



TOLLER ENERGY

The Next Stage of Capacity Market Evolution

Completing the Commercial Evolution of Capacity Markets

THE THESIS

Capacity markets have developed commercial features beyond centralized procurement — but have not yet evolved into markets that support transparent, long-term risk transfer.

Why Markets Exist

Markets perform four functions:

01 **Allocate resources**

03 **Transfer risk**

02 **Discover prices**

04 **Attract capital**

Function	Energy	Capacity
Allocate resources	✓	✓
Discover prices	✓	⦿
Transfer risk	✓	⦿
Attract capital	✓	⦿

What Makes a Market Mature?

Commercial Characteristic	Energy	Capacity
Accepted marketplace	✓	✓
Secondary trading	✓	✓
Standardized product	✓	⦿
Bilateral contracting	✓	⦿
Transparent forward pricing	✓	✗
Financial products	✓	✗
Market makers	✓	⦿
Continuous price discovery	✓	⦿
Financeability	✓	⦿
Long-term risk transfer	✓	⦿

✓ Has the characteristic ⦿ Limited ✗ Does not have the characteristic

How Markets Evolve

- Accepted Marketplace
- **Commercial Activity** — PJM Capacity Market
- Standardization
- Financial Infrastructure
- Deep Markets
- **Transparent Risk Transfer** — PJM Energy Market

Energy Markets Demonstrate the Destination

Retail choice and competitive procurement insulated consumers from approximately \$5.8 billion of day-ahead price volatility during Winter Storm Fern and the July heat events.

Mature markets create value for all participants and allow efficient risk transfer between natural parties through market makers, speculators, and robust futures and swaps markets.

RESULT — FACTSET ROUND-THE-CLOCK PRICE

Combined costs of events (Fern + July)	\$11.76B
Non-event margin to suppliers (FactSet \$64-derived)	\$3.18B
Net cost of events (RT0-wide)	\$8.58B
Scaled to retail-choice states ($\times 0.62$)	\$5.32B
Plus uplift ($0.62 \times \$798\text{M}$)	\$0.495B
TOTAL	$\approx \\$5.81\text{B}$

Sources: PJM — 2026/2027 Base Residual Auction Report · CBRE — market commentary on Winter Storm Fern DA pricing · Modo Energy — Winter Storm Fern load and real-time price analysis · PJM Inside Lines — "Reviews January Cold Weather Operations" (uplift figure) · Monitoring Analytics (IMM) — MIC presentation, April 8, 2026 (Fern DA average, uplift) · FactSet — July 2026 heat wave coverage (RT price average, YTD average) · PJM Operating Committee presentation, July 9, 2026 · Constellation — July 2026 market commentary · energyonline.com — PJM Day-Ahead Price for Hubs (direct hourly data pull)

Why Has Evolution Slowed?

Commercial evolution requires:

- Stable products
- Standard documentation
- Transparent valuation
- Financeability
- Regulatory certainty

PJM Capacity Market Timeline

PART ONE — 2007 TO 2018

2007–2013

Forward-market foundation

- RPM establishes a three-year forward procurement framework
- Transparent auction prices support bilateral contracting, retail procurement, and project finance
- Strong private investment and fleet transition follow

Commercial condition: standardized product, predictable timing, credible reference pricing.

2014–2018

Complexity begins to accumulate

- Capacity Performance and PAI-related obligations add settlement and nonperformance exposure
- Participants must begin pricing operational tail risk into contracts

Emerging risk: settlement complexity and widening model uncertainty.

States remove fixed-price capacity from BGS / SOS / POLR procurement.

PJM Capacity Market Timeline

PART TWO — 2019 TO 2026

2019–2022

Forward price discovery disrupted

MOPR proceedings delay Base Residual Auctions; bilateral markets fall back on proxies and bespoke assumptions.

Effect: reduced transparency, wider valuation ranges, declining liquidity.

PJM stops printing reference prices against which bilateral contracts would settle and margin.

Repeated auction delays and contested outcomes continue to weaken forward price discovery by reducing the availability of timely, transparent reference prices for bilateral contracting.

SEPTEMBER 2023

Shell raises the liquidity warning

Shell tells the PJM Board that forward markets supporting long-term hedging had lost significant liquidity, and that mechanisms must be "administratively simple, transparent, and durable."

Effect: a hedge provider warns the architecture no longer supports long-term risk transfer.

2022–2024

Performance and accreditation risk intensify

- Winter Storm Elliott exposes operational risk.
- ELCC changes accredited quantities.
- BGE and DPL-S raise scarcity-signal questions.
 - Markets are clearing tighter and LDA prices are falling.
 - Market outcomes heavily litigated, creating bilateral uncertainty and raising risk premiums.

Effect: both price and quantity become uncertain.

2024–2026

Scarcity prices rise, hedgeability unresolved

- Capacity prices move sharply higher.
- ELCC and load-forecast revisions continue.
- PJM adjusts deficiency rules.
- Policy calls for more long-term hedging grow.

Effect: despite RRI and other incentives, the PJM capacity market does not keep pace with load growth.

Illustrative Hedge

What if an entity tried to prudently hedge?

Illustrative ten-year capacity hedge, 2019–2028/29: 1,800 MW plant located in ATSI sells 1,600 MW ten years forward

Delivery Year	2023/24–32/33	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
Event Year	2019	2021	2022	2024	2025	2025	2026
Market Event	Hedge executed	Price declines	Market low	First ELCC auction	Clears at cap	Clears short at cap	Short, revised VRR
Actual Price	\$100.00	\$34.13	\$28.92	\$269.92	\$329.17	\$333.44	\$325.00
Uncapped Price	\$100.00	\$34.13	\$28.92	\$269.92	\$388.57	\$529.80	\$554.72
Accreditation	95% pre-ELCC	95% pre-ELCC	95% pre-ELCC	78%*	77%	74% BRA	78% BRA
Accredited Capacity	1,710 MW	1,710 MW	1,710 MW	1,404 MW	1,386 MW	1,332 MW	1,404 MW
Commercial Short	0 MW	0 MW	0 MW	196 MW	214 MW	268 MW	196 MW
Years Remaining	10	10	9	8	7	6	5
Buyer MTM	\$0	-\$385M	-\$374M	+\$794M	+\$937M	+\$818M	+\$657M
Generator MTM (Total Exposure)	\$0	+\$385M	+\$374M	-\$948M	-\$1.117B	-\$1.014B	-\$773M
Uncapped Total Exposure	\$0	+\$385M	+\$374M	-\$948M	-\$1.392B	-\$1.817B	-\$1.526B

The forward sale remained fixed at 1,600 MW, but the quantity available to support it changed from auction to auction — and could change again between the BRA and the 3rd IA.

*PJM reverted to a prior year's load forecast to reduce ELCC volatility.

E3 documents that larger units have lower, more volatile ELCC, since their outage is more likely to cause loss of load; PJM has three announced units over 4GW (NextEra, Homer City, SoftBank).

How Can We Advance Our Evolution Toward:

01 Stable products

03 Transparent valuation

05 Regulatory certainty

02 Standard documentation

04 Financeability

Completing the Capacity Market's Evolution to Empower Reliability and Risk Management

(Commercial Framework Incorporating Elements of Options A and C)

WHAT NEEDS TO HAPPEN

- **Simpler Product**
- **Standard Contracts**
- **Easier Valuation**
- **Bank Financing**
- **Forward Market**
- **Financial Liquidity**
- **Efficient Risk Transfer**

Restore the Three-Year Forward Market

WHY IT MATTERS

A predictable forward auction provides the reference price that underpins bilateral contracting, project finance, and long-term investment.

COMMERCIAL BENEFIT

- Restores transparent price discovery
- Improves bilateral liquidity
- Supports long-term hedging
- Reduces financing costs

Strengthen RPM's Price Discovery Function*

WHY IT MATTERS

RPM should not only procure sufficient capacity — it should also produce a transparent market price that participants can confidently use in commercial transactions.

COMMERCIAL BENEFIT

- Improves market confidence
- Supports retail procurement
- Facilitates bilateral negotiations
- Enhances investment signals

*Are the prices set reflective of fair value; neighboring regions (no-arbitrage conditions), EQR bilateral physical deals, filed rate cases...

Modernize Investment Signals*

WHY IT MATTERS

The reference cost of new entry should reflect today's construction costs, financing environment, development timelines, and commercial realities as well as localized LDA constraints.

ILLUSTRATIVE COMPONENTS INCLUDE

- Net CONE
- Gross CONE
- VRR curve
- Entry assumptions

COMMERCIAL BENEFIT

- Durable investment signals
- Efficient entry decisions
- Improved long-term adequacy
- Greater investor confidence

*Current Net CONE is bottom quartile of the last 12 years, despite numerous indications that more money is needed from the capacity market to support investment.

Improve Product Stability and Predictability*

WHY IT MATTERS

Participants cannot efficiently hedge or finance a product whose accredited quantity and valuation methodology remain highly uncertain and change year-to-year.

COMMERCIAL BENEFIT

- More predictable valuation
- Better financing terms
- Lower risk premiums
- Increased market liquidity

INCREASE ELCC TRANSPARENCY

- Publish annual and forward 10-year ELCC sensitivity analysis for load levels
- Consider confidence-interval offers based on ELCC standard deviations to manage volatility
- Reduced year-to-year ELCC and Load Forecast volatility
- Predictable implementation

*Nearly 100GW of PJM generation faces an ELCC standard deviation of 3%, creating a 12GW confidence interval around the true value of capacity. PJM's load forecast shows a 3% standard deviation from BRA to IA, creating an even larger confidence interval for capacity requirements.

Complete the Market's Commercial Evolution

WHY IT MATTERS

Capacity markets should evolve beyond centralized procurement into transparent commercial markets capable of supporting efficient long-term risk transfer.

COMMERCIAL BENEFIT

- More liquid forward markets
- Greater financial participation
- More efficient long-term risk transfer
- Improved capital formation
- Stronger investment incentives

CONCLUSION

These recommendations do not seek to redesign competitive markets. Rather, they seek to complete the commercial evolution of PJM's capacity market by strengthening the market infrastructure that enables transparent price discovery, efficient long-term risk transfer, and sustained private investment.

Markets create the greatest long-term value when they not only procure reliability, but also provide the commercial foundation that allows customers, load-serving entities, generators, and investors to efficiently manage risk. Completing that evolution will reinforce both market confidence and long-term resource adequacy.