
- Pros for the Texas approach
  - Worked well for Texas, which has robust production, transportation, and generation all in the same state
  - Tailored to each facility’s needs – “weatherization” means “*using methods a reasonably prudent operator would take given the type of facility, the age of the facility, the facility's critical components, the facility's location, and weather data for the facility's county or counties such as data developed for the Commission by the state climatologist*.”
  - Seems to have gotten results! Subsequent weather events have had far less power disruption than Winter Storm Uri
- Cons for the Texas approach
  - Harder (but by no means impossible) to do supply chain mapping across state lines
  - Industry standards can still result in disagreements over what weatherization methods are “reasonable”

Note: The PUCT also requires power plants to annually submit Weather Emergency Readiness Attestation

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Gas-Electric Coordination? Not so fast…

- So far, gas/electric harmonization efforts have often stalled due to the gas industry's unwillingness to change and the electric industry's unwillingness to adapt to the gas industry's existing structure
  - Electricity is bought and sold in 5/15-minute or hourly blocks in RTO trading. Gas is bought and sold by the day
  - Expensive storage capacity tends to be held by Gas LDCs that enjoy full cost recovery; merchant generators have no such cost recovery
  - Gas producers prefer to sell gas in long blocks; gas-fired generation needs gas in shorter increments
  - Pipeline transportation capacity and flowing gas are traditionally committed a day-ahead, which doesn't allow as much flexibility for real time changes
- Both the NAESB GEH process and the RTOs Strategies for Enhanced Gas-Electric Coordination process highlighted weekend/holiday trading practices and the need for improvement
  - Generators have trouble buying a three-day strip of gas as there is no method for them to recover the cost of unused gas (gas that is sold back at a loss)
  - Alternatively, Generators have to pay a premium to a supplier to secure the volumes they need at exactly the time they need it

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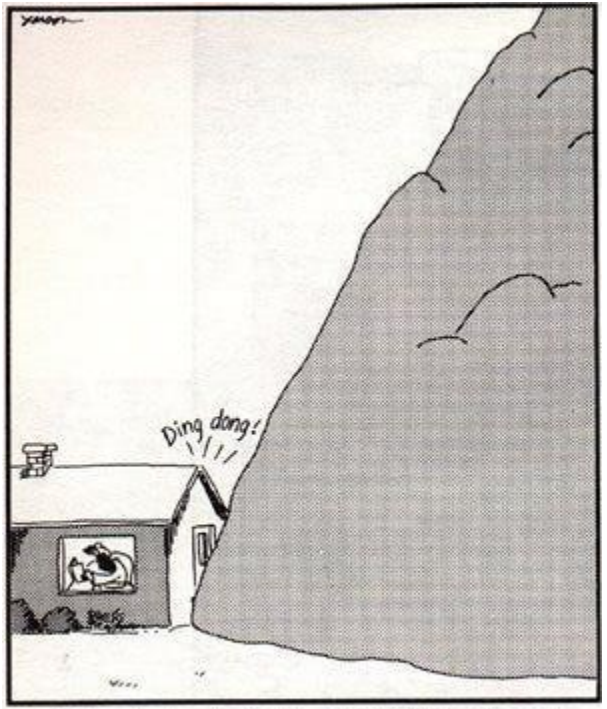
Reforms to Electric Market Design

- Multiple RTOs are experimenting with multi-day commitment options
  - Can be “all of the time” or for forecasted high-need times
  - Multi-day commitment enables generators to secure gas supply in larger blocks, which is easier to do over longer periods
  - The risk of multi-day commitment is uplift payments to the generators if actual market pricing makes the multi-day commitment uneconomic
- There has been a move to reward generators with on-site fuel capability
  - ISO-NE adopted this approach in the wake of a failed effort to subscribe to firm pipeline capacity and recover costs through regional network service rates
  - Even in Texas, 32 of the 33 participants in ERCOT’s Firm Fuel Supply Service Resource process use on-site fuel oil rather than gas storage
  - PJM’s ELCC gives a higher accreditation to dual-fuel facilities



Again the doorbell chimed. With his wife out of town, and not expecting any visitors, Mohammed began to grow uneasy.

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Gas Demand Response

- Form of Demand Response exists for large users directly connected to an interstate pipeline
  - To the extent that they can control their demand, they can often sell gas back to a marketer at prices reflective of the current market price
  - If transportation capacity is available, that gas can be taken to other nearby locations and resold
- Behind-the-City-Gate LDC Demand Response potentially useful, but limited for a few reasons
  - A gas LDC can lose pressure during high levels of gas consumption, so a primary function of LDC DR is to prevent this from happening
  - Gas behind LDC 'city gate' can't buck higher upstream pressures to be economically redirected to another use
  - Gas also does not move quickly enough to seamlessly cover large distances, most value would come through day-ahead optimization
- Some workable approaches to LDC Demand Response
  - Spiking gas prices are hidden from many retail customers, who only pay the bill for expensive wholesale purchases in arrears. There should be opportunities for those customers, possibly through aggregators, to face a financial incentive to respond
  - Interruptible tariffs have existed for decades; possible to expand use to other customer classes with other heat source or non-heat loads?
  - Only a couple Residential Gas DR programs exist (e.g., NYC utilities), but are worth evaluating

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Readiness Forum

- There are discussions about moving forward with a “Readiness Forum” concept for implementation this Winter
  - Process already exists in many states (modeled on the TERC)
  - Envisions multiple regional forums of stakeholders from the entire electricity supply chain (producers, marketers, transporters, grid operators, generators, regulators)
- Obstacles
  - Interstate pipelines already are required to publicly post critical notices regarding their facilities – not clear that they would have much incentive to participate
  - Producers have expressed antitrust/market manipulation concerns, as market participants that lost money during weather events could argue statements made (or not made) at the forums were improper
  - Size – given the number of states in many RTO footprints, certain regional forums could be unwieldy (The TERC has 25 members)

Note: INGAA, the NGSA, and the RTOs already hold an annual Winter-Preparedness meeting prior to the winter season

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